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The ASB BULLETIN

Volume 36, Number 1

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**The Official Quarterly Publication of
The Association of Southeastern Biologists**

ASB BULLETIN
(ISSN 0001-2386)

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1991: Kenneth W. McLeod, Savannah River Ecol. Lab., Drawer E, Aiken, SC 29802

Jim Ross, Dept. Biology, Cumberland College, Williamsburg, KY 40769

The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1989 April 5-8 University of North Carolina-Charlotte, NC

1990 April 19-21 Towson State University, Towson, MD

PATRON MEMBERS

Carolina Biological Supply Co., Burlington, NC

Martin Microscope Co., Easley, SC

THIS PUBLICATION IS PRINTED ON ACID-FREE PAPER.



PRESIDENT'S CORNER

A VIEW FROM HERE

Our Annual Meeting in Charlotte is shaping up to be a busy and enjoyable one. The Local Arrangements Committee provides a preview of the activities in this issue. Additional emphasis is placed on two areas of interest to the Association of Southeastern Biologists: conservation and education.

BIODIVERSITY WORKSHOP

Just before the pre-registration and registration information in this issue of the Bulletin, please note the announcement of the Biodiversity Workshop being held on Tuesday and Wednesday, April 4-5.

Regional Biodiversity Workshops are being planned throughout the country by the U.S. Forest Service to address the issue of diversity as it is related to management of our National Forests and the research priorities of the Forest Service. The Southeastern Chapter of the Ecological Society of America has worked closely with the Forest Service to hold this region's workshop on these days for the convenience of many southeastern biologists who may wish to attend and go to the ASB meeting as well. Rob Sutter is the Chapter's liaison with the Forest Service, and he is doing an excellent job in coordinating the Chapter's part of the program. This workshop will be an excellent opportunity to meet and talk with colleagues of the federal and state natural resource agencies.

How is it evaluated? At this meeting, resource managers *and* scientists will be addressing these questions and discussing applications of the concept when applied to genetic, species, community, and landscape levels of diversity. Of course, complete answers to the many questions surrounding biodiversity cannot be answered in two days. However, this workshop should promote more cooperation and dialogue between managers and scientists because they have a mutual interest in this important subject. Continued fragmentation of the Southeastern landscape does not permit similarly fragmented efforts to maintain and improve biological diversity.

Plan now to attend this important workshop if your schedule will permit early arrival in Charlotte. At least come to the Hilton on Wednesday afternoon and attend the final session. Summaries of the working groups will be presented at this time and a nationally-known scientist will provide the closing commentary on biodiversity.

ASB EDUCATION FORUM

Have you noticed the recent (and many) articles on public understanding of science? How about the nationwide survey of high school biology teachers that

reports 33 percent agreed (or weren't sure) that dinosaurs and humans lived at the same time?

Editorials and commentaries in several science and education publications strongly assert that the scientific community has to pay more attention to the education of non-scientists and the preparation of science teachers. In response to its charge, the ad hoc ASB Education Committee has moved quickly to organize a one-hour's Education Forum for the April meeting (Wednesday, 6:00–7:00 P.M.). Speakers will briefly discuss biological education in our elementary and secondary schools and some specific steps that we can take to become actively involved in improving the teaching and learning of biology.

Attend the Forum just before going to the first ASB social gathering. If the Forum is not next door, it will be nearby.

ASB MEMBERSHIP DIRECTORY

This year, everyone will receive a separate Membership Directory. This was a major item of interest in the survey conducted by the Publication Committee, so we have tried to respond with a directory modeled after other national organizations. If it evokes favorable responses, future directories will be revised and published as a regular service to the membership. Let the Executive Committee hear from you.

Preparation of an accurate and complete directory is a complex task, so please help us correct the errors in the names and addresses for the next one. Also, please check for a complete address and remember to provide your telephone number.

NEWS

50th. ANNUAL MEETING in CHARLOTTE, NORTH CAROLINA

The University of North Carolina at Charlotte will host the 50th annual meeting of the Association of Southeastern Biologists on 5-8 April, 1989 at the Hilton at University Place in Charlotte, North Carolina, about two miles from the University campus. Registration, paper and poster sessions, exhibits, placement services, and the general session will be at the Hilton. Also scheduled are a social hour on Wednesday at the Hilton, a buffet supper on Thursday evening uptown at Discovery Place Science Museum, and the traditional Friday evening banquet at the Hilton.

SOCIETIES MEETING WITH ASB IN CHARLOTTE

American Society of Ichthyologists and Herpetologists, SE Div.

Beta Beta Beta

Botanical Society of America, Southeastern Section

Ecological Society of America, Southeastern Chapter

Society of Wetlands Scientists, South Atlantic Chapter

Southeastern Fishes Council

Southeastern Society of Parasitologists

Southern Appalachian Botanical Club

CHARLOTTE, UNIVERSITY PLACE AND THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Please join us for the **50th Annual Meeting** of ASB. **Charlotte** is located in the western Piedmont region of North Carolina, less than three hours from the high mountains of the Blue Ridge and Southern Appalachians. The area is rich in historical sites, including the Reed Gold Mine where the first gold in America was discovered.

The new **Hilton at University Place** will serve as headquarters for the ASB meeting. This modern hotel offers excellent convention facilities including 240 guest rooms, various dining facilities and meeting rooms; and is located within an intriguing community of shops, restaurants and entertainment facilities surrounding a lake. PLEASE plan to stay at the Hilton if possible and be in the center of activity. *ASB has had to guarantee sufficient rooms to offset the cost of the meeting facilities.* All room rates at the Hilton are per room, not per person, and so sharing is a possibility.

University Place is the centerpiece - the heart - of University City, a growing commercial, educational, medical and residential community located in the northeast section of booming Charlotte & Mecklenburg County. As a focal point, University Place has brought together the favorable characteristics of a major research park, a dynamic university, an excellent road system, a wealth of recreational and shopping opportunities, a growing workforce and a strong base for residential development.

Since its inception in 1966, **The University of North Carolina at Charlotte** has been the fastest-growing campus in the 16-campus state university system. Now the fourth largest in the system, UNC Charlotte has over 12,000 students and 1,400 staff. It is also gaining a national reputation for excellence, having been ranked the South's third best comprehensive university in a recent survey of college presidents. The activities of the University's six colleges, with 33 undergraduate and 15 advanced degrees, link the worlds of learning, commerce and industry that are of particular value to University City.

The **Department of Biology** of UNC Charlotte has a faculty of 18 with 10 support personnel. Bachelor's and Master's degrees are offered with emphasis in the areas of botany, development, ecology, genetics, medical technology, microbiology, molecular biology, physiology, and zoology. Specialized facilities include state-of-the-art research laboratories, an electron microscope, modern greenhouses and ecological preserves.

DISCOVERY PLACE SCIENCE MUSEUM

Discovery Place will be the site for the Thursday evening supper consisting of a sumptuous international buffet with wine. It is a modern, hands-on science museum with a rain forest, a marine aquarium with touching pools, and exhibits on all aspects of science, health and technology. In co-operation with Discovery Place, the rental cost of the museum has been covered with a contribution from the UNC Charlotte Office of Academic Affairs; and much of the cost of the buffet has been provided as a gift to members of ASB by Dr. and Mrs. Thomas M. McMillan, of Honolulu, who are patrons of the University and benefactors of the McMillan Academic Greenhouse on campus.

BIO-DIVERSITY WORKSHOP

Perspectives in Biological Diversity in the Southeast - Tuesday and Wednesday, 4-5 April co-sponsored by the U.S. Forest Service and the Southeastern Chapter of the **Ecological Society of America**. The workshop, held at the Hilton, will precede ASB. Registration is apart from ASB, but is being handled by Gwen Hester of Continuing Education. Contact her for Workshop information (see registration form).

PRE-REGISTRATION AND REGISTRATION

A PRE-REGISTRATION FORM form is provided with this copy of the bulletin. Your pre-registration will enable us to plan facility needs and services to be expected at the ASB meeting. Pre-registration packets and late registration will be at the Hilton at University Place on Wednesday from 12:00 noon to 10:00 P.M. and on Thursday and Friday (see general schedule). **PRE-REGISTRATION is necessary to ensure the most effective planning for field trips, special meals, and social events.** Late tickets for special events may not be available at the registration desk.

Please bring your April, 1989 ASB Bulletin, containing the detailed program and abstracts, to the meeting. Copies will be sold at the registration desk for \$3.00 each.

This year, registration for members of **Beta Beta Beta** is included on the same form as regular ASB registration. Details of the schedule for Tri-Beta will be available.

TRAVEL TO CHARLOTTE

Automobile: UNC Charlotte and University Place are on the northeast side of Charlotte, about 1/2 mile south off Interstate 85, at the W.T. Harris Blvd. exit. The main routes to the area are Interstate 85 from the northeast and southwest, and Interstate 77 from the north and south.

Air service: Charlotte is served by seven major airlines through Douglas International Airport. However, **Piedmont Airlines** has been designated as the **official carrier** for the attendees of the Association of Southeastern Biologists meeting, 5-8 April, 1989. A special fare is available offering a **35% discount** off the standard round trip day coach fare for travel within the Continental United States. These special convention discounts are valid between 2-11 April, 1989.

SPECIAL AIRFARE INSTRUCTIONS

To obtain this discount, **you or your travel agent** must call Piedmont's Meeting and Convention Sales office at 1-800-334-8644, Monday through Friday, 8:30 AM - 6:00 PM, Eastern Time. **REFER TO GOLD FILE 296009.**

Shuttle: There is no regular shuttle service from Douglas Airport; you must use taxi (fare is about \$22 to the University area). **However, there will be a special shuttle available for ASB attendees staying at the Hilton.** The shuttle will run on Wednesday, 5 April at 10 AM and 12, 2, 4, and 6 PM to the Hilton only. *You must call and make a shuttle reservation:* phone or write travel co-ordinator Jim Travis at (704) 547-4052 (Biology Dept., UNCC, Charlotte, NC, 28223). The shuttle will also be available for return on Saturday, 8 April, by reservation only, at 7 & 10 AM and 12 PM.

Parking: Ample parking facilities are provided by the Hilton at University Place. No special permits are required. Parking for visitors on the UNC Charlotte campus will be at parking meters or in designated paid visitor lots.

ACCOMMODATIONS

Rooms will be available at the Hilton at University Place, which is offering special convention rates. Please note that all rooms are on a per room basis, not per person.

Please make reservations directly with the Hilton using the enclosed reservation card. To receive the special room rates be sure to identify yourself as an ASB participant.

The Hilton at University Place
Meeting Headquarters
8629 J.M. Keynes Drive
Charlotte, NC 28213

All rooms: \$65.00 per night

(704) 547-7444

There are several other motels at the Sugar Creek Road exit off I-85, five miles west of the Hilton. Please check with them directly for reservations and rates.

Days Inn
1408 W. Sugar Creek Rd.
(704) 597-8110

Luxbury Hotel
I-85 at Sugar Creek
(704) 596-9229

Econo-Lodge
I-85 at Sugar Creek Rd.
(704) 597-0470

Red Roof Inn
I-85 at Sugar Creek Rd.
(704) 596-8222

Fairfield Inn
5414 N. I-85
(704) 596-2999

Super-8 Motel
5125 N. I-85
(704) 598-8820

Holiday Inn
5301 N. I-85
(704) 596-9390

Residence Inn (an all suite hotel near
the Hilton) 8503 North 29
(704) 547-1122

GENERAL SCHEDULE

ALL EVENTS AT THE HILTON AT UNIVERSITY PLACE
EXCEPT WHERE NOTED

WEDNESDAY: APRIL 5

Registration: 12:00 - 10:00 PM

Field Trip: 1:00-5:00 PM, See description of Field Trips and Pre-registration form.

ASB Executive Committee Meeting: 2:00-6:00PM

Continuation of ASB Executive Committee Meeting (if needed): 8:00-10:00

ASB Education Forum: 6:00-7:00PM

SABC Council Meeting: 4:00-6:00 PM

SE Society of Parasitologists Executive Meeting: 5:30-6:30 PM

Symposium - Teaching Update:

"Seed Germination Biology: Overview and Update,"

Presented by *Dr. Jerry M. Baskin and Dr. Carol C. Baskin*

Sponsored by the SE Section-Botanical Society of America: 6:30-8:00 PM

Symposium - Southeastern Society of Parasitologists: 7:00-9:00 PM

ASB Social Hour: (Cash Bar) 7:00-10:00PM

THURSDAY: 6 APRIL

Past Presidents' Breakfast: 7:00-8:00 AM

Registration: 8:00 AM-5:00 PM

Exhibits: Glenwaters Room, 8:00 AM-6:00 PM

General Plenary Session: 8:30-9:45 AM

Welcome by *Dr. E.K. Fretwell, Jr.*, Chancellor of UNC Charlotte

Announcements by the Local Committee

Featured Address by *Dr. Jon Ahlquist*, Ohio University

General Title: "DNA-DNA Hybridization Studies Relating to Phylogeny"

Paper and Poster Sessions, Placement Service: 8:00 AM-5:00 PM

Symposia - "Biotic Communities of the Southeast: Aquatic and Terrestrial" Southeastern Section, Ecological Society of America

Luncheon Meetings:

Society of Wetland Scientists, 12:15-1:15 PM

Southeastern Society of Parasitologists, 12:30-2:00 PM

Business Meeting:

American Society of Ichthyologists and Herpetologists, Southeastern Division, 4:00-5:00 PM

Herbarium Curators' Workshop: McMillan Greenhouse on UNCC

Campus, 4:00-6:00 PM

ASB Reception and Buffet Supper at Discovery Place Science Museum in uptown Charlotte, 6:30PM

FRIDAY: 7 APRIL

Registration: 8:00 AM-12:00 PM

Breakfast and Business Meeting: Southern Appalachian Botanical Club and Southeastern Section, Botanical Society of America, 7:00-8:30 AM

Exhibits: 8:00 AM-12 NOON

Paper and Poster Sessions, Placement Service: 8:00 AM-5:00 PM

Business Meeting:

Tri-Beta, 11:00 AM-12:00 PM

Southeastern Society of Parasitologists, 11:00 AM-12:00 PM

Association of Southeastern Biologists, Business Meeting and election of officers: 11:30AM-12:30PM

Luncheon/Business Meeting:

Southeastern Chapter, Ecological Society of America, 12:30-2:00 PM

Social Hour (Cash Bar): Glenwaters Room, 5:30-7:00 PM

ASB Banquet: Hilton Lakeshore Ballroom, 7:00PM

SATURDAY: 8 APRIL

ASB Executive Meeting and Breakfast: 8:00AM

Field Trips: Begin at 7:00 or 8:00 AM, Departures from the Hilton

POINTS OF INTEREST IN THE CHARLOTTE AREA

- CAROLINA RAPTOR CENTER** - A non-profit educational organization devoted to the rescue and rehabilitation of injured and orphaned birds of prey, including eagles, owls, hawks, falcons and vultures. Open weekends from noon to 5 p.m. Admission is free. Located about 15 miles north of Charlotte. Call (704) 875-6521.
- CAROWINDS THEME PARK** - Just southwest of Charlotte at I-77 and Carowinds Blvd., the park has shows, rides and shops within its 77 acres. Great family entertainment. Weekends. (704) 588-2600.
- CHARLOTTE NATURE MUSEUM** - In southeast Charlotte, the Nature Museum provides a treehouse exhibit, Sea Life room, Live Animal rooms, Owl's Nest learning center, nature trails, Dragonfly Puppet Theatre and Kelly Planetarium. Open Daily. Call (704) 372-6261.
- DAVIDSON COLLEGE ARBORETUM** - The campus of this distinguished institution has been designated an arboretum with labeled trees, some over 100 years old. Self-guided brochure available. Located 19 miles north of Charlotte off I-77. Call Biology Dept. at (704) 892-2000 x 324.
- DISCOVERY PLACE SCIENCE MUSEUM** - The largest science and technology museum in the Carolinas provides a "hands-on" approach to learning by doing. The 72,000 sq. ft. museum features the Knight Rain Forest (for birds and plants); a touch pool and colorful aquarium; and exhibits on energy, physics, chemistry and life. (704) 372-6261.
- HEZEKIAH ALEXANDER HOMESITE** - Located at 3500 Shamrock Dr. in Charlotte, this historic home was built by an early patriot in 1774. The site includes a reconstructed spring house, log kitchen, herb garden and animal barn. Tours and a visitor center. Call (704) 568-1774.
- MINT MUSEUM OF ART** - Originally the site of a U.S. Mint, the museum houses exhibits ranging from American and European paintings, pottery, porcelain and pre-Columbian and African art. (704) 337-2000.
- NORTH CAROLINA ZOO** - Located about 60 miles east of Charlotte near Asheboro, it is one of the newest, largest, and most innovative zoos in the country. Large outdoor habitat settings display animals from around the world. Domed tropical bird house. (919) 879-5606.
- REED GOLD MINE STATE HISTORIC SITE** - About 20 miles east of Charlotte on Route 2 in Stanfield, this was the first gold mine in the U.S. Visitors may pan for gold, view the underground tunnel, see exhibits on history of gold and walk along interesting nature trails. (704) 786-8337

UNCC BOTANICAL GARDENS - On the campus, features the Van Landingham Glen, a garden of native plants and hybrid rhododendrons; the Susie Hardwood Garden, for exotic ornamentals; and the McMillan Greenhouse, with outstanding collections of orchids, succulents, carnivorous plants and a new rain forest conservatory. (704) 547-4055.

FIELD TRIPS

Transportation provided for all tours. Departures from the main entrance of the Hilton. Tour # 1 is on Wednesday afternoon, all others on Saturday. You will be able to purchase lunch during the Saturday field trips.

1. **MAGUIRE NUCLEAR PLANT (1-5 PM, Wednesday, 5 April):**
Duke Power Company will provide a tour of an operating nuclear power plant. **In order to receive security clearance for the visit, participants must register by February 22.** (\$3.00/person).
2. **CAROLINA BIOLOGICAL SUPPLY COMPANY (7 AM -3 PM, Saturday, 8 April):** Tour of the "Sears and Roebuck of Science." Carolina Biological sells more than 20,000 different items, from human brains to bacterial strains (over 100 kinds). Tour leaves promptly at 7:00 AM. (\$5.00/person).
3. **CHIMNEY ROCK PARK (8 AM-6 PM, Saturday, 8 April):**
Scenic granitic cliffs of Hickory Nut Gorge, with 130 m (400 ft) free-falling Hickory Nut Falls. Unusually cool microclimate on north-facing slope (elevation only 730 m, 2280 ft) harbors species of more northern and arctic plant communities. Easy access to numerous plant species not often encountered in other areas. Led by Elisabeth Feil, park naturalist. (\$10.00/person). Overnight accommodations are available at Chimney Rock Field Station for \$4.00 per person, paid to the Park. Make arrangements during trip or call (704) 625-9611. Collecting permitted.
4. **40-ACRE ROCK NATURE PRESERVE (8 AM-5 PM, Saturday, 8 April):** Granite outcrops with shallow pockets of soil harbor characteristic ephemeral plant species and communities. Rich diversity of woody and herbaceous Piedmont flora including unusual pteridophytes. Led by John Nelson, South Carolina Heritage Trust. (\$5.00/person). Collecting NOT permitted.
5. **WEYMOUTH WOODS NATURE PRESERVE (8 AM-6 PM, Saturday, 8 April):** Sand Hills region with "desert-in-the-rain" effect of rapid soil drainage is characterized by xeric longleaf pine-turkey oak-wire grass community which is being managed with controlled burns. Several colonies of rare red-cockaded woodpeckers are found here. Led by Alan Weakley, North Carolina Heritage Program. (\$5.00/person).

LOCAL ARRANGEMENTS COMMITTEE

CHAIRMAN:	James F. Matthews	(704) 547-4061
PROGRAM:	T. Lawrence Mellichamp	547-4055
PRINTING:	Edward F. Menhinick	547-4046
	Julian P. Smith	547-4066
PRE-REGISTRATION & REGISTRATION:	Patricia Weathers	547-2424
	Gwen Hester	547-4452
AUDIO-VISUALS:	Thomas L. Reynolds	547-4058
	Charlie Lewis	547-4067
	Sandra Zane	547-4051
EXHIBITS & EXHIBITORS:	Mary Beth Thomas	547-4050
	Susan E. Peters	547-4062
	David P. Bashor	547-2316
FIELD TRIPS:	Lawrence S. Barden	547-4059
SOCIAL ACTIVITIES:	Deborah M. Langsam	547-4054
	Stanley S. Schneider	547-4053
POSTER SESSION:	Jay Stoerker	547-4048
	James D. Oliver	547-4049
SIGNS:	Nancy C. Edwards	547-4045
	John A. Watts	547-4064
ACCOMMODATIONS & TRANSPORTATION:	James C. Travis	547-4052
	Philip E. Hildreth	547-4170
HOST INSTITUTION:	University of North Carolina at Charlotte Department of Biology Larry Leamy, Chairman Charlotte, NC 28223	547-2316
MEETING HEADQUARTERS:	The Hilton at University Place 8629 J.M. Keynes Drive Charlotte, NC 28213	547-7444

ASB PRE-REGISTRATION FORM- 1989

(Type or print; one form per registrant; duplicate as needed)

Name _____

Department _____ School _____

Mailing address _____

City _____ State _____ Zip _____ Phone(____) _____

Pre-Registration deadline will be March 27

Please check affiliation ASIH____, BSA____, ESA____, SWS____, SFC____, SSP____, SABC____

Regular \$18.00 _____ Student \$10.00 _____ Tri-Beta \$4.00 _____

(Registration at the meeting will be: Reg. \$30.00; Student \$15.00; Tri-Beta \$5.00)

ASB Social Hour & Banquet (Friday)

Regular.....	\$18.00	_____
Student & Tri-Beta	\$10.00	_____
Buffet Supper at Discovery Place (Thursday)	\$ 5.00	_____
<i>(subsidized by sponsors)</i>		

BREAKFASTS

ASB Past Presidents.....	\$ 9.00	_____
Southern Appalachian Botanical Club/ SE Section, Botanical Society of America.....	\$ 9.00	_____

LUNCHEONS

Ecological Society of America.....	\$11.00	_____
Society of Parasitologists.....	\$11.00	_____
Society of Wetland Scientists	\$11.00	_____

FIELD TRIPS

Please pre-register by entering fee

No. 1	Wednesday	Maguire Nuclear Plant	\$ 3.00	_____
[For Trip #1, must register by Feb. 22]				
No. 2	Saturday	Carolina Biological Supply.....	\$ 5.00	_____
No. 3	Saturday	Chimney Rock Park.....	\$10.00	_____
No. 4	Saturday	40-Acre Rock.....	\$ 5.00	_____
No. 5	Saturday	Weymouth Woods	\$ 5.00	_____
Contribution to ASB Enrichment Fund				_____

TOTAL AMOUNT ENCLOSED.... \$ _____

Make checks payable to UNC Charlotte - mail by March 25 to:

**Gwen Hester
Office of Continuing Education
UNC Charlotte
Charlotte, NC 28223**

ASSOCIATION AFFAIRS

GUIDELINES FOR POSTER SESSIONS

Poster sessions have been incorporated as a regular means of scientific presentation at the annual ASB meetings. This type of presentation provides a more informal environment that encourages a direct interchange of ideas and discussion between presenter and audience. Adherence to the following guidelines will help ensure the effectiveness of the poster sessions.

Poster sessions will be held in the Hilton Hotel at University Place in an area adjacent to the registration desk and exhibits. Consult program for time and location. Posters will be organized by subject matter and numbered sequentially in accord with abstract listings in the ASB Bulletin. All posters will be on display for a half day, although authors or co-authors are required to be with their posters only during a specified session. Thumb tacks and tape will be provided. Backing paper or other special display materials should be supplied by each presenter.

Posters should be carefully planned to maximize clarity and simplicity in conveying information. Poster boards of approximately 4' by 4' will be available for each paper. Arrange for a heading including title, author(s) and institution to be placed at the top in letters no less than 3 cm high. The body of the poster should include figures, tables, graphs, maps, or photographs displayed in a well-organized and coherent sequence from top to bottom. Do not crowd the display. All materials including text legends, and captions on figures or tables should be legible from a distance of about 2 m. Each illustration should be captioned. A limited degree of text (letters at least 1 cm high) can be included, but care should be taken not to overwhelm the audience. Authors may choose to post a large typeset copy of the abstract at the top of the poster and include a clear listing of specific conclusions at the bottom.

NOTICE OF RESEARCH AWARDS FOR 1989

ASB Faculty and Student Research Awards (\$500 each). Rules are as follows: (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting; in order to qualify for presenting the paper, the author(s) must submit an abstract by the December 1 deadline. Papers submitted for the competition must be received in triplicate and in their entirety by March 1 and must be journal-ready manuscripts worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission. (b) Only ASB members are eligible (this applies to all authors). (c) Papers may be in press but not published prior to the previous annual meeting. (d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Faculty and Student Research Award Committees, the award may be withheld or it may be split in case of a tie. (f) Winners will be announced

at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. Send to (faculty): Dr. James Fralish, Dept. Forestry, Southern Illinois Univ., Carbondale, IL 62901 (618/453-3341); Student: Dr. Ken P. Marion, Dept. Biology, University of Alabama, Birmingham, AL 35294 (205/934-3582).

The Eugene P. Odum Award—\$100 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points: (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) The title and abstract of the paper must be submitted to the Award Coordinator by 1 February. This can be a copy of the abstract submitted to ASB 1 December. Submit to: Dr. Courtney T. Hackney, Dept. Biology, Univ. North Carolina—Wilmington, Wilmington, NC 28403 (919/791-4330).

The North Carolina Botanical Garden Award—\$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is given for an especially meritorious paper presented in the areas of plant systematics, evolution, or conservation. The paper will be evaluated by a panel of judges at the time of presentation, on the following points: (a) significance of ideas, (b) creativity, (c) quality of methodology, (d) validity of results, and (e) clarity of presentation. The actual prize will be presented at the ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award.
- (b) The paper must deal with the systematics, evolution, species biology (including population biology), or conservation of vascular plants that are native or naturalized to the southeastern United States.
- (c) The paper must be presented in a regular Plant Systematics contributed-paper session; papers presented in poster sessions or in symposia are not eligible.
- (d) The title and abstract of the paper must be submitted to the Award Coordinator by February 1989. This may be a copy of the abstract submitted to ASB 1 December. Individuals interested in entering a paper for this

award should submit the title and abstract to: Dr. Larry Mellichamp, Department of Biology, University of North Carolina, Charlotte, NC 28213.

“TRAVEL” SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB—*DEADLINE: 1 February*. Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be members of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

1. Give information as to whether you submitted a title and abstract for a paper or poster.
2. Give a conservative, itemized estimate of meeting expenses excluding transportation.
3. In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications which have appeared or are in preparation, degree sought, name of major professor, and any other pertinent professional details.
4. Give your source(s) of support while in graduate school; *e.g.* NSF, NIH, USDA, Teaching Asst., Research Asst., etc.
5. Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.
6. Send application, with supporting letter, *all in triplicate*, to: Dr. Dan R. Varney, Dept. Biology, Eastern Kentucky University, Richmond, KY 40475 (606/622-2310).
7. Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

REVIEWS

Mitchell, Lawrence G., John A. Mutchmor, and Warren D. Dolphin. 1988. **Zoology.** The Benjamin/Cummings Publ. Co., Inc., CA. \$48.50. 862 p.

This multiauthored textbook covers a broad spectrum of topics in zoology ranging from cell structure and function to a brief description of the modern science of biotechnology. The book is written as an introductory animal biology text for undergraduate majors in biology.

A brief introductory chapter covers definitions used in zoology and a description of the scientific process as well as an overview of the major phyla. The book is then subdivided into four units: "Functional Systems of Animals," "Reproduction and Evolution," "The Animal Kingdom" and "Ecology."

The first unit includes a basic review of molecular and cellular structure and function useful as the authors state "in courses that do not have a biology course prerequisite." The body of this unit very adequately covers functional morphology with numerous examples that range from protozoa to humans. The last chapter in this unit does an admirable job of introducing students to the science of ethology. Classical studies by Pavlov and Tinbergen are described and the chapter culminates with the controversial views of modern sociobiology.

The second unit focuses on "long-term survival of the species." Earlier chapters made reference to survival of the fittest and natural selection, yet Darwinian evolution is not introduced until the last chapter of this unit. This would appear awkward except for a system of cross-references used throughout the text which allows the student to quickly locate additional information when needed. The unit presents general patterns of reproduction and development in the animal kingdom. It also introduces students to genetics and the molecular basis of life.

The third unit includes a more detailed examination of major groups. One of the objectives of this unit is to present a comprehensive survey of diversity among protozoa and animals. Each major phylum is described with respect to known representative species, distinguishing characteristics, general biology as well as evolutionary and ecological relationships. Minor groups are also included, *e.g.* a newly discovered phylum of meiofaunal loriciferans.

The fourth and last unit includes two chapters on ecological principles and descriptions of various ecosystems. A final section on human impact is disappointing because of its brevity and negative tone.

Overall, the authors maintain the reader's interest throughout the text. High quality photographs are used and a large proportion of these are in color. Most of the photographs depict animals in natural environments or activities, *e.g.* a blue crab in the process of ecdysis. Numerous drawings and graphs with detailed captions are used in all chapters and these aid in the understanding of complex concepts, systems and life histories. The use of photographs in conjunction with labelled illustrations is a very effective way of conveying information about animals. Short commentaries precede key chapters to "highlight the major events and milestones" in zoology and these help to maintain an evolutionary perspective. The use of boxed essays throughout most of the text present the current state of knowledge on numerous topics of interest to students, *e.g.*, how life began on earth, the function of prostaglandins and life in ocean vents.

The authors succeed in writing a very interesting and useful textbook. Although the sequence in which topics are presented may not satisfy every animal biology instructor, *Zoology* will be a valuable textbook.

ILEANA E. CLAVIJO. *Department of Biological Sciences, University of North Carolina, Wilmington, NC 28403.*

Mauseth, J. D. 1988. **Plant Anatomy.** The Benjamin/Cummings Publ. Co., Menlo Park, CA. \$39.95. 560 p.

In a discipline that has been dominated by one or two texts for over 30 years, a new English language textbook is a noteworthy event. This new book dealing with the anatomy of vascular plants is functional in approach rather than purely descriptive or comparative, and is intended as a comprehensive text and reference manual for graduate and undergraduate students. A full range of topics are covered and

an impressive amount of new information is synthesized. For the most part, topics are examined in an even manner and in adequate depth. Pertinent references are provided for those desiring more extensive treatments of particular subjects.

The book is organized in a logical and rather conventional manner, beginning with subcellular anatomy and continuing, in order, through simple tissues, complex tissues, the primary vegetative body, the secondary body, and tissues and organs of sexual reproduction. The concept of "simple" and "complex" plant tissues was utilized by Eames and MacDaniels in their well known text of 1947, but has generally not been followed in more recent anatomical literature. The revival of these terms by Mauseth is of interest. The sequence of specific chapters also follows a fairly traditional sequence, starting with cell and tissue types followed by discussions of the stem, leaf, root, and secondary growth, and ending with the flower, seed, and fruit. A separate chapter dealing with anomalous secondary growth is a welcomed part of the book. An appendix presents a very complete and valuable glossary of terms. The definitions are accurate and useful. Undoubtedly one of the strongest points of the book is the extensive and very up-to-date bibliography. No attempt is made to thoroughly review the older classical literature, and thus the subject is often not given a historical overview. Direct literature citations are presented and the vast majority of the original papers cited are post 1960, including up to 1988.

The book is well written and the author is quite successful in integrating concepts of structure and function of both vegetative and reproductive organs. Considerable detail of the research results of contemporary workers is included. The author does not shy away from presenting his own speculations on many important and timely topics.

The book makes extensive use of both photographs and line drawings. It is pleasing to see that the species selected for illustration are both diverse and world wide in distribution. An indication of the familial affiliation of illustrated taxa would have been informative. Unfortunately, the book is marred by numerous unsatisfactory illustrations. The photographs are not of uniformly high quality with many lacking detail and contrast. Furthermore, many photographs are carelessly arranged so that the subject is oriented at an angle across the page. A more effective grouping of illustrations could have been employed. A greater concern is seen in Figure 5.15, representing the presumed evolution of imperforate treachery elements. The diagram depicts that cells have increased in length during the course of evolution of libriform fibers from tracheids, when in fact cell length has decreased.

Aside from these criticisms, this is an excellent volume that should prove to be a significant addition to the anatomical literature. The author is to be congratulated on presenting an excellent up-to-date coverage of the current understanding of interrelationships of plant structure with physiology and ecology. I feel confident that students as well as professional botanists will find this book of great value.

WILLIAM C. DICKISON, *Department of Biology, University of North Carolina, Chapel Hill, NC 27599.*

Tootill, Elizabeth. 1988. **The Facts on File Dictionary of Biology**, Rev. Ed. Facts on File Publications, NY. \$19.95. 326 p.

If someone suggested that you should compile an encyclopedia or dictionary to terms used in biology, which 800, 2,000 or 3,000 would you choose? This must have been the dilemma faced by Abercrombie *et al.* (1967), Gray (1971), and recently by Elizabeth Tootill, a former research botanist, who has compiled such a list in *The Facts on File Dictionary of Biology*. While Tootill's volume, enhanced by 40 line drawings, contains 3,000 words and their definitions, as used in botany, zoology, genetics, medicine, or geology, and is aimed at the laboratory technician, student, physician, nurse, and animal breeder, the words included seem to have been chosen pell-mell. That is, botanical and zoological terms dominate but why are chemical or geological terms included (*i.e.* acetic acid, ACTH, carbolic acid, ester, galactose, marl, etc.) in a book on *biology*? What was the value of including Molish's (alpha-naphthol test, among others) without referring to many other types of tests? Why include abyssal and not hadal (perhaps that term is in the marine biology dictionary)? Other examples of imbalance are: zoogeography defined but no reference to vicariance, annulus for plants but ignore use of the term as an area on fish scales, cite *Astacus* but not *Cambarus* or other important decapod genera, *i.e.* *Callinectes*, single out the shark genus *Scyliorhinus* and ignore the more specious *Carcharhinus* sharks, cite glomerulus but not aglomerulus (kidney, as in oyster toadfish and pipefishes), mention continental drift but not plate tectonics, refer to ganoid and placoid but not cycloid or ctenoid scales, define nekton but exclude seston? Further, why cite terms to various parts of sharks and omit the important **Ampullae**

of Lorenzini or pterygiophores in fishes. Why aren't plesiomorphic, apomorphic, synapomorphy, or monophyletic, paraphyletic, polyphyletic, diplospondylosus versus monospondylosus defined. A chimaera is also a term for a fish as well as a plant. Paedomorphosis should have been included if one lists paedogenesis.

Some may have preferred the botanical or zoological terms grouped but that would have used up more space and necessitated more search time, if one didn't know where the term was used. One haunting question remains unanswered. Why was this dictionary really produced, if as the overleaf cites, there exists dictionaries in this published series to botany, geology and geophysics, marine biology, and chemistry?

Thus, as one can see, to produce a 3,000 word dictionary to biological terms that will please everyone in this day and age (where new names, usages, and disciplines proliferate at an alarming rate) is just as formidable a task as it was for Gray or Abercrombie *et al.* to produce their 800 and 2,000 word compilations of terms to the biological sciences, in an age and era when usages and names were not so great. We could go on and on debating why one word or discipline was included or emphasized to the exclusion of another. More importantly, Tootill has taken that bold step that all of us are reluctant to take, for we prefer to sit back and hope someone else will do the work for us. The ground-work has been laid, all of us should now build on this compilation as it applies to our interests, disciplines, and needs.

LITERATURE CITED

- Abercrombie, M., C. J. Hickman, and M. L. Johnson. 1967. *A Dictionary of Biology*. Aldine Publ. Co., Chicago. 254 p.
- Gray, Peter. 1970. *The Encyclopedia of the Biological Sciences*. 2nd ed. Van Nostrand Reinhold Co., NY. 1027 p.
- FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

Alabama

Tuskegee University, Department of Biology. The University Howard Hughes Medical Institute has received a five-year \$900,000 grant. The grant is to be used to develop a recruitment plan to attract high ability and talented high school seniors, who will enroll in the freshman year at the end of the summer, to the University. The major emphasis will be on modern biological fields such as molecular biology and biotechnology. A new position, the HHMI distinguished Professor of Molecular Science, will be established to enhance this program. Anyone interested in this position is urged to apply. The program begins with the Fall semester of 1988–89, and the first students will enroll during the summer of 1989.

Florida

The University of Florida, Department of Botany. Dr. William Louis Stern has recently been elected Treasurer of the Society for Economic Botany.

Georgia

Agnes Scott College, Department of Biology. The department has been awarded an NSF grant of \$32,545 for instrumentation and laboratory improvement in molecular and cellular biology. The proposal was submitted by Drs. Patricia M. White, Sandra T. Bowden, and Harry Wistrand.

Kentucky

Western Kentucky University, Department of Biology. Dr. Robert D. Hoyt has recently had his bibliography of the Early Life History of Fishes published by WKU. The two volume 980 page reference covers the literature of fishes of the world in respect to hatching and larval development. Dr. Valgene Dunham, Head of the Department, was the co-author and editor of the recent CRC Press publication, "DNA Replication in Plants." Dr. Dunham's co-author is Dr. John A. Bryant, Professor and Head of the Department of Biological Sciences at the University of Exeter, Exeter, England. Dr. Kenneth A. Nicely, Professor, was awarded a sabbatical leave for the Fall semester of 1988 for extensive research into plant families of Kentucky's flora and computerization of the WKU Herbarium. Dr. Herbert (Cotton) Shadowen retired from the department in the Spring of 1988. He continues his association on a part-time basis as director and developer of the new Center for Natural History. The Center has more than 2,500 square feet, and is being developed in historic Snell Hall to serve environmental education needs of the region. Total endowment funds donated specifically to the department by alumni, faculty, staff, and friends now exceed \$85,000 and will be used to support undergraduate biology majors. *Georgetown College, Department of Biology.* Mr. Richard K. Clements has joined the department as an instructor in biology, botany, and plant taxonomy. Mr. Clements came from the University of Tennessee, Knoxville. His research interest is in vascular plant taxonomy and floristics. He has recently completed a field survey of exotic plants in the Great Smokey Mountains National Park with Drs. Ed Clebsch and Eugene Wofford at The University of Tennessee.

Louisiana

Louisiana State University, Baton Rouge, Department of Botany. Dr. Meredith Blackwell has been promoted to Full Professor and Dr. James Grace, an Associate Professor, has received tenure. Dr. Russell Chapman, Professor of Botany, and Dr. Elizabeth A. Zimmer (Adjunct Assistant Professor of Botany) have received three-year funding (\$185,000) from the Systematics Program of NSF for their study of ribosomal genes and Chlorophyte phylogeny. Dr. Shirley C. Tucker (Boyd Professor of Botany) received a \$90,000 award from the Systematics Program of NSF for her comparative floral ontogenetic studies in legumes. Dr. Marsh Sundberg has been awarded two NSF grants totalling \$70,828 for "Research Experience for Undergraduates in Biological Science at LSU." and "Young Scholars in Basic Sciences at LSU." Ms. Elly von Eeckhout has received a \$48,000 award from Ciba-Geigy for the study of effects of propiconazol on pathogenetic fungi. She is a Ph.D. student working in the laboratory of Dr. Meredith Blackwell. Dr. Russell L. Chapman has been appointed Chairman of the Department of Botany and follows Dr. Thomas S. Moore, Jr. who completed two terms as Chairman, and one term as Acting-Chairman of the Department of Microbiology. Dr. Mark A. Buchheim has joined the department as a Postdoctoral Investigator, and will be involved in a *Chlamydomonas* species ribosomal RNA sequencing project.

Loyola University, Department of Biological Sciences. Dr. David A. White has been appointed chair of the Department. Dr. James L. Wee, from Loyola University in Chicago, has been hired as an aquatic plant biologist with research interests in molecular and morphological approaches to the evolution of chromophyte algae. This past year Dr. Craig S. Hood received a two-year NSF-RUI grant to study the evolution of fruit bat feeding mechanisms. Dr. Donald Hauber was promoted to the associate level, and was an invited speaker at the workshop on "Quantitative Cytogenetic Analysis of Polyploids" held during the XVIIth International Congress of Genetics in Toronto. Dr. Roland Lesseps, S.J., has returned from a sabbatical in Zambia, where he introduced and tested the performance of several new crops, while studying the suitability of some agro-forestry procedures in that semi-arid region of the tropics.

Mississippi

Gulf Coast Research Laboratory, Ocean Springs. Students from 20 institutions in 10 states were enrolled in the marine science program this past summer. Laboratory fisheries personnel transferred approximately 82,000 striped bass fingerlings to the Claude Petet Mariculture Center in Gulf Shores, Alabama in mid-June as part of the sixth year of the Mississippi-Alabama Cooperative Striped Bass Program. Sponsored jointly by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, this year's effort began on 4 May as 500,000 three-day-old striped bass fry were transported from the Alabama State Fish Hatchery to the Laboratory's semi-closed intensive culture facility in Ocean Springs. Within 45 days the fish grew to an average length of 1½ to 2 inches and were ready for the move to the brackish water ponds at Gulf Shores. In the fall, the 4 to 6 inch striped bass will be tagged and released into Mississippi and Alabama coastal streams, according to Larry Nicholson, the striped bass project leader.

Mississippi University for Women, Division of Science and Mathematics. Dr. Bill Parker was granted a one semester sabbatical during the Fall of 1988. He will return to his teaching duties in the Spring of 1989.

The University of Mississippi, Department of Biology. The following Assistant Professors have been added to the faculty: Dr. Timothy G. Forrest (Ph.D. Univ. of Florida, Developmental morphology, ecology and systematics of amphibians and reptiles, ecology of wetlands); Dr. Gary L. Miller (Ph.D. Mississippi State Univ., Community ecology of fishes, behavioral and evolutionary ecology of arthropods); Dr. Glenn R. Parsons (Ph.D. Univ. of South Florida, Fish physiology, ecological physiology, reproductive biology of fishes); Dr. W. David Dawson (Ph.D. Univ. of Texas, San Antonio, Development and regulation of membrane transport systems, electrophysiology, cell biology, and membrane biochemistry). Dr. Harold L. Drake has received an NIH grant for \$52,380, titled: "Acetogenic Autotrophy and Metabolism of Nickel." Dr. Paul K. Lago has been promoted to the rank of Professor of Biology.

Mississippi State University, Department of Biological Sciences. Dr. Randal K. Buddington (Ph.D. University of California, Davis) has joined the faculty as an Associate Professor. His research interests are comparative and regulatory physiology. Dr. William E. Gardiner (Ph.D. University of South Florida) is also a new Assistant Professor in the department. Dr. Gardiner's research interest is

molecular biology in the expression of plant and plant viral genes. *Dr. Janice Chambers* and *Dr. Howard Chambers* (Entomology) have received second year NIH funding, \$77,899, for a grant entitled, "Phosphorothionate Insecticide Activation by Rat Brain." *Dr. Dwayne Wise* has also received an NIH grant to fund "Microinjection of Insect Spermatocytes." *Dr. Wise* presented an invited workshop paper on non-random chromosome segregation at the International Congress of Genetics. *Dr. John C. Mickelson* retired in June 1988. *Dr. Michael Sullivan* has been promoted to the rank of Professor.

North Carolina

North Carolina State University, Department of Zoology. Two new faculty have joined the department. *Dr. Craig Sullivan*, a fish endocrinologist and *Dr. Thomas Losordo*, a specialist in water quality. The U.S. Fish and Wildlife Service has established a Combined Fish and Wildlife Research Unit in the department. This new unit is an expansion of the existing Cooperative Fisheries Unit under the direction of *Dr. Melvin Huish*.

Duke University, Department of Botany. The Botanical Society of America selected *Dr. Aubrey W. Naylor* to receive the Merit Award at their annual meeting at the University of California on 17 August 1988. The Merit Award is the highest honor awarded by the Society. *Dr. Naylor* has been a distinguished plant physiologist, author and botanical statesman for 50 years. His research expertise is the mechanisms of action of plant growth regulators, and of amino acid and nucleic acid metabolism.

East Carolina University, Department of Biology. New faculty include: *Dr. Will Ambrose*, Ph.D. University of North Carolina at Chapel Hill, Marine Invertebrate Zoology/Ecology; *Dr. Ed Baptist*, Ph.D. Massachusetts Institute of Technology, Eukaryotic Molecular Genetics; *Dr. Roger Rulifson*, Ph.D. North Carolina State University, Marine Fisheries; *Dr. Charles Singhas*, Ph.D. University of Virginia, Reproductive Biology/Endocrinology; *Dr. Don Stanley*, Ph.D. North Carolina State University, Estuarine Ecology; *Dr. Jane Stirling*, Ph.D. University of Newcastle on the Tyne, England, Plant Genetics/Tissue Culture; *Dr. Terry West*, Ph.D. Duke University, Marine Invertebrate Zoology. The following individuals have received new grant proposal funding: *W. E. Allen*, Internships in Biotechnology, \$66,342; *R. Christian*, Estuarine Nitrogen Loading, \$112,926; *R. Rulifson*, and *D. Stanley*, Striped Bass Investigations, \$120,158; *R. Rulifson*, Nursery Area Assessment, \$89,162; *D. Stanley*, Pamlico River Water Quality, \$75,000, Estuarine Nitrogen Cycling, \$60,000; *G. Davis*, Distribution of Aquatic Vegetation, \$35,987.

University of North Carolina at Greensboro, Department of Biology. *Dr. Robert E. Gatten, Jr.* was appointed Head of the Department. He succeeds *Dr. William K. Bates*, who served as Head for nine years, and returns to fulltime teaching and research. *Dr. Laura G. Anderton* retired in May 1987, after being associated with this institution for 39 years, first as Dean of Academic Advising and, for the past several decades, as Professor in the Department. *Dr. Steven M. Anderson* presented a paper at the XVIth International Congress of Genetics in Toronto, Canada. *Dr. Bruce K. Kirchoff* received an NSF three-year grant in 1988 for \$160,000 to study flower development and evolution in the Zingiberales. *Dr. Elizabeth P. Lacey* received a three-year NSH grant for \$225,000 to study maternal and paternal effects in *Plantago lanceolata*, the ribwort plantain. *Dr. Julian Lombardi* received a three year NSF grant for \$190,000 to study the relationship between mother and fetus in viviparous sharks. *Dr. Lombardi* presented a paper at the Dahlem Konferenzen in Berlin in August 1988. *Dr. Robert H. Stavn* was on research leave during 1986-87 at the University of Southern California, and the Naval Ocean Research and Development Activity, Bay St. Louis, MS. *Dr. Stavn* has recently received several research grants totalling \$80,000 from the Office of Naval Research to support theoretical and applied development in the optics of the oceans.

Highlands Biological Station, Highlands. The Biological Station has received a grant-in-aid from NSF which is providing for renovation and better winterization of the Coker Laboratory, development of a freshwater stream laboratory, and expansion and automation of the collection of climatological data. The Station is encouraging greater use of the laboratory facilities by visiting researchers during the academic year, as well as in the summer months. Grants-in-aid and research scholarships will be available in 1989 for both graduate students and postdoctoral investigators. Course offerings and instructors in the summer of 1989 include "Physiography and Phytoecology of the Southern Appalachians," *Dan Pittillo*, *Gary White*, and *Peter White*, 12-23 June; "Systematics and Ecology of Caddisflies, Mayflies, and Stoneflies," *John Morse*, 26 June-7 July; and "Biology of Plethodontid Salamanders," *Stephen Tilley*, 10 July-4 August 1989. For further information on research opportunities, and the summer course program, write Highlands Biological Station, P.O. Box 580, Highlands, NC 28741.

South Carolina

Furman University, Department of Biology. Dr. C. Leland Rodgers and Dr. Robert W. Kelly retired 1 September 1988. New faculty are Dr. Edward Otto, Dr. Joseph Pollard, and Dr. Wade Worthen. The department received an NSF grant of \$82,510 for physiology and \$45,216 for molecular genetics equipment. Dr. Lewis Stratton is on a full year sabbatical to work at the Office of Naval Research in Washington, D.C.

Clemson University, Department of Biological Sciences. Dr. Steven R. Hill has joined the department as the new Curator of the Herbarium, replacing Ms. Caroline Douglass Aldrich. Dr. Hill was formerly the curator of the Norton-Brown Herbarium of the University of Maryland 1979-84. His field of research expertise is the Malvaceae (Cotton Family) as well as floristics, systematics, and economic botany. Current research is on the genus *Gaya* and the marl forests of coastal South Carolina.

College of Charleston, Department of Biology. The Institute of Marine Biology, U.S.S.R. Academy of Sciences, Vladivostok, U.S.S.R. has invited Dr. Phillip Dustan to participate in an international expedition to the Indian Ocean, to study the ecology and photophysiology of reef corals. The expedition will be based on the Russian oceanographic ship R/V Nesmyanov, and will last approximately 90 days starting in January 1989. The majority of the research will occur in Madagascar.

Tennessee

Austin Peay State University, Department of Biology. The University's Center for Field Biology of Land Between the Lakes will conduct the Second Annual Symposium on "The Natural History of the Lower Tennessee and Cumberland River Valleys" 3-4 March 1989, at Brandon Spring Group Camp-LBL. Several leading authorities on the vegetation and flora of Tennessee will summarize their many years of research during the invited paper session on 3 March. Those individuals who wish to present a paper to the session on 4 March should submit a title and abstract by 20 January 1989. For more information or reservations (lodging and meals \$25.00 per day) write: Dr. Benjamin P. Stone, Director, Center for Field Biology of LBL, Austin Peay State University, Clarksville, TN 37044 (615-648-7781).

The University of Tennessee at Martin, Department of Biological Sciences. Dr. G. K. Sharma presented a paper entitled "Cuticular and Morphological Dynamics in *Salix nigra* L. and *Quercus alba* L. in Relation to Environmental Pollution" at the 15th International Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, Interlaken, Switzerland, 3 October 1988.

West Virginia

West Virginia University, Department of Biology. E. C. Keller, Jr. was named to the taskforce on "Science Education for Physically and Sensory Disabled Students," by the Advisory Board for Special Education of the National Science Teachers Association. Karen Katula received a \$350,000 First Award from NIH for the study of "Regulation of Actin Gene Expression in the Sea Urchin." She also received a \$30,000 NSF Instrumentation Grant for "Acquisition of an Ultracentrifuge." E. C. Keller, Jr. received a \$162,000 NSF grant to teach marine science to middle school hearing impaired students.

ABOUT MUSEUMS AND BOTANICAL GARDENS

Kentucky

Museum of History and Science, Louisville. During the first 25 days of the IMAX film "The Dream is Alive," total viewing attendance was 40,054. This attendance surpasses even the previous records broken by the animated dinosaur exhibit. Additional shows have been added on some days to accommodate the demand. According to a national survey conducted by the Association of Science Technology Centers, science centers are the most popular cultural attractions in the country.

Mississippi

The Crosby Arboretum, Picayune. Members of the Arboretum recently visited the National Wildflower Research Center near Austin, Texas. Former first lady Mrs. Lady Bird Johnson, treated members to refreshments at the LBJ Ranch, and gave them a personal tour of her own wildflower plantings.

Deadline: 1 February

TRAVEL AWARD APPLICATION FORM

Name _____

Department _____

University _____

City/State/Zip _____

Check one: Member of ASB or Dues enclosed

Check one: Paper presentation or Poster presentation

Title of paper _____

I request support for lodging for _____ nights. One-way travel time to ASB is anticipated to be _____ hours and will require _____ days of travel.

I request support for:

	Lodging	Meals	
Wednesday	_____	_____	Travel
Thursday	_____	_____	Meeting Dates
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Saturday	_____	_____	Field Trip Dates/Travel
Sunday	_____	_____	Travel
Total # of Days	_____	_____	
Cost per Day	\$_____	\$_____	
Total Amount Requested	\$_____	+ \$_____	= \$_____

Mail to: Dr. Dan R. Varney
Biology Department
Eastern Kentucky University
Richmond, KY 40475

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APPLICATION FOR ASB MEMBERSHIP

Give copies of this to your students, colleagues, and your school librarian.

Fill out blanks and enclose check or money order for one year's dues and mail to Dr. R. L. Beckmann, Dept. of Botany, N.C. State Univ., Raleigh, N.C. 27695-7612. **Please include phone number on application** _____.

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Title _____ Department _____

Institution _____

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The *ASB BULLETIN*

Volume 36, Number 2

April 1989

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The Association of Southeastern Biologists*

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Jim Ross, Dept. Biology, Cumberland College, Williamsburg, KY 40769

The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1989 April 5-8 University of North Carolina-Charlotte, NC

1990 April 19-21 Towson State University, Towson, MD

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THIS PUBLICATION IS PRINTED ON ACID-FREE PAPER.

Program of the
50th. ANNUAL MEETING of the
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

SOCIETIES MEETING WITH ASB IN CHARLOTTE

American Society of Ichthyologists and Herpetologists, SE Div.

Beta Beta Beta, Southeastern Region

Botanical Society of America, Southeastern Section

Ecological Society of America, Southeastern Chapter

Society of Wetlands Scientists, South Atlantic Chapter

Southeastern Fishes Council

Southeastern Society of Parasitologists

Southern Appalachian Botanical Club



MEETING HEADQUARTERS
THE HILTON AT UNIVERSITY PLACE



Canoe race on Hechenbleikner Lake, UNCC Campus



Bell tower carillon, UNCC Campus



Susie Harwood Ornamental Garden, UNCC Botanical Gardens



Main entrance and Administration buildings, UNCC Campus



McEniry Biology Building UNCC Campus

GENERAL INFORMATION

Registration - Registration for the 50th annual meeting of the Association of Southeastern Biologists, purchase of tickets for the banquet, buffet, breakfasts, luncheons and field trips have been arranged through pre-registration with the Local Arrangements Committee. Pre-registrants may obtain their information packet and tickets on the lower level of the Hilton at the **ASB Registration Desk**. The desk will be open from 12 noon to 10:00 P.M. on Wednesday, April 5; from 8:00 A.M. to 5:00 P.M. on Thursday, April 6; and from 8:00 A.M. to 12 noon on Friday, April 7. Late Registration will be possible at these times, but tickets for special events may not be available. Late registration fees are \$30 for regular members, \$15 for students, and \$5 for members of Tri-Beta. See the January 1989 issue of the ASB Bulletin for **pre-registration** information. Please bring your April 1989 ASB Bulletin to the meeting as free copies will not be available. Extra copies may be purchased at the ASB registration desk for \$3.00 each. Maps of the Charlotte area and the UNCC Campus will be available.

Parking - ASB participants may park free at the Hilton. No special permits are required. There will be no shuttle service from other area motels. For visitors to the UNCC Campus, please park in areas designated as (paid) visitor parking.

Job Placement Service - Message boards will be available at the Hilton in the Glenwaters Room for job notices and other communications.

Dining and Lounge Facilities - Meals and cocktails are available at the Hilton. Several eating facilities, ranging from fast food to elegant, are found within the immediate vicinity of the Hilton within the shopping center known as **University Place**. There are also many interesting shops located there. Information will be available at the registration desk.

Social Activities and Special Events - Check your registration packet for tickets to the events for which you have pre-registered. Consult the program schedule for time and place of the various events, meetings, and meals. A limited number of tickets for these may be available at the registration desk for those who did not pre-register.

Wednesday Evening Social - At the Hilton, lower level, **Salon I**.

Thursday Evening buffet - This special event will be in uptown Charlotte at Discovery Place science museum. Transportation will be free, by chartered buses.

ASB Banquet - This will be Friday evening at the Hilton.

Field Trips - All field trips will depart from the Hilton and you must pre-register .

Useful Telephone Numbers (Area Code 704) -

Jim Matthews (local arrangements)	547-4061	Hilton (reservations)	547-7444
Larry Mellichamp (program)	547-4055	Carolyn Blalock (registration)	547-4861

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS



April, 1989

Dear ASB Member:

Welcome to Charlotte and the 50th meeting of the Association of Southeastern Biologists! We know that you are looking forward to seeing old friends, meeting new ones, and learning about their activities this past year. We have tried to put together an interesting and appealing program for everyone. Plan to join us for the social and business events of ASB in addition to the affiliate meetings, symposia, paper sessions, and field trips of this special year.

Be sure to stop by the ASB booth to say hello and let us know how ASB can improve its service to you and the region. Have a good time and enjoy the return of springtime in the South!

Rebecca R. Sharitz
Past-President

William H. Martin
President

Joe E. Winstead
President-Elect

Frank P. Day
Vice-President

C. Ross Hinkle
Secretary

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Editor, ASB Bulletin

Madeline P. Burbanck
Archivist

James F. Matthews
Chair, 1989 Local Arrangements

T. Lawrence Mellichamp
Chair, 1989 Program

SPECIAL PRE-ASB WORKSHOP

PERSPECTIVES ON BIOLOGICAL DIVERSITY IN THE SOUTHEAST

The Hilton at University Place, Charlotte, NC

April 4-5, 1989

Sponsors: U.S. Forest Service, Southeastern Chapter of the Ecological Society of America, Association of Southeastern Biologists

Objectives: To gain a better understanding of biodiversity, improve communication between academics and land managers, and identify opportunities to conserve biological diversity through management.

Focus: Identifying, measuring, and managing genetic, species, community, and landscape diversity.

Format: Small working groups will discuss these issues. A keynote address will be given by Dr. Larry Harris, author of *The Fragmented Forest*.

For information, contact: Margaret Devall, USDA Forest Service, 701 Loyola Avenue, Room T-10210, New Orleans, LA, 70113. Telephone (504) 589-4552.

To Register, contact: Carolyn Blalock, Office of Continuing Education, UNCC, Charlotte, NC 28223. (704) 547-4861. **Cost:** available on request

Accommodations: Special rates: \$65 per room per night at the Hilton. (704)547-7444

April 4

PROGRAM

- 8:00 What is Biological Diversity and Why Is It Important? - **Art Cooper**, NC State University
- 8:45 Legal and Institutional Frameworks for Managing Biodiversity - **Hal Salwasser**, US Forest Service
- 9:15 Measuring Biodiversity - **Norm Christensen** and **Lynn Maguire**, Duke University
- 10:15 Processes Influencing Biodiversity - **Peter White**, UNC Chapel Hill
- 10:45 Landscape Diversity - **Reed Noss**, EPA
- 11:15 Community Diversity - **Alan Weakley**, NC Natural Heritage
- 11:45 Lunch
- 1:15 Species Diversity - **Joan Walker**, US Forest Service
- 1:45 Genetic Diversity - **Gene Namkoong**, US Forest Service
- 2:15 Charge to Working Groups
- 3:00 **Working Group Meetings** - Landscape, Community, Species and Genetic Diversity

April 5

- 8:00 Case Study - Landscape Diversity - **Reed Noss**, EPA
- 8:30 Case Study - Community Diversity - **Dorothy Allard**, The Nature Conservancy
- 9:00 Case Study - Species Diversity - **Rob Sutter**, NC Plant Conservation Program
- 9:30 Case Study - Genetic Diversity - **Peter Stangel**, Savannah River Ecology Lab
- 10:30 **Working Group Meetings** - Landscape, Community, Species and Genetic Diversity
- 12:30 Lunch
- 2:00 Summaries from Working Group Meetings
- 4:00 Major Address - Managing Biodiversity - **Larry Harris**, University of Florida

PROGRAM SUMMARY

All Events at the Hilton Except Where Noted

TUESDAY-WEDNESDAY APRIL 4-5, 1989

8:00 A.M. - 5:00 P.M. BIODIVERSITY WORKSHOP

WEDNESDAY APRIL 5, 1989

12:00 P.M. - 10:00 P.M. REGISTRATION, Hilton Lower Level
1:00 P.M. - 5:00 P.M. Field Trip: Maguire Nuclear Plant
2:00 P.M. - 6:00 P.M. ASB Executive Committee Meeting, Walden Room
4:00 P.M. - 6:00 P.M. SABC Council Meeting, Welwyn Room
5:30 P.M. - 6:30 P.M. SE Soc Parasitologists Executive Meeting, Keynes Room
6:00 P.M. - 7:00 P.M. **ASB Education Forum.** "Biological Literacy" Salon II
6:30 P.M. - 8:00 P.M. **Symposium:** Teaching Update: "Seed Germination
Biology: Overview and Update" by Dr. Jerry Baskin &
Dr. Carol Baskin. SE Sec. Botanical Society, Salon III
7:00 P.M. - 9:00 P.M. **Symposium:** SE Soc. Parasitologists, Salon IV
7:00 P.M. - 10:00 P.M. ASB Social: Cash Bar, Salon I

THURSDAY APRIL 6, 1989

7:00 A.M. - 8:00 A.M. Past Presidents' Breakfast. Olmsted Room
8:00 A.M. - 5:00 P.M. LATE REGISTRATION, Hilton Lower Level
8:00 A.M. - 5:00 P.M. **Exhibits,** Glenwaters Room
8:30 A.M. - 9:45 A.M. **General Plenary Session, Salons I & II**
Welcome by **Dr. E.K. Fretwell, Jr.**, Chancellor of
The University of North Carolina at Charlotte
Response by **Dr. William H. Martin**, ASB President
Featured Address: **Dr. Jon Ahlquist**, Ohio University,
"DNA-DNA Hybridization Studies Relating to Phylogeny."

POSTER SESSION: Keynes Room

10:00 A.M. - 5:00 P.M. Posters available for viewing (through 12:00 P.M. Friday)
4:00 P.M. - 5:00 P.M. Presenters with Posters

MORNING PAPER SESSIONS

10:15 A.M. - 12:15 P.M. **Symposium:** "Terrestrial Communities of the
Southeastern United States," Salon II. Sponsored by
the SE Chapter of the Ecological Society of America.

- 10:00 A.M. - 11:45 A.M. Animal Ecology, Session 1, Burnham Room
 10:00 A.M. - 11:30 A.M. Cryptogamic Botany, Welwyn Room
 10:00 A.M. - 12:30 P.M. Ichthyology, Session 1, Salon III
 10:00 A.M. - 12:00 P.M. Parasitology, Session 1, Salon IV
 10:00 A.M. - 12:00 P.M. Plant Ecology (Wetlands), Session 1, Salon I
 10:00 A.M. - 11:15 A.M. Plant Systematics, Session 1, Olmsted Room

BUSINESS AND LUNCHEON MEETINGS

- 12:15 P.M. - 1:15 P.M. **Luncheon:** Society of Wetland Scientists, Walden Room
 12:30 P.M. - 2:00 P.M. **Luncheon:** SE Society of Parasitologists. Slugs at University Place (a short walk from the Hilton).
 4:00 P.M. - 5:00 P.M. **Business Meeting:** American Soc. Ichthyologists and Herpetologists, Southeastern Division, Salon III

AFTERNOON PAPER SESSIONS

- 1:30 P.M. - 4:00 P.M. **Symposium:** "Aquatic Communities of the Southeastern United States." Salon II. Sponsored by the SE Chapter of the Ecological Society of America.
 1:30 P.M. - 5:15 P.M. Cell, Development, Genetics and Microbiology, Burnham Room
 1:30 P.M. - 5:00 P.M. Herpetology, Salon III
 2:15 P.M. - 5:15 P.M. Parasitology, Session 2, Salon IV
 1:30 P.M. - 5:00 P.M. Plant Ecology, Session 2, Salon I
 2:15 P.M. - 4:30 P.M. Plant Systematics, Session 2, Walden Room
 2:00 P.M. - 2:30 P.M. Teaching, Welwyn Room

SPECIAL MEETINGS

- 4:00 P.M. - 6:00 P.M. **Joint Meeting:** SE Herbarium Curators Forum and Carolina Collections Colloquium. Topic: "Computer Programs for the Capture and Use of Herbarium Specimen Data in the Southeast." McMillan Greenhouse Conservatory, UNC-Charlotte Campus.

SPECIAL EVENT

- 7:00 P.M. - 10:00 P.M. **ASB Reception and International Buffet Supper at Discovery Place Science Museum in uptown Charlotte.** First buses will leave from the Hilton at 5:30; second set will leave Hilton at 6:30. Travel is 1/2 hour one way. Return buses will leave Discovery Place starting at 9:00 P.M. with the last buses leaving at 10:00 P.M.

FRIDAY APRIL 7, 1989

- 7:00 A.M. - 8:30 A.M. **Breakfast and Business Meeting:**
Southern Appalachian Botanical Club
and SE Sec., Botanical Soc. of Am. Salon II
- 8:00 A.M. - 12:00 P.M. LATE REGISTRATION, Hilton Lower Level
- 8:00 A.M. - 12:00 P.M. **Exhibits, Glenwaters Room**
- 8:00 A.M. - 12:00 P.M. Posters, Keynes Room

MORNING PAPER SESSIONS

- 8:30 A.M. - 11:15 A.M. Animal Ecology, Session 2, Burnham Room
- 8:30 A.M. - 11:30 A.M. Animal and Plant Physiology, Welwyn Room
- 8:30 A.M. - 11:30 A.M. Ichthyology, Session 2, Salon III
- 9:00 A.M. - 11:15 A.M. Parasitology, Session 3, Walden Room
- 8:45 A.M. - 11:30 A.M. Plant Ecology, Session 3, Salon I
- 8:45 A.M. - 11:15 A.M. Plant Ecology, Session 4, Olmsted Room

BUSINESS AND LUNCHEON MEETINGS

- 10:30 A.M. - 11:30 A.M. **Business:** Tri-Beta, Salon IV
- 11:00 A.M. - 12:00 P.M. **Business:** SE Soc. Parasitologists, Walden Room
- 11:30 A.M. - 12:30 P.M. **ASB Business Meeting and Election
of Officers, Salon IV**
- 12:30 P.M. - 2:00 P.M. **Luncheon/Business:** Southeastern Chapter
Ecological Society of America, Salon II
- 4:00 P.M. - 5:15 P.M. **Business:** SE Fishes Council, Olmsted Room

AFTERNOON PAPER SESSIONS

- 2:00 P.M. - 5:30 P.M. Aquatic Ecology, Walden Room
- 1:30 P.M. - 5:00 P.M. Ichthyology, Session 3, Salon III
- 1:30 P.M. - 4:00 P.M. Invertebrate Zoology, Burnham Room
- 2:15 P.M. - 5:30 P.M. Plant Ecology, Session 5, Salon I
- 3:00 P.M. - 4:45 P.M. Plant Systematics, Session 3, Salon II
- 2:00 P.M. - 5:00 P.M. Tri Beta, District 1, Salon IV
- 2:00 P.M. - 5:00 P.M. Tri-Beta, District 2, Welwyn Room

SPECIAL EVENTS

- 6:00 P.M. - 7:30 P.M. **Social Hour** (Cash Bar): Glenwaters Room
- 7:30 P.M. **ASB Banquet:** Hilton, Salons I - IV

SATURDAY APRIL 8, 1989

- 7:00 A.M. or 8:00 A.M. Field Trips depart from the Hilton
- 8:00 A.M. ASB Executive Committee, Keynes Room

ASB PAPER, POSTER, AND SYMPOSIUM SESSIONS

WEDNESDAY EVENING, APRIL 5

**ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
EDUCATION FORUM**
Hilton, Salon II

IMPROVING BIOLOGICAL LITERACY FOR THE 21ST CENTURY

An increasing need for "**Biological Literacy**" is evident in the questions raised by growing numbers of people. Organized groups are addressing public issues such as **BIO-DIVERSITY, ABORTION, ANIMAL RIGHTS, AIDS, ACID RAIN, GENETIC ENGINEERING, GROUND WATER POLLUTION, RESTRICTIONS ON RESEARCH, and THE CREDIBILITY OF SCIENCE.** This is a problem which affects all Biologists. The **Education Forum** will try to address this and identify directions for action by ASB and its members.

Presiding: *Dr. Franklin Flint*, Randolph-Macon Woman's College and
Chairman, ASB *Ad Hoc* Education Committee.

- 6:00 **Introductory Remarks**
- 6:05 **Herr, Lucrecia.** (Spring Valley High School, Columbia, SC). The crisis in science education and the realities of science teaching in the classroom.
- 6:20 **Helms, Doris.** (Associate Dean of Science, Clemson University). Teachers, textbooks and teaching: impacts on biological literacy.
- 6:35 **Golley, Frank B.** (Research Professor of Ecology, University of Georgia). Linking science research with the classroom.
- 6:50 **Discussion** (will extend beyond the time limits of the forum).

SYMPOSIUM: Teaching Update **SEED GERMINATION BIOLOGY**

Sponsored by the SE Section, Botanical Society of America
Organized by Dr. Eloise Carter
Hilton, Salon III

Presiding: *Dr. Eloise Brown Carter*, Oxford College

- 6:30 1. **Baskin, Jerry M. and Carol C. Baskin.** (University of Kentucky).
Seed germination biology: overview and update.



DR. JON E. AHLQUIST

DNA HYBRIDIZATION
AND PHYLOGENETIC
RECONSTRUCTIONS

Jon Edward Ahlquist, a native of Ashtabula, Ohio, received the B.S. degree in biology from Cornell University. Graduate work in biology at Yale University gained both the M.S. and Ph.D. in biology. Upon completion of graduate work at Yale in 1974, he stayed on at Yale in various positions in vertebrate zoology and ornithology at the Peabody Museum before moving to Ohio University in 1986 as Associate Professor of zoology and biomedical sciences. At Ohio University he has established a DNA hybridization laboratory and he currently serves as an Associate Professor of Molecular Evolution, Molecular and Cellular Biology Program. With Dr. Charles G. Sibley of San Francisco State University and Professor Emeritus, Yale University, he has published over 40 papers dealing with vertebrate phylogeny and in April of 1988 Drs. Sibley and Ahlquist were jointly awarded the Daniel Giraud Elliot Medal for outstanding work in zoology by the National Academy of Sciences. Dr. Ahlquist was also a co-recipient of the Edwards Prize given by the Wilson Ornithological Society in 1983. A most recent publication with Charles Sibley and Burt Monroe, Jr., appears in the July 1988 (Vol. 105) issue of *AUK* entitled "A classification of the living birds of the world based on DNA-DNA hybridization studies." Currently, his laboratory is also involved in molecular evolutionary studies of both Lepidoptera and plants. An avid photographer of birds, Dr. Ahlquist is also renowned as an artist specializing in painting of birds.

The rapid development of recombinant DNA technology fueling the biotechnology industry also provides new techniques and methods to help further integrate molecular, cellular, organismal, and ecological studies. Dr. Ahlquist's presentation will provide insights relating to all areas of biology and coming developments in the profession.

SYMPOSIUM PATHOGENIC PROTOZOA IN WATER

Southeastern Society of Parasitologists

Hilton, Salon I

Presiding: *Dr. Mark Sobsey*, University of North Carolina, Chapel Hill

- 7:00 2. **Noblet, Gayle Pittman and Dennis E. Kyle.** (Clemson University and Walter Reed Army Institute of Research). Vertical distribution of protozoans in aquatic systems.
- 7:30 3. **Newsome, Anthony L.** (Emory University). Protozoa and bacteria interactions.
- 8:00 4. **Sobsey, Mark D. and Jon Anderson.** (University of North Carolina, Chapel Hill). *Giardia lamblia* and *Cryptosporidium parvum* contamination of drinking water.

THURSDAY MORNING, APRIL 6

POSTER SESSION

POSTERS AVAILABLE FOR VIEWING 10:00 A.M. - 5 P.M.
PRESENTERS WITH POSTERS 4:00 - 5:00 P.M.

Keynes Room

- 4:00 5. **Curran, Ann P. and John G. Morris.** (Florida Institute of Technology). The relationships between manatee abundance and distribution and boat traffic densities in four areas of Brevard County, Florida.
- 4:00 6. **Hernandez, J. David and Michael H. Smith.** (University of Georgia and Savannah River Ecology Lab). Patterns of genetic variation in eastern mosquitofish (*Gambusia holbrooki* Girard) from the piedmont and coastal plain of three drainages.
- 4:00 7. **Hunsinger, Ronald N. and W. Mike Howell.** (Samford University). The use of acetone to stabilize steroids for direct treatment of fishes in aquaria water.
- 4:00 8. **Lu, Chung-Cheng and Judith F. Thomas.** (North Carolina State University). *In vitro* floral morphogenesis in a day-neutral and an isogenic short-day line of *Nicotiana tabacum* L.
- 4:00 9. **Menhinick, Edward F.** (University of North Carolina, Charlotte). Production of scientific publications.
- 4:00 10. **Mettee, M.F., P.E. O'Neil, J.M. Pierson and R.D. Suttkus.** (Geological survey of Alabama, Alabama Power Company, and Tulane University Museum of Natural History). Fishes of the western Mobile basin in Alabama and Mississippi.

- 4:00 11. **Morris, John G., Ann C. Spellman and Kathryn A. Hicks.** (Florida Institute of Technology). Manatee demography in the winter refugium at Homosassa Springs, Florida: A five year study.
- 4:00 12. **Price, Wayne and Amparo Benitez.** (University of Tampa). Infestation and epidemiology of head lice in elementary schools in Hillsborough County, Florida.
- 4:00 13. **Thomas, Mary Beth and Sandra F. Zane.** (University of North Carolina, Charlotte). The origin of the manubrium of the hydroid *Eudendrium* sp.
- 4:00 14. **Wallace, James W. and Triloki N. Bhardwaja.** (Western Carolina University and University of Rajasthan). Flavonoids of aquatic and terrestrial forms of *Marsilea minuta*.
- 4:00 15. **Watson, Mark B., H. Wayne Elmore and Alan R. White.** (Marshall University and North Dakota State University). Characterization and linkage analysis of bracken fern extracellular polysaccharides.
- 4:00 16. **White, Patricia McGuire and Sandra T. Bowden.** (Agnes Scott College). The use of rapid tests in the screening of physiological and genetic characteristics of soil bacteria.
- 4:00 17. **Zavos, P.M., R.J. Grove, D.R. Varney, M.R. Siegel and R.W. Hemken.** University of Kentucky and Eastern Kentucky University). Effects of feeding endophyte-infected tall fescue seed on reproductive performance of female CD-1 mice via competitive breeding.
- 4:00 18. **Zavos, P.M., D.R. Varney, R.W. Hemken and M.R. Siegel.** (University of Kentucky and Eastern Kentucky University). Effects of feeding endophyte-infected tall fescue seed on the reproductive performance using a highly inbred and a crossbred mouse model.
- 4:00 19. **Stewart, T. Bonner, William C. Henk and Laura E. Younger.** (Louisiana State University). Scanning electron micrographs of perioral structures of swine nematodes.

SYMPOSIUM

Terrestrial Communities of the Southeastern United States

Sponsored by the Southeastern Chapter of the
Ecological Society of America
Organized by Dr. Ross Hinkle

Salon II

Presiding: *Dr. Paul Schmalzer*, Bionetics Corporation.

- 10:15 20. **Frost, Cecil C.** (University of North Carolina, Chapel Hill). Presettlement extent of upland fire communities of the southeastern Coastal Plain.

- 10:45 21. **Ware, Stewart.** (College of William and Mary). Potential upland forests of the southern mixed hardwood forest region.
- 11:15 22. **Bryant, William S.** (Thomas More College). Oak-hickory forests of the Southeast.
- 11:45 23. **Gilmore, R. Grant and Samuel C. Snedaker.** (Harbor Branch Oceanographic Institution and University of Miami). Mangrove forests.

ANIMAL ECOLOGY, Session 1 - Burnham Room

- Presiding: *Dr. Stanley S. Schneider*, University of North Carolina, Charlotte
- 10:00 24. **Ritchie, Lisa and W.D. Cocking.** (James Madison University). Effects of soil mercury concentrations on bioaccumulation by earthworms.
- 10:15 25. **Middendorf, G. and L. Wyatt.** (Howard University). Of chiggers and lizards: the importance of mite pockets.
- 10:30 26. **Schneider, Stanley S.** (University of North Carolina, Charlotte). Absconding behavior in the African honey bee.
- 10:45 27. **McNally, Linda C. and Stanley S. Schneider.** (University of North Carolina, Charlotte). The mechanisms of aggression in honeybee colonies.
- 11:00 28. **McGregor, Joanne H.** (Furman University). Orientation through olfactory discrimination in *Ambystoma maculatum*.
- 11:15 29. **Jackson, Mary E., David E. Scott and Ruth A. Estes.** (Memphis State University and Savannah River Ecology Lab). Determinants of nest success in the marbled salamander, *Ambystoma opacum*.
- 11:30 30. **Reichling, Steven B. and Raymond D. Semlitsch.** (Memphis State University). Density-dependent injury in larval salamanders.

CRYPTOGAMIC BOTANY - Welwyn Room

- Presiding: *Dr. Kenneth D. McFarland*, University of Tennessee.
- 10:00 31. **McGuire, Robert F.** (University of Montevallo). A numerical taxonomic analysis of selected heterocystous, unbranched, filamentous Cyanobacteria.
- 10:15 32. **Affronti, Lewis F. and Harold G. Marshall.** (Old Dominion University) A comparison between Utermohl and epifluorescence enumeration technique for picoplankton.
- 10:30 33. **David, Paul, David K. Smith and Kenneth D. McFarland.** (University of Tennessee). The discovery of antheridia in *Takakia*.
- 10:45 34. **Bowers, Frank D. and Alvin Diamond.** (University of Wisconsin-Stevens Point and Troy State University). The bryophyte flora of two limestone caves in Conecuh County, Alabama.

- 11:00 35. **Powell, Martha J. and Will H. Blackwell.** (Miami University). Phylogenetic reconstruction of Oomycetes using cladistic analysis of ultrastructural characters.
- 11:15 36. **Nussbaum, Francis.** (Kent State University). Dynamics of *Cladosporium* and other airborne fungal spore populations.

ICHTHYOLOGY, Session 1 - Salon III

Presiding: *Dr. Robert C. Cashner*, University of New Orleans

- 10:00 37. **Maurakis, Eugene G. and William S. Woolcott.** (University of Richmond). Were they accurate? Comparison between journal accounts and video recordings of reproductive behaviors of selected cyprinids.
- 10:15 38. **Schwartz, Frank J.** (University of Marine Sciences, University of North Carolina). Feeding behavior of the cownose ray, *Rhinoptera bonasus* (family Myliobatidae).
- 10:30 39. **Schwartz, Frank J. and William T. Barham.** (Institute of Marine Sciences, University of North Carolina and University of Zululand, South Africa). Gill filament responses and modifications during spawning by mouth brooders and pit spawning Tilapia.
- 10:45 40. **Ferguson, Mark T.** (University of Alabama). Crevice spawning behavior of *Cyprinella trichroistia*, *C. gibbsi* and *C. callistia*.
- 11:00 41. **Bellerud, Blane L.** (Mississippi State University). Habitat preference and behavior of the speckled dace, *Rhinichthys osculus*.
- 11:15 Break
- 11:30 42. **Kuhajda, Bernard R. and Melvin L. Warren, Jr.** (University of Alabama and Southern Illinois University, Carbondale). Life history aspects of the harlequin darter, *Etheostoma histrio*, in western Kentucky.
- 11:45 43. **Jennings, Dawn P. and James D. Williams.** (US Fish and Wildlife Service National Fisheries Research Center). Factors influencing the distribution of blackchin tilapia (*Sarotherodon melanotheron*) in the Indian River system, Florida.
- 12:00 44. **Poarch, Steven M. and James B. Layzer.** (Tennessee Technological University). Distribution and movements of striped bass in Old Hickory Reservoir, Cumberland River, Tennessee.
- 12:15 45. **Johnston, Carl.** (Illinois Natural History Survey). Spawning activities of *Notropis chlorocephalus*, *N. chiliticus* and *Hybopsis hypsinotus*, three nest associates of *Nocomis leptocephalus* in the southeastern United States.

PARASITOLOGY, Session 1 - Salon IV
Parasite Ecology, Systematics and Behavior

- 10:00 46. **Patton, Sharon.** (University of Tennessee College of Veterinary Medicine). *Toxoplasma* and the AIDS connection.
- 10:15 47. **Strawbridge-Johnson, S.L., Sharon Patten and M.D. McCracken.** (University of Tennessee College of Veterinary Medicine). Prevalence and pathology of *Dirofilaria immitis* in cats in Tennessee.
- 10:30 48. **Butts, J. A., E. B. Harris, R.E. Aldridge and I.G. Gillman.** (Appalachian State University) Prevalence of *Dirofilaria immitis* in northwestern North Carolina.
- 10:45 49. **Edwards, Robert W., Jennifer Scoville and Frances M. Woznick.** (University of North Carolina at Chapel Hill). Intestinal parasitic infections in migrant farmworker children in eastern North Carolina.
- 11:00 BREAK
- 11:15 50. **Frandsen, John C. and Byron L. Blagburn.** (USDA , ARS, Animal Parasite Research Laboratory, Auburn Alabama, and Auburn University). Dynamics of natural coccidial infections in a goat herd in Alabama.
- 11:30 51. **Snyder, Daniel E.** (USDA, ARS, Animal Parasite Research Lab, Auburn, Alabama). New information on the location of *Capillaria procyonis* (Nematoda: Trichuroidea) in the tongue of a raccoon (*Procyon lotor*).
- 11:45 52. **Blagburn, Bryon L., Mark V. Darlington and Frederic J. Hoerr.** (Auburn University). Taxonomy of avian *Cryptosporidium* species: problems and solutions.

PLANT ECOLOGY (Wetlands), Session 1 - Salon I

Presiding: *Dr. Cliff Hupp*, US Geological Survey

- 10:00 53. **Hupp, Cliff R. and Edward E. Morris.** (U.S. Geological Survey). Dendrogeomorphic approach to sedimentation in a forested wetland, Black Swamp, Arkansas.
- 10:15 54. **Bailey, John J. and Patrick Megonigal.** (Savannah River Ecology Laboratory). Effect of root quality on root decomposition.
- 10:30 55. **Megonigal, J. Patrick and Frank P. Day.** (Savannah River Ecology Laboratory and Old Dominion University). The influence of hydroperiod on soil nutrient dynamics in an organic soil.
- 10:45 56. **Ciravolo, Thomas G. and Kenneth W. McLeod.** (Savannah River Ecology Laboratory). Fly ash and the growth of water tupelo and bald cypress seedlings.
- 11:00 57. **Knowles, David B.** (East Carolina University). The seed bank of a brackish marsh dominated by *Juncus roemerianus*.

- 11:15 58. **Dooris, Patricia and George M. Dooris.** (HDR Engineering Inc. and Saint Leo College). Differences in selected community parameters in small Florida wetlands.
- 11:30 59. **Hoagland, Bruce W.** (Eastern Kentucky University). Wetland flora and vegetation of the upper Green River Basin, south central Kentucky.
- 11:45 60. **Tyndall, R. Wayne, Katharine McCarthy, J. Christopher Ludwig and Abigail Rome.** (Maryland Natural Heritage Program). Vegetation of six Carolina Bays in Maryland.

PLANT SYSTEMATICS, Session 1 - Olmsted Room

- Presiding: *Dr. J. R. Massey*, University of North Carolina, Chapel Hill
- 10:00 61. **Flisser, Daniel E.** (University of South Carolina). Megagametophyte development among two species of *Uniola* and two species of *Chasmanthium*.
- 10:15 62. **Chang, Chin-Sung and David E. Giannasi.** (University of Georgia). A flavonoid study of *Acer*, section *Palmata*, series *Palmata*.
- 10:30 63. **Pounds, L., C. Baskin, J. Baskin, M. Cunningham, H.R. DeSelm and T. Patrick.** (University of Tennessee, University of Kentucky, Oak Ridge National Laboratory and Georgia Dept. of Conservation). Flora and vegetation of Crowder Cemetery Barrens, Roane County, Tennessee.
- 10:45 64. **Bradley, Ted R.** (George Mason University). Viability of seeds produced via cleistogamy in *Triodanis perfoliata* (L.) Niewland var. *perfoliata* (Campanulaceae).
- 11:00 65. **Ramsey, Gwynn W., Charles H. Leys, Robert A.S. Wright, D.A. Coleman and Aubrey O. Neas.** (Lynchburg College, Old Dominion Box Co., Central Virginia Research Consortium and Wintergreen Resort-City of Lynchburg). The vascular flora of the James River Gorge Watershed in the central Blue Ridge mountains of Virginia.

THURSDAY AFTERNOON, APRIL 6**SYMPOSIUM****Aquatic communities of the Southeastern
United States**

Sponsored by the Southeastern Chapter of the
Ecological Society of America
Organized by Dr. Ross Hinkle

Salon II

Presiding: *Dr. Ross Hinkle*, Bionetics Corporation.

- 1:30 66. **Menzel, Ronald G. and Charles M. Cooper.** (U.S. Department of Agriculture). Small impoundments and ponds. Chapter thirteen in *Biotic Communities of the Southeastern United States*.
- 2:00 67. **Hobbs III, H.H.** (Wittenberg University). Caves and Springs.
- 2:30 BREAK
- 3:00 68. **Wallace, Bruce.** (University of Georgia). High gradient streams of the Southeast.
- 3:30 69. **William H. Martin.** (Eastern Kentucky University). Status of the BIOTIC COMMUNITIES OF THE SOUTHEASTERN UNITED STATES.

**CYTOLOGY, GENETICS, DEVELOPMENT,
MICROBIOLOGY
Burnham Room**

Presiding: *Dr. John M. Herr, Jr.*, University of South Carolina

- 1:30 70. **Herr, J.M. Jr.** (University of South Carolina). The use of dibutyl phthalate as a substitute for clove oil in 4 1/2-type clearing fluids.
- 1:45 71. **Wise, Drayne A.** (Mississippi State University). Nonrandom behavior of sex chromosomes in male lycosid spiders.
- 2:00 72. **Orvos David R. and John Cairns, Jr.** (Virginia Polytechnic Institute and State University). Environmental risk assessment of a genetically-engineered microorganism, *Erwinia carotovora*.
- 2:15 73. **Applegate, Arthur L.** (Saint Andrews Presbyterian College). A new method for banding human metaphase chromosomes.
- 2:30 74. **Kwarsick, Lisa M., Loren Knapp and Wallace D. Dawson.** (University of South Carolina). Mortality in hairless deer mouse.
- 2:45 75. **Ramey, Barbara A.** (Eastern Kentucky University). Teratogenic effects of zinc to the fathead minnow (*Pimephales promelas*).
- 3:00 BREAK

- 3:15 76. **Thomas, Donald L. and James B. McClintock.** (University of Alabama at Birmingham). Embryogenesis in the freshwater pulmonate gastropod, *Physella cubensis*: the effect of temperature on the embryonic and juvenile growth rates and sexual maturation.
- 3:45 77. **Denniston, Katherine J. and Robert B. Malamis.** (Towson State University). Characterization of two streptococcal viruses carrying genes for scarlet fever exotoxins.
- 4:00 78. **Williams, Roger C., Daniel H. Haapala and K.J. Denniston.** (Towson State University). Origin of the novel envelope glycoprotein gene of an endogenous feline retrovirus.
- 4:15 79. **Bowden, Sandra T. and Patricia M. White.** (Agnes Scott College). Bacterial ecology of two granite outcrop communities, DeKalb County, Georgia.
- 4:30 80. **Rushing, Ann E. , Roland R. Dute and James W. Perry.** (Auburn University and Frostburg State University). A comparison of torus structure and function of the wood of four genera of dicotyledons.
- 4:45 81. **Chen, Dillon T. and Lafayette Frederick.** (Howard University). The "terminal bud" of *Ulmus americanus*.
- 5:00 82. **Chen, Dillon T. and Lafayette Frederick.** (Howard University). SEM observations on leaf development in *Ulmus americanus*.

HERPETOLOGY - Salon III

Presiding: *Dr. Don Forester*, Towson State University

- 1:30 83. **Forester, Don C.** (Towson State University). Observations on the movements and social interactions of the shovel-nosed salamander, *Leurognathus marmoratus*.
- 1:45 84. **Dodd, C. Kenneth, Jr.** (National Ecology Research Center, U.S. Fish and Wildlife Service). Estimating burrow densities of the Red Hills salamander, *Phaeognathus hubrichti*.
- 2:00 85. **Braswell, Alvin L., R.Wilson Laney and David L. Stephan.** (N. C. State Museum of Natural Sciences, U.S. Fish and Wildlife Service, and N.C. State University). Amphibian populations using some seasonally flooded Carolina Bays in North Carolina.
- 2:15 86. **Hover, Edward L.** (Agnes Scott College). Correlation between habitat and throat color in a polychromatic lizard, *Urosaurus ornatus*.
- 2:30 87. **Giovanetto, Laine A. and John G. Morris.** (Florida Institute of Technology). Habitat use by the gopher tortoise in scrub and slash pine flatwoods on Merritt Island National Wildlife Refuge, Brevard County, FL.
- 2:45 88. **Taylor, Cindy L. and Opal H. Dakin.** (Mississippi State University). Escape behavior in larval amphibians.
- 3:00 BREAK

- 3:15 89. **Frazer, Nat B., J. Whitfield Gibbons and Judith L. Green.** (Mercer University and Savannah River Ecology Laboratory). Annual variation in the proportion of reproductively active female common mud turtles, *Kirosternon subrubrum*.
- 3:30 90. **Schorr, Mark S.** (Mississippi State University). Populational changes of enteric protozoans, *Opalina* spp., during the ontogeny of anuran tadpoles.
- 3:45 91. **Papay, Michael J. and Jeanne L. Blackwell.** (Mississippi State University). Ontogeny of tooth row lengths in anuran tadpoles.
- 4:00 92. **Murphy, William C. and Ronald Altig.** (Mississippi State University). Preliminary analysis of labial teeth shapes in anuran tadpoles.
- 4:15 93. **Cross, David C. and Ronald Altig.** (Mississippi State University). Spatial distribution and feeding of the tadpoles of *Gastrophryne carolinensis*.
- 4:30 94. **Carr, Karen and Ronald Altig.** (Mississippi State University). Abdominal and oral disc muscles of anuran tadpoles.
- 4:45 95. **Scott, A. Floyd.** (Austin Peay State University). Seasonal activity of amphibians around woodland and old field ponds in Land Between the Lakes.

PARASITOLOGY, Session 2 - Salon IV
Student Paper Presentations (Byrd-Dunn Award)

- 2:15 96. **Darlington, Mark V., B.L. Blagburn, K.M. Easterwood and C.A. Sundermann.** (Auburn University). Development of a murine assay for cryptosporidicidal drug evaluation.
- 2:30 97. **Haeber, Paula J., B.L. Blagburn, J.C. Frandsen, L.J. Swango and C.M. Hendrix.** (Auburn University). Isolation, cultivation and morphometrics of *Giardia* spp. of bovine and caprine origin.
- 2:45 98. **Bell, Constance A., J.E. Hall and R.R. Tidwell.** (University of North Carolina, Chapel Hill). *In vitro* activity of pentamidine and related amidines and imidazolines against *Giardia lamblia*.
- 3:00 99. **Berger, Bradley J., J.E. Hall and R.R. Tidwell.** (University of North Carolina, Chapel Hill). A sensitive liquid chromatographic assay for the detection of a series of diamidine compounds with potential chemotherapeutic value
- 3:15 100. **Ciesielski, Stephen and J.R. Seed.** (University of North Carolina, Chapel Hill). Transmission of intestinal parasites in migrant farm workers.
- 3:30 BREAK
- 3:45 101. **Cole, Rebecca A., B.L. Blagburn and C.M. Hendrix.** (Auburn University). Internal parasites of *Crotalus adamanteus* and *C. horridus* (Family Viperidae) from southern Alabama.
- 4:00 102. **Davis, Sara R. and Grover C. Miller.** (North Carolina State University). Parasites of some fishes from B. Everett Jordan Reservoir, North Carolina.
- 4:15 103. **Peel, Sheila A. and S.C. Merritt.** (University of North Carolina, Chapel Hill). The organization of tubulin genes in *Plasmodium falciparum*.

- 4:30 104. **Terry, Barbara A.** (North Carolina State University). The role of selected mouse anti IgA antibody in attracting eosinophils to the tegument of *Schistosoma mansoni*.
- 4:45 105. **Jetton, Thomas L. and B.J. Bogitsh.** (Vanderbilt University). Morphological and cytochemical observations of sperm maturation in trematodes, with an emphasis on schistosomes.
- 5:00 106. **Hutzler, L. Beatrice, K.A. Roberts, and G.K. Harper.** (Clinch Valley College). Effect of steroid hormones on the immune response of Sprague-Dawley rats to *Trichinella spiralis*.

PLANT ECOLOGY, Session 2 - Salon I

Presiding: *Dr. Lisa K. Wagner*, Georgia Southern College

- 1:30 107. **Wagner, Lisa K.** (Georgia Southern College). Seedling establishment in three weedy summer annuals.
- 1:45 108. **Winstead, Joe E.** (Western Kentucky University). Maple and yellow-polar stump sprout regeneration and dominance in a Cumberland Plateau hemlock forest.
- 2:00 109. **Schiffman, Paula M.** (Virginia Polytechnic Institute and State University). Absence of buried seed bank in a southern appalachian oak forest: implications for success.
- 2:15 110. **Busing, Richard T. and Edward E.C. Clebsch.** (University of Tennessee). Canopy gap processes of a southern Appalachian cove forest: second growth vs. old growth.
- 2:30 111. **Clebsch, Edward E.C. and Richard T. Busing.** (University of Tennessee). Secondary succession, gap dynamics and community structure in a Southern Appalachian mesic cove forest.
- 2:45 112. **Barden, Lawrence S.** (University of North Carolina, Charlotte). Repeatability of forest gap research: A comparison of studies in the Great Smoky Mountains.
- 3:00 113. **Schmalzer, P. A. and C. R. Hinkle.** (The Bionetics Corporation). Vegetation and soil changes during two years post-fire in oak scrub vegetation on John F. Kennedy Space Center, Florida.
- 3:15 114. **McCormick, J. Frank.** (University of Tennessee). Environmental impacts of resettlement and economic development in the amazon of Brazil.
- 3:30
BREAK
- 3:45 115. **Honggang, Liu and Song Yongchang.** (Marshall University). Vegetation of Wugishan Mountain in Eastern China.
- 4:00 116. **Stephenson, Stephen L. and Lal Singh Chauhan.** (Fairmont State College and Himachal Pradesh University). Forest vegetation of Himachal Pradesh in northwestern India.
- 4:15 117. **Long, Alice A.** (Southern Illinois University). Distribution and Vegetation of the barrens in southern Illinois.

- 4:30 118. **Workman, Sarah W. and Kenneth W. McLeod.** (University of Georgia and Savannah River Ecology Laboratory). Species composition after seasonal burns in a sandhills scrub oak community.
- 4:45 119. **Pittillo, J. Dan.** (Western Carolina University). A disturbance hypothesis for the vegetational patterns of the Craggy Mountains, North Carolina.

PLANT SYSTEMATICS, Session 2 - Walden Room

Presiding: *Dr. Charles N. Horn*, Newberry College

- 2:15 120. **Horn, Charles N.** (Newberry College). Geographical and ecological notes on *Solidago verna* (Asteraceae), a rare endemic of the Carolinas.
- 2:30 121. **Hardin, James W.** (North Carolina State University). How many basswood species in the U.S.
- 2:45 122. **Moore, Michael O. and David E. Giannasi.** (University of Georgia). Foliar flavonoids of *Vitis* L. subgenus *Muscadinia* (Planch.) Rehd.
- 3:00 123. **Broyles, Steven B. and Robert Wyatt.** (University of Georgia). Inflorescence size and reproductive success in milkweeds: evidence against the pollen donation hypothesis.
- 3:15
BREAK
- 3:30 124. **Cox, Patricia B. and L. E. Urbatsch.** (Louisiana State University, Baton Rouge). A cladistic analysis of the "coneflowers" (Asteraceae).
- 3:45 125. **Cypher, Ellen.** (Southern Illinois University). Distribution of the subspecies of *Phlox bifida* Beck.
- 4:00 126. **Smith, Gerald L. and Walter S. Flory.** (High Point College and Wake Forest University). Re-establishment of *Hymenocallis henryae* Traub.
- 4:15 127. **Davenport, L. J.** (Samford University). Habitat requirements and current status of the Cahaba lily (*Hymenocallis coronaria*) in Alabama.

TEACHING - Welwyn Room

Presiding: *Dr. William Martin*, Christchurch School, Virginia

- 2:00 128. **Parr, P. D. and K. M. Blair.** (Oak Ridge National Laboratory). Precollege science education: a hands-on approach to learning.
- 2:15 129. **Martin, William and Robert Atkinson.** (Christchurch School and Virginia Tech). Evolution of a marine science program on the Chesapeake Bay.

FRIDAY MORNING, APRIL 7**ANIMAL ECOLOGY, Session 2 - Burnham Room**

- Presiding: *Dr. Justin D. Congdon*, Savannah River Ecology Laboratory
- 8:30 130. **Congdon, Justin D.** and **Richard van Lobensels.** (Savannah River Ecology Lab and Red Mountain High School, Mesa, AZ). Growth and reproduction in the Blanding's turtle.
- 8:45 131. **Mills, Edward** and **David T. Rogers, Jr.** (University of Alabama). Nearctic passerine fall migration in central Belize.
- 9:00 132. **Flinchum, Renee Y.** and **Wallace D. Dawson.** (University of South Carolina). A test of genetic drift theory in a small population of *Peromyscus polionotus*.
- 9:15 133. **Scribner, Kim T.** (University of Georgia). Environmental and demographic correlates of spatial genetic structure in the cottontail rabbit.
- 9:30 134. **Rowe, Matthew** and **Donald H. Owings.** (Appalachian State University and University of California at Davis). The information afforded by rattlesnake rattles: a study of risk assessment by ground squirrels.
- 9:45
BREAK
- 10:00 135. **Steele, Michael A., Travis W. Knowles** and **Ken Bridle.** (Wake Forest University and RJR Industries). Partial consumption of acorns by vertebrate seed predators: the effects of tannins.
- 10:15 136. **Smith, Winston P.** (Tennessee Technological University). Behavioral and ecological response of white-tailed deer to livestock: a case study from southwestern Oregon.
- 10:30 137. **Hicks, Kathryn A.** and **John G. Morris.** (Florida Institute of Technology). Winter diet selection of the West Indian Manatee at Homosassa Springs, Florida.
- 10:45 138. **Colon, Jose L.** (Loyola University). Comparative ultrastructure and evolution of tongue papillae in insectivorous bats.
- 11:00 139. **Van Devender** and **Robert Wayne.** (Appalachian State University). A model for the Batesian-Mullerian Mimicry spectrum.

ANIMAL AND PLANT PHYSIOLOGY - Welwyn Room

- Presiding: *Dr. Janice Haldeman*, Erskine College.
- 8:30 140. **Kimbrough, Daniel T., L. B. Weekly** and **Gerald C. Llewellyn.** (Virginia Commonwealth University, Colorado State University and Bureau of Toxic Substances). Influence of calmodulin inhibitors on spontaneous gastrointestinal smooth muscle responses to angiotensin-II.
- 8:45 141. **Varney, D. R., L. A. Varney, R. W. Hemken, P. M. Zavos** and **M. R. Siegel.** (Eastern Kentucky University and University of Kentucky). Puberty in mice as affected by a diet containing endophyte-infected tall fescue seeds.

- 9:00 142. **Varney, D. R., R.A. Prestidge, D.D. Jones, L. A. Varney, P. M. Zavos and M. R. Siegel.** (Eastern Kentucky University, Ruakura Soil and Plant Research Station, New Zealand and University of Kentucky). The effect of edophyte-infected perennial ryegrass diet on growth and reproduction in mice.
- 9:15 143. **Fischer, Robert U., David E. Scott, Scott A. Busa and Justin D. Congdon.** (Savannah River Ecology Laboratory). Reproductive and lipid cycles in the cottonmouth, *Agkistrodon piscivorus*.
- 9:30 144. **Compton-McCullough, Dana, Julie Walton and James B. Claiborne.** (Georgia Southern College). The role of gills and kidney in acid-base regulation in a seawater teleost (*Myoxocephalus octodecimspinosus*) during exposure to lower salinities.
- 9:45
BREAK
- 10:00 145. **Toman, Frank, Kerrie Elliott and Juergen Pfeiffer.** (Western Kentucky University). Effect of manganese toxicity on ribulose 1, 5 bisphosphate carboxylase activity of tobacco chloroplasts.
- 10:15 146. **Toman, Frank, Kerrie Elliott and Juergen Pfeiffer.** (Western Kentucky University). The short term effects of manganese toxicity on isocitrate dehydrogenase in wheat and tobacco.
- 10:30 147. **Haldeman, Janice H. and Ronald L. Thomas.** (Erskine College and Clemson University). Use of gibberellic acid (GA3) for *in vitro* establishment of field grown shoot tips of tea, *Camellia sinensis*.
- 10:45 148. **Buetow, David H.** (Duke Power Company Environmental Laboratory and University of North Carolina, Charlotte). A characterization of the resting stage of the freshwater diatom, *Melosira italica* collected from Lake Norman, N.C.
- 11:00 149. **Hiltz, Terry A., H. N. McKellar and R. Tyler.** (University of South Carolina). Aquatic community metabolism as a function of macrophyte development in shallow pond ecosystems.
- 11:15 150. **Ballal, S. K. and Sharon Termon.** (Tennessee Technological University). Seed protein profiles of Jojoba during the germination sequence.

ICHTHYOLOGY, Session 2 - Salon II

Presiding: *Dr. Noel Burkhead*, US Fish and Wildlife Service, Gainesville, FL and *Dr. Fred C. Rohde*, North Carolina Division of Marine Fisheries.

- 8:30 151. **Burkhead, Noel and James D. Williams.** (U. S. Fish and Wildlife Service, Gainesville, FL). Current status of the exotic minnow, *Scardinius erythrophthamus* in the United States.
- 8:45 152. **Maurakis, Eugene G., James T. Magee and W.S. Woolcott.** (University of Richmond). Pebble nest microhabitats of *Semotilus* spp.
- 9:00 153. **Doyle, Sharon, Eugene G. Maurakis and W.S. Woolcott.** (University of Richmond). Pebble nest microhabitats of two *Nocomis* spp.

- 9:15 154. **Clavijo, I. E., D. G. Lindquist, M. R. Wessel and B. T. Pawlak.** (University of North Carolina, Wilmington). Deep reef fishes off Cape Fear, NC: Submersible observations and live collection of the red barbier, *Hemanthias vivanus*.
- 9:30 155. **Foster, Ann M. and James P. Clugston.** (U. S. Fish & Wildlife Service, Gainesville, FL). Gulf of Mexico sturgeon: historical view and current research.
- 9:45 156. **Burk, Sandra W., Ileana E. Clavijo and David G. Lindquist.** (University of North Carolina, Wilmington). Effects of internal anchor tags on black sea bass (*Centropristis striata*) and initial returns of fish tagged off southeastern North Carolina.
- 10:00 157. **Rohde, Fred D. and Rudolf G. Arndt.** (North Carolina Division of Marine Fisheries and Stockton State College). Status of *Etheostoma mariae* and *Semotilus lumbee*.
- 10:15 158. **Etnier, David A. and Mary Jane Larkin.** (University of Tennessee). Natural hybrid perciform fishes from the Southeast.
- 10:30 159. **Turner, John M. and Frank J. Bulow.** (Tennessee Technological University). Hybridization of redeye bass (*Micropterus coosae*) with native smallmouth bass (*M. dolomieu*) in a north-central Tennessee stream.
- 10:45 160. **Wilkins, S. David, John S. Peyton and Stephen T. Ross.** (University of Southern Mississippi). Fishes of the Chickasawhay, Leaf and Pascagoula rivers in southeast Mississippi.
- 11:00 161. **Pezold, Frank.** (Northeast Louisiana University). A phylogenetic revision of *Gobionellus*.
- 11:15 162. **Mayden, Richard L.** (University of Alabama). Evolution of eastern North American fishes: a new method in vicariance biogeography.

PARASITOLOGY, Session 3 - Walden Room

Parasite Biochemistry, Molecular Biology, Immunology and Genetics

- 9:00 163. **Seed, John R. and John Sechelski.** (University of North Carolina, Chapel Hill). Further studies on the trypanocidal factor in African primates.
- 9:15 164. **Lushbaugh, W. B., A. C. Turner and P. C. Klykken.** (University of Mississippi Medical Center). Characterization of a secreted cytoactive factor from *Trichomonas vaginalis*.
- 9:30 165. **Bone, Leon W., Craig R. Reinemeyer and Jack W. Oliver.** (USDA Animal Parasite Research Laboratory and University of Tennessee). Thyroid and gastrin hormone levels of *Trichostrongylus colubriformis*-infected goats.
- 9:45 166. **Faulkner, Charles T. and Sharon Patton.** (University of Tennessee). Enzyme immunoassay for detection of *Giardia* antigen in canine feces.
- 10:00 BREAK
- 10:15 167. **Lindsay, David S. and Byron L. Blagburn.** (Auburn University). Ultrastructure of endodyogeny of *Isospora suis* *in vitro*.

- 10:30 168. **Mann, Victoria H. and Stephen C. Merritt.** (University of North Carolina, Chapel Hill). Cell free gene transcription in nuclear extracts from *Trypanosoma brucei gambiense*.
- 10:45 169. **Merritt, Stephen C.** (University of North Carolina, Chapel Hill). P-glycoprotein-like activity in multidrug resistant *Plasmodium falciparum*.
- 11:00 170. **Sen, Dilip K., Hunter D. Hamlett and Rodney Higgs.** (Virginia State University). The effect of Cyclosporin A: an immunosuppressive agent on *Trypanosoma musculi* in Swiss Webster female mice.

PLANT ECOLOGY, Session 3 - Salon I

Presiding: *Patricia D. Parr*, Oak Ridge National Laboratory

- 8:45 171. **Cunningham, Maureen and Patricia D. Parr.** (Oak Ridge National Laboratory). Successful culture of the rare annual hemiparasite *Tomanthera auriculata* (Michx.) Raf.
- 9:00 172. **Porch, Susan S. and George W. Folkerts.** (Auburn University). Prey composition in three species of *Drosera* on the Gulf Coastal Plain.
- 9:15 173. **Bailey, Mark A. and George W. Folkerts.** (Alabama Natural Heritage Program and Auburn University). Conservation status of the pitcher plant *Sarracenia rubra* subsp. *wherryi*.
- 9:30 174. **Randall, John L.** (Virginia Polytechnic Institute and State University). Interference through improper pollen transfer between *Impatiens capensis* and *I. pallida* (Balsaminaceae).
- 9:45 175. **Buchele, David E., Jerry M. Baskin and Carol C. Baskin.** (University of Kentucky). Ecology of *Solidago shortii*, a federally-endangered species. I. History, geographical distribution, and successional relationships.
- 10:00 BREAK
- 10:15 176. **Buchele, David E., Jerry M. Baskin and Carol C. Baskin.** (University of Kentucky). Ecology of *Solidago shortii*, a federally endangered species. II. Physical habitat factors and plant associates.
- 10:30 177. **Buchele, David E., Jerry M. Baskin and Carol C. Baskin.** (University of Kentucky). Ecology of *Solidago shortii*, a federally endangered species. III. Ecological life cycle and reproductive biology.
- 10:45 178. **Rae, John G.** (Francis Marion College). Growth and reproduction in the endangered fragrant prickly-apple cactus, *Cereus eriophorus* var. *fragrans*.
- 11:00 179. **Spira, Timothy P.** (Georgia Southern College). Population biology of an alpine annual plant (*Gymnosteris parvula*) in California.
- 11:15 180. **Holifield, Vicky L. and M. Eloise Brown Carter.** (Emory University and Oxford College). Flora of the sandstone outcrops of the Altamaha Grit and a comparison of granite outcrops of the Georgia Piedmont.

PLANT ECOLOGY, Session 4 - Olmsted Room

Presiding: *Dr. John Nelson*, South Carolina Heritage Trust

- 8:45 181. **McLeod, Kenneth W.** (Savannah River Ecology Laboratory). Stress ecology: utility of growth and physiological measures.
- 9:00 182. **Wentworth, Thomas R.** and **H. Lee Allen.** (North Carolina State University). Environmental correlates of height and diameter growth in a loblolly pine (*Pinus taeda* L.) plantation.
- 9:15 183. **Mavity, Erika M., Nancy J. Stumpff** and **Kenneth W. McLeod.** (Savannah River Ecology Laboratory and Auburn University). Net photosynthesis in six species of tree seedlings under varying light intensities.
- 9:30 184. **Ray, Darrell L.** and **Joe E. Winstead.** (Vanderbilt University and Western Kentucky University). Geographic and season observations on sulfur content of eastern red cedar foliage from south-central Kentucky.
- 9:45 185. **Wein, Gary R.** and **Beverly S. Collins.** (Savannah River Ecology Lab and Memphis State University). Water relations and growth of *Heterotheca subaxillaris* in contrasting soils and watering regimes in the greenhouse.
- 10:00 BREAK
- 10:15 186. **Young, Donald R.** (Virginia Commonwealth University). Development of capacitance and drought tolerance in *Asimina triloba* seedlings.
- 10:30 187. **Creasman, Lisa A.** (Louisiana State University). A comparison of analysis techniques for long-term water quality records and the implications for cumulative impact assessment.
- 10:45 188. **Neufeld, Howard S., Jim Renfro** and **David Silsbee.** (Appalachian State University). The ozone effects program in the Great Smoky Mountains National Park: preliminary results.
- 11:00 189. **Gosselink, James G., Gary P. Shaffer, Lyndon C. Lee, et al.** (Louisiana State University and U. S. Environmental Protection Agency). Cumulative impact assessment and management in a bottomland hardwood forest landscape.

FRIDAY AFTERNOON, APRIL 7**AQUATIC ECOLOGY - Walden Room**

- Presiding: *Dr. Donald Tarter*, Marshall University.
- 2:00 190. **Smith, Michael E., Barbara J. Wyskowski, C. M. Brooks, C. T. Driscoll and C.C. Cosentini.** (Valdosta State College and Syracuse University). Relationships between acidity and benthic invertebrates of low-order woodland streams in the Adirondack Mountains, New York.
- 2:15 191. **Eggleton, Michael A., Wendell Pennington and Eric L. Morgan.** (Tennessee Technological University). Characterization of an acid-sensitive Southern Appalachian stream targeted for mitigative liming.
- 2:30 192. **Nelson, Charles H. and Richard M. Duffield.** (University of Tennessee, Chattanooga and Howard University). Stonefly emergence patterns in a Maryland stream.
- 2:45 193. **Matthews, K. A. and D. C. Tarter.** (Marshall University). Ecological life history, including laboratory respiratory studies of *Ameletus tarteri* Burrows in Carpenter Run, North Fork of Cherry River, West Virginia.
- 3:00 194. **Norman, Robert E. and Donald C. Tarter.** (Marshall University). Effects of artificial lake destratification on the benthic macroinvertebrate populations in Beech Fork Lake, West Virginia.
- 3:15 195. **Zappia, Humbert and Donald Tarter.** (Marshall University). Effects of second year artificial destratification on the benthic populations in Beech Fork Lake, West Virginia.
- 3:30 196. **Webb, Doshia J. and Thomas E. Weaks.** (Marshall University). The response of the periphyton community of Beech Fork Lake to artificial circulation.
- 3:45 BREAK
- 4:00 197. **Figiel, Chester R., Jr. and Raymond D. Semlitsch.** (Memphis State University). Geographic variation in survival and metamorphosis in larval salamanders of *Ambystoma maculatum*.
- 4:15 198. **McQuary, Wendy M., Cletus M. Sellers, Jr. and Norman E. Garrison.** (James Madison University). The effect of simulated acid precipitation on the ventilatory activity of rainbow trout.
- 4:30 199. **Kozel, Thomas R.** (Savannah State College). Water chemistry and ichthyofauna of three temporary ponds on Georgia's southernmost barrier island.
- 4:45 200. **Joo, Gea-Jae and Amelia K. Ward.** (University of Alabama). Patterns of phytoplankton productivity of two morphologically different oxbow lakes in Balck Warrior River drainage in Alabama.
- 5:00 201. **DeBiase, Adrienne E., Barbara E. Taylor and Diane L. Mahoney.** (Savannah River Ecology Laboratory). Diel vertical migration by invertebrate predators in a Southeastern cooling reservoir.

- 5:15 202. **Davidson, Mary L. and Armando A. de la Cruz.** (Mississippi University). Microbial utilization of toxins from the mangrove plant *Aegiceras corniculatu*.

ICHTHYOLOGY, Session 3 - Salon III

Presiding: *Dr. R.L. Mayden*, University of Alabama

- 1:30 203. **Burgess, G. H., F. F. Snelson, Jr., S. J. Walsh, S. T. Clark and K. G. Abbott.** (University of Florida and University of Central Florida). Preliminary biological and fishery assessments of the giant snake eel, *Ophichthus rex*.
- 1:45 204. **Blaylock, Robert A.** (Virginia Institute of Marine Science). Quantification of a massive school of cownose rays, *Rhinoptera bonasus*, in lower Chesapeake Bay.
- 2:00 205. **Menhinick, Edward F.** (University of North Carolina, Charlotte). Anal ray/gill raker variation in North Carolina catfishes.
- 2:15 206. **King, Mark A., Greg A. Garman, Jackson E. Jeffrey and Anne Wright.** (Virginia Commonwealth University). Aging methodology for stream centrarchids: scale versus otolith, and results for James River fishes.
- 2:30 207. **Wood, Robert M., K. Jack Killgore and Neil H. Douglas.** (University of Alabama, U. S. Army Corps of Engineers and Northeast Louisiana University). Ichthyofaunal comparison of a man-made and a natural lotic ecosystem in eastern Mississippi.
- 2:45 208. **O'Neil P. E. and M. F. Mettee.** (Geological Survey of Alabama). Factors associated with sampling stream fishes in Alabama.
- 3:00 209. **Winner, Brent L. and Frank J. Schwartz.** (University of North Carolina, Wilmington and University of North Carolina Institute of Marine Science). Relative growth of the heart in four species of Carcharhinid sharks.
- 3:15
BREAK
- 3:30 210. **Matson, Ronald H., R. L. Mayden and B. R. Kuhajda.** (University of Alabama). Allozyme differentiation in populations of the rainbow shiner, *Notropis chrosomus*.
- 3:45 211. **Rogers, James S. and James M. Grady.** (University of New Orleans). Evidence for tandem duplication of a glucosephosphate isomerase locus in *Sciaenops ocellatus*.
- 4:00 212. **Hernandez, J. David and Michael H. Smith.** (University of Georgia and Savannah River Ecology Laboratory). Factors affecting genetic differentiation of eastern mosquitofish (*Gambusia holbrooki* Girard) populations from the Broad-Santee and Pee Dee drainages.
- 4:15 213. **Angus, Robert A.** (University of Alabama, Birmingham). Inheritance of melanistic spotting in the eastern mosquitofish, *Gambusia holbrooki*.
- 4:30 214. **Denette, Philiias and Robert C. Cashner.** (University of New Orleans). Trends in habitat associations of the ichthyofauna of the Little Buffalo River, southwestern Mississippi.

- 4:45 215. **Warren, Mark A. and Robert C. Cashner.** (University of New Orleans). A comparison of the ichthyofaunal composition of Buffalo River, in southwestern Mississippi, over a twenty-year period.

INVERTEBRATE ZOOLOGY - Burnham Room

- Presiding: *Dr. Julian P.S. Smith III*, University of North Carolina, Charlotte
- 1:30 216. **Smith, Julian P. S. III.** (University of North Carolina at Charlotte). New ultrastructural evidence for the evolutionary origin(s) of the free-living flatworms (Platyhelminthes, Turbellaria).
- 1:45 217. **Richardson, John B. and Robert M. Anderson.** (Tennessee Technological University). A new quantitative sampling method for unionids in variable substrate streams.
- 2:00 218. **Tarter, D. C., D. R. Nelson, S. D. Gillenwater and K. K. Ruggles.** (Marshall University and East Tennessee University). First records of water bears (Phylum: Tardigrada) from West Virginia.
- 2:15 219. **Nehus, Tim J., J. B. Layzer and Wendell Pennington.** (Tennessee Technological University). Importance of reservoir biota to stream drift in Center Hill Tailwater.
- 2:30 220. **Wilkerson, W. S., W. L. Pennington, E. L. Morgan and D. Winford.** (Tennessee Technological University and U. S. Fish & Wildlife Services). Impacts on zooplankton and benthic macroinvertebrates by controlled barge traffic in the Ohio River.
- 2:45 BREAK
- 3:00 221. **Edwards, Dale D. and Ronald V. Dimock, Jr.** (Wake Forest University). The importance of size in intraspecific aggression by male water mites.
- 3:15 222. **Richardson, Terry D. and Kenneth M. Brown.** (Louisiana State University). Secondary production of two subtropical viviparid prosobranchs.
- 3:30 223. **Harrison, Julian R.** (The College of Charleston). The freshwater limpet *Hebetancylus excentricus* (Morelet) in South Carolina.
- 3:45 224. **Mooney, Richard L., Richard R. Mills and T. Daniel Kimbrough.** (Virginia Commonwealth University). Determination of the insecticidal properties of a novel catechol copolymer.

PLANT ECOLOGY, Session 5 - Salon I

- Presiding: *Dr. James Fralish*, Southern Illinois University, Carbondale
- 2:15 225. **Pauley, Eric F. and Richard T. Busing.** (University of Tennessee). Wind-related mortality of Great Smoky Mountains red spruce, *Picea rubens* Sarg.
- 2:30 226. **Busing, Richard T.** (University of Tennessee). Size-specific mortality in a Great Smoky Mountains red spruce population.

- 2:45 227. **Adams, Harold S. and Stephen L. Stephenson.** (Dabney S. Lancaster Community College and Fairmont State College). Forest communities of the higher elevations in western Virginia.
- 3:00 228. **Lipscomb, Mary V. and Erik T. Nilsen.** (Virginia Polytechnic Institute and State University). Biotic and abiotic factors influencing the natural distributions of evergreen and deciduous species on north and south slopes of Brush Mountain, Virginia.
- 3:15 229. **Muller, Robert N. and Paul J. Kalisz.** (University of Kentucky). Species distribution and ecosystem development in the Mixed Mesophytic Forest of eastern Kentucky.
- 3:30 230. **Liu, Yan and Robert N. Muller.** (University of Kentucky). Above-ground productivity and nitrogen mineralization in the mixed mesophytic forest of eastern Kentucky.
- 3:45 BREAK
- 4:00 231. **Gribben, Robert J. and Donald R. Young.** (Virginia Commonwealth University). Spatial variation in growth of *Hydrilla* within Lake Anna, Virginia.
- 4:15 232. **Kettler, Steve and James Fralish.** (Southern Illinois University). Forest succession patterns at Land Between the Lakes, KY and TN.
- 4:30 233. **Franklin, Scott and James Fralish.** (Southern Illinois University). Forest communities of xeric-mesic and mesic sites at Land Between the Lakes, KY and TN.
- 4:45 234. **Rudowicz, Lucy and James Fralish.** (Southern Illinois University). Forest communities of xeric sites at Land Between the Lakes, KY and TN.
- 5:00 235. **Hull, James C.** (Towson State University). Changes in nitrification potential of soils along a successional gradient in Maryland.
- 5:15 236. **Robertson, Philip A.** (Southern Illinois University). Dendrochronology of oaks from three lowland sites in southern Illinois.

PLANT SYSTEMATICS, Session 3 - Salon II

- Presiding: *Dr. David H. Rembert, Jr.*, University of South Carolina
- 3:00 237. **Rembert, David H., Jr.** (University of South Carolina). A visit to Kew after the storms.
- 3:15 238. **Pittman, Albert B., Vernon Bates and Lance Peacock.** (Arkansas Natural Heritage Commission and the Arkansas Natural Conservancy). A very distinctive new species of Compositae (Heliantheae) from the Ouachita Mountain Region of Arkansas.
- 3:30 239. **Jones, Robert L.** (Eastern Kentucky University). The vascular flora of wetlands on the Cumberland Plateau of Tennessee.
- 4:00 240. **Stalter, Richard and Eric Lamont.** (St. John's University and New York Botanical Garden). The vegetation of Assateague Island, Virginia.
- 4:15 241. **Sutton, Pat and Richard Stalter.** (St. John's University). The vegetation of Cape May Point State Park, New Jersey.
- 4:30 242. **Morris, M. Wayne.** (University of Florida). New reports of rare, threatened, or endangered vascular plants from northern Mississippi.

BETA BETA BETA, District 1 - Salon IV

- 2:00 **Pritchard, M. Karen and Douglas E. Facey.** (Sigma Gamma, Erskine College). Oxygen consumption and ventilation rates of yellowfin shiner, *Notropis lutipinnis*, exposed to mildly acidic water.
- 2:15 **Campagna, Jason.** (Beta Omicron, Miami University). The suppression and regression of the human ovarian carcinoma B6-1.
- 2:30 **Kaufmann, Sandra C.** (Beta Omicron, Miami University). A possible two-stage seed dispersal by birds and ants in an exotic *Ficus* species.
- 2:45 **Huthwaite, Lance Wesley.** (Beta Rho, Wake Forest University). *In situ* hybridization studies of myeloperoxidase gene expression in normal and leukemic blood cells.
- 3:00 **Monroe, Stephen.** (Beta Rho, Wake Forest University). Neurite growth in vitro on substratum-bound N-CAM.
- 3:15 **Oldenburg, Nicklas B.E.** (Beta Rho, Wake Forest University). Investigations of a novel bacterial cytolysin with potent killing activity of human leukemic cells.
- 4:15 **District Business Meeting**

BETA BETA BETA, District 2 - Welwyn Room

- 2:00 **Talton, Stepahnie.** (Eta Mu, Southern University). Mapping of plicotrophic genes, Ple C and Ple D and cloning of division gene, Dir K.
- 2:15 **Howell, Rosie.** (Eta Mu, Southern University). Lead uptake in tissues of the Louisiana red crayfish (*Procambarus clarkii*).
- 2:30 **Jones, Jennifer B., Joyce A. Rogers and Earl Doomes.** (Eta Mu, Southern University). Polyfunctional alkylsulfonfyl allylamino substrates.
- 4:15 **District Business Meeting**
- 5:00 **General Awards Meeting of Districts I and II, Salon IV**

Field Trip - April 6 - 1:00 P.M. Meet at the Hilton Hotel. Reed Gold Mine, transportation will be furnished. Admission free, but \$1.00 if you pan for gold. Guided tour.

ABSTRACTS

1

BASKIN, JERRY M. and CAROL C. BASKIN. University of Kentucky--Seed germination biology: Overview and update. Germination biology is inadequately and superficially covered in most general botany, biology, ecology, and plant physiology text books. Information on seed dormancy and germination in some texts is inaccurate and misleading. The purposes of this symposium are to (1) discuss the topics that need to be covered to give the student a good understanding of whole seed germination biology, (2) dispel some misconceptions about the ecology of dormancy-break in hard-seeded species, (3) discuss "pitfalls" to be aware of in doing ecologically meaningful experiments, including seed bank studies, and (4) suggest some laboratory exercises in whole-seed germination biology. Topics covered will include (1) types of dormancy mechanisms in seeds at the whole seed level, (2) the dormancy continuum, (3) dormancy cycles in seeds buried in soil, (4) effects of environmental factors, including factor interaction, on dormancy break and germination, (5) (somatic) germination polymorphism, (6) inter- and intra-population differences in seed dormancy - i.e., heredity vs. environment, and (7) life cycle, phylogenetic position, habitat, and geographical distribution in relation to dormancy type. A list of up-to-date references on the germination biology of whole seeds will be provided.

2

NOBLET, GAYLE PITTMAN and DENNIS E. KYLE. Clemson University and Walter Reed Army Institute of Research--Vertical distribution of protozoans in aquatic systems. Physical, chemical and biological characteristics of an aquatic ecosystem, as affected by meteorological events, are important factors to consider in environmental sampling for free-living or potentially pathogenic protozoans. In such sampling, both surface and subsurface environments should be examined. The subsurface environment is far from uniform. Due to heating in the summer, lakes can become stratified physically and chemically into several regions including massive chlorophyll concentrations, decomposition zones or layers composed of heterotrophic microbes, detritus and other organic material. The position of biotic or abiotic particulate layers can be located by discrete vertical sampling or, more efficiently, by use of a submersible horizontal beam transmittance meter, an instrument that measures attenuation of light due to absorption and scattering by particulates in the water column. To illustrate, a quantitative study of the seasonal distribution of thermo-tolerant (37°C and 45°C), small free-living amoebae was conducted in two warm, mono-

mittic lakes in the Piedmont region of South Carolina. Correlation of physical and chemical parameters with the seasonal distribution of amoebae was facilitated by partitioning each aquatic ecosystem into benthic, planktonic and neustonic habitats. The additional influences of watershed and basin morphology on variations in size and generic composition (Naegleria, Hartmannella, Vahlkampfia, and Acanthamoeba) of amoebae populations were included.

3

NEWSOME, ANTHONY L. Emory University--Protozoa and bacteria interactions The interactions between protozoans and bacteria within aquatic ecosystems can be classified into artificial categories used to describe the type of association. Numerous associations are available as examples of commensalism, synergism, mutualism, and others. Recent descriptions of certain protozoan-bacteria interactions may be of public health significance. A variety of easily used laboratory techniques are applicable to the study of these interactions. Hopefully some of these techniques will be of value to individuals wishing to pursue research and to those desiring to use protozoans and bacteria in a classroom setting. Laboratory studies have described the ability of protozoans to serve as a host cell for the intracellular replication of bacteria. This has most recently been illustrated by observing the interactions of Legionella pneumophila with the ciliate Tetrahymena and Naegleria amoebae. In addition, certain bacterial metabolites inhibit the cellular activities of protozoans. Inhibition of amoebae by iron-chelators produced by bacteria served as model system in vitro. The inhibition was examined in terms of affect on amoebae multiplication, viability and ultrastructure morphology. Electron microscopy and use of fluorogenic dyes were especially applicable to characterization of cell interactions and protozoan phagocytosis of bacteria. The dyes 4-6-diamidino-2-phenylindole (DAPI), fluorescein diacetate (FDA), and propidium iodide (PI), were found to be most suitable for determination of host cell viability and death and intracellular multiplication of bacteria.

4

SOBSEY, MARK D. and JON ANDERSON. University of North Carolina at Chapel Hill--Giardia lamblia and Cryptosporidium parvum contamination of drinking water. G. lamblia and C. parvum are important enteric pathogens whose cysts or oocysts, respectively, can contaminate fecally-impacted natural waters and cause drinking waterborne disease. Outbreaks of drinking waterborne giardiasis and cryptosporidiosis in the U.S. will be reviewed, as will methods for detecting G. lamblia and C. parvum in water. Because information on G. lamblia and

G. parvum contamination of N.C. drinking waters is limited, a survey for them was done in the raw and finished (fully-treated) waters of six piedmont N.C. municipal water supplies using surface water sources. (oo)cysts were recovered and concentrated from water by recently developed methods employing filtration, extraction, centrifugation and flotation. Samples were examined for (oo)cysts by epifluorescent microscopy after immunofluorescent staining using commercial reagents. G. lamblia and G. parvum were not found in samples of finished water. However, low concentrations of (oo)cysts were found in raw waters of 3 water supplies. Occurrence of (oo)cysts did not correlate with the levels of fecal indicator bacteria in water. These data suggest that G. lamblia and G. parvum contamination of some N.C. water sources exists but that conventional treatment reduces it to undetectable levels. With the development of new methods for recovery and detection of G. lamblia and G. parvum (oo)cysts in water and the documented evidence for their causation of drinking waterborne disease, further efforts should be made to determine the extent to which these enteric protozoans contaminate drinking water supplies.

5

CURRAN, ANN P. and JOHN G. MORRIS.
Florida Institute of Technology--
The relationship between manatee abundance and distribution and boat traffic densities in four areas in Brevard County, Florida.

Two areas each of designated high and low manatee densities were surveyed through aerial and land surveys. Boater questionnaires were distributed to supplement survey data. No significant relationships were found between the number of manatees or boats sighted in low and high density areas. The number of boats sighted on weekends were greater than on weekdays while the opposite was observed for manatees. Generally, the rate of manatees/two hour periods decreased, except in area three, as the rate of boats increased. Area three, a previously designated low manatee density area, was determined to be an important corridor area for manatees traveling from aggregation areas. Area two is used as a spring migration route for manatees leaving their winter refugia. Land surveys proved more valuable than aerial surveys for assessing manatee abundance and distribution in the study areas. Boaters responded favorably to questions concerning manatee/boater sensitive issues.

6

HERNANDEZ, J. DAVID and MICHAEL H. SMITH.
University of Georgia, and Savannah River Ecology Laboratory--Patterns of genetic variation in eastern mosquitofish (Gambusia holbrooki Girard) from the piedmont and coastal plain of three drainages.

Patterns of genetic variation at 21 loci are described for 88 Gambusia holbrooki

populations in three drainages of Georgia, South Carolina and North Carolina. Genetic diversity within populations (76-92%) was higher than that among populations (6-23%), drainages (1-2%), geographic provinces (2.8%) and water flow types (0.1%). The level of divergence among populations is one of the highest reported for fishes ($F_{ST}=0.175$). Coastal Plain populations had lower differentiation within drainages ($G_{ST}=6.4\%$) than those in the Piedmont ($G_{ST}=22.4\%$), lower average genetic distances among populations ($D=0.100$ vs 0.173) and drainages ($D=0.129$ vs 0.207), higher heterozygosity ($H=0.134$ vs 0.115), and more alleles per locus ($N_A=1.61$ vs 1.51). There were significant differences in allele frequencies among populations at 20 of 21 loci. Waccamaw populations were strikingly different from the other Coastal Plain populations. Genetic differentiation among populations of various drainages and water flow types also were detected for several loci. No evidence was found for a previously proposed north-south divergence of G. holbrooki into Type I and II.

7

HUNSINGER, RONALD N. and W. MIKE HOWELL.
Samford University--The use of acetone to solubilize steroids for direct treatment of fishes in aquaria water.

Our laboratory has been studying the effects of androgenic steroids on freshwater fishes. However, most steroids are highly insoluble in water. One aim of our research has been to solubilize the steroids so that they may be added directly to the water. Some steroid solvents are toxic to the fishes and tend to foul the water. We have found that acetone is an ideal solvent for most hydrophobic steroids. Because of the volatility of acetone, much of it appears to dissipate quickly from the water, leaving the steroid in solution. In this report, we describe studies in which $\Delta-4$ -androstene-3,17-dione, 5- α -androstan-3 β -ol, and methyltestosterone were all solubilized with acetone and mixed with aquaria water in order to masculinize female mosquitofish, Gambusia affinis. Additionally, the results of LC_{50} studies showed that acetone is relatively non-lethal to mosquitofish (static 96-hr $LC_{50} = 140$ ml/10L water; 95% CI = 128.7 -152.3 ml/10L water). Thus, volumes up to 50 ml acetone per 10L of aquaria water can safely be used to deliver steroids into the environment of the fish.

8

LU, CHUNG-CHENG and JUDITH THOMAS.
North Carolina State University--
In vitro floral morphogenesis in a day-neutral and an isogenic short-day line of Nicotiana tabacum L.

The ability of explants from donor plants of day-neutral (DN) N. tabacum NC-2326 and its isogenic short-day (SD) counter-part, NCTG-22 to form de novo floral buds has been examined. Explant sources included stem segment (SS) and thin cell layer (TCL) tissue from floral branches (FB) and the

main axis (MA). FB explants were obtained from either pedicel (PI) or peduncle (PU) at the flowering (FL) or green fruit (GF) stage. A basic medium composed of Murashige and Skoog's macro- and micro-elements was used with the addition of 100 mg/l myo-inositol, 1uM IAA and 1uM kinetin at pH 5.6. Materials were cultured at 24°C at 50% RH in the dark or under 8, 16 or 24-h photoperiods. The number of floral and vegetative buds were counted after 28 days in culture. FB explants from both DN and SD donors expressed the ability to form floral buds regardless of photoperiod, with DN>SD in number of buds formed. The highest number of floral buds was obtained on TCL from PI explants at the FL stage, and only callus, roots or vegetative buds formed on middle to basal MA explants.

9

MENHINICK, EDWARD F. University of North Carolina at Charlotte--Production of scientific publications.

Recent advances in word processors, laser printers, and halftone photography permit inexpensive production of quality handouts, manuals and even books. Steps used in the production of "The Freshwater Fishes of North Carolina" demonstrate the procedures. The manuscript was entered into "Write Now" on a Macintosh SE. After most corrections were made, it was transferred into "Pagemaker" for printing with an Apple Laserwriter. Final camera-ready copy was printed with a Varityper-600, and line drawings were pasted in place. Negatives were made of these pages with amberlith blocks protecting locations of shaded illustrations. Halftone negatives were made of shaded illustrations using amberlith overlays to produce white backgrounds. These negatives were pasted behind the screened areas of the manuscript negatives for production of plates which were run on an offset press.

10

METTEE, M.F.¹, O'NEIL, P.E.¹, PIERSON, J.M.² and SUTTKUS, R.D.³. Geological Survey of Alabama¹, Alabama Power Company² and Tulane University Museum of Natural History³--Fishes of the Western Mobile Basin in Alabama and Mississippi.

Data from 2,386 samples collected at 847 stations between 1942-88 were used to map the distributions of 151 fish species in the Black Warrior and Tombigbee River systems which collectively drain 20,200 mi² in western Alabama and eastern Mississippi. Notropis venustus was the overall dominant (79,657 specimens), and Lepomis megalotis was the most frequently collected species (7,429 samples). Geological processes and resulting features have strongly influenced the distributions of many species within the study area. Twenty Mobile basin endemics were col-

lected in the study area, four of which are shared with adjacent drainages outside the basin. Five Tennessee River system species have been collected in the Sipsey, Mulberry and Locust Forks. Four species common to the Cahaba and Coosa River systems have been collected in eastern tributaries of Locust Fork. Eighteen Coastal Plain species reach northern limits at the Fall Line and four upland species reach southern limits there. Ten species are rare or possibly absent in the Black Belt physiographic district but are widespread and often abundant north and south of it. A report including species' distribution maps will be published by the Geological Survey of Alabama in 1989.

11

MORRIS, JOHN G., ANN. C. SPELLMAN, and KATHRYN A. HICKS. Florida Institute of Technology--Manatee demography in the winter refugium at Homosassa Springs, Florida: A five year study.

Manatee population characteristics were examined during the winter months from 1984 through 1988 in the winter refugium at Homosassa Springs, Florida. This refugium has a winter resident population and a transient population whose members travel between the Homosassa and Crystal River refugia. The total population has ranged between 350 and 425 individuals in 1984, 1985, and 1988. There was a decrease to 140 individuals in 1986 due to a late winter storm and a resulting salt wedge intrusion that destroyed the fresh water vegetation, which is the manatee's principal food source. The fresh water vegetation had partially recovered by 1987 and the number of manatees had increased to 210 individuals. On any winter day the spring run will contain 10 to 60 individuals. Adults comprise 63 percent, juveniles 33 percent, and calves 4 percent of the winter population. Females slightly outnumber males in each age class except for calves.

12

PRICE, WAYNE and AMPARO BENITEZ. University of Tampa--Infestation and epidemiology of head lice in elementary schools in Hillsborough County, Florida.

An investigation of the prevalence and epidemiology of human head lice (Pediculus humanus capitis) was conducted in the elementary schools of Hillsborough County, Florida during the academic years of 1985-86 and 1986-87. A questionnaire survey of county schools showed that 6.7% of the students (excluding blacks) were infested in 1985-86. Nearly half of the cases were due to reinfestations. Students in one school were examined four times, at approximately 3 month intervals in 1986-87, and answered questionnaires. Ninety-seven (6.4%) of the 1515 white, Hispanic, and Asian students were infested, but none of the 436 blacks was infested. The distribution of pediculosis in non black students was significantly

influenced by season, sex, hair length, race, family size, crowding in the home, infestation of other family members, socioeconomic level, and mode of transportation to and from school. Classroom activities of students associated with increased lice infestation included using headsets, crowding at tables, and sitting on the floor.

13

THOMAS, MARY BETH and SANDRA F. ZANE. The University of North Carolina at Charlotte--The origin of the manubrium of the hydroid Eudendrium sp.

The polyp of Eudendrium bears an unusual bulbous oral projection, the manubrium. An opening forms distally; a second opening occurs between the the manubrium and the the hydranth proper. The manubrium is capable of rapid opening and executes a wide variety of shape changes. It thus resembles a medusa, which has a more complex muscular system than does the slowly responding polyp. The present study was designed to determine whether the manubrium originates by constriction of the embryonic body column, such that the distal opening is the true polypoid mouth, or is novel medusoid bud retained anterior to the true mouth. Bouillon (1966) demonstrated that the distribution of gastrodermal cell types is highly conserved in the hydrozoans. Electron microscopic studies of Eudendrium show that the cells typically associated with the mouth in other species occur in the manubrium, but not inside the second opening. Examination of the development of the manubrium shows no indication of an entocodon from which medusae bud in other species. Further, there is no indication of striated muscle which is typical of medusae. It is concluded that the manubrium is a modification of the primary gastric cavity of the polyp. Whether the distal opening remains open or heals over when closed as in other polyps (Campbell, 1987) is being examined.

14

WALLACE, JAMES W. ¹ and TRILOKI N. BHARDWAJ. ² Western Carolina University ¹ and the University of Rajasthan (India) ²--Flavonoids of aquatic and terrestrial forms of *Marsilea minuta*.

Marsilea, a genus of amphibious ferns, is known to contain a variety of polyphenolics including C-glycosylxanthones, C-glycosylflavones, flavone-O-glycosides and flavonol-O-glycosides. The flavonoid-O-glycosyl moieties include glucose, galactose, arabinose and xylose. Results of the current study indicate that the terrestrial form of M. minuta accumulates proanthocyanidins and flavonol-O-glycosides; in contrast, in addition to these compounds the aquatic form also contains

C-glycosylflavones. The compounds were identified by standard chromatographic (CC, PC, TLC, GLC) and spectral (UV-visible) procedures.

15

WATSON, MARK B., ¹H. WAYNE ELMORE, ¹ and ALAN R. WHITE. ² Marshall University¹ and North Dakota State University²--Characterization and linkage analysis of bracken fern extracellular polysaccharides

Bracken fern extracellular polysaccharides derived from the culture medium of suspension-cultured cells were analyzed. The extracellular polysaccharides were precipitated with 70% ethanol and charged polysaccharides were removed by QAE Sephadex ion-exchange chromatography. Fractions were pooled, dialyzed, lyophilized and subjected to Bio-Gel A-5m and Bio-Gel A-0.5m gel filtration chromatography to separate different sized fractions of polysaccharides. Major polysaccharides groups isolated were large, eluting close to the void volume of a Bio-Gel A-0.5m column. Glycosyl-compositions of pooled column fractions were determined by gas chromatography using the alditol acetates method and glycosyl-linkage compositions were determined by gas chromatography/mass spectrometry using methylation analysis. A major component of the extracellular polysaccharides was a type II arabinogalactan. The arabinogalactan contained 17% terminal arabinosyl and 14% 3,6-linked galactosyl residues. The small amounts of terminal xylose (5%) and 4,6-linked glucose (15%) detected suggests that xyloglucan is a minor component of bracken fern extracellular polysaccharides. The small amounts of charged sugar residues detected indicate that pectins are a minor component of the extracellular polysaccharides. The small amounts of xylosyl residues detected indicate that arabinoxylans, a major hemicellulose of monocots, is only a minor component of bracken fern extracellular polysaccharides.

16

WHITE, PATRICIA MCGUIRE, AND SANDRA T. BOWDEN. Agnes Scott College--The use of rapid tests in the screening of physiological and genetic characteristics of soil bacteria.

A variety of rapid tests was used to screen bacteria from two different plant communities on Davidson-Arabia Mountain, DeKalb County, Georgia. The API rapid test systems, 20ER, rapid NFT[®], 20GPTM, Staph Trac[®], and Rapid Strep tests, were used to collect physiological data for identifications and determinations of metabolic activities in soil. These tests yielded data from approximately 20 physiological tests within 4 to 24/48 hours. This is a modification in applications of API systems which are typically used for identification of clinical species. One area of interest is microbial interaction, an aspect of which is antibiotic production and resistance. The API MIC system was used to screen for minimum inhibitory concentrations of twenty-two different antibiotics. Correlations between physiological and resistance characteristics and the presence of plasmids have revealed genetic relationships be-

tween bacteria and their environments, providing genetic diversity and mobility within communities. Rapid plasmid screens indicate that both gram positive and gram negative isolates contain plasmids, often multiple, some of which are larger than 40kb.

- 17
Zavoş, P.M.¹, Groye, R.J.¹, Varney, D.R.², Siegel, M.R.¹ and Hemken, R.W.¹ University of Kentucky¹ and Eastern Kentucky University.² Effects of feeding endophyte infected tall fescue seed on reproductive performance of female CD-1 mice via competitive breeding.

This study was conducted to determine the effects of feeding endophyte infected (*Acremonium coenophialum*) tall fescue (*Festuca arundinacea*) seed on the growth and reproductive performance of female CD-1 mice via competitive breeding. One hundred sixty female mice were allocated to groups of ten and fed one of two diets. Diet 1 consisted of 50% Purina Mouse Chow and 50% tall fescue seed infected (80%) with *A. coenophialum*. After 50 d of preconditioning on their respective diets, a single male was introduced into each group of 10 females and allowed to cohabitate for 96 h (competitive breeding). The females continued through gestation on their respective diets. Body weights of dams and litter weights were recorded at parturition. There were no differences ($P > 0.05$) in pregnancy rates between dietary treatments 1 and 2 (50% vs 48.8%, respectively). The average number of pups born per litter (11.10 pups) and average total litter weight (17.21 g) was greater for those females consuming Diet 1 compared to Diet 2 (9.33 pups and 13.97 g, respectively). The incidence of dead and cannibalized pups was more frequent within Diet 2 than Diet 1 (0.13 vs 0.0 dead; 0.21 vs 0.03 cannibalized, respectively). The data suggest that although the pregnancy rates were similar between the two dietary treatments, the reproductive capacity or fecundity (litter size and litter weight) of female CD-1 mice was affected by the consumption of endophyte infected fescue seed.

- 18
Zavoş, P.M.¹, Varney, D.R.², Hemken, R.W.¹ and Siegel, M.R.¹ University of Kentucky¹ and Eastern Kentucky University.² Effect of feeding endophyte infected tall fescue seed on the reproductive performance using a highly inbred and a crossbred mouse model.

The objective of this study was to determine the effects of feeding endophyte infected (*Acremonium coenophialum*) tall fescue seed on the reproductive performance of CD-1 (crossbred) and C57BL/6 (BL6; inbred) mice through continuous breeding. Fourteen pairs of CD-1 and 14 pairs of BL6 mice (30 d old) were fed 1 of 2 diets which consisted of 40% mouse lab chow and (Diet 1) 60% noninfected tall fescue seed or (Diet 2) 60% infected tall fescue seed (80% infected). The 14 pairs of each of the CD-1 and BL6 mice were paired and allocated to 1 of the 2 diets

simultaneously. Mice fed Diet 1 were restricted to the intake level of those on Diet 2 which were fed ad libitum. Pairs were maintained until day 60, then the males were removed and the females were monitored for one additional gestational period (21 d). At delivery of each litter, female body weight, litter weight, and number of pups per litter were recorded. Pregnancy rates were similar in all treatments (100%) for all 3 litters born except in Diet 2 BL6 mice where they were reduced to 85.7%, 57.1% and 42.9% for litters 1, 2 and 3, respectively. Similarly, the number of pups per litter and body wt of pups born was more severely reduced in Diet 2 BL6 group of mice all across 3 litters produced. The results indicate that the highly inbred BL6 mouse model is more susceptible to fescue toxicosis than the CD-1 mouse model used in this study. Further studies should be conducted to establish if similar patterns exist in larger domestic species that consume fescue as the main source of their diets.

- 19
STEWART, T. BONNER, WILLIAM C. HENK, and LAURA E. YOUNGER. Louisiana State University--Scanning electron micrographs of perioral structures of swine nematodes. Large lips (*Ascaris suum*) or leaf-like lips and prominent sensory papillae (*Oesophagostomum dentatum*) are common to nematodes grazing the ingesta in the lumen of the small and large intestines, respectively. Nematodes intimately associated with the mucosa of the stomach (*Physocephalus sexalatus*) and small intestine (*Strongyloides ransomi*) have reduced lips or no true lips and less conspicuous sensory papillae. Blood feeding nematodes in the stomach (*Hyostrongylus rubidus*) and large intestine (*Trichuris suis*) have no lips or buccal capsule; however, the species in the small intestine (*Globocephalus urosubulatus*) has no lips and a large globular buccal capsule. Sensory papillae of the blood feeding nematodes are small. The lungworm (*Metastrongylus pudendotectus*) inhabiting the bronchioles, has two large tripartite lips and indistinct sensory papillae. Adaptations in perioral structures of swine nematodes studied appear to be related to the type of feeding behavior as well as to the organ parasitized.

- 20
FROST, CECIL C. University of North Carolina--Presettlement extent of upland fire communities of the southeastern Coastal Plain.

Fire-influenced savannas, woodlands and other communities once covered 97% of coastal plain uplands and parts of the Piedmont, with only 3% occupied by non-pyrophytic Southern Mixed Hardwood Forest. Today less than 3% remains of all natural upland vegetation types, while 97% consists of converted lands and disturbance vegetation. Longleaf pine, once the most abundant tree, can now be found in only about 1% of its original habitat. Nowhere in the South can longleaf be seen reinvading the mesophytic, non-pyrophytic successional forest that has replaced it. The spectacular

failure of the primeval pine forest to recover after exploitation is a milestone event in the natural history of the eastern United States, equal in scale and impact to the elimination of chestnut from Appalachian forests. A number of pyrophytic vegetation types are in danger of extinction. One of these, Sargent's transitional woodlands, shown on his 1884 map of longleaf pine, was a mixed savanna-woodland of longleaf, loblolly, shortleaf pines, oaks and hickories maintained by fire, which has never been recognized as a conservation priority and has been virtually extirpated. The decline of fire communities in general can be traced through the historical record of up to 400 years of land use by Europeans in the South. Historical material was used to construct a map of presettlement vegetation and a table of approximate acreage of uplands in each major vegetation type in presettlement times, along with changes in each type and conversion to new types as of 1900 and 1986.

21

WARE, STEWART. College of William and Mary--Potential Upland Forests of the Southern Mixed Hardwood Forest Region.

The open canopy fire-maintained longleaf (and slash) pine forests which originally occupied the uplands of the southeastern Atlantic and Gulf Coastal Plains from east Texas to southeastern Virginia have largely been replaced by closed canopy second growth forests of loblolly (and shortleaf) pine in which pine does not reproduce. Hardwoods, most once largely confined to the edges of swamps, have invaded the upland pine stands, and projection to a future upland forest in absence of fire and logging led to the concept of a Southern Mixed Hardwood Forest. Sweetgum is often the first and most abundant hardwood to invade under old field pines, but usually does not become a major canopy dominant. Water oak, southern red oak (especially on drier sites), southern magnolia (especially on moister sites), hickories (mockernut, pignut, sand), and white oak invade soon thereafter. Beech usually invades later, after hardwoods are abundant in the canopy. Holly, dogwood, black gum, and hop hornbeam may be important in the understory. Live oak and upland laurel oak regularly become dominants in peninsular Florida (where beech and white oak are absent) and the laurel oak may be abundant northward on sandy sites. The driest upland sites develop a less mixed forest much like the Piedmont oak-(pine)-hickory forests, while at the other end of the moisture gradient the upland Southern Mixed Hardwood Forest blends into bottomland forests dominated by beech, magnolia, and/or swamp laurel oak mixed with typical swamp forest species.

22

BRYANT, William S. Thomas More College--Oak-hickory forests of the Southeast.

In the Southeast, Kuchler's Oak-Hickory (K-O-H) covers major portions of Arkansas, Kentucky and Tennessee with extensions into Alabama, Mississippi,

Louisiana and Texas. The K-O-H as viewed today is the product of 150-200+ years of settlement which has reduced, modified, and fragmented the original forests. Strong genetic relations exist among the species groups of the K-O-H and are seen by the high degree of similarity between the mature mesic forests, although dry to xeric forests show greater differences in floristic makeup. Within the region a mosaic of types exists, however, there is an increasing importance of oaks and certain hickories from E to W across the K-O-H. The most extensive area of O-H and its variants is the Ozark uplands. However, even there mesic groupings occur on the lower slopes, in protected ravines, and on limestone soils. Local studies have shown that species sort out along a moisture gradient which may be projected for the entire region. Recent studies in the O-H forest area have shown that shade tolerant hardwoods are increasing in importance and the trend of succession toward this climax is very strong. The vertebrate fauna shows a strong similarity within the K-O-H, yet has been considered as depauperate relative to other areas. Continuing studies emphasizing forest dynamics, fire frequency, ecophysiology, species diversity, and other relevant baseline data are needed to better understand the K-O-H.

23

GILMORE, R. GRANT and SAMUEL C. SNEDAKER. Harbor Branch Oceanographic Institution and University of Miami--Biotic communities of the southeastern United States: Terrestrial communities-Mangrove forests.

Although mangrove growth may occur in warm temperate zones of several southeastern states, the better developed communities occur around the lower half of the Florida peninsula. The areal extent of mangrove forest coverage in Florida is estimated to be around 202,000 ha. Mangrove plant communities are classified in five major forest types: Fringe Forests; Overwash Mangrove Islands; Riverine Mangrove Forests; Basin Mangrove Forests and Dwarf Mangrove Forests. Successional patterns are controlled by short term changes in geomorphological processes, principally oscillating patterns of accretion and erosion; long term patterns, by changes in mean sea level. The transitional semi-aquatic mangrove forest community contains an equally transitional animal component. An indigenous community of aquatic, semi-aquatic and terrestrial organisms rely on mangroves and associated halophytic plant species for food, habitat and refugia from predation. Recent intensive quantitative studies of the communities allow the definition of various species guilds based on microhabitat preference and length of association. Although the annual rate of loss of mangrove coverage in Florida has been significantly reduced, there appears to be no corresponding decrease in the rate of deleterious ecological change within the existing mangrove vegetation.

24

RITCHIE, LISA and W. D. COCKING. James Madison University--Effects of soil mercury concentration on bioaccumulation of mercury by earthworms.

Earthworms living in mercury contaminated floodplain soils at Waynesboro, VA, have been shown to have significant tissue mercury concentrations. Uptake of mercury by *Lumbricus terrestris* in laboratory cultures was found to be directly related to the concentration present within the soil. Earthworms exposed to the most highly concentrated soils concentrated mercury in their tissues at much lower levels than the corresponding soil mercury concentrations, but greater than the amount of mercury in the earthworms from the soils containing small quantities of this element. Therefore earthworms in the most highly concentrated soils had lower accumulation ratios than those in the least contaminated soils. A direct relationship between the time the earthworms remained within the soil and the amount of mercury uptake was observed.

25

Middendorf, George and Lance Wyatt, Howard University--Of chiggers and lizards: the importance of mite pockets.

Chiggers, the larvae of trombiculid mites, parasitize many species of lizards and are often associated with morphologically distinct areas of the lizard epidermis called mite pockets. These sites are usually characterized by folds or small invaginations in the epidermis, covered by smaller-than-normal scales. These locations provide chiggers with easier access to food, while reducing exposure to intense light and heat, and decreasing the likelihood of being brushed off. Current theory suggests that these pockets evolved to minimize chigger damage by localizing parasitic attack. When access to the nuchal mite pockets of *Sceloporus jarrovi*, an iguanid lizard, was blocked, the total number of trombiculid mites on these lizards was not observed to differ significantly from that seen on control lizards. However, when denied access to the nuchal pockets, the chiggers occupied alternative sites, often infesting areas of the eyes, ears, and lips. If ectoparasite occupation of these alternative sites results in increased harm to the lizards, the evolution and occupation of mite pockets by chiggers may serve to reduce the potential for damage.

26

SCHNEIDER, STANLEY S. University of North Carolina, Charlotte--Absconding Behavior in the African Honey Bee.

Absconding behavior was examined in a natural population of honey bees in the Okavango Delta, Botswana. An absconding season appeared to begin in October-November, and during this time 50% of all excavated colonies

had abandoned their nests. The absconding season may have been associated with deteriorating foraging condition. Waggle dance activity was monitored in two observation colonies preparing for absconding. Dancers indicated sites far removed from their regular foraging range, suggesting colonies migrated into unfamiliar areas. Colonies traveled in the directions in which the majority of their waggle dances were concentrated; however, a specific nest site did not appear to be selected prior to departure.

27

MCCALLY, LINDA C. and STANLEY S. SCHNEIDER. University of North Carolina, Charlotte--The Mechanisms of Aggression in Honeybee Colonies.

Honeybee colonies are typically viewed as "peaceful" societies; however, recent evidence suggests that subtle aggression may play a role in organizing worker interactions. This study therefore explored the possible mechanisms of intracolony aggression in the honeybee. In queenless colonies, workers' ovaries develop, resulting in heightened aggression. Thus, aggression was investigated by comparing 3 worker interactions [grooming, trophallaxis (food exchange), and mauling (harassment)] in queenless (QL) and queenright (QR) colonies with respect to (1) the degree of ovarian development of participants and (2) the frequency of performance of each behavior. These comparisons provided insights into the possible role of subtle aggression in worker interactions in "normal" colonies, which possess a queen. In the QL colonies, workers which groomed and mauled had significantly less developed ovaries than their recipients. For trophallaxis, workers giving food had more developed ovaries than recipients; however, this difference was not significant. QR workers generally had undeveloped ovaries. Yet, when developmental differences existed, they were in the same direction as those observed for the QL hives. The frequencies of grooming and trophallaxis were similar in the QL and QR colonies; however, mauling increased significantly under QL conditions. Thus, while the analyses of ovarian development suggest grooming, trophallaxis and mauling may function as mechanisms for the regulation of aggression, the relationship between these behaviors and aggression is not clear at present.

28

MCGREGOR, JOANNE H. Savannah River Ecology Laboratory--Orientation through olfactory discrimination in *Ambystoma maculatum*.

The salamander, *Ambystoma maculatum*, is philopatric and its annual breeding migrations are oriented. Olfaction has been suggested as an orientation mechanism for this species, because migrations occur on overcast nights when visual and celestial cues are not available. The olfactory mechanism was examined experimentally using a habitat choice apparatus with mud and water odor cues from two locations, the salamander's home pond and a foreign pond. *A. maculatum* demonstrated a significant prefer-

ence for home pond odors over those of the foreign pond in two trials ($\chi^2 = 9.08$; $df = 2$; $p < 0.05$ and $\chi^2 = 7.43$; $df = 2$; $p < 0.05$). The ability to distinguish and choose between closely related odor cues may be crucial for salamanders to locate breeding waters each winter.

29

JACKSON, MARY E.¹, DAVID E. SCOTT², and RUTH A. ESTES². Memphis State University and Savannah River Ecology Laboratory--Determinants of nest success in the marbled salamander, *Ambystoma opacum*.

Nest distribution of the terrestrial-breeding marbled salamander, *Ambystoma opacum*, was examined in relation to several environmental factors at a breeding site in South Carolina. Females placed nests in areas of high total vegetative cover, and exhibited a tendency to concentrate nests in the lowest portion of the breeding site. Nests placed at high and medium elevations exhibited a non-random, aggregated pattern while nests at low elevations were more randomly distributed. Nest success (i.e., the proportion of a clutch that successfully hatched to the free-swimming larval stage) of 95 nests was measured in relation to nest elevation and the number of days a female remained with (brooded) the nest. Nest success was highest in the nests placed at low elevations, and in nests that females brooded for longer periods of time. Natural selection may favor nest site selection and brooding behavior as mechanisms to reduce embryo stage mortality.

30

REICHLING, STEVEN B. and RAYMOND D. SEMLITSCH. Memphis State University--Density-dependent injury in larval salamanders.

The effects of initial larval density, food level, and pond drying regime on intraspecific aggression of larval *Ambystoma talpoideum* were studied in an artificial pond experiment. Aggression was measured by the frequency of injury of feet, limbs, tail, and the extent of tail loss. Initial larval density had a significant effect on the frequency of foot, limb, and tail loss but not on the extent of tail loss. More larvae reared at medium and high densities sustained injuries than larvae reared at low densities but injuries were not more extensive. Food level had no effect on the four measures of injury. Pond drying regime had no effect on foot loss, limb loss, or the extent of tail loss but more larvae reared in constant water level ponds had tail loss than in drying ponds. The frequency of limb and tail loss was negatively correlated to density-dependent survival which was the result of intraspecific predation or cannibalism. These results indicate that substantive levels of body

injury, particularly tail loss, can occur at high natural larval densities and may result in a subsequent reduction of growth and survival.

31

MCGUIRE, ROBERT F. University of Montevallo--A numerical taxonomic analysis of selected heterocystous, unbranched, filamentous Cyanobacteria.

Thirty-six strains of heterocystous, unbranched, filamentous Cyanobacteria were investigated by using 22 traits from previously published literature. All of these strains reproduce by hormogonia and many also produce akinetes. The strains investigated have been assigned to *Anabaena*, *Nodularia*, *Cylindrospermum*, *Nostoc*, *Scytonema*, and *Calothrix*. The problem was to determine if the 22 traits would be sufficient to separate independently the 36 strains into their respective genera and to note any irregular clusterings. Character states were assigned to each character for each strain; simple matching coefficients were calculated and these converted into Euclidean Taxonomic Distances for the construction of a dendrogram. Within the dendrogram, the 7 *Anabaena*, the 3 *Cylindrospermum*, the 13 *Nostoc*, the one *Nodularia*, the one *Scytonema*, and 10 of the *Calothrix* strains clustered independently and within their respective genera. However, one akinete producing *Calothrix* strain was so removed from the others that its generic status is in question.

32

AFFRONTI, LEWIS F. and HAROLD G. MARSHALL. --A comparison between Utermohl and epifluorescence enumeration techniques for picoplankton.

A 12 month study of picoplankton (0.2 μ m - 2.0 μ m) abundance was made from October 1987 to September 1988 in the lower Chesapeake Bay. A comparison was made using two phytoplankton counting techniques for enumerating annual picoplankton abundance. Epifluorescence microscopy was found to be a more accurate method of enumerating picoplankton compared to a modified Utermohl technique employed in this study. However, the annual patterns of abundance were found to be similar using both the Utermohl and epifluorescence techniques. Utermohl counts showed an overestimation of total cells in the fall and winter months and an underestimation in total cells in the spring and summer months. Annual picoplankton abundance using epifluorescence microscopy ranged from 2.75 x 10⁶ cells/L in the winter to 1.03 x 10⁹ cells/L during late summer indicating the importance of including this microscopic component in phytoplankton inventories of the picoplankton for the Chesapeake Bay if more accurate numbers are desired. Supported in part by the Virginia State Water Control Board.

- 33 DAVISON, PAUL G., DAVID K. SMITH, and KENNETH D. MCFARLAND. The University of Tennessee, Knoxville--The discovery of antheridia in Takakia.

The discovery of Takakia (Bryophyta) in 1951 is considered among the important bryological discoveries of this century. The genus contains only two species T. ceratophylla and T. lepidozoioides. After 37 years of study, a considerable body of information has been gathered which has clarified species relationships; yet, its hierarchical classification has remained open to speculative interpretations. Its simplistic gametophyte morphology and low chromosome number (n=4, 5) has lead some bryologists to align Takakia with the liverworts (Hepaticae) near or within the "primitive" Calobryales. The discovery of mosslike archeogonia in 1958 raised new questions as to its relationships within the liverworts as traditionally defined. Recent morphological and developmental studies of gametophyte apical development and the discovery of antheridia-bearing plants in T. ceratophylla from the Aleutian Islands are new evidence for regarding this odd archeogoniate as a moss. Interpretation of the mosslike antheridia of Takakia support realignment of the class Takakiopsida next to the Andreaeopsida (Musci).

34

BOWERS, FRANK D. AND ALVIN DIAMOND

University of Wisconsin-Stevens Point and Troy State University--The bryophyte flora of two limestone caves in Conecuh county, Alabama.

The two limestone cave sites have a rich bryophyte flora with over seventy species present. The rarest find is Luisierella barbula (Schwaegr.) Steere found before in the southeast only from one location in Georgia and a few sites in Florida. Comparisons between species list of the cave sites, limestone areas in northern Florida and sink holes in Tennessee: Indicate the cave site flora is like that of the Florida sites. The areas geology, climate, land-use history, and topography will be discussed.

35

POWELL, MARTHA J. and WILL H. BLACKWELL. Miami University--Phylogenetic reconstruction of Oomycetes using cladistic analysis of ultrastructural characters.

Ultrastructural features of motile cells have been used to structure much of the current taxonomic and phylogenetic concepts of Protista. Among Oomycetes, ultrastructural details of organelles and of the flagellar apparatus have been empirically compared, but not subjected to more objective methods of analysis. The purpose of this study is to collate existing ultrastructural data on motile cells of heterokont Protista and to analyze it using cladistic methodology. Although there are readily identifiable gaps of information in the data set, analysis within Oomycetes supports the close affinity of the order Leptomitales to the

Saprolegniales and a possible link to the Peronosporales. The order Lagenidiales does not hold together by character analysis, and hence represents a heterogeneous grouping of organisms which should be realigned into different orders. Chromophytous algae prove to be plausible outgroups to the Oomycetes.

36

HUSSBAUM, FRANCIS. Kent State University--Dynamics of Cladosporium and other airborne fungal spore populations.

Airborne fungal spore populations were sampled by opening yeast malt extracts agar petri plates four times a day at weekly intervals at four sites during June 1988 on the Tuscarawas Campus of Kent State University. The sites were an unshaded lawn, the lawn within a grove of Pinus sylvestris, the lawn below a grove of Platanus occidentalis and an asphalt covered parking lot. The unshaded lawn produced its highest spore counts during the morning and its lowest counts in the afternoon. Counts within the pine and sycamore groves were highest at midday and were lower during the morning and afternoon. Evening spore counts tend to increase following the low counts of the afternoon. Colony counts from the parking lot were consistently low with no significant diurnal fluctuations. Elevated airborne fungal spore counts occur during the morning when temperatures are rising and the relative humidity is decreasing. The peak densities in airborne spore populations are attained several hours later in areas of shaded lawn compared to areas of unshaded lawn. Dominant molds in the sample plates were species of Cladosporium. These findings should be useful when predicting risk to persons sensitized to fungal allergens. The importance of the microenvironment must be considered when attempting to correlate clinical records of fungus allergies with seasonal fluctuations in airborne fungal spore populations.

37

EUGENE G. MAURAKIS and WILLIAM WILLIAM S. WOOLCOTT.

University of Richmond--Were they accurate? Comparison between journal accounts and video recordings of reproductive behaviors of selected cyprinids.

Video taped examples of the reproductive behaviors of pebble nest building, interspecific and intraspecific aggression (parallel swim, circle swim and head butting), and spawning are presented with representatives of the species Nocomis leptoccephalus interocularis, Semotilus corporalis, and Rhinichthys atratulus. The video recordings are compared with literature accounts that are taken from

notes of field observations by earlier naturalists. A narrative based on excerpts from literature accounts pertinent to each behavior pattern accompany corresponding behaviors on video recordings. Supported in part by the University of Richmond Faculty Research Fund, the Richard Gwathmey and Carolyn T. Gwathmey Memorial Trust, and Grants-in-Aid from the Highlands Biological Station.

38

SCHWARTZ, FRANK J. Institute of Marine Sciences, University of North Carolina. --Feeding behavior of the cownose ray, Rhinoptera bonasus (family Myliobatidae). Cownose rays, Rhinoptera bonasus, are benthic hydraulic miners of muddy or sandy substrates during their feeding searches for their preferred molluscan foods: Mya arenaria, Gemma gemma, Ensis directus, Macoma balthica, Tagelus divinus, and Mercenaria mercenaria. Motion pictures capture the feeding behavior of aquarium held specimens and reveal how wild rays utilize the fleshy flaps that are located on the anterior-ventral aspect of the head. A specific glide pattern is exhibited indicating intent to feed. Mining commences once a food is sensed. The flaps are held tightly against the head when swimming. During feeding, the flaps are flared downward and medially and act, as the ray bobs and digs along the substrate, in channeling the food toward the mouth. Flat pavement toothed jaws crush and eject the shells prior to maceration and swallowing of the food. A peculiar arching of the body, onto its wing tips, occurs while the ray purges muds or sands from its gills and ventral surface before assuming "normal" swimming or food searching elsewhere.

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SCHWARTZ, FRANK J.¹ and WILLIAM T. BARHAM² Institute of Marine Sciences, University of North Carolina, NC¹ and Dept. of Zoology, University of Zululand, South Africa². --Gill filament responses and modifications during spawning by mouth brooders and pit spawning Tilapia. Cichlid fishes commonly called Tilapia were divided by Trewavas (1973,1983) into mouth brooders (genus Sarotherodon) and pit spawners (genus Tilapia). We refer both types to the genus Tilapia. Gill filament number, size, weight, and area of three species were examined to determine responses by female T. mossambica (mouth brooder), carrying a mouth full of eggs or larvae, during the breeding season, with non-mouth brooder pit spawners T. aurea and T. rendalli). Gill filaments of male and female T. aurea and T. rendalli were unaffected during spawning, although slight numerical increases occurred with body growth. Gill filaments of female T. mossambica increased in number, weight, and size (perhaps area) during incubation/brooding and fish size. Egg clutch size

remained constant regardless of fish size. Small, rather than large female brood larger larvae. Male T. mossambica have more gill filaments than females with or without broods. T. aurea have more gill filaments than T. mossambica while T. rendalli have less than either T. aurea or T. mossambica. Filament changes have far reaching physiological implications in how females supply sufficient oxygen to eggs, larvae or themselves. Filament studies also permit successful resolution of hybrid identity between tilapias.

40

FERGUSON, MARK T. University of Alabama--Crevice spawning behavior of Cyprinella trichroistia, C. gibbsi, and C. callistia.

Spawning behaviors of Cyprinella trichroistia, C. gibbsi, and C. callistia were observed in laboratory aquaria and compared. Crevice spawning, a reproductive strategy characteristic of this genus, was verified in all three species. Crevices were simulated with two clay tiles separated by 5 mm and placed horizontally in each tank. Reproduction in C. trichroistia and C. gibbsi appeared very similar. Males would guard a crevice along the tiles, often with several males guarding the same edge. No dominance was apparent among these males, which would chase away intruding fish and each other. Typically, guarding males attracted gravid females by performing mock spawning runs along the crevice. A single gravid female would approach the crevice, where a guarding male would join her and the two would swim side by side horizontally, releasing adhesive eggs and milt into the opening. "Sneaking" behavior was observed in a male C. trichroistia exhibiting reduced secondary sexual characteristics. This fish was also observed spawning alone with a female, unnoticed by guarding males. Male C. callistia also guarded territories near a crevice; however, the larger and/or more tuberculate males were dominant over other guarding males. These males were much more aggressive than those of the other two species, often leaving the crevice to actively chase females in other areas of the aquarium.

41

BELLERUD, BLANE L. Mississippi State University--Habitat preference and behavior of the speckled dace, Rhinichthys osculus.

The habitat preference of the speckled dace (Rhinichthys osculus) in Wilson Creek, Kittitas Co., Washington were studied in relation to fish size and behavior. Young fishes used the stream edge and moved to less sheltered habitat and faster water as adults. Schooling and feeding dace used areas of faster current and less cover than solitary or nonfeeding fishes. Stomach analyses showed a shift in food items from insect larvae in the summer to diatoms and algae during the winter.

42

KUHAJDA, BERNARD R. and MELVIN L. WARREN, JR. University of Alabama and Southern Illinois University at Carbondale--Life history aspects of the harlequin darter, Etheostoma histrio, in western Kentucky.

Harlequin darters were collected from the east and west forks of Clarks River and Blood River from June 1984 to May 1985. Most darters were taken over sand or fine-coarse gravel in moderate-fast current, and were commonly associated with detritus, especially in the spring. *Etheostoma histrio* disappeared from our study sites in February and March at the peak of the breeding season. Length-frequency data and scale annuli indicate specimens live up to 4+ years of age. The sex ratio was skewed in the fall samples (2.9 females to 1 male) and in the total samples (1.7 females to 1 male). Females apparently spawn in their first year. Average ovarian egg counts (N=16-19) were 89, 101, 268, and 456 for Class II, III, IV, and the total ova, respectively. Not enough Class I ova were present in our samples to determine average numbers per individual. Average egg size (N=44-90) was 1.16, 0.99, 0.74, and 0.52 mm for Class I, II, III, and IV, respectively. Diet consisted mainly of chironomid larvae, followed by simuliid and trichopteran larvae, and mayfly naiads.

43

JENNINGS, DAWN P. and JAMES D. WILLIAMS. U.S. Fish and Wildlife Service--Factors influencing the distribution of blackchin tilapia (*Sarotherodon melanotheron*) in the Indian River system, Florida.

The blackchin tilapia (*Sarotherodon melanotheron*) is an exotic cichlid fish native to estuarine areas of west Africa from Senegal to Congo. It was first collected from the Indian River system at Satellite Beach, Brevard County, Florida in 1980. Since 1980, it has expanded its range northward along the coast approximately 37 km, and southward about 63 km to Vero Beach. The northern distribution of *S. melanotheron* probably will be limited by cold temperature however, the potential exists for extensive coastal invasion south of its present limits. When subjected to a temperature decline of 1° C/hour from an acclimation temperature of 18° C, mortality occurred at a mean temperature of 6.9° C. Cold tolerance was not significantly different between salinity concentrations of 5, 15, and 35 ppt, reflecting the euryhaline nature of *S. melanotheron*. Results from preliminary studies on salinity tolerance indicate an ability of this species to reproduce in salinities ranging from 0 to at least 35 ppt, and tolerate hypersaline concentrations of at least 100 ppt.

44

POARCH, STEVEN M. and JAMES B. LAYZER. Tennessee Technological University--Distribution and Movements of Striped Bass in Old Hickory Reservoir, Cumberland River, Tennessee.

Temperature-sensing ultrasonic transmitters were surgically implanted into 45 striped bass (*Morone saxatilis*) to determine if the distribution and movement of striped bass within Old Hickory Reservoir was related to water temperature. During summer and early fall, striped bass congregated mainly in the upper third of the reservoir, which is more riverine and typified by water temperatures less than 20°C. By late fall, and into winter, two patterns of behavior

emerged. One pattern consisted of fish that moved downstream in the reservoir; many of which reached and stayed in the warm water discharge of the Callatin Steam Plant. Water temperatures in the discharge averaged 15°C during the winter. The other pattern consisted of fish that remained in the upper portion of the Cumberland River and then moved into the Caney Fork River, a cold tailwater tributary where water temperatures rarely exceeded 13°C. Spring brought an upstream movement by most tagged fish that wintered at the discharge and a downstream movement by fish out of the Caney Fork. During April and May fish congregated near an island 35 km downstream from Cordell Hull Dam and 79 km upstream from the discharge. Movement of fish into cooler water during the summer and into warm water during the winter suggests that their movements were temperature related. Results of our study will be useful in management of striped bass and in minimizing conflicts between sport and commercial fishing interests.

45

JOHNSTON, CAROL E. Illinois Natural History Survey--Spawning activities of *Notropis chlorocephalus*, *N. chiliticus*, and *Hybopsis hypsinotus*, three nest associates of *Nocomis leptoccephalus* in the Southeastern United States.

Spawning activity was observed for *Notropis chlorocephalus* in 1987 and 1988, and for *N. chiliticus* and *Hybopsis hypsinotus* in 1988. Aggregations of males of all three species were observed over the nests of *Nocomis leptoccephalus*. A female typically initiated spawning by moving over the nest, where she was pursued by one to several males. Spawning occurred in *N. chlorocephalus* and *N. chiliticus* when a female moved or was driven by a male (or males) to the substrate, where they vibrated and presumably released gametes. Spawning often occurred in small pits on the tops of nests; these pits were probably constructed by male *Nocomis* for their own spawning. The spawning act was not observed for *H. hypsinotus*, but numerous tuberculate males were observed holding territories over nests and ripe females were collected from the area immediately behind the nests. These spawning observations are part of a long-term study on the evolution of nest association in North American minnows. As part of this study, ten artificial nests were constructed in streams with active *Nocomis* nests to determine if association behavior was due to a lack of suitable spawning substrate elsewhere in the stream. No fish were seen over the artificial nests (41 observations), indicating that the associate species are attracted to other factors associated with *Nocomis* nests or that the associates under observation had chosen spawning sites before the artificial nests were constructed. This research was supported in part by a Grant-in-Aid of Research from Sigma Xi, The Scientific Research Society.

46

PATTON, SHARON. University of Tennessee College of Veterinary Medicine--Toxoplasma and the AIDS Connection.

Toxoplasmic encephalitis, one of the most common causes of encephalitis in the US, is probably the most frequent opportunistic infection of the CNS in patients with AIDS (acquired immunodeficiency syndrome). The pathogenic mechanisms involved in the interaction of these two diseases are not fully understood, and methods for the rapid diagnosis and treatment of this condition are lacking. Recently, a feline immunodeficiency virus (FIV) was isolated from domestic cats with an immunodeficiency-like syndrome. FIV is a typical lentivirus which resembles HIV. The sequelae of a concurrent infection in cats of FIV and T. gondii are not known. Information on this subject would be beneficial to the cat population and also offer an opportunity to investigate the usefulness of concurrent infections of FIV and T. gondii in cats as an animal model for the study of toxoplasmic encephalitis. Since 1981, UTCVM parasitology laboratory has checked animals for the presence of toxoplasmosis and banked the serum. At the present time, 183 of these approximately 500 sera have been tittered for antibody against FIV by IFA technique, and the results correlated with the Toxoplasma titers and clinical signs. Results were as follows: 29.51% of the cats were positive for antibodies to FIV with some positive serum samples present from each year of the collection period; 48.15% of the cats positive for FIV were also positive for Toxoplasma.

47

STRAWBRIDGE-JOHNSON, S.L., SHARON PATTON, and M.D. MCCRACKEN. University of Tennessee College of Veterinary Medicine--Prevalence and Pathology of Dirofilaria immitis in Cats in TN.

Three (2.5%) of 122 adult cats from a stray cat population euthanized at the Knox County Animal Shelter and necropsied at UTCVM had one adult D. immitis in the right ventricle of the heart. Blood samples from each cat were examined for antibodies to D. immitis by ELISA and IFA tests and antigen produced by adult heartworms with the ClinEase Canine Heartworm Antigen Test Kit (Synbiotics Corp). The ELISA-ab titers ranged from 8 - 4096; IFA titers ranged from 0 - 453. The ELISA titers of the cats with D. immitis were 1024, 1024 and 256; the IFA titers were 0, 0, and 69. Only one cat was positive for heartworm antigen. Three cats (clinical cases) were necropsied and D. immitis adults were found in the heart. ELISA-ab titers were 256, 512, and 8192; IFA titers were 302, 460 and 1078. The 3 clinic cases were positive on the Ag- test. One intact worm was recovered from the right ventricle of one of these cats; the other 2 had 4 worms in the right ventricle. All 6 cats had gross pathological changes in the pulmonary arteries similar to those seen in canine dirofilariasis. Microscopic changes were consistently present in the pulmonary

arteries and lungs. From November 1985 - June 1988, serum collected from cats suffering from respiratory or circulatory problems or those with unresolved vomiting was analyzed for D. immitis adult-ag. Six (12%) of the 56 samples were positive. During this same period 14.29% (70) of 490 samples from dogs that were negative for microfilariae were positive for adult-ag. The incidence of occult heartworm in dogs and cats as determined by the presence of adult antigen was not significantly different.

48

BUTTS, JEFFREY A., ELIZABETH B. HARRIS, ROBERT E. ARLEDGE, and I. GENE GILLMAN. Appalachian State University--Prevalence of Dirofilaria immitis in Northwestern North Carolina.

Canine Heartworm, Dirofilaria immitis, has been a veterinary concern in the Piedmont and Coastal Plain areas of North Carolina for several years. However, in the Mountain Region of Northwestern North Carolina, veterinarians have assumed that infection with this filariid was not present. In June of 1988 a study was begun to determine the presence or absence of D. immitis in this region of the state. Stray dogs scheduled for euthanasia at the Watauga County Animal Shelter, which serves both Watauga and neighboring Ashe County, were tested for microfilariae of D. immitis using the Knott's technique. Preliminary results indicate that 13% of the dogs tested are positive for microfilariae of D. immitis. Thus Canine Heartworm is present in Northwestern North Carolina.

49

Edwards, Robert W., Jennifer M. Scoville and Frances M. Woznick. University of North Carolina at Chapel Hill--Intestinal parasitic infections in migrant farmworker children in eastern North Carolina.

A total of 248 children of migrant farmworkers living in eastern North Carolina were screened for gastrointestinal parasites from May through September 1988. Seventy-one (28.6%) individuals were positive for one or more species of enteric parasites. Of this group 39.4% had a single infection and 15.5% had concurrent infections of two or more parasitic organisms. Prevalence of Giardia lamblia (32.4%) was highest followed by Entamoeba coli (22%), Trichuris trichuria (7.2%), Cryptosporidium parvum (5.8%), with Hymenolepis, Entamoeba histolytica and Ascaris (all less than 3%). Protozoan, especially Cryptosporidium, infections were found to vary significantly in association with the age of the child. Children who were singularly infected with Giardia demonstrated a significantly high rate of asymptomatic cyst passage. Clinical presentation of symptomatic gastrointestinal distress was significantly higher in those individuals who were found to have two or

more intestinal parasites or were infected with Cryptosporidium parvum. The results compare favorably with previous reports that migrant farmworker children are at high risk for parasitic infections. However, both children attending day-care and those who remain asymptomatic during some portion of the course of infection, pose unique public health problems to their close associates and potentially to a much larger portion of the general population.

50

FRANDSEN, JOHN C. and BYRON L. BLACBURN. USDA, ARS, Animal Parasite Research Laboratory, Auburn, AL 36831-0952, and Auburn University, AL 36849. Dynamics of natural coccidial infections in a goat herd in Alabama.

Adult goats in Alabama harbor drug-resistant, generally asymptomatic coccidial infections that continually produce large numbers of fecal oocysts. Contamination of the environment with these oocysts leads to infections in young kids, with resultant morbidity and mortality. Fecal samples were collected over the past year from adult, sentinel goats in the laboratory herd in order to determine the species responsible for the coccidial infections and the dynamics of oocyst production by these species. During the spring and summer - from March through September - Eimeria arloingi, E. christenseni and E. parva were responsible for the infections, with E. arloingi producing the most oocysts, E. parva generally the least. The magnitude of the environmental contamination by E. arloingi oocysts is indicated by counts/gram feces as high as 50,000 in the spring.

51

SNYDER, DANIEL E. USDA-ARS, Animal Parasite Lab--New information on the location of Capillaria procyonis (Nematoda: Trichuroidea) in the tongue of a raccoon (Procyon lotor).

Capillaria procyonis was described as a new species in 1975 from the esophagus of raccoons (Procyon lotor) in Louisiana. More recently, unembryonated capillariid-type eggs were found in the sediment resulting from digests of the tongue of raccoons. Adult parasites were not recovered from these digests and based on measurements and surface topography, the eggs were tentatively identified as those of C. procyonis. The purpose of this report is to follow up on this earlier finding and describe the presence of adult parasites and eggs of C. procyonis as seen histologically in the epithelial covering of the tongue of a raccoon. The nematodes and their eggs were seen within parasite-induced tunnels in the stratified squamous epithelium. There was no evidence of any inflammatory infiltrate either within the epithelium or the subjacent lamina propria. The interior of the parasite-induced tunnels were lined by flattened and attenuated cells and the shape of the tunnels approximated that of the resident nematodes. Based on these findings and other reports in the literature, the sites of infection of C. procyonis in the

raccoon should include in addition to the esophagus, the oral, lingual and pharyngeal epithelium.

52

BLAGBURN, BYRON L., MARK V. DARLINGTON and FREDERIC J. HOERR. Auburn University--Taxonomy of avian Cryptosporidium species: Problems and solutions.

Cryptosporidium spp. are apicomplexan protozoans that inhabit the microvillus borders of epithelial surfaces of vertebrates. Six species are recognized as valid; two in mammals, two in avians, and one each in reptiles (controversial) and fish. Among avians, Cryptosporidium has been observed in the respiratory, enteric or urinary tracts of 19 different host species. Disease results most often following colonization of the respiratory tract of chickens, turkeys and quail, and the enteric tract of turkeys and quail. Species determinations are based primarily upon host species, sites of infections, cycles of endogenous development and stage (principally oocyst) morphometrics. Our studies indicate that such criteria do not validly distinguish between quail and turkey Cryptosporidium "species". Similar sizes of stages and sites of development within organs and cells preclude (in most cases) their use as species determinants. Future nomenclatural criteria should include studies of endogenous development and cross-transmission, combined with more advanced methodologies such as SDS-PAGE, FICE, or isoenzyme analysis. This is only possible, however, if large numbers of parasites can be obtained.

53

HUPP, CLIFF R. and EDWARD E. MORRIS. U.S. Geological Survey--A Dendrogeomorphic Approach to Sedimentation in a Forested Wetland, Black Swamp, Arkansas.

Dendrogeomorphic techniques were used to describe and interpret the spatial and temporal patterns of sedimentation in the Black Swamp, located along the Cache River in eastern Arkansas. At 30 sites, along four transects, 148 trees were sampled for depth of accretion and cored for age determination. Tree-ring and geomorphic analyses showed that mean-sedimentation rates were significantly associated with site elevation, topographic position, and the distribution of tupelo gum and baldcypress. Maximum-mean rates of sedimentation, up to 0.60 cm/year, generally occur in sloughs, areas low in elevation, and where baldcypress and, in particular, where tupelo gum grow. Mean-sedimentation rate appears to have a negative exponential relation with increasing elevation. No relation was found between distance from river and mean-sedimentation rate. Tree-age data showed a significant increase in sedimentation rate over the most recent 35 to 40 years, from a mean at or below 0.01 cm/yr to a mean of 0.28 cm/yr for the past 19 years. Dendrogeomorphic techniques provide valid estimates of actual sedimentation rates and allow for the integration of decades of depositional processes into rate calculation.

54

BAILEY, JOHN J. and J. PATRICK MEGONIGAL. Savannah River Ecology Laboratory--Effects of Root Quality on Root Decomposition.

Both environmental conditions and tissue composition are key factors controlling rates of leaf litter decomposition. We are investigating the relative importance of these factors in the decomposition of woody roots. Roots of three tree species were buried on three sites of widely different hydroperiods (saturated in the rooting zone 94%, 19% and 0% of the growing season). The tree species (Acer rubrum, Pinus taeda and Quercus virginiana) were chosen because of large presumed differences in tissue composition or quality. Fine roots obtained from nursery stock were placed in mesh bags and buried randomly along transects at each site. At two months there were no significant differences in weight loss within a species between the sites. There were no significant differences between species within a transect on the two wettest sites. However, loss rates on the driest site were significantly different (ANOVA, $p \leq .0001$); mean weight losses were 27.8%, 19.9% and 11.4% for A. rubrum, P. taeda and Q. virginiana. This suggests that root quality is of less importance on the wet sites than on the dry site where conditions for decay are not as favorable.

55

MEGONIGAL, J. PATRICK and FRANK P. DAY. Savannah River Ecology Laboratory, and Old Dominion University--The influence of hydroperiod on soil nutrient dynamics in an organic soil.

The influence of flooding on soil nutrient cycles is poorly understood and difficult to study experimentally. Large experimental mesocosms (100m³), planted with bald cypress saplings, were used to investigate the effects of hydroperiod on the availability of nutrients in an organic soil. The mesocosms were continuously flooded or seasonally flooded. Water samples were drawn from paired wells at five depths twice monthly and analyzed for NH₄, PO₄, Ca, Mg, Fe and Mn. Concentrations of NH₄, PO₄, Ca, Fe and Mn were generally greater in the continuously flooded mesocosm (ANOVA, $p < .05$). Except for Fe, the elements increased in concentration with increasing depth in the continuously flooded cell (ANOVA, $p < .01$) but not in the periodically flooded cell. Concentrations of most elements peaked in late summer-early fall and then declined during the winter. The winter decline was rapid for NH₄ and gradual for PO₄. A strong seasonal cycle in Fe concentration is not related to redox conditions but may reflect seasonal variation in pH. The results suggest that during periods of soil saturation, the pore water

of a periodically flooded organic soil will have lower nutrient concentrations than that of a continuously flooded soil.

56

CIRAVOLO, THOMAS G. and KENNETH W. MCLEOD. Savannah River Ecology Laboratory -- Fly ash and the growth of water tupelo and bald cypress seedlings.

Fly ash, a by-product of coal powered electric generation is enriched in boron. Boron is an essential element for plant growth but has a relatively small range between deficient and toxic levels. The consequences of intentional or accidental release of this material into swamp ecosystems is unknown. The effect of incorporation method (layering on the surface vs mixing) and rate of fly ash additions (0 to 10 % w/w) to fertilized sand on the growth of water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum) were studied. The seedlings were grown under saturated to slight flooding (less than 2 cm of standing water) in greenhouse conditions. Method of incorporation had no significant affect on height, basal diameter, and biomass of leaves, stems, or roots. Fly ash rates less than 2.5 % increased growth of water tupelo and bald cypress. The effect of fly ash greater than 2.5 % on water tupelo seedlings was typified by reduced height and diameter growth; pale yellow-green to white coloration of new leaves and death of the apical meristem. Damage was proportional to fly ash rate. Although height of bald cypress was depressed in the 5 and 10 % rate, the greatest biomass was at the highest fly ash (10 %) rate.

57

Knowles, David B. East Carolina University--The seed bank of a brackish marsh dominated by Juncus roemerianus.

In irregularly flooded brackish marshes, the role of seed germination and seedling establishment in the colonization of devegetated areas is generally considered to be minor. Vegetative propagation is usually the principal means of colonization. However, given favorable environmental conditions of decreased hydroperiod, relatively low salinity, and a barren marsh surface, seedlings may contribute to colonization. A greenhouse experiment was conducted to determine the existence of a seed bank and if differing hydroperiod and salinity regimes had a significant effect on germination. Surface soil was collected from each of three vegetation zones in a brackish marsh within the Cedar Island National Wildlife Refuge, N.C. Replicate

samples were exposed to flooded or drawdown conditions with water either fresh or with a salinity adjusted to a concentration approximating that at the collection site. After 5 months, no seedlings were found in the flooded treatments. In the drawdown treatments, Juncus roemerianus and Fluchea purpurascens seedlings were most common. Species diversity increased from the zone at marsh edge to the interior. Saline waters significantly reduced germination in all but the most interior zone where ambient salinity was only 5 ppt. The results indicate a viable seed bank exists in all vegetation zones but environmental conditions often preclude its expression.

58 DOORIS, PATRICIA M. and GEORGE M. DOORIS. HDR Engineering Inc. and Saint Leo College--Differences in selected community parameters in small Florida wetlands.

The significance of small (<1 acre) forested and herbaceous wetlands in Florida has been disputed, particularly in the past 5 years as state regulations designed to preserve wetlands conflict with pressures to develop land only marginally suited for building. There is a clear need to determine the ecologic value of these systems in order to justify regulatory efforts and economic impacts associated with the conservation of these small wetlands. This work aimed at collecting quantitative vegetational data on 10 small wetlands in central Florida. For each wetland, data were obtained on shrubby species from 4 10M X 10M quadrats centered on a 60M transect; tree species were enumerated and dbh's measured within a 5M X 60M plot; the cover by herbaceous species was determined from 4 pairs of 1M X 1M quadrats; and zonation was determined along a 60M transect. This and other qualitative sampling was done quarterly for one year, and the results were compared among the 10 wetlands. Data show that parameters such as species diversity, richness, and importance value for the small wetlands are of a magnitude similar to those derived for larger wetland systems. This work was supported by the West Coast Regional Water Supply Authority, Clearwater, Florida.

59 Hoagland, Bruce W. Eastern Kentucky University--Wetland Flora and Vegetation of the Upper Green River Basin, South Central Kentucky.

During the 1988 collecting season, floristic studies and vegetation sampling were carried out in the upper Green River basin in south central Kentucky. The study area extended from the back of the Green River Reservoir

in Adair County, through Casey County, into the headwaters in Lincoln County, some 417 square miles. Fifteen sites were visited regularly, with some random collecting throughout the basin. Quantitative data were obtained for trees, woody understory and shrubs using the point-center quarter method. These data show a trend in forest type from maple-white oak-beech in the headwaters to red maple-black gum-pin oak-beech in the lower basin. Open water habitat was characterized by Cephalanthus occidentalis L., Nuphar luteum (L.) Sibth. & Sm., Typha latifolia L., Saururus cernuus L., Sparganium americanum Nutt., Acorus calamus L., and many species of Juncus, Carex and Eleocharis. Rare plants in the area include Marsilea quadrifolia L., Physostegia virginiana (L.) Benth. and Platanthera peramoena A. Gray.

60 TYNDALL, R. WAYNE, KATHARINE A. MCCARTHY, J. CHRISTOPHER LUDWIG, and ABIGAIL ROME. Maryland Natural Heritage Program--Vegetation of six Carolina Bays in Maryland. Vascular plant communities in six Carolina Bays in Maryland were classified using stratified-random plot sampling of presence and cover in conjunction with Bray-Curtis Polar Ordination and Sorensen's Index of Dissimilarity. Species richness, diversity, and annual cover differences were studied during 1987 and 1988. Collectively, five community types were identified. The most frequent type, dominated by Leucothoe racemosa, was restricted to the forested perimeter. Panicum hemitomon and Carex walteriana types were contiguous but very different from L. racemosa. Rhexia virginica and Panicum verrucosum communities were limited to the innermost zone. Species richness, diversity, and annual differences in cover increased from perimeter to center. Leucothoe racemosa, P. hemitomon, and C. walteriana communities, restricted to drier portions of the gradient, had low values for these parameters compared to the more mesic R. virginica and P. verrucosum communities.

61 FLISSER, DANIEL E. University of South Carolina--Megagametophyte development among two species of Uniola and two species of Chasmanthium. The loosely united genus, Uniola, was earlier divided into three separate genera on the basis of morphologic features of the sporophyte. In an effort to review that separation, this research investigated embryogenic developmental patterns. Female gametophyte development was observed among two species of Uniola and two species of the new genus, Chasmanthium. Fixed and cleared material was observed under Nomarski and phase contrast microscopy. Clearing facilitated investigation of patterns and rates of gametophyte development; and of relative growth rates of the nucellar regions. Nucellar growth indices and nucellar growth profiles were calculated for each of the four species. This provided a means of comparison of the relative

magnitude of growth of their gametophytes, as well as the degrees of growth of the epinucellus and hyponucellus of each. An embryogenic basis was demonstrated for the separation of these *Chasmanthium* species from *Uniola*. Previously established species-species differences within each genus were supported as well.

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Chin-Sung Chang and David E. Giannasi
the University of Georgia ---- A
flavonoid study of Acer, section Palmata,
series Palmata.

A flavonoid survey of 14 species and 1 variety of *Acer*, section *Palmata*, series *Palmata* was conducted. Inter- and infra-specific flavonoid variability was correlated with certain morphological characters. Three species groups were observed based on flavonoid classes. The "japonicum type" group produced only flavonols, while the "palmatum type" group contained C-glycosyl-flavones and flavonols. The third group, the "robustum type" contained flavones and flavonols. Based on available flavonoid biogenetic information, the *japonicum* group appears to be the most primitive, the *robustum* group the most advanced and the *palmatum* group intermediate, but highly specialized. These chemical groups, correlated with morphology, and suggested that the presence or absence of pubescence on the ovary, petioles and leaves are the most reliable diagnostic morphological characters for the delimitation of the taxa. The chemical and morphological data, along with the probable phytogeographical history of this series, also supports a putative migratory route of evolution of these taxa from southeastern China to North America via Japan. These combined data produce a more plausible hypothesis of the phylogenetic history of these taxa.

63

POUNDS, L.,¹ C. BASKIN,² J. BASKIN,² M. CUNNINGHAM,³ H.R. DE SELM,¹ and T. PATRICK⁴.
University of Tennessee¹, University of Kentucky², Oak Ridge National Laboratory³, and Georgia Department of Conservation⁴--
Flora and vegetation of Crowder Cemetary
Barrens, Roane County, Tennessee.

The flora and vegetation of Crowder Cemetary Barrens, a rocky limestone cedar barrens, has been studied. The flora to date consists of 194 taxa of vascular plants, 95% of which are native. Plant families represented by the largest number of species are the Asteraceae, Poaceae and Fabaceae. The largest genus is *Panicum*, with eight species. Four species at Crowder (*Tomanthera auriculata*, *Liatris cylindracea*, *Delphinium exaltatum* and *Solidago ptarmicoides*) are on the Tennessee rare plant list, and *T. auriculata* is a candidate for federal listing. *Hypericum dolabriforme* is the only cedar glade endemic that occurs at Crowder. Species with the highest importance values (relative frequency + relative cover) are *Schizachyrium scoparium* (little blue stem) (33), *Silphium terebinthinaceum* (18), *Helianthus occidentalis* (17) and *Aster laevis* (14). Partial funding was provided by the Oak Ridge National Environmental Research Park.

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BRADLEY, TED. R. George Mason University
--Viability of seeds produced via
cleistogamy in *Triodanis perfoliata* (L.)
Nieuwland var. *perfoliata* Campanulaceae).
The Venus's Looking-glass, *Triodanis perfoliata* (L.) Nieuwland, produces early cleistogamous flowers and later chasmogamous flowers. Trent (1942) reported that seeds of normal appearance, when produced via cleistogamy, germinated in 0.07% of seeds tested. This was in contrast to the 47.5% germination of seeds which had been produced via chasmogamy. Attempts to repeat these findings under greenhouse conditions have resulted in higher germination percentages. Three experimental sets of data using seeds produced via cleistogamy resulted in 50.0%, 56.4% and 56.6% germination. Seeds produced via chasmogamy germinated at 43.1% of seeds tested. Further observance of ungerminated seeds probably would have resulted in still higher germination percentages.

65

RAMSEY, GWYNN W.¹ CHARLES H. LEYS,²
ROBERT A. S. WRIGHT,³ DOUGLAS A.
COLEMAN,⁴ and AUBREY O. NEAS.⁵
Lynchburg College,¹ Old Dominion
Box Co.,² Central Virginia Biological
Research Consortium,³ Winter-
green Resort,⁴ and City of Lynchburg
5--The Vascular Flora of the James
Gorge Watershed in the Central Blue
Ridge Mountains of Virginia.

A decade of study reveals that the vascular flora of the James River Gorge Watershed between Snowden and Glasgow, Virginia, including the James River Face Wilderness and portions of Amherst, Bedford and Rockbridge counties, is superbly diverse. The diversity of the flora in this spectacularly beautiful and rugged water gap is attributed to many ecological factors such as: sharp elevational changes on both the north and south sides of the James, numerous habitats, complex geological and soil mosaics, age of the river and gorge, natural and unnatural disturbances and adjacency to the Ridge and Valley and Piedmont physiographic provinces. Herbarium voucher specimens document that the hydrological systems composing the 3585 hectare research area supports a vascular flora of at least 121 plant families and 420 genera with 843 taxa at the specific or infraspecific level. The largest plant families are: Asteraceae, 97 species; Poaceae, 68 species; Fabaceae, 42 species; Cyperaceae, 36 species; Rosaceae, 34 species; Lamiaceae, 28 species; Brassicaceae, 27 species. Ground level and aerial color slides will be used to show the physiographical features, geological formations, disturbances, habitat types and unique plants.

- 66 MENZEL, RONALD G. and CHARLES M. COOPER. United States Department of Agriculture -- Small Impoundments and Ponds. Chapter 13 in Biotic Communities of the Southeastern United States, Volume II, Aquatic Communities.

There are about one million farm ponds and impoundments smaller than 16 ha in surface area in the 12 southeastern states. Major uses include livestock watering, irrigation, and fish production for farm ponds, and municipal water supplies and recreation for small impoundments. Community structure of the ecosystems varies greatly in different impoundments, depending on location and management. Planktonic algae or rooted macrophytes contribute most of the primary productivity, which has been measured from 0.1 to 1.1 kilograms of carbon per square meter. Energy transfer to higher trophic levels has been measured in only two small ponds, one in northeast Georgia and one in north central Texas. In both ponds, herbivores consumed about 1/4 of the primary production, although the herbivores were predominantly benthic organisms in the Georgia pond and zooplankton in the Texas pond. Fish production was inefficient in both ponds, even though the Georgia pond was managed for fee fishing. Common problems of pond management include control of fish populations, deposition of sediment, and lack of incentive or resources for proper management.

- 67 HOBBS III, H. H. Wittenberg University-- Biotic Communities of the Southeastern United States: Caves and Springs.

Caves and springs are widely distributed over the southeastern United States and are found within several major physiographic provinces. Within these areas nearly 20,000 caves and countless thousands of springs and seeps are known to exist. They are generally characterized as being very "stable" ecosystems and although species diversity indices are usually low, they can support complex and diverse aquatic assemblages. Springs range from deep artesian systems to minor seeps and differ considerably in community complexity, sunlight being one of the most important controlling variables. Caves, found primarily in limestone terranes termed karst areas, are solution features that tend to demonstrate curvilinear or rectilinear plans closely related to joint patterns in the bedrock and vary considerably in their vertical and horizontal complexity. Since light and thus green plants are absent, organisms have evolved a variety of strategies to persist on the limited allochthonous input. Trogllobites, the most highly specialized category of cave inhabitants, are represented in aquatic communities by planarians, snails, isopods, amphipods, shrimps, crayfishes, fishes, and salamanders. Many cave faunas are isolated relicts of more widely distributed surface species that either became extinct or dispersed elsewhere because of changing surface conditions. Evidence of cave and spring water pollution in the southeastern United States is accumulating at alarming

rates. Protection, management and preservation of these sensitive environments is imperative.

68

Wallace, Bruce - Abstract not available

69

Martin, W. H. - Abstract not available

70

HERR, J. M. Jr. University of South Carolina--The use of dibutyl phthalate as a substitute for clove oil in four-and-a-half type clearing fluids.

Dibutyl phthalate, first introduced as a clearing agent by C. F. Crane (1987, Amer. J. Bot. 74: 477), in several features resembles eugenol, the principal constituent of clove oil. Both substances are benzene derivatives of similar density, index of refraction, and solubility in organic solvents. They are, however, distinctive in molecular structure and in some physical properties. Dibutyl phthalate, unlike eugenol or clove oil, is highly resistant to photooxidation which enhances its value as a clearing agent. The ingredients of the 4½ type clearing fluids are combined by weight. An exact weight substitution of dibutyl phthalate for clove oil produces a fluid that is equal to the standard mixture in clearing some whole structures and thick sections. It does not readily darken with age at room temperature, and it can be produced at a fraction of the cost of the clove oil-based fluids.

71

WISE, DWAYNE A. Mississippi State University--Nonrandom behavior of sex chromosomes in male lycosid spiders.

Male spiders of the genus *Lycosa* have 13 autosomal pairs + X_1X_2 , 00 at meiosis. Females have $X_1X_1X_2X_2$ sex chromosome constitution. Since males are the heterogametic sex, the production of male and female progeny depends on the directed nondisjunction of the two nonhomologous X 's at anaphase I of meiosis in the male. It appears that the X_1 and X_2 chromosomes are joined throughout their lengths by a structure, the junction lamina, which is not similar to the synaptonemal complex, the structure which joins homologous chromosomes at pachytene. Apparently, nondisjunction of the X_1X_2 "pair" is accomplished by persistence of the junctions lamina through prometaphase, metaphase and anaphase I. The ultrastructure of the junction lamina and its effect on sex chromosome behavior will be explored.

72

ORVOS, DAVID R. and JOHN CAIRNS, JR. Virginia Polytechnic Institute and State University--Environmental risk assessment of a genetically-engineered microorganism, *Erwinia carotovora*.

Release of genetically-engineered microorganisms (GEMs) has been limited, in part, because of potential adverse environmental consequences. Genetically-engineered *Erwinia carotovora*, containing a kanamycin-resistance gene from Tn903 and having enzyme-coding DNA regions deleted from the genome, was studied to develop a risk assessment protocol that may be useful to predict environmental risk, if any, after release. Using terrestrial microcosms, survival, competitiveness, microbial structural effects, and potential exchange of recombinant DNA (rDNA) of the GEM were examined. The genetically-engineered and parental *Erwinia* strains survived at detectable levels for more than forty days but did not affect total bacterial populations or populations of selected bacterial genera. In addition, the engineered strain did not compete better than the wildtype strain. Finally, potential exchange of rDNA was examined using DNA:DNA hybridization. These results indicate genetic exchange may have occurred but additional studies are indicated before exchange is proven.

73

APPLEGATE, ARTHUR, L. St. Andrews Presbyterian College--A new method for banding human metaphase chromosomes. A family of dyes were produced by combining gallocyanin with the following metal ions: Chromium, Cadmium, Copper, Cerium, Lead, Molybdenum, and Tungsten. Dyes that band human metaphase chromosomes resulted from adding 0.2M Gallocyanin to 0.5M of Chromium Sulfate, or Copper Sulfate, or Cerium Ammonium Sulfate in 100 mL distilled water. The mixtures were boiled 20 minutes, allowed to cool, filtered after the pH was brought to 2.5 with 1.0 N NH₄OH. The staining solutions were prepared by dissolving 0.1 gram of the dried precipitate in 50 mL 0.1 M H₂SO₄. Slides having white blood cell metaphase chromosomes on their surfaces were stained for 24 hours then processed in 70%, 95%, 100% ethanol and xylene, before mounting coverslips with Permount. Initial analysis of the banding pattern produced by the copper salt indicates an R or reverse pattern. Techniques are being developed to observe the same banded chromosomes with both the light microscope and the transmission electron microscope.

74

KWARSICK, LISA M., LOREN W. KNAPP and WALLACE D. DAWSON. University of South Carolina--Mortality in hairless deer mouse. The hairless-2 mutant of the deer mouse, *Peromyscus maniculatus* is inherited as an incompletely dominant trait. In addition to genetic defects of the skin and its derivatives, these mice have a higher than normal mortality rate. The rate for the homozygous recessive is at least 200% greater than heterozygotes and wild type. 70% of these deaths occur within 10 days of birth. Mice lost before 10 days are cannibalized by their mothers. 25% of the deaths occur between 20 and 35 days after birth. The most common cause of death at this stage is dehydration

due to severe chronic diarrhea. There is a marked increase in the number of an unidentified intestinal flagellate in heterozygous and homozygous mice associated with the dehydration. The genetic defects associated with the hairless-2 mutant possibly contributes to other complications, including immunodeficiency. The hairless-2 mutant mouse may be a useful model for future studies of interactions between genetic and environmental factors in pathology. Research supported by grants from The Upjohn Co. (R-88-663) and NSF (BSR 84119860).

75

RAMEY, BARBARA A. Eastern Kentucky University--Teratogenic effects of zinc to the fathead minnow (*Pimephales promelas*). Embryos and larvae of the fathead minnow (*Pimephales promelas*) were exposed at various developmental stages to zinc in a static-renewal bioassay system. Tests were initiated within 14 hr of fertilization, at 24 hr intervals prior to hatching, and at hatching (96 hr). Studies also were conducted in which eggs were exposed to Zn for 96 hr, then placed into clean culture water. Exposures were carried through 4 days after hatching, and test responses included mortality and teratogenesis. Nominal concentrations of zinc ranged from 0.5 to 3.0 mg/L. For animals exposed to Zn through 4 days posthatching, survival at 0.5 to 3.0 mg/L showed a dose-response relationship, as did the frequency of abnormal animals. All surviving animals at 1.0 mg Zn/L displayed varying degrees of spinal curvature, cardiac and cephalic edema, and reduction in body size. Animals placed in clean water prior to hatching did not show the same degree nor frequency of abnormalities as did those exposed during the posthatching period. These findings suggest that zinc should not be classified as a true teratogen to the fathead minnow.

76

THOMAS, DONALD L. AND JAMES B. McCLINTOCK. UNIVERSITY OF ALABAMA AT BIRMINGHAM--Embryogenesis in the freshwater pulmonate gastropod *Physella cubensis*: the effects of temperature on embryonic and juvenile growth rates and sexual maturation.

Embryonic development in *Physella cubensis* was found to be similar to that in other members of the genus *Physella*. Egg masses laid by individuals collected from Shades Creek, Birmingham, Alabama were subjected to three temperature treatments (10, 20, and 30° C) and developmental stages documented until hatching. Hatched juveniles were raised in their respective temperature regimes to sexual maturation (onset of egg mass deposition). Juveniles (0.8 mm shell length) hatched in 36 days at 10°, 13 days at 20° C, and 9 days at 30° C. Juveniles raised at 20 and 30° C produced egg masses 69 and 35

days after hatching and had shell lengths of 6.2 and 4.4 mm, respectively. Juveniles raised at 10° C did not attain sexual maturity over 100 days and attained a size of only 1.7 mm shell length. These laboratory investigations indicate that temperature has a significant effect on rates of embryogenesis, juvenile growth and the onset of sexual maturation and may strongly influence the population dynamics of P. cubensis in the field.

77

DENNISTON, KATHERINE J. AND ROBERT B. MALAMIS. Towson State University--Characterization of two streptococcal viruses carrying genes for scarlet fever exotoxins.

Streptococcus pyogenes is the bacterium responsible for acute pharyngitis (strep throat) and a number of post-infection sequelae including rheumatic fever. When S. pyogenes is infected with certain streptococcal viruses it can also cause the red skin rash known as Scarlet Fever. Two scarlatinal strains of S. pyogenes have been isolated from throat cultures of two children with Scarlet Fever. Two viruses, ST4 and SW2, have been grown, purified and characterized with respect to their nucleic acid and protein content. The DNA genomes of these viruses are both approximately 35,000 base pairs. However, restriction enzyme analysis reveals that the genomes have quite different restriction site complements. In addition, SDS-polyacrylamide gel electrophoresis of unlabeled and ³⁵S-methionine labeled viral proteins demonstrate that the structural proteins of the two are different. Finally, pulse labeling studies revealed that one of the viruses, ST4, is maintained as a stable lysogen in the infected host cells. The second isolate, SW2, is in a state of pseudolysogeny.

78

WILLIAMS, ROGER C., DANIEL K. HAAPALA, AND KATHERINE J. DENNISTON. Towson State University. -- Origin of the novel envelope glycoprotein gene of an endogenous feline retrovirus.

A search for a variant endogenous feline retrovirus led to the isolation of two viruses, L1L and L2LL. Although the core proteins of L1L and L2LL are identical, the envelope glycoproteins of the two are completely unrelated. Restriction endonuclease maps and Southern hybridization of the two virus DNAs showed that the 5' terminal 6 kilobase pairs of the two viral genomes, which encode the core proteins and reverse transcriptase, are identical. However, the 3' terminal sequences coding for the envelope glycoprotein differ in size and restriction sites. Reeves, et al. (J. Virol. 52: 164, 1984) cloned a series of feline virogenes from the normal cat genome. Among these we noted an isolate that had a HindIII fragment in the envelope region that was the same size as a HindIII fragment

found in the envelope region of L2LL. In addition to the similarity in size and restriction enzyme sites, Southern hybridization experiments indicated that the HindIII fragment of the cellular virogenes hybridizes to the envelope region of L2LL, but not to that region of L1L. These data suggest that L2LL virus arose as a result of a recombination event between the L1L virus and the cellular oncogene characterized by Reeves and coworkers.

79

BOWDEN, SANDRA T. AND PATRICIA MCGUIRE WHITE. Agnes Scott College--Bacterial ecology of two granite outcrop communities, DeKalb County, Georgia.

Research on bacterial populations of two granite outcrop plant communities was initiated in 1988. Studies involve aerobic and facultative bacteria amenable to laboratory cultivation, with the following aims: (1) isolation and identification of bacteria from two distinctly different plant communities; (2) estimations of numbers by direct count with fluorescence microscopy and by activity assays; (3) assays for metabolic activities related to major nutrient cycles; (4) assays for antibiotic production and sensitivities as aspects of microbial interactions; (5) studies of soil, genomic, and plasmid DNA to elucidate aspects of genetic interactions among the populations. From a community dominated by Diamorpha cymosa and one with a variety of annual and perennial angiosperms, over 200 isolates have been obtained. The diversity of bacterial types and characteristics include: gram positive and gram negative; spore formation; motility; varying oxygen requirements; one or more plasmids; and diverse physiological traits including sensitivities to antibiotics. When compared to the annual/perennial community, the species diversity and activity levels of the Diamorpha community are greater than predicted given low levels of soil moisture, little organic matter, and the shallow, sandy soil.

80

RUSHING, ANN E.,¹ ROLAND R. DUTE,¹ and JAMES W. PERRY.² Auburn University¹ and Frostburg State University.²--A comparison of torus structure and function of the woods of four genera of dicotyledons.

The torus is a wall thickening found in the intervacular pit membrane of many gymnosperms. It is thought to function in the isolation of gas embolisms within the water-conducting cells of the xylem. The xylem of some species of the dicotyledonous genera Celtis, Ulmus, Daphne, and Osmanthus also has such structures. In Celtis and Ulmus, the torus develops by the thickening of the primary walls of the pit membrane. The torus of Osmanthus is formed, not by any thickening of the original pit membrane, but rather by the addition of thick pads of wall material to both sides of that membrane. The torus of Daphne also contains additional layers of wall material, but these layers are much thinner than those of Osmanthus. The presence of air in wood causes a physical dis-

placement of the pit membrane referred to as aspiration. If the torus is chemically removed or if (as in *Daphne mezereum*) no torus is normally present, aspiration results in the rupture of the pit membrane. In those species of dicots with tori (including *D. odora*) the pit membrane remains intact during displacement. It is hypothesized that the torus prevents membrane rupture during aspiration.

81

CHEN, DILLION T. and LAFAYETTE FREDERICK.
Howard University--The "terminal bud" of *Ulmus americana*.

Buds on branches of *Ulmus americana* are eccentrically positioned in leaf axils. The bud at the top of dormant twigs is also eccentrically positioned and is subtended by a leaf scar. Though appearing to be a terminal bud, it is topographically lateral and is situated at the end of a branch because abortion of the elm shoot tip occurs before the twig matures. We have examined with light and scanning electron microscopy shoot tip abortion on branches of trees as well as on naturally occurring and potted seedlings of the American elm. The bud at the tip of a dormant twig gives rise to a young branch that typically forms 9 to 11 mature leaves on lead branches and 5 to 7 leaves on lateral branches. Before the leaf that will occupy the terminal position on a twig matures, the shoot tip with a few undeveloped leaves aborts at a point slightly above the base of the axillary bud of the terminal leaf. An obscure abscission scar forms at this point. The lateral bud enlarges and when the leaf abscises it appears to occupy a terminal position. In young seedlings the shoot tip remains active over a longer period of the growing season. Eventually the upper portion of this shoot tip aborts and a small abscission scar is left above the base of the pseudoterminal bud. Dormant elm twigs lack, therefore, a true terminal bud.

82

CHEN, DILLION T. and LAFAYETTE FREDERICK.
Howard University--SEM observations on leaf development in *Ulmus americana*.

The development of young leaves on branches of trees as well as on one- and two-year old seedlings of the American elm has been studied with scanning electron microscopy. Histological sections of comparable developmental stages have also been studied. Our observations have shown that new leaves begin with the appearance of slightly conical primordia on the shoot apex. The primordium elongates into a slender, slightly flattened protrusion with a shallow median depression in its adaxial surface. As the primordium increases in length, discrete localized protrusions appear progressively in acropetal order from the adaxial meristems on each side of the leaf axis. Apical growth of these protrusions result in the formation of fingerlike subaxes on the primordium of the strongly folded leaf axis. Up to 11 or 12 subaxes develop from the adaxial meristem on each side of the elongating primordium and they

represent the precursors of primary veins of the leaf blade. Vein primordia bifurcate near their tips prior to the cessation of elongation. Interveneal tissue is not present between vein primordia at this stage of leaf development. Later growth of the adaxial marginal meristems produce zones of tissue between vein primordia and leads to interveneal tissue formation. Leaf development in shoot tips of seedlings differs somewhat from the pattern found in buds. In seedlings, leaf primordia give rise to the folded elongate axis with adaxial meristems broader than those found in leaf primordia of buds. These meristems become progressively lobed in acropetal order and represent places where primary veins will occur. Unlike leaf development in buds, discrete vein primordia are absent in developing leaves of seedlings.

83

FORESTER, DON C. Towson State University--Observations on the movements and social interactions of the shovel-nosed salamander, *Leurognathus marmoratus*
Mark and recapture techniques were used to study *Leurognathus marmoratus* in two low elevation streams (800 m) in the Nantahala National Forest of western North Carolina. At site #1, I marked and released 37 sub-adult (sv=37-49 mm) and 19 adult (sv > 49 mm) salamanders. During a two week period, 12 of these animals were recaptured a total of 21 times. The mean movement for sub-adults (n=8) was 369.4 cm, and the mean movement for adults (n=4) was 345.0 cm. Collectively, marked animals did not exhibit a tendency toward directional movement. At site #2, 21 adult salamanders were marked and released. Over a one week period, 16 animals (76%) were recaptured a total of 29 times, with the mean movement being 373 cm. There was a slight tendency toward upstream movement.

Eleven animals (4 sub-adults and 7 adults) were recaptured a sufficient number of times to facilitate the calculation of preliminary home ranges. Although twice as large, the mean size for sub-adult home range (1.24 m²) was not significantly different from that of adults (2.47 m²) (t=-2.13, df=10, P=.057).

In the laboratory, adult *Leurognathus* readily accepted artificial cover objects, but did not actively defend them against intruding black-bellied salamanders (*Desmognathus quadramaculatus*) or adult conspecifics. During 20 combined trials, I did not observe a single act of aggression directed against an intruder. Based on these observations, I conclude that *Leurognathus* do not defend territories.

84

DODD, C. KENNETH, JR., U.S. Fish and Wildlife Service--Estimating burrow densities of the Red Hills salamander, *Phaeognathus hubrichti*.

The Red Hills salamander, *Phaeognathus hubrichti*, is a federally protected species endemic to south-central Alabama. From March to August, 1988, I conducted a reevaluation of the species' status at 144

sites. At 10 sites where burrows were judged to be common based on time constraint sampling, I used a line transect method to estimate burrow density. A computer program ("Transect"), using a Fourier series, generated burrow density estimates from 2.6 to 9.4 burrows/100 m² of optimal habitat. Truncating distances significantly improved the robustness of the estimate by reducing the coefficient of variation. The pooled Fourier density estimator [f(0)] of 0.6769 with a standard error of 0.03195, coupled with line transect data from other sites, could enable comparable estimates at sites slated for acquisition, at sites not covered during this survey, or for comparing future trends in burrow density at the 10 sites. Until the exact relationship between burrow density and salamander density is established, however, line transect estimates should not be used to estimate population size.

85

BRASWELL, ALVIN L.¹, R. WILSON LANEY², and DAVID L. STEPHAN³. North Carolina State Museum of Natural Sciences¹, U. S. Fish and Wildlife Service², and North Carolina State University³--Amphibian populations using some seasonally flooded Carolina Bays in North Carolina.

As many as 20 amphibian species have been verified breeding in a single ephemeral Carolina Bay in the Sandhills region of North Carolina. Recent surveys in 9 clay-based Carolina Bays (all partly or wholly owned by The Nature Conservancy) have demonstrated that these bays, located in Scotland, Hoke, and Robeson counties, support populations of such rare species as the Tiger Salamander (*Ambystoma tigrinum*) and Crawfish Frog (*Rana areolata*). While serving as refugia for rare species, these natural depressions of unknown origin support populations of many other amphibians, reptiles, and numerous rare plant species. Carolina Bays have undoubtedly played an important biogeographic role in determining the current and past distribution of amphibians in SE N. C. The frequently large populations occurring in these bays offer great conservation and research potential, which may not be fully recognized unless these unique ecosystems are afforded more regulatory protection than presently exists. A recent study of isolated and headwater wetland systems in several N. C. counties, including one containing Carolina Bay wetlands, demonstrated that such systems comprise an important and extensive wetland resource base. Present regulations allow widespread destruction of these systems through drainage and conversion or filling. Regulations should be revised to provide more protection for Carolina Bays and other isolated and headwater systems, thereby preserving their important functions which benefit public resources.

86

HOVER, EDWARD L. Agnes Scott College--Correlation between habitat and throat color in a polychromatic lizard, *Urosaurus ornatus*.

Throat color patches in male lizards function as signals in social interactions. In some populations of *Urosaurus ornatus* males are polymorphic for throat color, and in two populations throat color has been shown to be related to the likelihood of winning an aggressive encounter. If status signalling is important to reproductive success, different color morphs are apparently using different reproductive strategies. However, the number and types of color morphs differ among populations, leading to questions about factors that may influence the role of color in status signalling. Habitat structure should be one such factor, because it could affect the costs and benefits of dominance and the visibility of color signal. In a population near Alpine, Texas, I found two distinct color morphs, one with a blue throat, and one with a green throat rimmed with orange. The proportions of these morphs differed between two habitats. Where the major vertical surfaces were rocks, blue males made up 22.9% of all males; in a contiguous area with scattered trees and few rocks, blue males made up 50% of all males. Thus morph proportions were correlated with an obvious habitat characteristic, although the reasons for this relationship remain to be investigated.

87

GIOVANETTO, LAINE A. and JOHN G. MORRIS. Florida Institute of Technology--Habitat use by the gopher tortoise (*Gopherus polphemus*) in scrub and slash pine flatwoods on Merritt Island National Wildlife Refuge, Brevard County, Florida.

A 300 x 300 m study plot was established in a slash pine flatwoods stand within a mixture of well and poorly drained soil types. Gopher tortoises used all four scrub types (oak, oak/palmetto, palmetto, and disturbed) throughout the study, but higher overall densities were found in poorly drained areas (palmetto scrub) than in well drained areas (oak scrub). Densities ranged from 1.16/ha in oak scrub to 4.17/ha in palmetto scrub with a mean density of 1.89 tortoises/ha for the entire study site. Edge relationships were significant in oak and oak/palmetto scrub. Correction factors to compute the numbers of tortoises from active and from active and inactive burrows combined were 0.34 and 0.20, respectively.

88

TAYLOR, CINDY L. and OPAL H. DAKIN. Mississippi State University--Escape behavior in larval amphibians.

One would predict different patterns of escape behavior of larval amphibians based on larval morphology and color, habitation of different vertical and horizontal zones of the water, and different foraging techniques of the predators. Measurements of the angle of descent from positions in the water column and the distance swam were measured after larvae were stimulated by

consistent tactile stimuli. In the laboratory, tadpoles of *Hyla chrysoscelis* were tested at 8, 16, and 24 cm water depth under bright white and dim red light. In the field, various stages of larval *Ambystoma opacum*, *A. talpoideum* and *A. maculatum* were tested. Interspecific and ontogenetic differences of escape patterns will be discussed.

- 89) FRAZER, NAT B.¹, J. WHITFIELD GIBBONS² and JUDITH L. GREEN² Mercer University¹ and Savannah River Ecology Laboratory²--Annual variation in the proportion of reproductively active female common mud turtles, *Kinosternon subrubrum*.

Long-term studies of turtle populations have begun to provide data necessary for assessing life history evolution within the Order. Much information is available on clutch size and intraseasonal clutch frequency for turtles. Some studies have determined whether clutch size or frequency varies among years. Estimates are available for some species on the mean proportion of females reproductively active in a given year. However, few studies provide any indication of annual variation in the proportion of reproductively active females. Results from a study of mud turtles, *Kinosternon subrubrum*, in South Carolina indicate that the proportion of reproductively active females may vary widely from year to year, although mean clutch size and mean intraseasonal clutch frequency vary but little. For the nine years in which a Carolina Bay was completely encircled by a drift fence, estimates of the proportion of reproductively active females ranged from 34% to 71%. Thus, the main way in which reproductive output varies in a population may not be in the size or intraseasonal frequency of clutches, but rather in terms of the number or proportion of females that nest in any given year (interseasonal clutch frequency). These findings suggest that previous estimates of fecundity must be adjusted downwards to reflect true *per capita* fecundity for life table analyses. The findings also indicate that static life tables may not provide an adequate indication of annual variability necessary for conducting comparative studies of life history evolution in turtles across species or locations.

- 90) SCHORR, MARK S. Mississippi State University--Population changes of the enteric protozoan *Opalina* spp. during the ontogeny of anuran tadpoles.

Changes in population density of *Opalina* spp. during the ontogeny of 8 species of anuran tadpoles were studied at 10 sites in east-central Mississippi. Significant amounts of the variation in protozoan densities were explained by the host species, developmental stage and collection site in tadpoles and metamorphs. Log-linear relationships detected between *Opalina* density and host stage showed either an increasing or a decreasing pattern with tadpoles ontogeny. Only a pattern of decline was detected for metamorphs. The length of the larval period and habitat stability are suggested as modulators of these patterns in tadpoles. The metamorphic decline detected

among tadpoles with either pattern likely reflects the alterations of the gut during metamorphosis common to all tadpoles.

- 91) PAPAY, MICHAEL J. and JEANNE L. BLACKWELL. Mississippi State University--Ontogeny of tooth row lengths in anuran tadpoles.

The serially-arranged, transverse rows of keratinized labial teeth of anuran tadpoles serve as abrasive structures during feeding, although details of their functions and the implications of interspecific variations are not understood. The growth patterns of the oral disc were analyzed relative to Gosner stages 25-36 in 4 species of tadpoles, and then lengths of each row and various combinations of rows relative to oral disc dimensions were analyzed. Linear relationships among individual row lengths or total row length throughout ontogeny suggest no ontogenetic change in feeding abilities of a given oral configuration.

- 92) MURPHY, WILLIAM C. and RONALD ALTIG. Mississippi State University--Preliminary analysis of labial teeth shapes in anuran tadpoles.

Most anuran tadpoles have serially arranged, transverse rows of keratinized labial teeth on an oral disc external to the mouth. The diversity of shapes observed suggest differences in feeding mode, although the functional details of interspecific variations are not known. Teeth from the center of the first upper row (75 species) were extracted and photographed, and a series of measurements were taken on each tooth to describe shape. These measurements were analyzed by cluster analysis in an attempt to delimit groups of teeth of similar shape (assumed similar function) regardless of taxonomic assignment. These groupings will be described and discussed.

- 93) CROSS, DAVID C. AND RONALD ALTIG. Mississippi State University--Spatial distribution and feeding of the tadpoles of *Gastrophryne carolinensis* (Microhylidae).

The tadpole of *Gastrophryne carolinensis* lacks keratinized mouth parts typical of most tadpoles, floats motionless in mid-water much of the time at least at night and is assumed to filter-feed on suspended particles. Observations of various populations in outdoor enclosures addressed the effects of tadpole size (stage) and population density interactions on the positions of tadpoles in the water column throughout the 24-h period. Also, contents of the anterior portion of the gut of field-collected specimens were correlated with chlorophyll analyses and phyto- and zooplankton samples taken concurrently. The ecology of this unique tadpole will be discussed in the context of spatial distribution and feeding.

94

CARR, KAREN K. and RONALD ALTIC.
Mississippi State University--Abdominal
 and oral disc muscles of anuran tadpoles.

Observations of the oral disc and ventral body wall of tadpoles with polarized light reveal the occurrence and distributions of previously unknown muscles that vary interspecifically. These oral muscles apparently modify the shape of the oral disc and the pitch of the tooth rows during feeding. The mandibulolabialis inferior originates at the base of Meckel's cartilage and inserts as a fan-shaped array on the tooth ridges of the three lower tooth rows and ventrolateral marginal papillae in tadpoles of *Hyla femoralis*. The mandibulolabialis superior originates as above and inserts on the lateral third of the upper two rows and adjacent marginal papillae. Interspecific variations in the extent and configurations of the rectus abdominis complex appear to correlate with feeding methodologies.

95

SCOTT, A. FLOYD. Austin Peay State University, Center for Field Biology of Land Between the Lakes--Seasonal activity of amphibians around woodland and old field ponds in Land Between the Lakes.

Terrestrial activity of amphibians at a woodland and a nearby old field pond in TVA's Land Between the Lakes (KY/TN) was studied from 1 July 1987 through 30 June 1988. Drift fences and pitfall traps were used to monitor movements. Fifteen species (most the same) were encountered at each pond; 17 species were represented overall. The same six species accounted for over 90 percent (91% and 94%, respectively) of the total captures (2787 and 2352, respectively) at each pond. However, the relative importance of these six differed at each pond. Activity was detected during every month of the year and followed the same pattern at both ponds: lowest during midwinter and highest during late winter and midsummer. Directional movements were balanced throughout most of the year. However, significantly more outward than inward movements were detected at both ponds during summer and early fall and at the old field pond during late spring. Egression of recently metamorphosed *Ambystoma maculatum*, *Gastrophryne carolinensis* and *Hyla chrysocelis* accounted for the summer and fall imbalance while outward bound metamorphs of *Rana sphenoccephala* were the cause of the late spring imbalance.

96

DARLINGTON, MARK V., BYRON L. BLACBURN, KATHY M. EASTERWOOD and CHRISTINE A. SUNDERMANN. Auburn University--Development of a murine assay for cryptosporidial drug evaluation.

The development of an assay that provides quantifiable data concerning the efficacy of potentially cryptosporidicidal drugs has been difficult to achieve. We have investigated three possible model systems; cell culture using *Cryptosporidium parvum*, a chicken egg system using *Cryptosporidium baileyi*, and a suckling mouse system using *C. parvum*. To date, the suckling mouse model has proven the most successful and is described here. Croups of eight outbred Swiss-Webster mouse pups with an average weight of 3.5 g are administered either drug or carrier per os on day -1 using a tuberculin syringe fitted with a small length of microbore tubing and Tracor Atlas syringe pump. The syringe pump and syringe have been previously calibrated using mercury to accurately determine the delivery volume at different pump settings. Based upon the weight of each pup, the pump setting that will deliver the correct volume of carrier or drug is selected. On the morning of the following day (day 0), the mouse pups are infected with 100,000 *C. parvum* oocysts per mouse. On the afternoon of the same day drug or carrier is once again administered to the pups. They continue to receive drug or carrier based upon daily weight up to and including day 6. The mouse pups are sacrificed on day 7 and the posterior alimentary tract is removed and placed in a vial containing 10 ml of 2.5% potassium dichromate solution. The contents of each vial is homogenized using a Tekmar tissue homogenizer and the number of oocysts in each vial is determined by counting an aliquot from the vial on a hemacytometer.

97

HAEBER¹, PAULA J., BYRON L. BLACBURN¹, JOHN C. FRANSDEN², LARRY J. SWANCO¹, and CHARLES M. HENDRIX¹. Auburn University¹ and Animal Parasite Research Laboratory²--Isolation, cultivation and morphometrics of *Giardia* spp. of bovine and caprine origin.

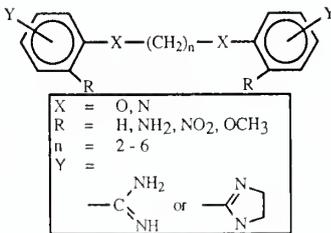
Giardia spp. are enteric zooflagellates that have been recovered from a variety of animals including humans. Following morphological analysis using microscopy, three distinct subgroups were recognized as valid. These include *C. agilis*, *C. muris* and *C. duodenalis*. We frequently observe *Giardia* cysts in the feces of domestic ruminants. However, little is known regarding the morphology and biology of *Giardia* spp. parasitizing ruminant hosts. Cysts of bovine and caprine origin were purified from feces using zinc sulfate, excysted following exposure to artificial gastric solution and maintained at 37 C in 25 cm² tissue culture flasks containing Kiester's medium, fetal bovine serum and antibiotics. Following DIC microscopy, cysts and trophozoites recovered from both hosts were morphologically similar to those within the *C. duodenalis* subgroup. Cysts contained 2-4 visible nuclei, axoneme(s), a single claw-like median body and a peritrophic space. Transmission electron microscopy revealed portions of the adhesive disks, flagellar axonemes and a tubular-vacuolar system beneath the cyst wall. Bovine cysts were 13.75 ± 0.15 X 9.46 ± 0.11 μm (n=50).

Caprine cysts were $13.42 \pm 0.60 \times 9.97 \pm 0.13 \mu\text{m}$ (n=50). Length/width indices (n=50) were 1.46 ± 0.03 (bovine) and 1.36 ± 0.02 (caprine). Trophozoites of bovine origin were peariform, binucleate, with axonemes, a ventral adhesive disk and median bodies. Trophozoites were $16.3 \pm 0.31 \times 10.0 \pm 0.26 \mu\text{m}$ (n=20).

98

BELL, CONSTANCE A., JAMES E. HALL and RICHARD R. TIDWELL. University of North Carolina at Chapel Hill--In vitro activity of pentamidine and related amidines and imidazolines against *Giardia lamblia*.

Giardia lamblia is the most common pathogenic enteric protozoan and is an important cause of gastrointestinal disease throughout the world. The therapeutic agents currently employed to treat giardiasis were developed for the treatment of other infections and later found to be efficacious against *Giardia lamblia*. These drugs have undesirable side effects such as nausea, anorexia, diarrhea and abdominal pain, and have not been proven safe for use during pregnancy. In addition, treatment failures have been reported following the use of metronidazole, tinidazole, furazolidone and quinacrine. Thus, less toxic and more effective anti-giardial agents are needed. Pentamidine is toxic but has been safely used for the treatment of other parasitic protozoan infections such as the Gambian form of African trypanosomiasis, antimony resistant leishmaniasis and *Pneumocystis carinii* pneumonia. We have investigated the activity of pentamidine and 35 related amidines and imidazolines in an in vitro microculture system using a ³H-thymidine incorporation assay. Pentamidine was found to have moderate activity against *Giardia lamblia* while some of the less toxic amidines and imidazolines had pronounced anti-giardial activity. One compound, dimethoxypropamidine, had anti-giardial activity at the same order of magnitude as that of the compounds currently used to treat giardiasis in the United States.

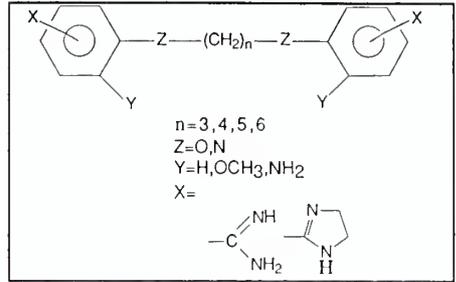


99

BERGER, BRADLEY J.*, JAMES E. HALL, and RICHARD R. TIDWELL. University of North Carolina at Chapel Hill--A sensitive high performance liquid chromatographic assay for the detection of a series of diamidine compounds with potential chemotherapeutic value.

To study the tissue distributions and pharmacokinetics of novel diamidine compounds (see below) that display profound anti-*Pneumocystis carinii* activity, a sensitive and accurate assay is required. A high performance liquid chromatographic (HPLC) method was devised, utilizing an acetonitrile/water solvent run at a gradient of 31.5% to 35% acetonitrile over the course of ten minutes.

The solvent contained 10 mM heptane sulfonate as an ion-pair agent, and 10 mM tetra-methylammonium chloride and 4.2 mM phosphoric acid to prevent irreversible binding to the C-18 reverse phase column. Eight representative test compounds were chosen, added to rat urine in known concentrations with an internal standard, extracted over C-18 solid-phase extraction columns and analyzed by HPLC. The assay was found to be accurate, reproducible, and sensitive, with the limit of detection being as low as 5 μM for several of the test compounds.



100

CIESIELSKI, STEPHEN, JOHN SEED. University of North Carolina at Chapel Hill--Transmission of intestinal parasites in migrant farmworkers.

In 1988 a cross-sectional and longitudinal study of parasitic transmission in farmworkers was accomplished. 173 subjects in 17 migrant camps participated in the cross-sectional study. Hookworm was the most common parasite, occurring in 22% of Haitian subjects, 40% of Central American subjects, and 4% of Mexican subjects. Other parasites were also frequent. Risk factors were studied and demographic profiles obtained. This aspect of study employed a random sample, increasing the validity of results. Hematocrits were performed on the majority of subjects providing stool samples. Based upon study of risk factors in 1987, it was predicted that incidence of parasites would be found in 1988. 30% of the 266 subjects in the 1987 study were relocated; an incidence rate of 10% for all parasites and 6% for pathogenic parasites was demonstrated. Insufficient numbers of new helminthic infections were found to test for risk factors associated with helminthic infections, but microbiologic testing of water in migrant camps implicated water as a risk factor in protozoal incidence. 46% of migrant camps had water positive for total coliforms, 27% positive for fecal coliforms, and 7% for *E. coli*. All camps with incidence of protozoa had positive bacteriologic findings, and the presence of latrines as opposed to flush toilets was also associated with positive water samples.

101

COLE, REBECCA A., BYRON L. BLAGBURN and CHARLES M. HENDRIX. Auburn University--Internal parasites of *Crotalus adamanteus* and *C. horridus atricaudatus* (Family Viperidae) from southern Alabama. *Crotalus adamanteus* ranges from coastal North Carolina southward throughout the peninsula of Florida and westward to southern Mississippi and extreme southeast Louisiana. *C. horridus atricaudatus* ranges from coastal southeastern Virginia southward to southern Florida and westward to eastern Texas. We are not aware of any information on parasites of rattlesnakes from southern Alabama. During February and March of 1988, seventy-eight rattlesnakes (3 *C. h. atricaudatus*, 75 *C. adamanteus*; 51 female, 27 male) were collected within a 30 mile radius in southeastern Alabama (latitude 30°14' longitude 87°16') and examined for internal parasites. Snake lengths ranged from 0.94 m to 1.70 m (mean 1.37 m). Weights ranged from 450 g to 3,025 g (mean 1594 g). Standard necropsy procedures were used to recover metazoan organisms with Sheather's sucrose flotation and fecal smears followed by trichrome staining performed to recover protozoans. Parasites representing 4 phyla (Pentastomida, Nematoda, Mastigophora and Apicomplexa) were recovered. Fourteen specimens of *Porocephalus crotali* were recovered from the trachea, bronchi or pleural cavity of 2 *C. horridus*. Feces from sixteen snakes were positive for *Capillaria* (tentatively *C. crotali*) eggs demonstrable by fecal flotation, whereas only 11 were found to harbor nematodes. Eight immature nematodes were recovered from the gastrointestinal tracts. Sporocysts and oocysts of *Sarcocystis* sp. and *Caryospora bigenetica* were recovered from several snakes. An amoeba (presumably *Entamoeba invadens*) was also recovered from the feces of several snakes.

102

DAVIS, SARA R. and GROVER C. MILLER. North Carolina State University--Parasites of some fishes from B. Everett Jordan Reservoir, North Carolina. Two hundred fishes from the families Centrarchidae, Clupeidae, and Ictaluridae were collected from B. Everett Jordan Reservoir in Chatham County, North Carolina and examined for parasites between August 1987 and December 1988. Thirty-one species of parasites were recovered consisting of eighteen species of monogenetic trematodes, three species of digenetic trematodes, three species of cestodes, two species of nematodes and five species of copepods. An apparent new host record is established for the monogenean, *Cleidodiscus nematocirrus* from *Pomoxis nigromaculatus*, the black crappie.

103

PEEL, SHEILA A. and S. C. MERRITT. University of North Carolina at Chapel Hill--The organization of tubulin genes in *Plasmodium falciparum*. Genomic DNA isolated from the multidrug resistant clone, W2-MEF of *Plasmodium falciparum* was utilized to construct a

genomic library in the phage vector EMBL4. Heterologous DNA probes for alpha and beta tubulin genes generated from *Trypanosoma brucei* were utilized to identify recombinant phages with strong sequence similarity to these genes in *Plasmodium falciparum*. Analysis of independently isolated recombinants by restriction digest mapping has demonstrated that the loci for these genes are linked in the plasmoidal genome. Recombinant DNA was subcloned into a plasmid vector to identify subclones specific for either alpha or beta tubulin for detailed genomic restriction mapping and DNA sequencing. Tubulin genes are involved in numerous cellular processes, and are critical to the survival of the parasite. They have not been previously described in *Plasmodium falciparum*.

104

TERRY, BARBARA A. North Carolina State University--The role of selected mouse anti-IgG antibody in attracting eosinophils to the tegument of schistosomula of *Schistosoma mansoni*. *S. mansoni* is a parasitic helminth that causes schistosomiasis in humans and livestock. Pathology associated with this disease is concentrated primarily in the liver and is chronic in nature, often resulting in death. *S. mansoni*'s ability to avoid destruction in vivo by the host immune mechanisms is observed in all stages of the life cycle except the schistosomula. Further, it appears that study of anti-schistosomula antibodies in cooperation with various immune effector agents may provide specific data needed to develop effective vaccines against schistosomiasis. In this study, peripheral blood eosinophils were isolated and identified by use of the 3,3' diaminobenzidine stain and Gill-Papanicolaou counterstain. Mouse IgG antibodies were isolated and studied to determine their role in attracting eosinophils to the tegument of schistosomula and in destruction of the parasite. Positive test results were observed in the experiments. The antibodies tested appeared to play a role in eosinophil attraction to schistosomula. Damage of the tegument of the schistosomula could be correlated with the eosinophil/antibody concentration.

105

JETTON, THOMAS L. and BURTON J. BOGITSCH. Vanderbilt University--Morphological and cytochemical observations of sperm maturation in trematodes, with an emphasis on schistosomes.

Schistosomes display considerable variation in their patterns of spermatogenesis and mature sperm structure. While sperm of the rodent schistosome, *Schistosomium douthitti*, exhibit a development and morphology comparable to most trematodes, those of the human schistosomes, *Schistosoma japonicum*, *S. hematobium* and *S. mansoni*, are radically different. In the human schistosomes, germ cells separate at various intervals during the course of spermatogenesis, and thus lack the

characteristic "rosettes" of developing spermatogenic cells seen in other flatworms. As a result, cells in the same stage of spermatogenesis are (1) scattered throughout the testes in *S. mansoni*, (2) partially zoned with transient rosettes in *S. japonicum*, and (3) zoned with unusual spermatid clusters in *S. hematobium*. In addition, polarization of the mitochondria to the anterior end of human schistosome sperm is unique among flatworm sperm development. Testicular sperm of *S. mansoni* and *S. japonicum* have a blunt anterior tip with a single mitochondrial derivative and a short tail with a single, unique axoneme. During spermiogenesis in *S. hematobium* nucleolar material and ribosomes are retained in the future head region until relatively late in the developmental sequence. Sustentacular cells are intimately involved with germinal cells throughout spermatogenesis in human schistosomes.

106

HUTZLER, L. BEATRICE, KENNETH A. ROBERTS, and GREGORY K. HARPER. Clinch Valley College--Effect of steroid hormones on the immune response of Sprague-Dawley rats to *Trichinella spiralis*.

Sexual dimorphism in the immune response to parasites has been observed. It is believed that estrogen inhibits T suppression. It is known that gonadal steroids influence adrenal cortical function. Outbred white rats were gonadectomized, sham operated, or left intact in male and female groups of 6 each, infected with *T. spiralis* and treated variously with 0.005 mg estradiol, 0.05 mg testosterone, 0.5 mg hydrocortisone every other day for 21 days, or as controls. Serum was collected from cardiac punctures every 10 days from day 5 to 45 post infection for serotiter and steroid concentration analyses. The rats were sacrificed on day 45, thymuses and spleens were collected for weights and histologic analysis, and the carcasses digested for worm counts. The data obtained show that the males harbored significantly more larvae than the females. Thymic weights showed an increase with gonadectomy compared with the sham operated controls. This increase was not significantly reduced by the administered hormones. There were significantly different spleen weights between hydrocortisone treated males and females. It is concluded that there are inherent differences between male and female rats in resistance to *Trichinella spiralis*, the females being more resistant whatever the steroid treatment at the concentrations administered.

107

WAGNER, LISA K. Georgia Southern College--Seedling establishment in three weedy summer annuals.

Microsite variation has been shown to influence seed germination and seedling establishment in a number of species. This study investigated the effects of two components of microsite variation - litter cover and depth of burial - on seedling establishment in 3 weedy species common in the southeastern U.S.

Seeds of *Cassia obtusifolia* (Sick lepod), the largest-seeded species, had the greatest probability of seedling establishment when buried (1 and 2.5 cm depth) compared to seeds on bare soil or covered with litter. Seeds of *Desmodium tortuosum* (Florida beggar weed), which are intermediate in size, were most likely to become established when buried 1 cm deep or when litter covered, and exhibited decreased establishment at 2.5 cm depth or on the soil surface. Establishment of *Digitalia ischaemum* (Crabgrass)

seeds was greatest when seeds were buried 1 cm deep or covered with litter, but was considerably diminished in seeds buried 2.5 cm. *Digitalia* seeds were the most able to become established on bare soil, almost half of seeds producing an established seedling. Differences in response among these three species can be related to their distribution in cultivated fields and roadsides; *Digitalia* is often found in recently tilled and open soil, whereas occurrence of *Cassia* and *Desmodium* is variable depending on cultural practices.

108

WINSTEAD, JOE E. Western Kentucky University--Maple and yellow-poplar stump sprout regeneration and dominance in a Cumberland Plateau hemlock forest.

Twenty-three years after being clear cut, a hemlock forest in Laurel County, Kentucky has shifted in composition to a maple-poplar stand due to significant stump sprouting. Forty-eight percent of the basal area of 36.6 m² ha⁻¹ present in 1988 was dominated by *Acer rubrum* L. and *Liriodendron tulipifera* L. compared to the 56% composition of *Tsuga canadensis* (L.) Carr. in standing timber volume prior to clear cutting in 1965. While red maples produced more sprouts per stump (avg. of 3.6) than yellow-poplar (avg. of 2.6) the average diameter of 8.9 cm was significantly less than the 19.1 cm dbh found in *Liriodendron*. Seedling development surveyed every two years for the past decade indicates highly variable survival with red maples consistently dominant. Hemlock and yellow-poplar seedlings have been minor components in the understory development with a corresponding decline in *Betula lenta* L. seedling survival. *Cornus florida* L. and *Ilex opaca* Ait. appear to show stable survival in seedling class size as the canopy develops.

109

SCHIFFMAN, PAULA M. Virginia Polytechnic Institute and State University--Absence of a buried seed bank in a southern Appalachian oak forest: Implications for succession.

By germinating following disturbance, buried seed banks typically play an important initial role in vegetation regeneration. The seed contents of soil and forest floor litter samples collected from six naturally replicated sites in the southern Appalachians (Brush Mountain, Montgomery, Co., VA) were estimated by seedling emergence and visual examination methods. Few seeds were found in the samples (< 1 seed per m²), and most perennial forest species were completely absent. These findings suggest that seed dispersal, a potentially stochastic process, may be an important factor affecting post-disturbance vegetation composition. A tenet of ecological theory indicates that environmentally similar sites

support compositionally and structurally similar vegetations. Stochastic seed inputs, however, could result in the divergence of successional pathways at environmentally similar sites where buried seed banks are absent.

110

BUSING, RICHARD T. and EDWARD E.C. CLEBSCH. University of Tennessee
--Canopy gap processes of a southern Appalachian cove forest: second growth vs. old growth.

Canopy gap disturbance and tree regeneration were characterized in adjacent second-growth (67 yr) and old-growth stands near Long Branch, Great Smoky Mountains National Park, TN. The Liriodendron dominated second-growth stand is comprised of narrow, nonoverlapping crowns, while the Acer saccharum-Tsuga-Halesia dominated old-growth canopy is comprised of large, spreading and overlapping crowns. Secondary stand gaps are small (<100 m²) but numerous. Shade-tolerant species regenerate throughout the understory; regeneration of intolerants is low. Individual gap microsites are not markedly different from the remaining understory. Old stand gaps are often larger, higher light microsites contrasting sharply with the shaded forest floor. Regeneration of most deciduous species is concentrated in gap areas. The wider range of gap sizes in old forests accommodates a variety of species, including intolerants.

111

CLEBSCH, EDWARD E.C. and RICHARD T. BUSING. University of Tennessee, Knoxville--Secondary succession, gap dynamics and community structure in a Southern Appalachian mesic cove forest.

Forest succession was studied in a species-rich cove forest of the Great Smoky Mountains, TN. Long-term compositional and structural changes in secondary stands, 15-63 yr after agricultural abandonment (ca. 1920), were compared to an adjacent old-growth stand. Later successional trends were projected by computer simulation. The colonizing stand (15 yr) is dominated by Liriodendron tulipifera and Robinia pseudo-acacia. Common old-growth species absent at this early stage include Aesculus octandra, Fagus grandifolia, and Tsuga canadensis. By year 50, Liriodendron dominates the overstory and all old-growth dominants are represented in the understory. After 60 years, Acer saccharum is clearly the most abundant understory species. Gap model projections indicate that after 200 yr it will dominate the forest. The actual old-growth stand is dominated by Acer saccharum. Species richness peaks at mid-succession (ca. 50 yr), while diversity (H') and evenness (J') of species biomass are high at the old-growth stage. Richness peaks with the coexistence of shade-intolerant colonizers in the overstory and shade-tolerants in the understory. Canopy gap processes of the secondary and old-growth stands differ sharply. The old-growth canopy is comprised of large,

spreading, and overlapping crowns, while the second-growth stand is comprised of narrow, nonoverlapping crowns. Gaps in the secondary stand tend to be small (<100 m²) but numerous. The regeneration of intolerants is low and individual gap microsites are not markedly different from the understory as a whole. Old-growth gaps are often larger, higher light microsites which contrast sharply with the shaded forest floor. The wider range of gap sizes in old forests accommodates a variety of species, helping make it of high diversity.

112

BARDEN, LAWRENCE S. University of North Carolina at Charlotte--Repeatability in forest gap research: A comparison of studies in the Great Smoky Mountains.

A comparison of two independent studies of tree regeneration in small canopy gaps of the same old-growth southern Appalachian hardwood forests shows that estimates of gap longevity, gap closure rate and percent land area in gaps differ by factors of 2.5, 2.4 and 2.2, respectively. These differences probably result from differing definitions of gap closure and inherent biases in methods of searching for gaps. As a consequence, estimates of annual turnover rate of land area into and out of gaps differ by a factor of 5.2. Despite these differences, the two studies found that tree replacement in small canopy gaps could account for the species composition of the surrounding forest. A new study using methods of both investigators in Joyce Kilmer Memorial Forest suggests that annual canopy turnover rates in old-growth southern Appalachian forests may be half (0.5% vs 1.0%) those reported for tropical rain forests and northern coniferous forests.

113

SCHMALZER, P.A. and C.R. HINKLE. The Biometrics Corporation, NASA, Biomedical Operations and Research Office, John F. Kennedy Space Center--Vegetation and soil changes during two years post-fire in oak scrub vegetation on John F. Kennedy Space Center, Florida.

We have followed changes in the vegetation and soil in two stands of oak scrub vegetation dominated by scrub oaks (Quercus spp.), saw palmetto (Serenoa repens), and ericads that burned in December 1986. Permanent transects (15 m length) had been established in each stand and previously sampled in 1983 and 1985. Stand 1 had not burned for 11 years, and stand 2 had not burned for 7 years. We resurveyed transects at six months, 12 months, 18 months, and 24 months post-fire. In addition, we collected soil samples from 0-15 cm and 15-30 cm layers immediately post-burn and at the times of vegetation sampling. Soils have been analyzed for organic mat-

ter, pH, exchangeable $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, Ca, Mg, Na, K, available P, Cu, Fe, Mn, and Zn. Sprouting of shrub species dominated the post-fire recovery of scrub. Height and cover increased rapidly at first and then at a slower rate. Shifts in dominance occurred, since the initial regrowth of saw palmetto was more rapid than that of the oaks. Some herbaceous species present post-fire were not previously recorded from these transects, but these were a minor element of the regrowth.

114

MCCORMICK, J. FRANK. *University of Tennessee--Environmental Impacts of Resettlement and Economic Development in the Amazon of Brazil.*

Agriculture, hydroelectric development, mining and urban expansion are major causes of environmental deterioration in lowland tropical forests and rivers of the Amazon basin. Hydroelectric projects already approved are sufficient to place 40% of the Amazon under water. Farmers must clear two-thirds of the land they colonize in order to receive title to that land. Industrial, hospital and domestic wastes are indiscriminately deposited in forest clearings on the periphery of municipalities. In response to these and related issues, environmental legislation was implemented in 1986 which required environmental assessments of development projects. Environmental impact assessment training courses, conducted cooperatively by the Universities of Amazonas and Tennessee, are preparing scientists and engineers to conduct environmental assessments in the Amazon of Brazil and neighboring countries. As in all developing regions of the world, the emphasis is upon site selection and creative mitigation rather than upon go and no-go decisions more characteristic of industrialized and affluent regions of the world. Projects already completed by course participants have minimized adverse impacts and have saved time and money required for development projects.

115

LIU, HONGGANG AND SONC YONCHANG. *Marshall University and East China Normal University--Vegetation of Wuqishan Mountain in Eastern China.*

The subject of this study is the community ecology of a subtropic evergreen broad-leaf forest. The Wuqishan Mountain is at a latitude of $29^{\circ}47' - 30^{\circ}12'$ and with an elevation from 400 to 1227m. The vegetation of Wuqishan Mountain consists of natural and man-made forest. Most of the natural forest is the evergreen broad-leaf type, dominated by *Lithocarpus henryi*, *Litsea coreana* var. *sinensis* and *Cinnamomum subavenium*. There are evergreen and deciduous broad-leaf forest above 800m of elevation and in the valleys. *Lithocarpus henryi*, *Platycarya strobilacea* and *Albizia kalkora* are dominant elements at higher elevations while *Lithocarpus henryi*, *Pteroceltis tatarinowii* and *Lindera glauca* are dominant species at lower elevations. Shrublands occur on ridges above 1100m and are dominated by *Crataegus cuneata* and *Serissa serissoides*.

The evergreen broad-leaf forest, dominated by *Lithocarpus henryi* is a new vegetation type in China. In this study numerical classification and ordination are used. Perspectives of natural conservation and rational utilization of the forest are discussed.

116

STEPHENSON, STEVEN L. and LAL SINGH CHAUHAN. *Fairmont State College and Himachal Pradesh University--Forest vegetation of Himachal Pradesh in northwestern India.*

The vegetation of Himachal Pradesh, located in the Himalayan region of northwestern India, ranges from subtropical forests in the foothills to alpine meadows above treeline. The climate of the region is montane temperate and is strongly influenced by the summer monsoon. The flora shows pronounced Euro-Mediterranean affinities, and many of the ecologically important genera (e.g., *Pinus*, *Quercus*, and *Rhododendron*) are also important in the forests of eastern North America. In general, subtropical dry coniferous forests strongly dominated by *Pinus roxburghii* occur at lower elevations (1000 to 2000 m), whereas temperate moist forests consisting of various combinations of both coniferous and broadleaf trees are found at higher elevations (2000 to more than 3000 m). Among the more important subtypes of the latter are forests in which such species as *Quercus incana*, *Cedrus deodara*, *Pinus wallichiana*, *Quercus semicarpifolia*, *Rhododendron arboreum*, *Picea smithiana*, and *Abies pindrow* are dominants or codominants. Like many developing countries, India faces a serious problem of diminishing forest resources. Most of the original forests in accessible areas have been exploited, both by destroying trees to clear land for agriculture and by harvesting trees for fuelwood, fodder, and building materials on a sustained and largely uncontrolled basis. (Supported by a grant from the National Geographic Society.)

117

LONG, ALICE A. *Southern Illinois University--Distribution and vegetation of the barrens in southern Illinois.*

"Barrens" once occurred throughout Illinois, covering entire townships in some areas; however, presently, The Nature Conservancy considers the barrens plant community to be the most endangered habitat in Illinois. Twenty-one sites in southern Illinois were studied using the canopy coverage method on 30 0.05ha circular plots per site. Barrens are dominated by grasses, primarily *Schizachyrium scoparium* or *Danthonia spicata* and numerous forbs depending upon various environmental factors including substrate, soil characteristics, past disturbance and topography. In addition, stunted *Quercus stellata* and *Quercus marilandica* are often scattered throughout the barrens. In general, species diversity was highest on limestone sites or sites with little exposed bedrock. Due to fire suppression and the subsequent arboreal encroachment by species such as *Juniperus virginiana*, *Rhus copallina*, *Ulmus alata* and *Quercus muhlenbergii*, many of the barrens are rapidly degrading.

118

WORKMAN, SARAH W. and KENNETH W. McLEOD. University of Georgia and Savannah River Ecology Lab--Species composition after seasonal burns in a Sandhills scrub oak community. A summer (Aug. 1980) and a winter burn (Jan. 1981) were conducted in a (Pinus palustris-Quercus laevis) Sandhills community of the Savannah River Plant Site in South Carolina. Plant species composition was sampled prior to burn treatment ('80), the growing season following treatment ('81), and seven years after treatment ('88). All tree species decreased density the first growing season following both the single summer burn treatment and the single winter burn treatment but had recovered to pre-burn density seven years post-fire. Seven year post-burn estimates indicate Longleaf pine (P. palustris) decreased in number of trees/ha while the species basal area increased relative to pre-burn estimates. Basal area of Turkey oak (Q. laevis) increased while reproduction and density were equal or slightly higher than pre-burn values. Scrub post oak (Q. margaretta) density was lower than pre-burn estimates on the summer burn plot though 7 year post-burn reproduction was greater than observed pre-burn. Scrub post oak had increased basal area and density on non-burn and winter plots. Other hardwood species had increased density and reproduction on burn treatment plots but had decreased or not changed on the non-burn plot. Herbaceous species cover and frequency data suggest species diversity 7 years after burn treatment was lower on the summer burn plot and was higher on the winter burn plot than prior to burning.

119

PITTILLO, J. DAN. Western Carolina University--A Disturbance Hypothesis for the Vegetational Patterns of the Craggy Mountains, North Carolina. Observed vegetational patterns of high elevational peaks of the Craggy Mountains suggest major disturbances during the history of the area. Recently Shaffer suggested a sequence of events for the nearby Balsam Mountains that begins with high elevational tundra during the Holocene at the conclusion of Pleistocene glaciation. Relict populations usually associated with tundra vegetation are well represented in the Craggy flora. These populations typically are associated with disturbance factors that inhibit domination and competitive exclusion by tree species. Stunted beech, deformed yellow birch, and extensive heath communities rather than the expected spruce-fir forest dominate the peaks of Craggy Pinnacle and Craggy Dome. Evidence of disturbance during historic times is linked with prehistoric findings and supports a disturbance theory for the existing vegetational patterns. Inter-

action of grazing and browsing animals with Native Americans is suggested as the probable main factor in maintaining the tundra relicts and excluding an expected spruce-fir forest in the high elevations of the Craggy Pinnacle and Craggy Dome area.

120

HORN, CHARLES N. Newberry College--Geographical and ecological notes on Solidago verna (Asteraceae), a rare endemic of the Carolinas. The spring flowering goldenrod, Solidago verna, is an endemic composite of southeastern North Carolina and northeastern South Carolina. The species distribution correlates well with the outcrop of Upper Cretaceous formations in the Carolinas. In South Carolina distribution is apparently further limited by three factors: shade, soil composition, and soil moisture. Most commonly, populations occur in partially shaded sites between dry upland sandhill soils and lowland loamy soils. Specific sites of plant growth have shifted from frequently burned (naturally) savannah and pocosin sites to locations along powerlines and roads regularly maintained by mowing. Plants flower between mid May and early July. Surveys of populations during this time revealed that no more than 30% of the plants flower each year. Further, plants with inflorescence stems from the previous year were not in flower, suggesting plants do not flower two years in a row. The future of Solidago verna will, strangely enough, depend in the maintenance of disturbed powerline and roadside sites. This project was funded by a grant from the South Carolina Heritage Trust Program.

121

HARDIN, JAMES W. North Carolina State University--How many basswood species in the U.S.? The taxonomy of the North American basswoods (Tilia) is problematical. Recently, the choice has been to recognize four or only one polymorphic species. Lacking definitive foliar, floral, fruit, or flavonoid features, most workers have argued strongly that the only reliable character is the presence/absence and nature of the hairs on the leaves. Others have argued, just as adamantly, that this is a trivial and variable character of no taxonomic value. Detailed micro-morphology using SEM shows four basic trichome types, with some subtypes: 1) bulbous gland, 2) acicular (long and short forms), 3) stellate (sessile, stipitate, or pedicelled and variable no. of rays), 4) stipitate-fasciculate (with or without a pedestal or basal collar and with variable no. of rays). Recognizing the quantitative nature of ecotypic, ecophenic, and seasonal variation in vestiture, and also the possibility of introgression, there are still significant micro-morphological differences in trichome type, correlated with geographical

region, that are useful in recognizing three varieties of Tilia americana: var. americana, var. heterophylla, and var. caroliniana.

122

MOORE, MICHAEL O. and DAVID E. GIANNASI.
The University of Georgia--Foliar flavonoids of Vitis L. subgenus Muscadinia (Planch.) Rehd.

Two major natural groups exist within North American Vitis. Whether these groups are deserving of separate generic status (Vitis and Muscadinia) or if they should be considered as two subgenera within Vitis is debated. Previous studies have documented the use of foliar flavonoids in Vitis systematics. Thus, the major goals of this study were to determine if the flavonoids of subgenus Muscadinia were distinct enough from representatives of subgenus Vitis to justify the separate generic recognition and to apply the data to systematic problems within subgenus Muscadinia. A total of six flavonol-3-O-glycosides were isolated from the three species of subgenus Muscadinia. In general, the flavonoid profiles distinguish between V. rotundifolia and V. munsoniana, except in limited areas where their geographical ranges overlap. The profiles of V. rotundifolia and V. popenoei were identical. Principal components analysis and UPGMA clustering of flavonoid data suggest that the species of subgenus Muscadinia are very closely related. Comparison of the Muscadinia and Vitis data show that the flavonoids of subgenus Muscadinia are distinct but fall within the known flavonoid classes found thus far in Vitis. Thus, retaining Muscadinia as a subgenus within Vitis seems more appropriate at this time than its elevation to generic status.

123

BROYLES, STEVEN B. and ROBERT WYATT.
University of Georgia--Inflouescence size and reproductive success in milkweeds: evidence against the pollen donation hypothesis.

Recently evolutionary biologists have stressed the importance of sexual selection in the evolution of inflorescence size in flowering plants, including milkweeds (Asclepias). They have postulated that large floral displays are adaptations to enhance the probability of fathering seeds on other plants in the population. Paternity exclusion analysis using genetic markers indicates, however, that plants of A. exaltata with large floral displays do not experience disproportionate success as pollen donors (i.e., males). Pollinia removal, the usual estimate for potential male reproductive success, was significantly correlated with numbers of seeds sired ($r = .47$; $P < 0.001$) and seeds produced ($r = .71$; $P < 0.001$). Contrary to the sexual selection argument, individuals with large inflorescences did not behave primarily as males. In fact, individuals with the highest total reproductive success had about equal success in producing and in fathering seeds.

Proportional increases in male and female reproductive success, as observed in A. exaltata, indicate the potential for natural, rather than sexual, selection to operate in the evolution and maintenance of large floral displays.

124

COX, PATRICIA B. and L. E. URBATSCHE.
Louisiana State University--A cladistic analysis of the "coneflowers" (Asteraceae).

Historically, Linnaeus placed the coneflowers in the genus Rudbeckia. At present, the coneflowers are distributed among the genera Dracopis, Echinacea, Ratibida, and Rudbeckia. Stuessy grouped these four genera together within the subtribe Helianthinae. Later, Robinson erected the subtribe Rudbeckiinae to include Dracopis, Ratibida, and Rudbeckia. He removed Echinacea to the subtribe Ecliptinae on the bases of chromosome number and anatomical features. Twenty-four characters were chosen for cladistic analyses performed by means of various algorithms in PAUP. These analyses support the historical placement of Echinacea with the coneflowers. Two different tree topologies of the Rudbeckiinae were produced depending on OTU's present in the data matrix: (1) the first cladogram included all taxa of the coneflowers and eight members chosen from the Ecliptinae. This analysis presents the Rudbeckiinae as a monophyletic group with all taxa of the Ecliptinae forming a grade; (2) in the second cladogram, the ingroup consisted of the Rudbeckiinae. The resulting phylogeny shows Echinacea as the terminal taxon more closely related to Rudbeckia sect. Macrocline, Rudbeckia sects. Rudbeckia and Laciniata form a clade which includes Dracopis with Ratibida representing the most primitive taxon of the subtribe.

125

CYPHER, ELLEN A. Southern Illinois University--Distribution of the subspecies of Phlox bifida Beck.

Phlox bifida Beck comprises subspecies bifida and subspecies stellaria (Gray) Wherry. The latter is being considered for federal listing as an endangered taxon, but its abundance and distribution were unknown because of the difficulty of distinguishing the two subspecies. The most reliable differentiating characteristic is the presence of glandular trichomes on pedicels of P. bifida ssp. bifida versus pedicels glabrous or with eglandular hairs in P. bifida ssp. stellaria. A survey of herbarium specimens and in situ populations indicated that P. bifida ssp. bifida occupies a more northerly range than P. bifida ssp. stellaria. Only the former occurs in Illinois, Iowa, and Wisconsin, both subspecies are found in Arkansas, Indiana, Kentucky, and Missouri, and only P. bifida ssp. stellaria grows in Tennessee. Indeed, of the 24 known populations of P. bifida ssp.

130

CONGDON, JUSTIN D., AND RICHARD VAN LOBEN SELS. Savannah River Ecology Laboratory, Aiken, SC and Mesa Red Mountain High School, Mesa, AZ--Growth and reproduction in the Blanding's turtle.

A population of Blanding's turtles (*Emydoidea blandingi*) in southeastern Michigan were continuously studied from 1975 through 1988. Sex ratio of adults in the population was 1:3.8. Body sizes of adult males and females were not significantly different. The average size of a group of females with mean minimum ages of 47 years was not significantly different from a younger group with a mean age of 21 years. Body size of adults reached a plateau at approximately 200 mm carapace length and 1,200 g in body mass. Observations of nesting, palpation, and X-radiographs of females indicated that two females matured at a minimum age of 13 years. Approximately 59% of the reproductive females in the population were smaller than one of the 13 year old females. The smallest reproductive female (157 mm and 163 mm in plastron and carapace length, respectively) in the population was 20 years of age. Over the 11 years of the study (1978 through 1988) females did not produce more than one clutch per year. Clutch size ranged from 3 to 19 ($X=10.2$ eggs). Clutch size and to a lesser degree egg size, showed a significant positive relationship with body size but not with age of females. Hatchlings averaged 31.0 mm plastron length, 35.3 mm carapace length and 9.2 g in body wet mass.

131

MILLS, EDWARD D. AND DAVID T. ROGERS JR. University of Alabama--Nearctic passerine fall migration in central Belize.

We studied nearctic bird migration in 3 orange orchards that varied in age, height and trunk diameter during fall 1986 in central Belize, Central America. We captured 1170 migrants of 47 species (0.33 birds per net hr) during the migration period (25 Aug - 18 Nov). Wood warblers accounted for 79% of the individuals. Three warbler species (*Dendroica magnolia*, *D. petechia*, and *Protonotaria citrea*) accounted for 36% of the individuals. Migrants arriving in central Belize had not lost muscle mass and still had fat reserves remaining. The largest migration peak coincided with the first cold fronts to move into the Gulf during the fall season. Weights of migrants arriving before the fronts were not significantly different than those arriving after the fronts. We caught 14 species not previously recorded on the Yucatan mainland during fall migration, and speculate that the northern part of the peninsula is an overflight zone. Typical open country species were more common in the younger, more open orchard, and typical forest species were more numerous in the older, shadier orchards. The number of migrant individuals in the older orchard was significantly fewer than expected. We believe that central Belize is part of a major flyway and that orange orchards are important stopover and wintering sites for many nearctic migrants in the neotropics.

132

FLINCHUM, RENEE Y. and WALLACE D. DAWSON. University of South Carolina--A test of genetic drift theory in a small population of *Peromyscus polionotus*.

The transformation of local agriculture from cotton and other crop production to pine forest throughout South Carolina in the last four decades has created small isolates in the population of the oldfield mouse, *Peromyscus polionotus*. These isolates are subject to all the problems of a small population facing extinction. Variations in allelic frequency should be due primarily to genetic drift as a function of small population numbers. During summer and autumn 1988 live traps were placed at individual mouse burrows on a powerline transect in Lexington County, South Carolina. The transect, bounded by dense pine and turkey oak forest and secondary roads, is maintained in perpetual early successional stage by periodic mowing. Mice captured were numbered, ear-marked and released immediately. A portion of them were also blood sampled and genetically typed for serum proteins. Twenty seven mice were marked. Recapture data was recorded for a total of 128 captures. Initial data suggests a high degree of juvenile loss, particularly among males. Adult males establish territories which include the burrows of more than one female, indicating possible polygyny. Of eleven mice typed for transferrin, one was heterozygous for the E allele and the remainder were C type. The continued presence of the relatively low frequency of the E transferrin allele at the same levels found in nearby populations two decades ago suggests that drift is not fixing the more common C allele, and selection may play a stronger role than anticipated.

133

SCRIBNER, KIM T. University of Georgia--Environmental and demographic correlates of spatial genetic structure in the Cottontail rabbit.

Cottontail rabbits (*Sylvilagus floridanus*; N=543) from two isolated populations were characterized genetically, demographically and ecologically to examine factors underlying existence of, and temporal dynamics in population structure. Intra-population structure was manifested as nonrandom spatial distributions of genotypes, cohorts and habitat variables. Microgeographic genetic structure was seen as significant spatial autocorrelation of genotypes at three electrophoretic loci and contiguous clusters of individuals of like genotype within each population. Spatial autocorrelation analyses revealed significant spatial genotypic associations within both populations, during each of four seasons, though considerable temporal variation in autocorrelative pattern and distances were observed. Greater evidence of contiguous genotypic associations were observed during the spring, summer and fall seasons than were documented during the winter, prereproductive season. Mantel matrix regressions were used to document relationships between demographic and habitat variables and spatial genetic structure. Localized genotypic assemblages were shown to characterize areas of localized breeding.

activity, patchy dispersion of suitable habitat and distances of effective gene flow. Genetic structure appears to be maintained during the winter as a result of spatial heterogeneity in suitable habitat, and during the reproductive season by localized breeding and non-random dispersion of individuals from specific cohorts.

134

ROWE, MATTHEW¹ and DONALD H. OWINGS². Appalachian State University¹ and University of California at Davis²--The information afforded by rattlesnake rattles: a study of risk assessment by ground squirrels.

California ground squirrels (*Spermophilus beecheyi*) approach, harass, and even attack one of their major predators, the rattlesnake (*Crotalus viridis*). In some of these encounters, rattlesnakes respond by rattling. In an earlier study, we demonstrated that the intensity and spectral composition of the rattling sound is correlated with the size of the rattlesnake. Squirrels use this information, and respond more aggressively when they hear rattling from a small, and therefore less dangerous, rattlesnake. In this study we assess another component of risk -- the body temperature of the snake. We recorded the rattling sounds and strike speeds (using high-speed video) of 14 rattlesnakes at 4 different body temperatures: 10, 18, 27, and 35° C. As expected, the strike speed of a rattlesnake is positively correlated with its body temperature. Several characteristics of the snake's rattling sounds also vary with its T_b . Experiments are now underway to determine if squirrels pay attention to this "unintended" information; e.g., by responding more cautiously when they hear rattling from warmer, faster-striking rattlesnakes.

135

STEELE, MICHAEL A., TRAVIS W. KNOWLES, and KEN BRIDLE¹. Wake Forest University and RJR industries¹--Partial consumption of acorns by vertebrate seed predators: the effects of tannins.

We observed gray squirrels (*Sciurus carolinensis*), common grackles (*Quiscalus quiscula*) and blue jays (*Cyanocitta cristata*) feeding on acorns of the willow oak (*Quercus phellos*), and noted that each species frequently consumed only the proximal portion of the seed. Each animal employed a different technique for opening acorns, but all consumed only 30-50% of the endosperm. Gray squirrels also exhibited similar feeding behavior at several other red oaks of the subgenus *Erythrobalanus*: *Q. rubra*, *Q. laevis*, *Q. nigra*, *Q. coccinea*. Chemical analyses (protein precipitation assay) of acorns from

27 *Q. phellos* and 19 *Q. laevis* trees indicated that the total phenolics (primarily tannins) were significantly higher in the distal half of the acorns, where the embryo is located. Moreover, germination experiments with *Q. phellos* acorns revealed equal or greater germination success for half-eaten acorns as compared with whole acorns. We argue that the higher tannin levels render the distal portion of acorns unpalatable, thus improving the probability of seed survival even after attack by seed predators.

136

SMITH, WINSTON P. Tennessee Technological University--Behavioral and ecological response of white-tailed deer to livestock: A case study from southwestern Oregon.

The response of Columbian white-tailed deer, *Odocoileus virginianus leucurus* (Douglas), to livestock was part of an overall ecological profile conducted within the interior valleys of the Umpqua River Basin in southwestern Oregon, May 1978 - December 1980. Radio-telemetry and direct observations from horseback along a 65-km transect were used to determine movement patterns, home range and habitat use. Dams exhibited significant ($P < 0.05$) shifts in center of activity (geometric center of home range) associated with the establishment of additional, discontinuous home ranges during the fawning period. All marked dams ($n = 12$) exhibited their largest straight-line displacement in center of activity during May - July; 7 females undertook extended ($\bar{x} = 1445$ m) excursions during 25 April - 20 May. Fawns of three dams were captured an average distance of 1926 m from annual home range centers of activity. Dams avoided ($P < 0.05$) areas supporting livestock during fawning; an average of 1 fawn per 91.4 man-hours of search was encountered in portions of the study experiencing > 6 AUMs of livestock use whereas 1 fawn per 7.1 man-hours of effort was encountered in areas experiencing < 3 AUMs. Natal areas ($n = 52$) were concentrated within denser, lusher vegetation. Livestock use reduced ($P < 0.05$) the quantity and diversity of herbaceous vegetation as well as available escape cover. Establishment of separate home ranges by dams during the fawning season was apparently a response to relatively high livestock use. Discrimination of suitable fawning habitat according to livestock use probably reflects a general aversion to continued disturbance; presumably reduces competition for nutritious, palatable forage; and may reduce predation pressure on neonates.

137

HICKS, KATHRYN A. and JOHN G. MORRIS. Florida Institute of Technology--Winter diet selection of the West Indian Manatee at Homosassa Springs, Florida.

The diet of the West Indian Manatee (*Trichechus manatus*) was examined during the winter months from 1986 through 1988. Diet composition was determined by the recovery of plant epidermal fragments from fecal samples. The submerged aquatic species *Ruppia maritima*, *Hydrilla verticillata*, *Ceratophyllum demersum*, *Vallisneria spiralis*, and *Myriophyllum spicatum* comprise 85% of the winter diet. Shifts

in diet composition were observed between early and late winter with a decrease in the occurrence of Hydrilla, Ruppia and Vallisneria and an increase in the occurrence of Ceratophyllum. The shifts in diet composition are correlated with changes in abundance and food value of the plant species. Submerged aquatic species were consumed at or below their mean abundance in the habitat except for Ceratophyllum. Significant correlations occurred between the carbohydrate content of Ruppia and Vallisneria, the protein content of Ruppia and Ceratophyllum, and the lipid and caloric content of Ceratophyllum and the amount of these species in the fecal samples.

138

COLON, JOSE L. Loyola University--
Comparative ultrastructure and evolution of tongue papilla in insectivorous bats.

A comparative study of surface microstructure of the tongue papillae in 3 genera of vespertilionid bats (Nycticeus, Myotis, Pipistrellus, Plecotus) and 1 molossid species (Tadarida brasiliensis) was designed to examine the interaction of functional constraints of feeding ecology and historical constraints of evolutionary history. SEM and computer digitized image analysis revealed both similarities and differences in the form, number, and position of tactile and gustatory papillae. All taxa have numerous complex "mechanical" tactile papillae coating most of the dorsal surface of the tongue. Long pointed filiform papillae and a pair of circumvallate papillae are concentrated in the basal region. Consistent differences among the taxa examined include the number and distribution of fungiform papillae and the form of filiform papillae. These differences confirmed by statistical analysis cannot be explained solely on the basis of adaptation to a single functional constraint, such as insectivory. It appears that chemoreception may play an important role in the evolution of the tongue in these chiropteran genera.

139

VAN DEVENDER, ROBERT WAYNE.
Appalachian State University--
A Model for the Batesian-Mullerian mimicry spectrum.

The relationship between Batesian and Mullerian forms of mimicry and of predictions based on the two models were explored using a numerical simulation that included a fixed number of primary noxious individuals called master models, a variable number of mimics or co-models, variable noxiousness and attractivity of mimics and co-models, and a fixed predator pool with varying attentiveness to the mimicry system. Under all conditions, co-models with any level of noxiousness resulted in improved survivorship of the master model, as originally

predicted for Mullerian mimicry. Presence of attractive mimics reduced the survivorship of the master models as predicted for simple Batesian mimicry. Including variable attractiveness of mimics makes this model a bit more realistic. Regardless of noxiousness, rare co-models cannot exist without a master model to share the load of training predators. Mimics with minimal or variable attractiveness have little effect on master models unless they are very common.

140

KIMBROUGH, T. DANIEL,¹ WEEKLEY, L. D.,² and LLEWELLYN,³ Virginia Commonwealth University,¹ Colorado State University,² and Bureau of Toxic Substances, Richmond, Virginia.³--Influence of calmodulin inhibitors on spontaneous gastrointestinal smooth muscle contractile responses to angiotensin-II.

An investigation involving inhibition of the combined effects of calmodulin and angiotensin-II in rats has suggested a new role for calmodulin. Isolated duodenal segments were pretreated with either of the calmodulin inhibitors, proadifen or tri-fluoroperazine and the subsequent contractile force and frequency response to angiotensin-II were monitored. Both inhibitors decreased spontaneous contractile activity and attenuated the force generation in response to angiotensin-II. In separate experiments, isolated duodenal segments were pretreated with saralysin, and in $\pm 44\%$ of the cases, saralysin acted as an agonist on force generation while in $\pm 56\%$ of the cases, it antagonized the action ascribed to angiotensin-II. These results suggest that the action of angiotensin-II on duodenal smooth muscle activity is dependent on calmodulin. Apparently, angiotensin-II's effect on duodenal smooth muscle motility is dependent on calmodulin. Angiotensin-II may have more than one mechanism of action, or it may reflect receptor heterogeneity as indicated by the results with saralysin.

141

Varney, D.R.¹, L.A. Varney¹, R.W. Hemken², P.M. Zavos² and M.R. Siegel². Eastern Kentucky University¹ and University of Kentucky².--Puberty in mice as affected by a diet containing endophyte-infected tall fescue seed.

This study was undertaken to assess the effect of feeding endophyte-infected tall fescue seed to CD-1 mouse dams, during pregnancy and suckling, on the growth and sexual development of their male and female progeny. Pups (24 males and 24 females) were weaned at 21 days from dam fed a dietary treatment containing 50% rodent chow (w/w) and 50% KY-31 tall fescue (Festuca arundinacea) seed. In treatment 1, the seed was infected by Acremonium coenophialum, while the seed in treatment 2 was noninfected. Postweaning, the pups were fed rodent chow, ad libitum and, at 28 days, were paired with 42 day-old non-treatment, virgin mice for cohabitation

through one parturition. The age at first parturition for both male ($76.8 \pm 2.2d$) and female ($58.4 \pm 2.1d$) Treatment 1 pups were significantly later ($P < 0.05$) than the number of days required to parturition for treatment 2 males and females ($64.1 \pm 1.8d$ and $51.9 \pm 1.2d$, respectively). Female pups, at first parturition age, exhibited no significant differences in mean weight per dam or number of pups born per litter, however, total litter weight ($11.38 \pm 1.14g$) and mean weight per pup ($1.40 \pm 0.04g$) for Treatment 1 females were lower ($P < 0.05$) when compared to Treatment 2 females ($14.53 \pm 0.57g$ and $1.66 \pm 0.02g$, respectively). No significant differences were observed for total litter weight or number of pups per litter when comparing the two male treatment groups. Although Treatment 1 males weighed less at weaning and at pairing, the final weight (84d) was not significant ($P > 0.05$).

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Varney, D.R.¹, R.A. Prestidge², D.D. Jones¹, L.A. Varney³, P.M. Zavos³, and M.R. Siegel³ Eastern Kentucky University¹, Ruakura Soil and Plant Research Station, New Zealand², and University of Kentucky³. The effect of endophyte-infected perennial ryegrass diet on growth and reproduction in mice. This study was undertaken to determine whether a small animal bioassay (mouse) could be used to study the clinical effects of endophyte (*Acremonium lolii*) infected perennial ryegrass (*Lolium perenne*) on livestock. Seventy-two CD-1 mice (36 males and 36 females) were randomly assigned to 1 of 6 dietary treatments and housed separately for 56 days before being allowed to cohabit for 49 days. The diets included ad libitum feeding of rations containing 50% (w/w) rodent chow plus 50%, 37.5%, 25% and 0% infected perennial ryegrass seed, and rations containing either 50% noninfected seed or 100% rodent chow restricted to the average daily intake of the 50% infected diet. Mice fed the 50% infected seed diet did not exhibit lower feed consumption but gained significantly less weight ($P < 0.05$) during the 56 day trial. All mice fed ryegrass mice gained less than the mice fed restricted chow mice ($P < 0.05$) during this time. The parturition data indicated a trend of fewer pups per litter and significantly lower ($P < 0.05$) total litter weight and mean weight per pup born from mice fed the 50% infected seed diet. Mice fed the 50% infected diet had fewer pups that survived through a 14 day suckling period. Aberrant behavior was also noted in mice fed the toxic diets, which may lead to a bioassay for neurological dysfunction in animals consuming endophyte infected perennial ryegrass in their diets.

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FISCHER, ROBERT U., DAVID E. SCOTT, SCOTT A. BUSA, AND JUSTIN D. CONGDON. SAVANNAH RIVER ECOLOGY LABORATORY -- Reproductive and lipid cycles in the cottonmouth, *Agkistrodon piscivorus*.

During each of seven one-week periods in 1985-1987 we systematically collected 30-40 individuals of the eastern cottonmouth, *Agkistrodon piscivorus*, from the Savannah River swamp system in Aiken County, South Carolina. The reproductive condition of each adult was determined, and lipids were extracted from the fat bodies, liver, gonads, and carcass using petroleum ether and a Soxhlet apparatus. Individual eggs and embryos from pregnant females were also extracted. Analysis of covariance indicated that both the sex and the size of the snake, as well as the month of capture, had significant effects on the total lipid concentrations ($P < 0.05$). Sex and month also affected fat body lipid concentrations, but not liver or carcass lipids. Total lipid levels in females were two times greater than males immediately prior to breeding (April). Lipid levels also tended to differ between years, perhaps in response to altered habitat/resource availability.

144

COMPTON-MCULLOUGH, DANA, JULIE WALTON and JAMES B. CLAIBORNE. Georgia Southern College--The role of the gills and kidney in acid-base regulation in a seawater teleost (*Myoxocephalus octodecimspinosus*) during exposure to low salinities. In teleost fish, the gills are normally considered to be the main site of acid-base regulation, while the possible role of the kidney has often been neglected. The kidneys of freshwater fish have been reported to account for 10-20% of the total measured transfers, while the renal contribution of marine species is normally thought to be insignificant. We report here the response of the long-horn sculpin, a stenohaline marine teleost, when exposed to a dilute environment. In order to determine the contribution of the gill and renal mechanisms, transbranchial transfers and urine excretion of acid-base relevant ions were measured in separate experimental groups. Net whole body H^+ excretion in the seawater sculpin was $110 \mu M \cdot kg^{-1} \cdot hr^{-1}$ and reversed to an uptake (or loss of HCO_3^-) of $65 \mu M \cdot kg^{-1} \cdot hr^{-1}$ following exposure to 20 mM seawater for 24 hours. During this time, plasma Tco_2 increased by 62% (from a control of 5.14 mM to 8.33 mM after 24 hours). The net H^+ excretion in the urine measured under these same conditions was 7.8 and 4.0 $\mu M \cdot kg^{-1} \cdot hr^{-1}$, respectively. Thus, exposure to low salinities induced an increase in plasma CO_2 and HCO_3^- which was lost to the water across the gills. Renal H^+ loss in seawater made up 7% of the measured whole body excretion and when branchial H^+ transfers were reversed in low salinities, the continued renal H^+ efflux ameliorated the net H^+ load by 6%. Therefore, the contribution of the kidney to pH regulation in these animals is less than that measured in freshwater species but still may assist the animal in times of acid-base imbalance. (Funded by NSF DGM 86-02905 to JBC).

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ELLIOTT, KERRIE L. and FRANK R. TOMAN.
Western Kentucky University--Effect
of manganese toxicity on ribulose
1,5 bisphosphate carboxylase activity
of tobacco chloroplasts.

The effect of manganese toxicity on tobacco chloroplasts was studied at 6 hour intervals by measuring the ribulase 1,5 bisphosphate carboxylase activity of the chloroplasts. Bio-Rad protein analysis followed by rocket immunoelectrophoresis was used to quantify the enzyme. Manganese levels in the tobacco leaf tissue were determined by atomic absorption spectrometry.

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TOMAN, FRANK R. AND JUERGEN W. PFEIFFER.
Western Kentucky University--The short
term effects of manganese toxicity
on isocitrate dehydrogenase in wheat
and tobacco.

The short term effects of high manganese levels on wheat and tobacco isocitrate dehydrogenase (IDH) activity was studied. The change in activity was then compared to the concentrations of manganese in the tissues. As the time of manganese exposure increased, the fresh weight IDH activities in wheat and tobacco decreased. In contrast both control groups had similar enzyme activities every 6 hr over the 24 hr test period. The decrease in IDH activity of wheat and tobacco plants in experimental groups seemed to be related to an increase of the manganese in the leaf tissue. The slower decrease in the IDH activity of wheat and the faster decrease in the IDH activity of tobacco appeared to correspond to manganese levels in the respective tissues. It appears that wheat is able to tolerate the higher manganese concentration in the growth media better than tobacco.

147

HALDEMAN, JANICE H. AND RONALD L. THOMAS.
Erskine College and Clemson University--Use of gibberellic acid (GA₃) for in vitro
establishment of field-grown shoot tips of
tea, Camellia sinensis.

Overcoming dormancy of buds has been a problem with *in vitro* shoot tip culture of woody species. Buds of field-grown tea demonstrated a growth lag of 4 weeks or more *in vitro*. Since dormancy of field shoots has been successfully broken by application of gibberellic acid (GA₃), its use *in vitro* might also enhance bud break and growth. Nodal explants were aseptically presoaked in solutions of GA₃ in concentrations of 100, 200, or 300 mg/l prior to culture on media with and without phytohormones naphthaleneacetic acid (NAA) and/or benzyl adenine (BA) or zeatin (ZEA). The GA₃ treatment enhanced bud break and growth, and apical buds grew significantly more than treatments without GA₃. Growth response to GA₃ was significant across all levels of other phytohormones. The concentrations of GA₃ used were not greater than those used *in vivo*, but they were much higher than those conventionally used *in vitro*. This pre-treatment with GA₃ which has promoted growth

of tea buds may be useful for tissue cultures of other species of *Camellia*, related genera, and other woody plants.

148

BUETOW, DAVID H. Duke Power Company
Environmental Laboratory--A Character-
ization of the resting stage of the
freshwater diatom, Melosira italica
collected from Lake Norman, N. C.

The formation of resting cells or spores is known to be an important survival mechanism in several species of marine and freshwater diatoms. While a number of studies have been done on diatom resting spores, whose frustules are morphologically distinct from vegetative cells, relatively little is known about the formation and occurrence of diatom resting cells, where only the internal contents undergo a change. The resting stage of the seasonally dominant freshwater diatom, *Melosira italica* was studied in culture and observed in naturally occurring populations in Lake Norman, N. C. Darkness was the key factor in inducing the formation of resting cells *in vitro*, both in the presence and absence of nutrients. Upon reexposure to light, the cell contents of *Melosira* resting cells expanded to resemble normal vegetative cells within 6 days. Resting cells were found in abundance in Lake Norman below the thermocline as the lake stratified during summer, presumably as vegetative cells became trapped in the dark hypolimnion. Viable cells of *Melosira* were also found to a depth of 20 cm in the deep sediments of Lake Norman, corresponding to an age of 10 to 15 years.

149

HILTZ, TERRY A., H.N. MCKELLAR, and R. TYLER. University of South Carolina--Aquatic
community metabolism as a function of macrophyte
development in shallow pond ecosystems.

Interactions between aquatic macrophytes and phytoplankton are a feature of many aquatic ecosystems. We investigated seasonal patterns of primary productivity and community respiration of plankton and benthic components in four shallow ponds on the inner coastal plain of South Carolina. Although the hydrography and size of the ponds were similar, considerable differences between levels of macrophyte development and control affected patterns of community metabolism. Phytoplankton productivity (oxygen production) displayed distinct seasonal patterns which were well correlated with phytoplankton abundance (chlorophyll *a*). In the ponds with moderate to heavy macrophyte development, the late summer increase in phytoplankton abundance corresponded to a decline in macrophytes, suggesting some competition between these two communities. Phytoplankton abundance and metabolism was highest in the pond with the lowest level of macrophyte development. P:R ratios were usually less than 1 in all ponds; however, lowest values (0.3 to 0.4) were observed in the pond with the highest level of macrophyte development suggesting a considerable amount of organic matter being input to the system. Plankton productivity dominated community metabolism where macrophyte development was low, whereas benthic metabolism dominated where macrophyte development was high. Intermediate levels of macrophyte development resulted in shifts from macrophyte to plankton dominance in the fall.

150

S. K. BALLAL and SHARON TERMON. Tennessee Technological University--Seed protein profiles of Jojoba during the germination sequence.

Simmondsia chinensis (Jojoba) is a desert shrub of the American southwest. Increased attention is being paid this taxon because of the high concentration of digestible protein in the seeds. The seed meal contains approximately 30% protein by weight which has a potential for use as a livestock feed. In this investigation, the seed proteins from dry seeds and seeds at various stages of germination were profiled on molecular weight basis. Seeds were analyzed for their protein profiles up to three weeks into germination. In dry seeds and during the initial stages of germination, the molecular weights of seed proteins dominated the 24 kd to 45 kdrange. As the embryonic axis elongates into a distinct plumule and radicle, the molecular weights drop to 3 kd to 16 kd. It is hypothesized that larger proteins are hydrolyzed into smaller subunits, which might be a necessary step in the developmental process. This research is supported by a grant from the National Science Foundation DCB-8611889.

151

BURKHEAD, NOEL and JAMES D. WILLIAMS. U.S. Fish and Wildlife Service--Current status of the exotic minnow, Scardinius erythrophthalmus, in the United States.
The rudd, S. erythrophthalmus, is a cyprinid fish native to Europe and central Asia. Outside its native range it is established in Ireland, Australia, the North Island of New Zealand, and Maine and New York in the United States. During the past three years rudd was cultured as a bait fish on minnow farms in Arkansas where it escaped during floods in 1987. It was distributed to at least four southeastern states during 1987-1988 where it was sold as an ornamental or bait fish. Two states, Alabama and Florida, have recently passed regulations prohibiting the importation of rudd. The rudd most closely resembles the native golden shiner, Notemigonus crysoleucas. Diagnostic features distinguishing larval, juvenile and adult stages of rudd and golden shiners will be presented. Results and implications of hybridization studies between the two species will be discussed.

152

EUGENE G. MAURAKIS, JAMES T. MAGEE, AND WILLIAM S. WOOLCOTT. University of Richmond.--Pebble nest microhabitats of Semotilus spp.
The pebble nest microhabitats of four species of Semotilus were compared. Pit/mound nests of Semotilus corporalis were significantly larger than the pit/ridge nests of Semotilus atromaculatus, Semotilus lumbee, and Semotilus thoreauianus. Nests of S. corporalis were in wider and deeper streams. Pits of S. lumbee nests were longest; those of S. corporalis nests were widest and deepest. S. corporalis used a greater proportion of larger stones (23 mm² or greater) in nest construction. There was no

significant difference in the electivity index (percentage of nest pebble sizes versus those of the substrate) among the species for the three largest stone sizes (6.0, 11.3, and 23.0 mm²); however, S. corporalis chose the second largest size whereas the other species selected the largest size. Pebble nests, mound and ridges, served as breakwaters, reducing the flow to near zero in the downstream pit below the ridge or mound of the nest. Supported in part by the University of Richmond Faculty Research Committee, Richard Gwathmey and Caroline T. Gwathmey Memorial Trust, and The Highlands Biological Station.

153

SHARON A. DOYLE, EUGENE G. MAURAKIS, AND WILLIAM S. WOOLCOTT. University of Richmond.--Pebble nest microhabitats of two Nocomis spp.

Pebble nest microhabitats of Nocomis micropogon and Nocomis leptocephalus were compared. There were no significant differences between the nest characteristics of the two subspecies of Nocomis leptocephalus (leptocephalus and interocularis), therefore data were combined and compared with those of Nocomis micropogon. Mound nests of N. leptocephalus were higher; mound length and width were the same. Pits were in the upstream side of the mounds. A large proportion of medium-large stones (11.3 mm) were used in the nests. N. leptocephalus also used a high proportion of medium size stones (6.0 mm) and stones from the largest size class (23.0 mm). There was no significant variation in the electivity index (percentage of nest pebble sizes versus those of the substrate) between the species for the two largest size classes (11.3 and 23.0 mm). N. micropogon mound nests were in wider streams with greater flow; hence currents within its nest were greater. Supported in part by the University of Richmond Faculty Research Committee and Undergraduate Research Program; Gwathmey Memorial Trust; and Highlands Biological Station.

154

CLAVIJO, ILEANA E., DAVID G. LINDQUIST, MICHAEL R. WESSEL and BRIAN T. PAWLAK. University of North Carolina at Wilmington.--Deep reef fishes off Cape Fear, NC: Submersible observations and live collection of the red barbler, Hemanthias vivanus.

A preliminary project to assess the maximum depth of the reef fishes off Cape Fear, NC was initiated August 8, 1987. A transect perpendicular to the continental shelf break began at a depth of 149 m aboard the submersible, Johnson-Sea-Link. A 1 m relief reef was encountered between the depths of 106 and 96 m and quantitative visual assessments of the

ichthyofauna were made. A live collection of 58 Hemanthias vivanus was made at 96 m with quinaldine anesthetic and suction apparatus. Over one-third of the fish survived the ascent but only three fish survived longer than 19 hours. Behavioral observations of the captive fish and a gut contents analysis of the preserved fish were subsequently carried out in the laboratory. We acknowledge the support of the National Undersea Research Center at the University of North Carolina at Wilmington.

155

FOSTER, ANN M. and JAMES P. CLUGSTON. U.S. Fish and Wildlife Service--Gulf of Mexico sturgeon: historical review and current research.

The Gulf sturgeon, Acipenser oxyrhynchus desoti, was once widely distributed throughout the rivers of eastern and central Gulf of Mexico. Sturgeon populations have steadily declined because of loss of suitable habitat and overexploitation. The Suwannee River, Florida, appears to support the largest and perhaps major viable spawning population of the Gulf sturgeon. Present cooperative research focuses on population estimation, movement, and various life history aspects including age and growth, food, and temperature preferences.

156

Burk, Sandra W., Ileana E. Clavijo and David G. Lindquist. University of North Carolina at Wilmington--Effects of Internal Anchor Tags On Black Sea Bass (Centropristis striata) and Initial Returns of Fish Tagged Off Southeastern North Carolina.

A total of 64 black sea bass (Centropristis striata) were kept and observed in a flow-through aquarium system for up to two months. Thirty-two experimental fish were tagged with Floy internal anchor tags and held with 32 control fish in five separate tanks. Effects of the tags on feeding, swimming and behavior of all fish were observed. External conditions on the tag entry site were recorded throughout the study for all tagged fish. Four hundred black sea bass were tagged with Floy internal anchor tags and released on an artificial traincar reef (AR372) and a natural reef five miles off Wrightsville Beach, North Carolina. Two hundred black sea bass were tagged with orange tags and released on the traincar reef and 200 were tagged with yellow tags and released on a natural reef 0.8 km inshore from the artificial reef. Preliminary results show a mixed pattern of residency and limited movement between reefs, with some off-reef movement by fish. One fish traveled over five miles from the artificial reef site. This study was funded in part by UNC Sea Grant and the North Carolina Wildlife Federation.

157

ROHDE, FRED C. and RUDOLF G. ARNDT. North Carolina Division of Marine Fisheries and Stockton State College--Status of Etheostoma mariae and Semotilus lumbee.

Sampling throughout the North Carolina and South Carolina ranges of the pinewoods darter and the sandhills chub from August-November 1988 (89 sites visited) revealed that the former is present at 26 sites in the Lumber River drainage, and the latter at 24 sites in the Cape Fear, Lumber, and Pee Dee river drainages. The two were found together at 10 sites. The darter was previously known from 33 sites, and the chub from 28. The historic range of both species has been expanded slightly. The darter was generally found in streams with a sand/gravel substrate and with abundant submerged Sparganium. Taken with it were numerous other fish species. Optimal habitat for the chub is small fast-current headwater streams up to two meters wide lacking vegetation. Here it was often the only species taken, or with a few associates. Populations of both species are strong, although we did not find the darter in South Carolina, where we fear it is extirpated. Damming of streams by man and beaver has been slightly detrimental to both fishes. An additional 52 fish species were taken in this survey.

158

ETNIER, DAVID A. and MARY JANE LARKIN. University of Tennessee--Natural hybrid perciform fishes from the Southeast.

Hybrid perciforms poorly known or unknown in ichthyological literature are portrayed and discussed. Putative parents were determined based on morphological characters, assuming that most hybrid characters would be intermediate to those of parents. Hybrids included are Micropterus dolomieu X M. punctulatus, M. dolomieu X M. salmoides, Etheostoma olmstedii X E. collis, E. rufilineatum X E. vulneratum, E. zonale X Percina caprodes, P. caprodes X P. phoxocephala, P. caprodes X E. macrocephala, P. caprodes X P. shumardi, and P. shumardi X P. squamata.

159

TURNER, JOHN M. JR. AND FRANK J. BULOW. Tennessee Technological University--Hybridization of redeye bass (Micropterus coosae) with native smallmouth bass (M. dolomieu) in a north-central Tennessee stream.

In 1952 and 1953, the Tennessee Game and Fish Commission introduced redeye bass into Roaring River, a tributary of the Cumberland River in north-central Tennessee. Redeye bass inhabit the headwater area of the river while the smallmouth bass inhabit the middle and lower sections. Recent sampling has indicated that the introduced redeye bass may be hybridizing with the native smallmouth bass in an area of habitat overlap. To ascertain that hybridization is occurring, a morphological and meristic analysis was conducted on

redeye bass, smallmouth bass and suspected hybrids from Roaring River. In addition, redeye bass from Post Oak Creek and smallmouth bass from Watts Bar Lake were analyzed and used as controls. A habitat analysis was also conducted on Roaring River to evaluate the differences between redeye bass, smallmouth bass and suspected hybrid habitat. The numeric data were subjected to cluster analysis to separate the morphometric and meristic variables into distinct groups.

160

WILKINS, S. DAVID, JOHN S. PEYTON, and STEPHEN T. ROSS. University of Southern Mississippi-- Fishes of the Chickasawhay, Leaf, and Pascagoula rivers in southeast Mississippi.

We sampled 42, 38, and 61 Km sections, respectively, of the lower Leaf and Chickasawhay and upper Pascagoula rivers to determine patterns of species' distributions and relative abundances. One-hundred-eighty-two collections were made during April-September, 1988, using seines, hoop nets and gill nets. Additional data were obtained through interviews of sport and commercial fishermen. While samples are still being processed, over 25,000 specimens, representing 18 families, 40 genera, and 81 species, were collected. Minnows (Cyprinidae, 81.6%) were numerically dominant, followed by basses and sunfish (Centrarchidae, 6.8%), darters (Percidae, 3.3%), mosquitofish (Poeciliidae, 3.1%) and hogchokers (Soleidae, 1.4%). One species, Notropis venustus, dominated the collections, comprising 65% of the total number of fishes and 80% of the Cyprinidae. Seventeen species were caught by commercial or recreational fishermen, but two species, channel catfish and longear sunfish made up over half of the total catch. Based on Morisita's Index the three streams show high faunal similarity (Im > 95%).

161

PEZOLD, FRANK L. Northeast Louisiana University--A phylogenetic revision of the genus Gobionellus.

Phenetic and cladistic analyses of the gobiid fish genus Gobionellus using characters of the post-cranial axial skeleton and the cephalic lateralis system gave evidence that the genus is not monophyletic. Six species of this genus form the sister group to Gobioides. This group includes Gobionellus oceanicus and retains the name Gobionellus. Fifteen other species currently

assigned to Gobionellus (including G. boleosoma, G. shufeldtii and G. smaragdus) are most closely related to gobies in the genera Evorthodus, Oligolepis and Oxyurichthys. Those fifteen species are removed to the resurrected genus Ctenogobius of which G. fasciatus is the type species. Gobionellus stigmalophius is reassigned to Oxyurichthys.

162

MAYDEN, RICHARD L. University of Alabama--Evolution of eastern North American fishes: A new method in vicariance biogeography.

The North American fish fauna has enormous potential for use in investigations and tests of biogeographic and evolutionary theories. The fauna of Central Highland rivers is employed as a case study in applications of phylogenetic relationships of organisms in vicariance biogeography. In this new method species relationships and distributions are coded in a binary and multistate data matrix and analyzed using a parsimony algorithm to elucidate the age, origin, and biogeographic history of the fauna. Rivers inhabited by species are analogous to taxa; relationships between species and their distributions are analogous to characters possessed by each of the taxa (Rivers).

From seven fish clades, 33 equally parsimonious cladograms are obtained for the Central Highland drainages. The resulting strict consensus cladogram is consistent with the known pre-Pleistocene geological history of eastern North American rivers and supports the hypothesis of an ancient ichthyofauna. With this group of fish clades the Mobile Basin forms the sister group to all rivers of the Mississippi River Basin. Among the Mississippi River tributaries, a clade inclusive of the Tennessee, Duck, Cumberland, and Green rivers forms a clade sister to a large Teays-Mississippi clade. These relationships may be predicted from pre-glacial drainage patterns, but not by present-day drainage connections and supports the existence of a diverse and widespread pre-Pleistocene Central Highlands ichthyofauna.

163

Seed, John R., and J. Sechelski. University of North Carolina--Further studies on the trypanocidal factor in African primates.

It has been shown that the sera of 5 species of African primates contain a trypanocidal factor which will kill Trypanosoma brucei brucei. To date, only, but not all, African primates have this factor. It has not been possible to explain the presence or absence of the trypanocidal activity based on the species dietary preference. It has therefore been hypothesized that this non-specific trypanocidal activity has arisen in man and the other African primates through the selective pressure of African trypanosomiasis. If correct, it would be predicted that a chemically similar macromolecule exists in all African primates with trypanocidal activity. In addition, it would predict that they have similar modes of biological activity. Evidence is presented which suggests that the

factor in the sera from all five species share similar antigenic epitopes, as well as similar modes of biological activity. It is of interest, however, to note that the factor in human and gorilla sera can be distinguished from the activity in the baboon-mandrill sera. Finally, it would appear that other higher primates which do not demonstrate trypanocidal activity also have a macromolecule in their sera which also shares antigenic epitopes with the human trypanocidal factor. It would appear that the trypanocidal activity is detected only in primates which are under the constant threat of tsetse attack. This work was supported in part by a grant from the NIH (ROI AI23654).

164

Lushbaugh, W.B., A.C. Turner and P.C. Klykken. The University of Mississippi Medical Center -- Characterization of a secreted cytoactive factor from *Trichomonas vaginalis*

T. vaginalis grown in Dulbecco's modified Eagle's medium, with or without serum, produced a factor (TVF) which altered the morphology of mammalian cells in tissue cultures. Coincubation of TVF with adherent target cells caused their detachment and a marked rounding and clumping. These reversible morphologic changes were concentration, time, and energy dependent. Target cell perturbations were not accompanied by significant changes in growth as measured by nuclei counts, DNA content and ³[H] thymidine incorporation, or in cell leakage as assessed by lactate dehydrogenase activity and trypan blue dye exclusion. TVF-induced effects were also independent of cyclic AMP and cyclic GMP levels in BHK cells exposed to TVF for 5 minutes to 24 hours. Gel filtration of serum-free TVF on Sephacryl S300 isolated a cytoactive proteinaceous substance with a molecular weight of 250,000. This purified TVF produced a single (50,000) band by SDS-PAGE (Coomassie Blue Stain). TVF, possibly a pentamer of 50kd subunits, is a metabolic product of virulent *T. vaginalis* trophozoites and may participate in pathogenesis of trichomoniasis by detaching and clumping host vaginal epithelial cells. This study was supported in part by a grant from the NIH (BRSG S07RR05386).

165

BONE, LEON W.¹, CRAIG R. REINEMEYER², and JACK W. OLIVER². USDA, Animal Parasite Research Laboratory¹ and School of Veterinary Medicine, University of Tennessee²--Thyroid and Gastrin Hormone Levels of *Trichostrongylus colubriformis*-infected goats.

Sheep, infected by the ruminant nematode *Trichostrongylus colubriformis*, exhibit altered levels of thyroid hormone. No information is available about similar effects in parasitized goats. Groups of five goats were infected with 0, 10,000, 25,000, 40,000

or 50,000 larvae of *T. colubriformis*. Blood samples were taken on days 0, 7, 14, 21 and 28 post infection. After collection of baseline samples, thyrotropin releasing factor (TRF) was given and blood samples were taken after 1 and 4 hours. Thyroxine (T4), tri-iodothyronine (T3), thyroid binding globulin (TGB) and gastrin levels were determined. Gastrin levels were not altered by infection level or duration of infection. TGB levels were similar throughout the course of infection and in control versus infected animals. TRF significantly elevated post-stimulation levels of T3 and T4, but no effects of parasite burden or duration of infection were found. In contrast to sheep, thyroid hormone levels are constant during helminthiasis with *T. colubriformis*.

166

FAULKNER, CHARLES and SHARON PATTON. University of Tennessee College of Veterinary Medicine--Enzyme Immunoassay for Detection of *Giardia* Antigen in Canine Feces.

Infection with *Giardia*, a flagellate protozoan parasite, is an important cause of human intestinal disease in most inhabited areas of the world. Giardiasis is difficult to diagnose and often characterized by periods of low parasite activity when the organism and its products are present in the feces at low density or not at all. A recently developed ELISA test, ProSpect/*Giardia* (Alexon Biochemical), detects *Giardia* infections with the use of a specific antibody to a 65kd molecular weight glycoprotein (GSA 65) which is secreted by the organism and passed in the feces of the host. The clinical efficacy of this test for diagnosing Giardiasis in the absence of cysts passed in the feces was evaluated at the UT College of Veterinary Medicine. The feces of 14 dogs were monitored daily for the presence of *Giardia* cysts. Observations on stool color and consistency were also recorded with the presence or absence of *Giardia* cysts in each of the daily fecal samples. Cysts were recovered by zinc sulfate flotation in the feces of 9 of the 14 dogs (64%). Chi-square analysis indicated that there was no relationship between stool consistency and the presence of cysts in the feces. Intermittent shedding of *Giardia* cysts was observed in 3 of the 9 positive dogs. The ELISA test detected the presence of GSA 65 in the aqueous extract of 1 of the 3 specimens in which no *Giardia* cysts were observed. On 2 occasions a few cysts were present in the fecal samples, but the ELISA test was positive. The test also detected GSA 65 in a clinic case in which infection with *Giardia* was suspected although the fecal examination was negative.

167

LINDSAY, DAVID S. and BYRON L. BLAGBURN. Auburn University--Ultrastructure of endodyogeny of *Isospora suis* in vitro. Monolayers of primary porcine kidney cells or primary embryonic bovine kidney cells were inoculated with sporozoites of *Isospora*

suis to study development by endodyogeny. Infected monolayers were fixed and examined at various times postinoculation. Intracellular sporozoites and merozoites had most of the organelles typical of invasive stages of coccidia. These included a trimembranous pellicle, polar rings, a conoid, rhoptries, micronemes, subpellicular microtubules, a nucleus, ribosomes, mitochondria, endoplasmic reticulum, Golgi apparatus, lipid bodies, amylopectin granules, and micropore(s). These stages also contained crystalloid bodies which are not found in Eimeria spp. Development was first noted when the sporozoite nucleus became horseshoeshaped prior to nuclear division. At this time the membranes of developing daughter merozoites were present as merozoite anlage. Eventually all the organelles were incorporated into developing daughter merozoites as the nucleus divided or had divided. Some binucleate mother cells had intact conoids with rhoptries suggesting that these stages were capable of host cell penetration. Eventually the inner membrane of the mother cell degenerated and was replaced by the membranes of the developing daughter merozoites. This resulted in the formation of two daughter merozoites. Endodyogeny was repeated several times in vitro.

168

MANN, VICTORIA H. and STEPHEN C. MERRITT. University of North Carolina at Chapel Hill--Cell free gene transcription in nuclear extracts from Trypanosoma brucei gambiense.

We have established a method for the purification of transcriptionally active nuclei from bloodstream form trypanosomes isolated from infected animals. High salt extracts prepared from these nuclei interact with cloned trypanosomal genes such as tubulin and a spliced leader construct in a template dependent manner. Southern blot analysis indicates a marked preference of the system for cloned trypanosome sequences over other sources of template such as phage or plasmid DNA. This transcription is progressive for up to 30 minutes at 30°C. Technical difficulties resulting in high background labelling of endogenous RNA and rapid depletion of ATP have been largely eliminated. Inhibitor studies indicate that the activity involves a true RNA polymerase and that it ceases when the DNA template is altered by intercalating agents. Additionally, the products of these reactions are sensitive to the effects of enzymes such as RNase T₁. This cell-free transcription system should provide useful information on the regulation of gene transcription and mRNA maturation in trypanosomes.

169

MERRITT, STEPHEN C. University of North Carolina at Chapel Hill. P-glycoprotein-like activity in multidrug resistant Plasmodium falciparum.

Characterization of the multidrug resistance trait in human malarial parasites suggests

similarities to the P-glycoprotein-mediated resistance of mammalian cells. Decreased accumulation of antimalarial drugs appears to be involved in the manifestation of resistance. The resistance to chloroquine and mefloquine is reversed by calcium channel blockers such as verapamil, calmodulin antagonists such as calmidazolium, and microtubule inhibitors such as vinblastine. This pattern of reversal occurs well below toxic levels of the individual agents although the resistant parasites appear to be more susceptible to toxic effects of these drugs than do their sensitive counterparts. Protein labeling experiments and DNA probing both indicate that P-glycoprotein-like activity exists in human malarial parasites although the exact nature of the protein mediating this activity has yet to be determined.

170

SEN, DILIP K., HAMLETT, HUNTER D. and HIGGS, RODNEY. Virginia State University--The Effect of Cyclosporin A: An Immunosuppressive Agent On Trypanosoma muscui In Swiss Webster Female Mice.

This study reports the effects of Cyclosporin A (CsA) on Trypanosoma muscui development in Swiss Webster (SW) female mice. Forty SW female mice weighing 25g - 30g were employed in the first experiment (Exp. I) and thirty mice were employed in the second (Exp. II). The control as well as the experimental groups were infected with a standard inoculum of 50,000 T. muscui on day 1 of experimentation. Five mice in Exp. I and 10 mice in Exp. II were injected with 25mg/Kg of CsA on day 3 prior to inoculation of a standard inoculum of trypanosomes per mouse. Five other mice in Exp. I and 10 mice in Exp. II were injected with 25mg/Kg of the drug CsA on day 3 after trypanosome inoculation. Twenty Untreated mice in Exp. I and ten in Exp. II which were infected with the standard inoculum of T. muscui served as controls. Higher levels of parasitemia were observed in the drug treated experimental mice in both experiments when compared to the untreated control counterparts. The timing of CsA administration appeared to be of no significance in the observed effect.

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171

CUNNINGHAM, MAUREEN and PATRICIA D. PARR. Oak Ridge National Laboratory--Successful culture of the rare, annual hemiparasite, Tomanthera auriculata (Michx.) Raf.

Tomanthera auriculata, an annual member of the Scrophulariaceae, is a rare species reported to be hemiparasitic. Seed collected from a natural population in Roane Co. Tennessee, were stratified and sown in a greenhouse in flats filled with sand. Each flat contained one of six potential host species observed growing in the vicinity of

I. auriculata in the field. Two species (Rudbeckia fulgida Aiton. and Helianthus occidentalis Riddell.) proved to be suitable hosts; seedlings in these flats grew to maturity and flowered. Sand was rinsed off the roots to verify the parasitic nature of I. auriculata. This is the first reported success of culturing this species with selected hosts under greenhouse conditions and is significant for recovery efforts and management of the species. The species is currently under review by the U.S. Fish and Wildlife Service for possible listing as a federally threatened or endangered species. Research sponsored by the Oak Ridge National Environmental Research Park, Ecological Research Division, Office of Health and Environmental Research, U.S. Department of Energy, under contract No. DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

172 PORCH, SUSAN S., and GEORGE W. FOLKERTS. Auburn University--Prey composition in three species of Drosera on the Gulf Coastal Plain.

Three species of sundews (Drosera: Droseraceae) with markedly different growth forms were examined for differences in prey composition. Differences occurred among different species at the same site, and among the same species at different sites. Of the total prey items captured, 23.5% for D. capillaris were springtails, 7.4% were biting midges, and 14.4% were ants. For D. intermedia, total prey items included 14.1% springtails, 8.5% biting midges, and 5.4% ants. For D. tracyi, 0.8% of prey items were springtails, 17.6% were biting midges, and only 0.3% ants. Capture by D. capillaris at one site showed 29.0% of the total prey were ants, while only 4.7% of the prey were ants at another site. Seasonal differences in a variety of prey items also occurred and was attributed to seasonal phenomena in the life cycles of the prey. Factors hypothesized to influence prey capture include 1) plant and leaf morphology, 2) prey characteristics, 3) weather, and 4) habitat characteristics.

173 BAILEY, MARK A., and GEORGE W. FOLKERTS. Alabama Natural Heritage Program and Auburn University--Conservation status of the pitcher plant, Sarracenia rubra subsp. wherryi.

Over 100 sites in southern Alabama, southeastern Mississippi, and the western Florida panhandle were surveyed for the presence of Sarracenia rubra subsp. wherryi. Populations of the taxon were located at a total of 76 sites in two Florida counties, two Mississippi counties, and four Alabama counties. Most of the populations (58) are in Baldwin

and Washington counties, AL. The populations occupy sites totalling approximately 600 A. Mean site acreage is approximately 7.8 A. The largest site occupies nearly 200 A. The total number of existing plants of this taxon is estimated at 26,800. The mean number of plants per site is 351. One site in Baldwin Co., AL harbors 3000 plants. The great majority of the sites are in private ownership. Factors causing population decline include: 1) fire restriction and resultant invasion by woody species, 2) drainage, 3) conversion of sites to pine monoculture, 4) off-road vehicular traffic, 5) disturbances associated with commercial harvest of Sarracenia leucophylla.

174 RANDALL, JOHN L. Virginia Polytechnic Institute and State University -- Interference through improper pollen transfer between Impatiens capensis and I. pallida.

Mechanisms of interference through improper pollen transfer are described for sympatric populations of the simultaneously flowering annuals Impatiens capensis and I. pallida. Bumblebees are the primary pollinators in allopatric populations. In mixed stands, however, I. capensis attracts hummingbirds and solitary bees, while I. pallida continues to attract bumblebees. Pollen of I. pallida adheres to and germinates on the stigmas of I. capensis and the pollen tubes reach the ovules. In contrast, pollen of I. capensis adheres poorly to I. pallida stigmas and fails to germinate. No hybridization occurs between the two species. Scanning electron micrographs of pollen and stigma surfaces of the two species revealed no morphological differences. Despite the interference of I. pallida, I. capensis persists in mixed populations with I. pallida by 1) depending on hummingbirds and solitary bees for pollination, 2) possessing stigmas which are receptive to pollen throughout the female phase, 3) having the ability to produce a full seed complement via one pollination event, and 4) possessing cleistogamous flowers to ensure sexual reproduction.

175 BUCHELE, DAVID E., JERRY M. BASKIN, and CAROL C. BASKIN. University of Kentucky--Ecology of Solidago shortii, A federally-endangered species. I. History, geographical distribution, and successional relationships.
Solidago shortii T. & G. (Asteraceae) is a federally endangered goldenrod endemic to a 12.2 km² area in the Eden Shale Belt (Blue Grass Region) in Fleming, Nicholas, and Robertson counties, Kentucky. It was

extirpated from the type locality on Rock Island at the Falls of the Ohio River in Louisville, Jefferson County, Kentucky, apparently over 100 years ago. In the 1930's, Dr. E. Lucy Braun discovered the species in Fleming, Nicholas, and Robertson counties, about 160 km west of the type locality. Approximately 73000 stems occur at 13 population sites, which are in various stages of succession from open glade and gladelike areas to fairly dense redcedar and hardwood-redcedar thickets or woodlands. Some of the sites have remained relatively stable for at least 50 years, while others have undergone marked successional changes. A conceptual model of the successional relationships of *S. shortii* was developed based on extensive field observations and on examination of aerial photographs taken in 1937, 1949, 1973, and 1985. (Research reported here and in the following two abstracts was supported by funds from the USF&WS to the Kentucky Nature Preserves Commission.)

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BUCHELE, DAVID E., JERRY M. BASKIN, and CAROL C. BASKIN. University of Kentucky--Ecology of *Solidago shortii*, A federally-endangered species. II. Physical habitat factors and plant associates.

Solidago shortii T. & G. grows in a range of light environments from full sun to fairly dense shade, and on several soil types. Soils at the 13 population sites are not atypical in amounts of major nutrients and organic matter, pH, and texture. Sixty-two percent of 934 soil depth measurements taken at the 13 sites were 25 cm or less, but 17% were greater than 50 cm. Although moisture content of the 5-10 cm soil depth zone, where most of the roots of *S. shortii* occur, frequently drops below the FWP in summer, established plants do not wilt because some roots extend 50 cm or more into cracks in the rocky soil. The *S. shortii* "association" is not a floristically unique assemblage of plants. Most of the more than 200 species of vascular plants in the community are common and geographically widespread, have C₃ photosynthesis, are hemicryptophytes, and flower in late spring and/or summer. *Solidago shortii* is the only federally-listed species in the community, and none is a candidate for listing. *Hypericum dolabriforme* Vent. is the only cedar (limestone) glade endemic that grows with *S. shortii*, and only three of its associates are on the Kentucky rare plant list.

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BUCHELE, DAVID E., JERRY M. BASKIN, and CAROL C. BASKIN. University of Kentucky--Ecology of *Solidago shortii*, A federally-endangered species. III. Ecological life cycle and reproductive biology.

Solidago shortii T. & G. is a polycarpic perennial hemicryptophyte that reproduces by asexual and vegetative means. Buds

formed at base of current year's shoots in October to early December produce aerial stems and rhizomes; the apex of each rhizome gives rise to an aerial stem. Stems emerge in November or in late February or early March. Shoot elongation begins in late winter and continues through June (short, nonflowering stems) or August (tall, flowering stems). Flower bud formation begins in June, and anthesis occurs from early August to mid-October. Vernalization is not required for flowering, but vernalized plants flower more uniformly than nonvernalized plants. Seeds ripen in late October and early November and are dispersed until March. They are conditionally dormant at maturity, afterripen and become nondormant during winter (or after 8-12 weeks of cold stratification) and germinate in late February to early April. Few seeds germinate in the field, and seedling/juvenile survival is very low. A persistent seed bank is not formed. Although plants can flower in their first year in cultivation, it takes more than 2 years for them to reach reproductive maturity in the field. Cross pollination is required for seed set. The most prevalent insect visitor, and presumably the major pollinator of the species, is the goldenrod soldier beetle, *Chauliognathus pennsylvanica*. The life cycle characteristics of *S. shortii* do not seem to differ in any significant way from those of weedy and/or geographically widespread members of the genus.

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RAE, JOHN G. Florida Department of Natural Resources and Francis Marion College--Growth and reproduction in the endangered Fragrant Prickly-apple Cactus, *Cereus eriophorus* var. *fragrans*.

The endangered Fragrant Prickly-apple Cactus is known to survive only in three populations along the southeastern coast of Florida in a strip of ancient dune 1/10 mile wide and seven miles long. In order to establish proper management procedures, portions of the two populations that are proposed for state purchase and preservation were studied to obtain some basic population data. Plants in each population were tagged (total 216 plants). Size and reproductive state were noted each month for one year. There was great individual variation but population trends are as follows. Vegetative growth occurred in every month with a slightly greater rate from July to September. Flowering occurred in every month between April and December with a major peak in April-May and a minor peak in September-October. Fruiting successes in the two populations were 38% and 60% and there was a standing crop of fruit present throughout the year. There was no recruitment during the year and mortality rates were 7% and 2% respectively (heaviest in July-August). Plants had a clumped distribution and frequently were found under *Sabal palmetto*, the cabbage palm. High individual variability in growth and reproduction may be due to microhabitat differences in shading and moisture.

179

SPIRA, TIMOTHY P. Georgia Southern College--Population biology of an alpine annual plant (*Gymnosteris parvula*) in California.

Few species of annual plants are generally found in alpine environments. This probably reflects the inability of most annuals to complete their life cycle in a single, short, cold growing season. In this paper, the population biology of a representative alpine annual, *Gymnosteris parvula*, is discussed. The species was studied in the White Mountains of California, a range in which there are an unusually high concentration of alpine annuals. Plants were small (< 1 cm tall) with a shallow root system (< 2 cm deep). More than 93 % of the flowers sampled matured fruit and > 83 % of the ovules within fruits set seed. The \bar{X} number of seeds produced per plant was 20.4 ± 3.0 and 12.0 ± 1.4 in the two years sampled ($\bar{X} \pm S.E.$). The viability of freshly produced and overwintered seeds approached 100 % while the viability of one and two year old seeds dropped to 80.4 and 27.1 % respectively. Of 600 seeds sown on the soil surface, 70.2 % germinated and successfully emerged. The proportion of emerged seedlings which survived to reproduce was 82.4 and 61.4 % in successive years. Rapid flowering, high reproductive efficiency, and a relatively high survivorship rate contribute to the success of this species at high elevations.

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HOLLIFIELD, VICKY L.¹ and M. EUGENE BROWN CARTER.² Emory University¹ and Oxford College²--Flora of the sandstone outcrops of the Altamaha Grit and a comparison to granite outcrops of the Georgia Piedmont.

The Altamaha Grit cuts across the Coastal Plain of Georgia and is characterized by sandstone outcrops. The vascular flora of these areas was first described by Roland Harper in 1906. A careful investigation of herbarium records and field surveys revealed that no species are endemic to the sandstone outcrops. However, *Penstemon dissectus*, *Marshallia ramosa* and *Bigelovia nuttallii* are characteristic of and occur almost exclusively on these outcrops. By comparison at least 17 species are endemic to the granites in Georgia. The results confirmed Harper's observation that species common to both sandstones and granite outcrops are numerous (over 35 species).

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MCLEOD, KENNETH W. Savannah River Ecology Laboratory -- Stress ecology: utility of growth and physiological measures.

Individual species have specific abiotic requirements and tolerances which eventually determine species' success in different environments. Each environment can be defined by a series of abiotic factors, with numerous aspects to each factor, including a time scale. The

individual species' response will vary greatly depending on the intensity and duration of each abiotic factor, especially as stressful thresholds are reached. At these thresholds, intensity and duration interact strongly so that less intense, long duration events produce the same ultimate response as very intense, short duration events. A series of experiments has been conducted evaluating the effect of root temperature, flooding and their combined effects on growth and physiology of woody swamp species. From these experiments, the relative species' responses to high temperature, short duration events did not permit accurate prediction of the response to lower temperature, longer duration episodes. Likewise, all growth and physiological measures within a species do not respond similarly nor do these individual measures respond similarly between species. Thus, each species has its own tolerances and individualistic responses to varying levels of stress.

182

WENTWORTH, THOMAS R. and H. LEE ALLEN. North Carolina State University--Environmental correlates of height and diameter growth in a loblolly pine (*Pinus taeda* L.) plantation.

The annual growth increment of loblolly pine responds to environmental effects of climatic variation and forestry management practices. Within-growing season correlations of growth and environment are less well understood. We measured height and root collar diameter of loblolly pine seedlings at approximately biweekly intervals during the third growing season of an experimental plantation near Henderson, NC. Environmental variables monitored were maximum/minimum temperatures and total precipitation during the interval prior to each measurement, and soil moisture content at the time of measurement. Across all experimental treatments, soil moisture content was closely linked to mean daily precipitation during the preceding interval and was a good predictor of mean daily diameter increment for the same interval. In contrast, soil moisture content was a poor predictor of mean daily height increment during the preceding interval. Mean daily stem volume increment was most strongly correlated with minimum soil temperature during the interval. Experimental treatments (site preparation and weed control) affected the magnitude of growth responses, but not the general patterns of seasonal variation.

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MAVITY, ERIKA M.¹, NANCY J. STUMPF² AND KENNETH W. MCLEOD¹. Savannah River Ecology Laboratory¹ and Auburn University²--Net photosynthesis in six species of tree seedlings under varying light intensities.

Light is often one of the more limiting factors to plant growth in natural conditions. The ability of a species to maintain positive net photosynthesis under light conditions which can change dramatically either because of overstory destruction or invading plant cover is an advantage for establishment. To examine seedling response to differing light conditions, net photosynthesis was measured under controlled conditions for six broadleaf tree species (Betula nigra, Platanus occidentalis, Acer rubrum, Quercus falcata, Quercus hemisphaerica, and Ulmus alata). Seedlings were grown in shade houses at either 100, 53, 20 or 5 percent of full sunlight. At the end of the first growing season, randomly selected plants from each house were moved from their original environment and placed in either 100 or 5 percent full sunlight. Photosynthetic rates were measured in spring and fall of the second growing season. Few significant differences were found in photosynthetic rates between seedlings originally from differing light intensities; however, what differences were found showed seedlings originally from the lowest light levels had higher rates than other seedlings in the same current light condition.

184

RAY, DARRELL L. and JOE E. WINSTEAD. Vanderbilt University and Western Kentucky University--Geographic and season observations on sulfur content of eastern red cedar foliage from south central Kentucky.

Juniperus virginiana L., the eastern red cedar, is a common early woody invader of disturbed areas, displaying high phenotypic diversity, environmental adaptability, and genetic plasticity. Preliminary analysis of a late spring collection taken from near an urban area of Warren County, Kentucky and rural Monroe county, Kentucky showed no significant differences in sulfur levels of foliar materials, with Warren County samples displaying a mean of .699 mgS/g dwt versus a mean of .681 mgS/g dwt for Monroe County specimens. The lack of a significant difference between rural and urban populations of red cedar may indicate the possibility of a uniform pollutant exposure pattern over a wide geographic region. This species may, however, provide a model system for seasonal deposition patterns of SOx.

185

WEIN, GARY R. and BEVERLY S. COLLINS. Savannah River Ecology Lab, and Memphis State University--Water relations and growth of *Heterotheca subaxillaris* in contrasting soils and watering regimes in the greenhouse.

Heterotheca subaxillaris was grown from seed under high or low soil fertility and with or without the capacity for soil moisture recharge. Water use physiology and biomass was measured to determine if variations in soil resources influence plant growth or water relations in a way that might explain the patchy distribution of Heterotheca in oldfields on the South Carolina Coastal Plain. Stomatal conductance and water potential of Heterotheca did not differ significantly with treatment, either over a daily cycle or during experimental drydowns. Shoot biomass was greater in the more fertile soil and with soil moisture recharge capacity. These results indicate that variations in soil fertility and moisture across an old-field may not influence water relations of Heterotheca subaxillaris, but may contribute to differences in plant biomass.

186

YOUNG, DONALD R. Virginia Commonwealth University--Development of capacitance and drought tolerance in *Asimina triloba* seedlings.

A combined field and greenhouse study examined the development of capacitance and drought tolerance in seedlings of Asimina triloba, a tree common within mesic, well shaded forests of the southeastern United States. A three year analysis of seedling survivorship within a central Virginia deciduous forest indicated that only 25% survived the first growing season. However, survivorship increased to 90% for both the second and third years. Biomass allocation in the first two years was predominantly belowground (60%), with a 100% increase in stem height and a 50% increase in leaf area during the third growing season. Pressure-volume measurements of root, stem and leaf capacitance indicated that the relatively succulent taproot (0.30 MPa^{-1}) may provide water storage for Asimina. The greenhouse study revealed that first year seedlings tolerated drought beyond 14 days, although midday stomatal closure occurred within 5 days, leaf wilting occurred within 7 days and all leaves dropped by day 14. Apparently, factors other than an inability to tolerate moisture stress limit the distribution of Asimina triloba to mesic, well shaded sites.

187

CREASMAN, LISA A. Louisiana State University--A comparison of analysis techniques for long-term water quality records and the implications for cumulative impact assessment.

Cumulative impacts, which result from individually minor but collectively significant actions, are now being seriously considered by management agencies as a landscape scale approach to management. In assessing cumulative impacts of riparian ecosystems water quality is one tool used to determine the effects of incremental changes on ecosystem integrity. As part of the assessment long-term existing data bases are used to determine if trends exist, in water quality data and in comparisons of water quality and land

use. In this report I evaluate the appropriateness of different techniques for the analysis of long-term water quality records. Specifically, I determined the relative power of the Seasonal Kendall, Seasonal Kendall Slope Estimator, flow adjustment, and other time series analysis techniques, to elucidate time trends in nitrogen, phosphorus, and turbidity at several stations on the Pearl River. The implications of the techniques and results for cumulative impact assessment will be discussed.

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NEUFELD, HOWARD S.,¹ JIM RENFRO,² and DAVID SILSBEE.² Appalachian State University¹ and Uplands Research Lab, Great Smoky Mountains National Park²--The ozone effects program in The Great Smoky Mountains National Park: Preliminary results.

There is concern within the National Park System that plants may be suffering from the impacts of a variety of air pollutants. A four-year study has been initiated in the Smoky Mountains National Park to characterize the potential impacts of ozone in native park plants. The program consists of monitoring the ambient air quality in the park and testing the effects of ozone on the growth and appearance of park plants. Ozone levels varied depending on altitude within the park, with nighttime levels remaining elevated at higher sites. Peak ozone concentrations within the Park often exceeded 100 ppb during the growing season. Four woody plant species were exposed in open-top chambers to 3 ozone treatments: simulated ambient, twice ambient, and charcoal filtered. Additional plants were grown outside of the chambers. Preliminary results showed that the twice ambient treatment induced foliar discoloration of all species, while the simulated ambient treatment showed little damage. However, over 40 species surveyed in their natural habitats showed evidence of ozone damage to foliage during the growing season. Future fumigations will examine the effects of ozone during the growing season on the ability to tolerate winter conditions.

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GOSSELINK, JAMES G., GARY P. SHAFFER, et al. Louisiana State University -- Cumulative impact assessment and management in a bottomland hardwood forest landscape.

We use a case study of the 1,000,000 ha Tensas Basin in northeastern Louisiana to test a general approach to cumulative impact assessment and management. Our methodology, developed specifically for bottomland hardwood forest (BLHF) wetlands, involved three steps: assessment, goal-setting, and planning. The assessment relied on a few widely available long-term data sets on water quality, hydrology, and biota, supplemented with land-use maps. By 1988, 85% of the original BLHF had been cleared. The reduction in BLHF was accompanied by large man-induced alterations in the basin's hydrology, and degradation in water quality and biota. Since forest fragmentation is a major factor in erosion of biotic diversity, and cleared stream banks contribute disproportionately to water quality degradation, the goal-setting and planning phases focused on landscape pattern, and were based on principles of island biogeography as applied to nature preserves. A key element for restoration and enhancement of water quality, hydrology, and biota is the re-establishment of

corridors along stream banks connecting major forest patches, and a prioritization scheme for the patches. Establishing about 400 ha of corridors between forest patches would increase the effective size of the largest patch from 50,000 to 100,000 ha, and 600 ha of appropriately placed corridors would form a second patch of 63,000 ha. These corridors could be established by purchase of conservation easements, through mitigation, or through a number of non-regulatory programs. In short, a methodology for cumulative impact assessment and management, which is anticipatory in nature, can lead to protection and restoration of ecosystems.

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SMITH, MICHAEL E.,¹ BARBARA J. WYSKOWSKI,² CAROL M. BROOKS,² CHARLES T. DRISCOLL,² and CHRISTINA C. COSENTINI.² Valdosta State College¹ and Syracuse University²--Relationships between acidity and benthic invertebrates of low-order woodland streams in the Adirondack Mountains, New York.

Benthic invertebrates were collected during January, April, July and October 1985 from three low-order woodland streams in the Adirondack Mountains, New York to determine relationships between acidity and stream invertebrates. Total invertebrate generic richness, generic diversity, Ephemeroptera density and richness, collector-gatherer richness, and scraper density and richness were positively correlated to stream pH. Ephemeroptera and Naididae (Oligochaeta) were absent from the acidic sampling site. Enchytraeid oligochaetes and Tubellaria were collected at all sites, but in significantly higher densities at the acidic site. Elmids beetles (Optioservus ovalis, Oulimnius latiusculus, Promoresia tardella), the mayflies Cinygmula and Baetis, and the caddisflies Glossosoma, Apatania and Micrasema were abundant at sites where pH was highest, but were absent from other sampling locales. Total invertebrate density was not decreased at the acidic site when compared to most other sampling sites.

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EGGLETON MICHAEL A., WENDELL L. PENNINGTON and ERIC L. MORGAN. Tennessee Technological University -- Characterization of an acid-sensitive southern Appalachian stream targeted for mitigative liming.

Laurel Branch, a second order stream in the Tellico River drainage of east Tennessee, is typical of many southern Appalachian streams. The water is soft (hardness <10ppm), dilute (ionic strength 400µeq/L) and infertile (<0.1mg/L NO₃, <0.05mg/L P₀₄) with distinct seasonal trends in ANC. The stream is subject to episodic acid pulses during high flow in which decreased ANC and calcium and increased H⁺, sulfate and aluminum levels are noted. The benthic macroinvertebrate population is characterized by high diversity and densities comparable to other southern Appalachian streams. Drift rates and densities are also

similar to other upland streams. The resident rainbow trout population is characterized by small size (most specimens <150mm TL) and fair to good condition. The population is dominated by age 0 and 1 year classes with few older fish. Basically drift feeders, trout tend to feed randomly as changes in the drift are normally mirrored by changes in the diet. Laurel Branch is scheduled for mitigative liming beginning in early 1989. The objective will be to assess its effectiveness in not only mitigating pH depressions but promoting trout production. Baseline data collection is complete and ecological effects will be studied through 1990.

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NELSON, CHARLES H., and RICHARD M. DUFFIELD. University of Tennessee-Chattanooga and Howard University--Stonefly Emergence Patterns in a Maryland Stream.

Stoneflies were collected and identified from Big Hunting Creek located in both Cunningham Falls State Park and Catoctin Mountain Park, Fredrick County, Maryland. A total of 4286 specimens representing 9 families, 23 genera, and 39 species were collected during the period from 1984-1988. Adults were obtained during each month of the year, but most species were collected from April through June. Twenty-four species are recorded from Maryland for the first time.

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MATTHEWS, KIMBERLY A. and DONALD C. TARTER. Marshall University--Ecological life history, including laboratory respiratory studies, of Ameletus tarteri Burrows in Carpenter Run, North Fork of Cherry River, Greenbrier County, West Virginia.

An ecological life history study was conducted on the mayfly Ameletus tarteri Burrows from Carpenter Run, Greenbrier County, West Virginia, from November 1986 to November 1987. A total of 504 nymphs was collected with the highest relative abundance occurring in November 1987. Nymphal exuviae were recovered from May 30 to July 3. Length frequency distributions indicate a univoltine life cycle. A bimodal pattern of emergence was indicated with the first emergence period beginning in late May and continuing to early July and a second emergence period in September. An estimate of 21 instars was made using the Janetscheck method. Monthly foregut analysis indicates that nymphal mayflies are detritivores with 77.3 percent of their diet composed of plant detritus. Studies using the Gilson respirometer indicate that oxygen consumption decreases as temperature increases and that as pH is lowered, oxygen consumption increases. The correlation coefficient between oxygen consumption and body weight at pH 5.0 was -0.503. The correlation coefficient for oxygen consump-

tion and body weight at pH 7.2 was -0.536. When the slopes of the two regression lines were compared, they were found to be statistically different (0.05 confidence level), supporting the hypothesis that the relationship between these two variables is different at the two pH values. Direct egg counts ranged from 382 to 1286 eggs/female with a mean of 715. A correlation coefficient of 0.85 was calculated for female body length versus number of eggs. Mean egg measurements were 0.25 mm in length and 0.16 mm in width.

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NORMAN, ROBERT E. and DONALD C. TARTER. Marshall University--Effects of artificial lake destratification on the benthic macroinvertebrate populations in Beech Fork Lake, West Virginia.

The benthic macroinvertebrate populations at Beech Fork Lake, Wayne County, West Virginia, were studied in 1987 to determine the effects of first year operation of artificial destratification fans upon the populations compared to pre-destratification samples taken in 1985. The samples were taken from two stations at 5 and 15 feet and 15 feet at two additional stations during all sampling seasons. Water quality profiles were also taken weekly from each study period.

The analyses of the benthic macroinvertebrate populations and water chemistry show significant changes occurring during both seasons in first year operation based on MANOVA ($p < 0.05$), t-tests ($p < 0.05$) and step-wise discriminant analysis ($p < 0.01$). Significant increases have occurred in number of individuals, diversity values, number of taxa, and temperature. Depending upon the location, significant increases and decreases have occurred in the dissolved oxygen values. Significant decreases occurred in the pH values. The resident benthic macroinvertebrate populations migrated into the profundal zone. The overall trophic structure shows a slight trend towards the resident detritivores and away from the predators. Based on Wilks' Criterion, significant ($p < 0.05$) overall increases have occurred in the benthic populations during both seasons. The benthic macroinvertebrate populations at Beech Fork Lake are limited by the water quality. The changes in the water quality that have occurred in 1987 due to operation of the destratification fans are favorable for the benthic macroinvertebrate populations.

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ZAPPIA, HUMBERT and DONALD TARTER. Marshall University--Effects of second year artificial destratification on the benthic populations in Beech Fork Lake, West Virginia.

In May 1987, the U. S. Army Corps of Engineers, Huntington District, began operating four artificial destratification fans in Beech Fork Lake, Wayne County, West Virginia. Artificial destratification is a major technique used as an in-lake method for improving water quality. In order to collect base-line data, pre-destratification benthic collections were made in summer and fall of

1986 using Hester Dendy multiplate samplers. Four stations were selected for the benthic sampling. At two stations divers with SCUBA gear installed multiplate samplers (triplicate) at depths of 5 and 15 feet for six weeks. At two additional stations, multiplate samplers were installed at 15 feet for six weeks. The same stations and procedures were followed in summer and fall of 1987 and 1988. The following comparisons of benthic populations will be discussed in relation to changes in water quality: species diversity, equitability, number of taxa, number of specimens per square foot, and functional feeding groups (predators, shredders, collectors, grazers).

196

Webb, Doshia J. and Tom E. Weak. Marshall University--The response of the periphyton community of Beech Fork Lake to artificial circulation.

Beech Fork is a typical, warm, monomictic lake which was artificially destratified in June 1987. A comparison was made of predestratification data to post-destratification data to show the effects of artificial circulation on the periphyton community. A total of 80 species of periphyton was found to occur at four stations during the 1987-88 sampling period. Five divisions, 6 classes, and 24 families were represented. The majority of the species were diatoms with green and blue-green forms well represented. Cell densities reached their highest level in the upper lake zone during the spring 1987 and, thereafter, sharply declined throughout the following three seasons. This pattern of distribution was closely duplicated in the middle lake zone but with densities being substantially less. Densities for the lower lake zone were highest during the fall but were depressed throughout the four season sampling period. Similarity index values for water column strata, according to season, were generally higher and more uniform in 1987-88 than for 1985-86. This suggests a higher degree of habitat homogeneity (or lower heterogeneity) for 1987-88 than for the previous years.

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FIGIEL, CHESTER R., JR. and RAY D. SEMLITSCH. Memphis State University--GEOGRAPHIC VARIATION IN SURVIVAL AND METAMORPHOSIS IN LARVAL SALAMANDERS OF AMBYSTOMA MACULATUM

Growth, survival, feeding activity, and frequency of metamorphosis were measured in larval spotted salamanders, Ambystoma maculatum, to determine if populations have differentiated in response to their local environmental conditions. Using a 4 X 2 randomized block design, equal number of larvae from four geographic locations

were reared in forty artificial ponds in the presence and absence of a natural predator, the bluegill sunfish, Lepomis macrochirus to determine if variation exists in these life history traits. Significant differences among populations were revealed in survival, frequency of metamorphosis, and feeding activity of larvae in relation to location. Feeding activity and growth were significantly affected by sunfish. No significant interaction between treatments was revealed. Since adult A. maculatum are philopatric to natal breeding ponds with little immigration from adjacent populations, adaptation to local environmental conditions could ultimately result in variations in life history traits among populations. Variation could potentially result from genetic differentiation, although nongenetic maternal effects and phenotypic plasticity can not be dismissed.

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MCQUARY, WENDY M., CLETUS M. SELLERS, JR., AND NORMAN E. GARRISON. James Madison University--The effect of simulated acid precipitation on the ventilatory activity of rainbow trout.

Sulfuric acid, added to water to produce a pH of 4.0, resulted in a statistically significant increase in rainbow trout (Salmo gairdneri) ventilatory volume ($p = 0.108$), ventilatory rate ($p < 0.005$), and coughing frequency ($p < 0.0005$). There was no statistically significant interaction between pH and time for each of these parameters. However, the volume of water pumped by fish at pH 7.0 clearly tended to decrease toward the end of the test period, after about 90 minutes.

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KOZEL, THOMAS R. Savannah State College--Water chemistry and ichthyofauna of three temporary ponds on Georgia's southernmost barrier island.

Three shallow (0.6m) temporary ponds, two containing brackish and one fresh water, on the extreme southern end of Cumberland Isl. Nat'l Seashore, Cumberland Isl., GA were sampled over a 1 yr period (Apr '88-Apr '89) to determine basic water quality parameters and ichthyofaunal composition. Depth, and surface values for water temp., D.O., turbidity, color, pH, conductivity, alkalinity, C.O.D., tot. non-fil. residue, NH_3N , NO_3N , NO_2N , total PO_4 and salinity were obtained at approximately 1 mo. intervals at 3 stations in each of the ponds. Fishes were collected with the same frequency by seining and dipnetting. Flora and macroinvertebrates were noted when and where possible. Ponds were drastically reduced in surface area by mid-Aug., but enlarged to near maximum size by the end of Sep. after heavy rains and spring tides. Water temps. reached near the lethal limit for fishes (40 C) in Aug.; pH was usually slightly alkaline; PO_4 values were elevated in all ponds; alkalinity was less than 100mg/l

and D.O. varied from 4 to 16mg/l. Salinity in one brackish pond varied from 1 to 4 ppt and from 4 to 25 ppt in the other. Most parameters were quite variable due to the cycle of filling and evaporation. *Gambusia affinis* was the most abundant fish in all 3 ponds. *Poecilia latipinna*, *Cyprinodon variegatus*, *Fundulus heteroclitus* and *F. confluentus* were collected from the pond with the highest salinity. *Mycobacteria americana* foraged in one pond.

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JOO, GEA-JAE and AMELIA K. WARD.
University of Alabama--Patterns of phytoplankton productivity of two morphologically different oxbow lakes in Black Warrior River drainage in Alabama.

Many different types of oxbow lakes, created by river meandering, exist in the drainage of the Black Warrior River. Phytoplankton productivity and spatial distribution of productivity using the C-14 method were studied in two morphologically different oxbow lakes. Touson Lake is a typical oxbow lake type in the region with steep basin morphometry, length (L):1.2 Km, maximum depth (Zm):6 m. Cypress Pond has shallow depth and well developed submersed aquatic plants, L:2.25 Km, Zm:2.2 m. Daily production at Touson Lake ranged from 43 to 550 mgC/m³/day (mean:258, n=6) while Cypress Pond showed somewhat lower productivity (range:16 to 256 mgC/m³/day, mean:88 n=4). In highly stained Touson Lake, highest productivity usually occurred at the surface. In the Cypress Pond, productivity was inhibited at the surface by light and was highest at the 0.5 m depth. Spatial distribution of productivity at Touson Lake was not variable among 5 sites (19.86 ± 6.6 mgC/m³/h n=5). However, highly variable distribution of primary productivity occurred in Cypress Pond (16.51 ± 19.1 mgC/m³/h n=6). This variability was partly supported by variable underwater light condition caused by distribution of submersed aquatic plants. Based on phytoplankton productivity, Touson Lake and Cypress Pond appear to belong to the dystrophic and oligotrophic lake categories respectively.

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DEBIASE, ADRIENNE E., BARBARA E. TAYLOR, and DIANE L. MAHONEY. Savannah River Ecology Laboratory--Diel vertical migration by invertebrate predators in a Southeastern cooling reservoir.

Cyclopoid copepods and larval *Chaoborus* are the major invertebrate predators in L-Lake, a 47-ha cooling reservoir on the Savannah River Plant in South Carolina. They show a strong daily vertical migration. Samples were taken on a monthly basis at midday and again at midnight. Strong changes in the vertical distribution were noted for the cyclopoids and *Chaoborus*. Both remained in the deeper water and in the sediments during the day. At night, they were most numerous in the top 5 m. Cladocerans showed similar migration patterns, but they were not as abundant as *Chaoborus* or cyclopoids. Rotifers showed some changes

in vertical distribution, but they were always most abundant in the upper 5 m of the water column. *Chaoborus* larvae and cyclopoid copepods seem to have a significant impact on L-Lake's zooplankton community. Vertical migration is probably the means which allows these invertebrate predators to coexist with planktivorous fish.

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DAVIDSON, MARY L. and ARMANDO A. DE LA CRUZ. Mississippi State University--Microbial utilization of toxins from the mangrove plant *Aegiceras corniculatum* (Myrsinaceae).

Soil and water samples with and without previous exposure to toxin-producing *Aegiceras* plants were collected from a mangrove forest in the Philippines. Microorganisms isolated from these samples were assayed against aqueous extracts (0.05 g ml⁻¹) of *Aegiceras* for inhibition by disc assay method and utilization by enrichment culture technique. Bacterial species isolated from soil and water samples previously exposed to *Aegiceras* did not show any sensitivity to the extracts. Several species of *Bacillus* isolated from samples unexposed to *Aegiceras* were inhibited. The growth of certain sensitive bacteria in the medium derived from enrichment cultures indicated that there are certain bacterial populations that metabolize the toxins in the *Aegiceras* extracts. This apparent microbial utilization of toxins may provide a mechanism for removal of phytotoxins from the mangrove environment.

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BURGESS, G.H.¹, F.F. SNELSON, JR.², S.J. WALSH¹, S.T. CLARK², and K.G. ABBOTT¹. University of Florida¹ and University of Central Florida²--Preliminary biological and fishery assessments of the giant snake eel, *Ophichthus rex* (Anguilliformes, Ophichthidae).

The giant snake eel, *Ophichthus rex*, is a largely unexploited resource that has the potential to become a viable component of established offshore fisheries. This preliminary report is based on an ongoing study in the north-central Gulf of Mexico. Longline catches over mud bottom in 200-500 ft of water consist of *O. rex* and sharks (predominantly *Rhizoprionodon terraenovae*) in about equal numbers. Eel catch-per-unit-effort (CPUE) shows no seasonal pattern; diurnal data suggest increased catches at night and peak in feeding activity at dawn. CPUE generally increases with depth. Females outnumber males by about 4 to 1 and also reach a larger size. Females average 150 cm total length (TL) (range 101-196) and 6.3 kg total weight (1.6-14.5); males average 134 cm TL (83-166) and 3.9 kg (0.7-9.0). Length-frequency data show that larger individuals are found in deeper water. Regressions of whole and carcass weight (marketable portion) on TL are logarithmic. Morphometric analysis shows that relative body girth is positively correlated with TL. Otolith sectioning reveals up to 22 rings (presumptive annuli) but the correlation between size and ring number is relatively low, as in other eels. Monthly comparison of stomach contents suggests some seasonality in diet composition. Crabs and fishes, especially other eels, are the major food items. Gonad histology and gonosomatic indices (GSI) reveal that both sexes exhibit peak gametogenesis from November-January. Gonads of both sexes become latent in spring and summer, suggesting a single spawning period in midwinter. GSI of females increased predictably with increased TL, but the limited sample of males results in a poor correlation between testes mass and TL.

204

BLAYLOCK, R. A. Virginia Institute of Marine Science, School of Marine Science, College of William and Mary--Quantification of a massive school of cownose rays, *Rhinoptera bonasus*, in lower Chesapeake Bay.

The cownose ray, *Rhinoptera bonasus*, inhabits Chesapeake Bay in large numbers during the summer and forages on commercially valuable shellfish. During aerial surveys to examine the distribution and abundance of this species, I encountered a school in lower Chesapeake Bay a few kilometers north of the Chesapeake Bay Bridge-Tunnel so large and dense that it was impossible to quantify visually. I subsequently resurveyed this school using vertical aerial photography to determine ray density (rays/m²) and flew eight transects across the school using Loran C to locate the school edges and estimate its areal extent. The density of cownose rays within the school was 1.1 rays/m² (+ 0.22 SD, n = 116) including all rays visible from the air (to about one meter depth due to turbidity). The school occupied an area of approximately 457 ha. This resulted in a school size estimate of 5 X 10⁶ rays. This does not include those rays more than one meter below the surface; however, using a commercial fish-finder, I estimated that the rays were "stacked" approximately 2-5 deep beneath the surface. This, the largest school of cownose rays ever reported, represents an enormous biomass and suggests a potentially devastating impact on benthic shellfish stocks in Chesapeake Bay and its subestuaries.

205

MENHINICK, EDWARD F. University of North Carolina at Charlotte--Anal ray/gill raker variation in North Carolina catfishes (*Ictalurus* spp.)
Scatter diagrams of anal rays and total gill rakers overlap only for *Ictalurus melas* vs. *I. catus*, *I. nebulosus* vs. *I. platycephalus*, and *I. natalis* vs. *I. punctatus*. They thus permit differentiation of all other species, i.e., *I. brunneus* vs. *I. platycephalus* and *I. nebulosus* vs. *I. melas*. Individuals having standard lengths of from 2.5-4.0 cm have about two fewer gill rakers than larger specimens. Small *I. catus* also have two fewer anal rays than usual. Variation of rakers and anal rays with range are discussed along with an evaluation of other characteristics commonly used to differentiate species of *Ictalurus*.

206

King, Mark A., Greg C. Garman, Jackson E. Jeffrey and Anne Wright. Virginia Commonwealth University--Aging methodology for stream centrarchids: scale versus otolith, and results for James River fishes.
Otoliths and scales from smallmouth bass and redear sunfish from a large ambient temperature stream, the

James River, Virginia, were used to determine ages for growth estimates. Otoliths are generally considered superior to scales for aging, especially for older specimens. Prepared in thin transverse section (except those from young-of-year specimens which were whole-mounted), otoliths exhibited distinct annuli, generally without false rings. Annuli counts from 0 to 13 were considered accurate age determinates. Scale ages determined from annuli counts from projected images agreed with otolith ages in >90% of comparisons for both smallmouth bass and redear sunfish for age-0 to -4. Redbreast sunfish >age-3 were rarely encountered whereas smallmouth bass >age-4 were an important component of the fishery. Accuracy for scale ages was only 17% for the >age-4 smallmouth bass samples, unacceptable for growth estimation. Calculated lengths of smallmouth bass were significantly greater (p<0.05) for stations in the lower Piedmont Province when compared to stations of the Valley and Ridge Province. Redbreast sunfish growth was similar at up- and downstream stations. Cost-effective sample schemes which allow otolith verification of all ages of stream dwelling centrarchid species were considered.

207

Wood, Robert M.¹, K. Jack Killgore², and Neil H. Douglas³. University of Alabama¹, U.S. Army Corps of Engineers WES², Northeast Louisiana University³--Ichthyofaunal Comparison of a Man-Made and a Natural Lotic Ecosystem in Eastern Mississippi.

The construction of the Tennessee-Tombigbee Waterway resulted in the elimination of many species of fish from the Tombigbee River allowing them to survive only in reduced numbers in a few tributaries. In an effort to circumvent this process, an experimental gravel bar was constructed below Columbus Dam, Lowndes Co., MS. This study was conducted to determine how the existing fish fauna at the experimental site varied over four seasons and how this variation and faunal composition compared to that of a naturally occurring gravel bar. A total of 9575 specimens were collected from both sites representing 60 species and 13 families. Of the species taken, 37 were collected from the experimental gravel bar and 47 were collected from the natural gravel bar. Twenty-four species were common to both sites. Faunal diversities were lowest in May 1987 at the experimental site (H' = .474) and highest in October 1987 at the natural site (H' = 1.16). Faunal similarity of the two sites increased over the nine months of study from a low in May 1987 (I_M = .08) to a high in February 1988 (I_M = .93). On the experimental gravel bar 15 of the 37 species collected were persistent in at least three collections. At the natural gravel bar 33 of the 47 species were found in at least three of the four collections. Based on units of equal effort collecting the number of individuals captured at either site during a given collection period or within a single site across time did not vary significantly (P < .05).

208

O'NEIL, P.E. and METTEE, M.F. Geological Survey of Alabama--Factors Associated with Sampling Stream Fishes in Alabama.

Environmental assessments that include fish sampling programs require subjective decisions regarding sampling interval, collection duration and data analysis procedures. Monitoring studies completed in Alabama indicate that several months of sampling may be required in order to confidently predict species composition in selected second through fifth order streams. Species richness appears to be influenced by stream size, location and local geology. Changes in the cumulative relative abundance of fishes can be used to document stream perturbations that may not directly affect species richness.

209

WINNER, BRENT L. and F. J. SCHWARTZ.

University of North Carolina at Wilmington and University of North Carolina, Institute of Marine Sciences. Relative growth of the heart in four species of Carcharhinid sharks.

Organisms grow not as a whole, but as a complex series of individual growth cycles by its various parts. Bertin (1958) suggested that the heart of a fish develops in accord with the muscular development of the species; smaller relative heart sizes for sedentary species (0.015-0.05%) and larger relative heart sizes for highly active species (0.1-0.25%). A total of 18, Carcharhinus limbatus; 13, Galeocerdo cuvieri; 31, Mustelus canis; and 41, Rhizoprionodon terraenovae were collected by longline off the southeastern coast of North Carolina. A linear regression analysis of log x log plots comparing heart and total weight showed positive correlations for all species. R-square values ranged from 0.90 for R. terraenovae, to 0.91, 0.97, and 0.98 for M. canis, C. limbatus, and G. cuvieri respectively. Mean heart weight, as a percentage of total weight, was greatest for G. cuvieri (0.182), followed by R. terraenovae (0.142), C. limbatus (0.139) and M. canis (0.134). These values were comparable to those for other species of fishes recorded by previous researchers. Values for several species of marine mammals were found to be significantly higher than those for fish. The rate of heart growth remained fairly constant for all species with an increase in total weight except G. cuvieri, which showed signs of a hypomegalistic growth relationship. It appears that Carcharhinid sharks have heart size percentages comparable to those of more active fishes which is indicative of their roving type of life-style.

210

MATSON, RONALD H., R. L., MAYDEN, and B. R. KUHAJDA. University of Alabama--Allozyme differentiation in populations of the rainbow shiner, *Notropis chrosomus*.

The rainbow shiner, *Notropis chrosomus*, is endemic to streams of the Mobile Bay drainage of Alabama, Georgia and Tennessee. As part of a systematic study of North American minnows, individuals of the rainbow shiner were collected from four locations in Alabama. Two sites are in the Cahaba River drainage while the other two are in the Coosa drainage. Extracts of eye/brain, liver and skeletal muscle were taken from each individual and

subjected to horizontal starch gel electrophoresis. The products of 35 presumptive gene loci were scored for allelic variation. 24 loci were monomorphic in all populations. Percent polymorphic loci ranged from 11.4% to 20.0% and average heterozygosity ranged between 0.010 and 0.046. The two Cahaba River populations were fixed for a fast allele at the adenosine deaminase locus (Ada-A) while the Coosa River populations were fixed for the alternative, slow allele. These fixed differences indicate that the individuals collected from these four localities do not represent a single, panmictic population. This finding is significant given that there are currently no known morphological differences between populations of *N. chrosomus* found in these two drainages.

211

ROGERS, JAMES S. and JAMES M. GRADY. University of New Orleans--Evidence for Tandem Duplication of a Glucosephosphate Isomerase Locus in *Sciaenops ocellatus*.

Starch gel electrophoresis of the enzyme glucosephosphate isomerase from samples of tissue of the red drum (*Sciaenops ocellatus*) revealed more isozyme bands than would be expected for a dimeric protein that is coded by two loci, the common condition among teleostean fishes. We concluded that this is the result of a recent tandem duplication of the Gpi-B locus.

212

HERNANDEZ, J. DAVID and MICHAEL H. SMITH. University of Georgia, and Savannah River Ecology Laboratory--Factors affecting genetic differentiation of eastern mosquitofish (*Gambusia holbrooki* Girard) populations from the Broad-Santee and Pee Dee drainages.

Spatial distributions of alleles at 21 loci in 85 *Gambusia holbrooki* populations showed that this species has high estimated gene flow ($Nm=1-21$) and significant correlations between genetic and geographic distances among populations, positive mean spatial autocorrelation among populations up to 240 km apart, clinal distributions of PGM-2 and GPI-2 allele frequencies across the Piedmont and Coastal Plain, and different levels of correlation among genetic variables and among genetic and geographic variables. Correlations of population multilocus heterozygosity (H) with their distances from the Fall Line (DFL) and altitude (ALT) of their locations were significant; H was highly predictable ($r^2=0.80$) with ALT. Correlations between H and DFL were significantly different between drainages for the Piedmont but not for the Coastal Plain populations. The spatial genetic divergence of mosquitofish is only partially explained by isolation by distance. Drift must be important due to the variable nature of this species' habitats, which causes a high divergence among populations ($G_{ST}=0.148$). Given the high levels of H (0.126), drift must interact with gene flow and selection in producing the spatial genetic patterns. The effects of these factors must be

constrained by historical events and by isolation of various parts of the gene pool of *G. holbrooki*.

213

ANGUS, ROBERT A. University of Alabama at Birmingham--Inheritance of melanistic spotting in the eastern mosquitofish, *Gambusia holbrooki*.

The inheritance of melanistic spotting due to the presence of large macromelanophores was investigated in two stocks of eastern mosquitofish of different geographic origin. In one stock, the melanistic phenotype is almost entirely restricted to males and is inherited as a Y-chromosome-linked single-gene trait. The Y-linked melanism allele (*M*) is temperature sensitive. It is dominant with high penetrance when fish are raised at 22°C. Penetrance is much reduced, about 42%, when fish are raised under warmer conditions (26 - 29°C). Patterns of sex-linked inheritance observed in this stock imply the existence of an XX - XY sex chromosome system. This is in contrast to the closely related western mosquitofish which has a WZ, ZZ sex chromosome mechanism. Another stock was founded from a single melanistic female mated to a melanistic male carrying the Y-linked *M* allele. Segregation ratios in various crosses are consistent with a model in which melanistic females are a result of atypical sex determination. Melanistic females have an XY sex chromosome makeup, but carry a dominant autosomal female-determining gene which overrides the male-determining tendency of the Y chromosome. Thus, melanistic females, like melanistic males, carry the same Y-linked melanism gene.

214

DENETTE, PHILIAS E. AND ROBERT C. CASHNER. University of New Orleans --Trends in habitat associations of the ichthyofauna of the Little Buffalo River, southwestern Mississippi.

The Little Buffalo River in rural southwestern Mississippi is a relatively short (9 km), fourth order tributary to the Buffalo River in the lower Mississippi River Basin. Within the stream course there is a fairly high level of habitat diversity. The habitat associations of the ichthyofauna were recorded over an 18 month study period. Four permanent stations, containing at least three major types of macrohabitats, were established from the headwaters of the Little Buffalo to its confluence with the Buffalo River. Within each macrohabitat all visible microhabitats were sampled. A total of 20 physical and chemical parameters were measured at either the macrohabitat or microhabitat level. These data and the temporal variations in fish species occurrence were analyzed statistically to test for seasonal trends in habitat associations and for within and between station variability. Preliminary results indicate some variances in trends at both the macro-

habitat (temporal variation) and microhabitat (parameter associations) levels; with most fishes with high year around abundances showing no unique positive correlations at either level.

215

WARREN, MARK A. AND ROBERT C. CASHNER. University of New Orleans--A comparison of the ichthyofaunal composition of Buffalo River, in southwestern Mississippi, over a twenty-year period.

A survey of the fishes of Buffalo River, the lowermost major westward-flowing tributary to the Mississippi River, was conducted between September 1986 and August 1988 to augment a previous study done from 1968-1970. A total of 189 collections yielded 93 species from the Buffalo River system during these two surveys. During both periods, cyprinids, cyprinodontids, centrarchids and percids were dominant, but the abundance of individual species changed noticeably. In 1968-70, *Notropis camurus*, *N. longirostris*, and *N. venustus* were the top three in abundance and made up nearly 70% of the 65,000 specimens collected. In 1986-88 the combined percentages of these three shiners dropped to 34% of the 55,000 specimens collected, and the silvery minnow, *Hybognathus nuchalis* was the second most abundant.

216

SMITH, JULIAN P.S. University of North Carolina at Charlotte--New ultrastructural evidence for the evolutionary origin(s) of the free-living flatworms (Platyhelminthes, Turbellaria).

The free-living flatworms (Turbellaria) are traditionally regarded as the prototypical acoelomates and among the most primitive of bilaterally-symmetrical animals. There is now abundant evidence from recent ultrastructural studies of the parenchyma that the Turbellaria are derived from ancestors that possessed a body cavity that would be regarded as a pseudocoel by traditional definitions of the term. None of the current theories concerning the evolutionary origins of the flatworms adequately accounts for this fact. More recent ultrastructural studies of ciliary rootlets, ciliary tips and epidermal gland cells in primitive turbellarians, in the unusual metazoan *Xenoturbella* and in enteropneust hemichordates reveal unique, apparently homologous similarities. This raises the possibility that at least some of the Turbellaria may have arisen as neotenic descendents of the larvae of Hemichordates. (Supported in part by NSF BSR81-16894; S. Tyler, P.I.)

217

RICHARDSON, JOHN B. and ROBERT M. ANDERSON. Tennessee Technological University--A new quantitative sampling method for unionids in variable substrate streams.

Quantitative sampling for unionids is an integral part of assessing populations by documenting species abundance and community structure. Problems exist in obtaining accurate quantitative information in many streams including low densities and non-random distribution of mussels, and variable substrates. Current methods include brailling line transects, timed snorkeling collections, and quadrat sampling. Substrate searching within randomly placed rigid-framed quadrats is generally accepted as yielding the most accurate density estimates. Substrates varying from fine sands to large boulders present difficulties in placement of rigid frame samplers. Chain link was used to construct a flexible series of 10 lm^2 cells. This series of cells is stretched perpendicular to the current in a central location within a mussel bed. The lower left corner in benchmarked using permanent objects on the riverbank. The chain link sampler is moved consecutively upstream 1m at a time until a 100 m^2 area is defined. Three systematically selected cells within each cell series is thoroughly searched for each of 10 rows. Cells are thoroughly searched by removing all coarse substrate and hand sifting through finer material while observing the area through a diving mask. This technique provides an economical, reproducible estimate of relative mussel density. Funding provided by The Center for Management, Utilization, and Protection of Water Resources--Tennessee Technological University.

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TARTER, DONALD C.,¹ DIANE R. NELSON,² SANDRA D. GILLENWATER,¹ AND KIMBERLY K. RUGGLES.¹ Marshall University¹ and East Tennessee State University²--First Records of Water Bears (Phylum: Tardigrada) from West Virginia.

Fourteen species of tardigrades, representing nine genera (Diphascon, Hypechiniscus, Hypsibius, Isohypsibius, Itaquascon, Macrobiotus, Milnesium, Minibiotus, Pseudechiniscus), were collected from mosses (Amblystegium atrichum, A. serpens, Brachythecium salebrosum, Dicranum scoparium, Endodon cladorrhizans, Hedwigia ciliata, Hypnum pratense, Platydictya subtilis, Ulota crispa) on the ground, rocks and trees (beech, elm, red and sugar maples, red spruce) on Spruce Knob Mountain, West Virginia. The collections were from elevations of 2800, 3800 and 4800 feet. The most common species was Milnesium tardigradum. These species constitute the first records of tardigrades from West Virginia.

219

NEHUS, TIM J., J.B. LAYZER and W.L. PENNINGTON. Tennessee Technological University--Importance of reservoir biota to stream drift in Center Hill Tailwater.

Invertebrate drift samples were collected approximately 1 km downstream from Center Hill Dam. Samples collected during hydroelectric discharges were grouped on the basis of origin. Terrestrial, lotic, and lentic organisms occurred in the drift throughout the year; however, the relative importance of each varied seasonally. Lentic organisms dominated the drift in density and biomass during the fall, winter, and spring. Daphnia sp. and Leptodora kindtii were the most numerous lentic organisms of the drift during these seasons. Threadfin shad (Dorosoma petenense) dominated the biomass of the drift during the winter period. Apparently, the cold reservoir water in the winter stressed these fish making them more susceptible to entrainment. Although the importance of stream benthos and terrestrial insects to fish populations is generally recognized, the contribution of the reservoir to the forage base should also be considered when assessing the impacts of hydroelectric generation on fish populations.

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WILKERSON, W.S.,¹ W.L. PENNINGTON,¹ E.L. MORCAN,¹ and D. WINFORD.² TENNESSEE TECHNOLOGICAL UNIVERSITY¹ and U.S. FISH AND WILDLIFE SERVICES²--Impacts on Zooplankton and Benthic Macroinvertebrates by Controlled Barge Traffic of the Ohio River.

Commercial barge traffic on the Ohio River is an economical means of transportation and is projected to increase in the future. The physical forces generated by this increased traffic has become a concern because of potential environmental impacts. The main objective of this study is to ascertain the impacts of controlled barge traffic on the zooplankton and benthic macroinvertebrate communities. Four tugs of different draft, horsepower, propeller RPM's and propeller size were used in the study. Zooplankton tows were collected immediately before and immediately after passage of the tug and classified as pre-impact and post-impact respectively. Three 250 micron mesh nets were used to collect the zooplankton samples. The samples were processed, identified and counted in the laboratory with the predominant zooplankters being Diaphanosoma leuchtenhergianum, Bosmina longirostris and Diaptomus reighardi. Post-impact tows also collected benthic macroinvertebrates and larval fish along with zooplankton indicating that benthic macroinvertebrates are being incorporated into the water column as a result of forces generated by the tugs. Larval fish were injured or dead indicating damage by passage of the tugs. Correlation of tug size and number of benthic macroinvertebrates incorporated into the water column indicates that the larger the tug, the greater the effect on the benthic community.

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EDWARDS, DOLF, D. and RONALD V. DIMOCK, Jr. Wake Forest University--The importance of size in intraspecific aggression by male water mites.

The water mite Unionicola formosa is a common symbiont of freshwater mussels of the genus Anodonta. A female biased sex ratio is characteristic of this species, with most individuals of the host population harboring a single male but as many as eighty or more females. Both experimental and field studies from our laboratory suggest that intrasexual aggression and territoriality exhibited by males are responsible for this distribution and that this behavior constitutes a female defense polygynous mating system. Additional studies suggest male size is important in determining the success of male mites during male aggressive encounters. An assessment of four morphometric parameters indicated that males that survived agonistic interactions in vitro were significantly larger than the males with which they had been paired. These data are discussed in relation to hypotheses regarding the role of male size in polygynous mating systems.

222

RICHARDSON, TERRY D. and KENNETH M. BROWN. Louisiana State University--Secondary production of two subtropical viviparid prosobranchs.

Annual secondary production was determined for two subtropical populations of the prosobranch snails, Viviparus subpurpureus and Campeloma decisum. The two large, live-bearing detritivores were sampled monthly from the littoral zone of a detritus rich, low gradient, alluvial plain stream in southern Louisiana. Production was estimated using the size-frequency method in two different ways: (1) directly from sampling data with resulting underrepresentation of smaller size classes, and (2) using regression analyses to estimate density of individuals in underrepresented size classes. Both methods included estimates of production in embryos. Annual standing stocks differed significantly between species ($p < 0.025$) and were relatively high at $16.0 \text{ g dry mass/m}^2$ for Viviparus and $8.5 \text{ g dry mass/m}^2$ for Campeloma. Including underrepresented size classes did not change average annual biomass estimates for Viviparus but did increase values for Campeloma from 8.5 to $10.2 \text{ g dry mass/m}^2$. The species also differed significantly in annual production ($p < 0.05$) with the magnitude of difference between species depending on the method employed. Using uncorrected sampling data, Viviparus had a productivity of $35.4 \text{ g dry mass m}^{-2} \text{ yr}^{-1}$ but with corrected data, $45.6 \text{ g dry mass m}^{-2} \text{ yr}^{-1}$. For Campeloma, production differed by 59%, increasing from $15.2 \text{ g dry mass m}^{-2} \text{ yr}^{-1}$ to $22.9 \text{ g dry mass m}^{-2} \text{ yr}^{-1}$ using corrected data. Regardless of the method used, these are still among the highest single-species production estimates reported for lotic macroinvertebrates.

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HARRISON, JULIAN R. College of Charleston --The freshwater limpet Hebetancylus excentricus (Morelet) in South Carolina.

Hebetancylus excentricus (Morelet), a freshwater limpet of the Caribbean region, is

known also from coastal Georgia, southern Florida, southeastern Louisiana, central Texas, and southern Oklahoma. The discovery of a large population in coastal South Carolina establishes the species in that state and represents an extension of the range approximately 180 km northeast of the nearest known station on Sapelo Island, McIntosh Co., GA. The limpets occupy an isolated irrigation pond in an abandoned field on James Island, Charleston Co., SC. A study of 150 specimens from this site revealed the second known instance of septum formation in shells of the species. The population probably originated as a consequence of passive dispersal by migratory birds.

224

MOONEY, RICHARD L., RICHARD R. MILLS and T. DANIEL KIMBROUGH. Virginia Commonwealth University--Determination of the Insecticidal Properties of a Novel Catechol Copolymer

The objective of this study was to assess the toxicity of a maleic-anhydride bridged catechol copolymer when injected into the haemocoel of the American cockroach and into the circulatory system of albino mice. The animals were given dosages ranging from 1 mg/kg b.w. to 10 mg/kg b.w. and observed for three days. The experimental results show the polymer to be extremely lethal to cockroaches at the minimum dosage of $1 \text{ mg/kg body weight}$. Virtually no effects were noted in the mice at any polymer dosage. In mice, radioactively labelled polymer was cleared in the urine after 24h. Filtration rates for the cockroaches were unattainable due to the polymer's rapid and lethal effects on the animal. Our current research suggests that the catechol subunit of the polymer actively binds haemolymph proteins responsible for normal cuticle sclerotization in the cockroach

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PAULEY, ERIG F. and RICHARD T. BUSING. University of Tennessee--Wind-related mortality of Great Smoky Mountains red spruce, Picea rubens Sarg.

During winter 1987-1988, extensive windthrow of red spruce occurred on Mt. Collins, Great Smoky Mountains National Park. Transects were located through windfall patches to obtain data on mode of death, direction of fall, height, diameter (dbh), and recent radial growth rate of spruce. Four modes of death were recognized: uprooted (46%), toppled (23%), tipped-up (on uproot mounds; 21%), and snapped (9%). Direction of tree fall corresponded with directions of several peak winds at nearby Noland Divide. Height and diameter distributions of killed spruce were bimodal, due to larger trees toppling or tipping up smaller trees. Radial growth rates did not differ among modes of death or between larger and smaller trees. Following death of most mature Fraser fir (Abies fraseri (Pursh) Poir.) from the balsam woolly adelgid

(*Adelges piceae* Ratz.), spruce may be incurring increased mortality from wind exposure.

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BUSING, RICHARD T. University of Tennessee--Size-specific mortality in a Great Smoky Mountains red spruce population.

Tree mortality and radial growth trends were studied in an old-growth red spruce population at Mt. Collins, North Carolina and Tennessee. Population size class and age class structure was determined. Census and size class data indicate high survivorship among intermediate sized (30-60 cm dbh) trees. Tree vigor, assessed by radial growth, tends to be high in this intermediate diameter range, and low among recently killed trees. Semi-logarithmic size- and age structure curves are rotated sigmoid in form. These results suggest a relationship between radial growth and mortality rate.

227

ADAMS, HAROLD S. and STEVEN L. STEPHENSON. Dabney S. Lancaster Community College, and Fairmont State College--Forest communities of the higher elevations in western Virginia.

Forest communities dominated by red oak (*Quercus rubra* L.) or red spruce (*Picea rubens* Sarg.) characteristically occupy many high elevation (>1000 m) sites in western Virginia. During the period of 1982-86, twenty-four stands in which red spruce was present as a canopy species (average IV = 60) and fourteen stands dominated by red oak (average IV = 70) were intensively sampled to obtain quantitative data on the structure and composition of all strata of vegetation. Mean values for basal area and density of overstory trees (stems >10 cm DBH) for the red spruce stands were 46.1 m²/ha and 834 stems/ha, respectively. The corresponding values for red oak stands were 26.1 m²/ha and 589 stems/ha. The most important associates of red oak in the stands we sampled were red maple, black birch, and white oak; the most important species sharing dominance with red spruce were hemlock and yellow birch. Although red spruce communities tend to occur at higher elevations than red oak communities, considerable overlap exists in their elevational distribution. The ecotone between red oak communities and adjacent forest types is one of gradual blending, whereas transition between red spruce and surrounding hardwood communities usually is more abrupt.

228

LIPSCOMB, MARY V. and ERIK T. NILSEN. Virginia Polytechnic Institute and State University--Biotic and abiotic factors influencing the natural distributions of evergreen and deciduous species on north and south slopes of Brush Mountain, Virginia.

Canopy tree distributions have often been related to topographically de-

finied moisture gradients. This study examines the distributions of canopy and subcanopy species in relation to topographically and biotically defined light and moisture gradients. Although community dominance and diversity characteristics of the canopy were similar between slopes, the south slope had higher dominance, lower equitability, lower richness, and a higher evergreen to deciduous importance ratio than the north or valley positions. Subcanopy indices for light and water availability were developed and compared to the traditional Forest Site Quality Index (FSQI). Our moisture index was directly related to the FSQI however the light index was not related to the FSQI or the moisture index. The canopy species composition was most related to aspect rather than moisture or light indices in both direct and indirect gradient analyses. Direct gradient analysis of subcanopy plants indicated variable distributions of individual species in relation to light and water indices. The direct gradient analysis of the subcanopy was not dominated by topographic characteristics. Subcanopy sites were separated more clearly on the basis of the subcanopy moisture and light availability indices.

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MULLER, ROBERT N. and PAUL J. KALISZ. University of Kentucky--Species distribution and ecosystem development in the Mixed Mesophytic Forest of eastern Kentucky.

Recent studies of species gradients in the Eastern Deciduous Forest suggest that species distribution may be related to subtle gradients of moisture and nutrient availability. However, there is evidence to suggest that nutrient availability is closely related to patterns of internal cycling of nutrients which are related to species composition. Ninety 0.05 ha plots were analyzed in the Mixed Mesophytic Forest of eastern Kentucky to test the hypothesis that nutrient accumulation patterns are a function of species composition and are unrelated to fertility patterns of the underlying substrate. Significant differences were observed in soil Ca and N accumulation among 4 vegetation types (beech, mixed mesophytic, hickory, and oak). These differences were apparent in both the A horizon and the underlying subsoil. Sites occurring on the same geologic substrate but dominated by different vegetation types also exhibited significant differences in nutrient accumulation. These results suggest that species composition may significantly influence patterns of nutrient accumulation not only in the surface horizon but in the subsoil as well.

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LIU, YAN and ROBERT N. MULLER. University of Kentucky--Above-ground productivity and nitrogen mineralization in the mixed mesophytic forest of eastern Kentucky.

Species composition is closely associated with gradients of soil fertility in the forests of the Cumberland Plateau in eastern Kentucky. Total above-ground productivity was measured over four vegetation types (beech, mixed mesophytic, hickory, and oak) to test the hypothesis that above-ground productivity of eastern Kentucky's forests is related to species composition and site quality. Anaerobic nitrogen mineralization was measured as an index of site quality. Based on 31 0.05 ha sample plots, the data showed significant differences in nitrogen mineralization among vegetation types with mineralization rates being highest in mixed mesophytic plots (244 ppm per 7 days) and lowest in oak plots (68 ppm per 7 days). However, total above-ground productivity did not differ among vegetation types and averaged 6316 kg/ha/yr. Productivity was unrelated to either species composition or site quality. These results do not agree with other studies which suggest that the rate of nitrogen cycling may be closely linked with productivity. We suggest that differential nutrient use efficiency along the gradient of species composition that we studied may account for the lack of a relationship between nitrogen mineralization and above-ground productivity.

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GRIBBEN, ROBERT J. and DONALD R. YOUNG.
Virginia Commonwealth University--
Spatial variations in growth of
Hydrilla within Lake Anna, Virginia.

Hydrilla verticillata, an exotic weed of tropical origin, has been migrating northward after establishment in the southeastern United States. Within the last two years it has been found in Lake Anna, a cooling reservoir for the Virginia Power North Anna Nuclear Power Station. Measurements of seasonal variation in growth within the reservoir were related to greenhouse investigations of H. verticillata grown in representative samples of lake hydrosol to assess the potential for plant spread in Middle-Atlantic states. Within the reservoir, plants grew approximately 50% better in open areas as compared to shaded ones, with measurable growth from June through October. Growth also varied among the hydrosol samples due to differences in pH, soil nutrients, and especially heavy metal concentrations. The wide range of hydrosols that support growth coupled with extensive vegetative propagation indicates that H. verticillata is becoming a serious weed in the lakes of central Virginia.

232

Kettler, Steve and James Fralish.
Southern Illinois University and
Austin Peay State University--
Forest succession patterns at
Land Between The Lakes, KY and
TN.

A study of successional change in the forests of LBL is being conducted under the auspices of the

Center for Field Biology-LBL at Austin Peay State University, and the Department of Forestry, Southern Illinois University. Major forest successional sequences have been identified in the Pinus echinata and the Quercus alba communities. A cluster of P. echinata stands is isolated near the southern boundary of LBL; this community is steadily progressing to one dominated by Q. stellata or Q. alba depending on soil and slope aspect. In the southern half of LBL, a large proportion of Q. alba stands have a moderately dense understory of Acer saccharum; here the soils are developed primarily from limestone and have a high water and nutrient capacity. In the northern half where most soils developed in low nutrient Coastal Plain sediments, an understory of A. saccharum is found in Q. alba stands only at low elevations (<460 ft), on north slopes, or where limestone bedrock (high nutrient soils) occurs. Succession in Q. alba stands appears related to soil water and nutrients and topographic factors. A hypothesis integrating the effects of water, nutrients and topography is proposed.

233

Franklin, Scott and James Fralish. Southern Illinois University and Austin Peay State University--Forest communities of xeric-mesic and mesic sites at Land Between The Lakes, KY and TN.

Research on forest communities at LBL is being conducted under the auspices of the Center for Field Biology-LBL at Austin Peay State University and the Department of Forestry, Southern Illinois University. The forest community on moderate to deep soil of south slopes and on north slopes and stream terraces is dominated primarily by Quercus alba. This range of sites appears analogous to a soil moisture gradient; along this gradient Q. alba site index increases from 40 to 75. Stands with high site index often have an understory of mesophytic species primarily Acer saccharum. Other important overstory species include Quercus velutina, Q. coccinea, Ulmus alata, and Liriodendron tulipifera. Fagus grandifolia or Acer saccharum and a mixture of mesophytic species such as Fraxinus americana, Quercus rubra, Juglans nigra and Nyssa sylvatica dominate a few communities restricted to north slopes and stream terraces. These stands are associated with soil of high water and nutrient holding capacity derived by limestone.

Most community patterns can be explained in terms of soil moisture and nutrients and history.

234

Rudowicz, Lucy and James Fralish. Southern Illinois University and Austin Peay State University--Forest Communities of xeric sites at Land Between The Lakes, KY and TN.

Since 1986, research on the composition and structure of forest communities at LBL has been conducted under the auspices of the Center for Field Biology-LBL at Austin Peay State University and the Department of Forestry, Southern Illinois University. Xerophytic forest communities are dominated primarily either by Quercus prinus, Q. stellata or Pinus echinata. Quercus prinus dominates south slopes and ridgetops where the soil is coarse-textured and has a high rock volume, but occasionally will dominate on silt loam soils of north slopes; although low in importance, Oxydendrum arboreum appears in all stands on south slopes. Quercus stellata stands are found on south and southwest slopes and ridgetops where a fragipan is present in the silt loam soils. Associated species include Q. marilandica, Q. falcata, Q. prinus, Q. alba, Q. velutina, and Carya glabra. Near the southern boundary of LBL in Tennessee, communities of pinus echinata occur on fine-textured soil. Species of the Q. stellata community are overstory and understory components of most stands and apparently will replace pine through natural succession.

235

HULL, JAMES C. Towson State University--Changes in nitrification potential of soils along a successional gradient in Maryland.

The concentrations of soil ammonium and nitrate and the numbers of nitrifying bacteria found during the growing season within three stands in the Piedmont of Maryland were compared to assess changes in nitrification along a successional gradient. In early successional stands soil nitrate and nitrifying bacteria were high while soil ammonium was low. In late successional stands soil ammonium was high while soil nitrate and nitrifying bacteria were low. Mid-successional stands had low levels of nitrate, ammonium and nitrifying bacteria. Laboratory measurements of nitrification potentials correlated with the field measurements and were related to the numbers of nitrifying bacteria present. Experiments showed no significant inhibition of nitrification by water soluble leachates of forest or grassland litter.

236

ROBERTSON, PHILIP A. Southern Illinois University--Dendrochronology of oaks from three lowland sites in southern Illinois.

Increment cores from 220 trees of 8 oak species found on or adjacent to floodplains of the Big Muddy, Mississippi and Cache rivers were collected, prepared, measured and analyzed using standard dendrochronological techniques. Ring-width series were detrended using a 66 year cubic spline and index chronologies were calculated using a biweight estimation of the mean. Ring-width chronologies were related to monthly temperature, precipitation and river discharge using correlation, response function and regression techniques. The most important variable related to tree growth was June temperature which showed a negative correlation. Generally, high temperatures of the summer months were negatively related to growth. High precipitation during the summer was positively related to growth of trees on more mesic sites and became less important to trees on wetter sites. Variation in river discharge accounted for less than 30 percent of the variance in the chronologies. Discharge was generally positively related to growth of trees on the Pine Hills and Little Black Slough sites and negatively related to growth on the Horseshoe Lake site. This differential effect may be related to differences in flooding regimes between the smaller rivers (Big Muddy and Cache) affecting the two former sites and the Mississippi which impacts the Horseshoe Lake study site.

237

REMBERT, DAVID H., JR. University of South Carolina--A visit to Kew after the storm.

Not in two hundred and eighty four years had England experienced such a storm as the one that slammed ashore during the early morning hours of October 16, 1987. The one hundred knot winds moved through Sussex and Kent taking nineteen lives and destroying fifteen million trees. Hamlets and gardens were left in devastation as the dawn broke on that unimaginable scene. At Kew in the west of London, there was good news and bad. Approximately a thousand trees were damaged or destroyed in the three hundred acre Royal Botanic Garden; however, most of the trees native to the southeastern United States survived. Although a small part of the loss was irreparable, many trees were duplicates and several of the rare or historic trees that were damaged can be propagated. The "natural" pruning of the collection at Kew has provided an unexpected opportunity for root anatomy study at the plant anatomy section at Kew's Jodrell Laboratory. Tree-ring research has received a boost and the additional space in the Garden may enable the botanists to expand their work on economically important plants.

238

PITTMAN, ALBERT B.,¹ VERNON BATES,² and LANCE PEACOCK.² Arkansas Natural Heritage Commission¹ and the Arkansas Nature Conservancy²--A very distinctive new species of Compositae (Heliantheae) from the Ouachita Mountain Region of Arkansas.

Beginning in April of 1988 an intensive field survey of the Ouachita National Forest was undertaken with the combined efforts of the Arkansas Natural Heritage Commission, the Arkansas Nature Conservancy, and the U.S. Forest Service. Both rare plant occurrences and significant plant communities were mapped and described. In early October of 1988, during fieldwork along the Little Missouri River in southwestern Arkansas, the senior author noticed an unusual composite growing abundantly in an open area of novaculite talus. The plants, approaching two meters in height and exuding a pungent odor, were often directly attached to bare rock surfaces by both adventitious and thickened secondary roots. Also present in the talus were Ambrosia trifida, Hybanthus concolor, Phytolacca americana, Rhamnus carolinianus, Bumelia lycioides, Asimina triloba, and several abundant woody vines, Toxicodendron radicans, Vitis rotundifolia, Campsis radicans, and Parthenocissus quinquefolius. The overstory on the terrace below the talus slope consisted primarily of Fagus grandifolia, Carpinus caroliniana, Magnolia tripetala, and Ilex opaca, while Quercus muhlenbergii, Liquidambar styraciflua, Ostrya virginiana, and Celtis laevigata occurred on the adjacent drier slopes. Even though the plants were strikingly similar in general appearance to Polymnia (both canadensis and laevigata), several differences were immediately evident. This botanical survey of the Ouachita National Forest was supported by grants from the Arkansas Nature Conservancy and the U.S. Forest Service.

239

JONES, RONALD L. Eastern Kentucky University--The vascular flora of wetlands on the Cumberland Plateau of Tennessee.

During the summer of 1987 a floristic survey was conducted on the Cumberland Plateau of Tennessee. The objectives were to survey wetland sites, describe the communities, document the species, locate rare plant populations, determine geographic affinities of the species, and prepare distribution maps for selected species. Over 60 sites were studied and classified into 4 categories: aquatic beds, emergent wetlands, shrub swamps, and forested wetlands. A total of 367 species were documented, with the largest families being the Cyperaceae (51 species), Asteraceae (39), and the Poaceae (38). The largest genera were Carex (25 species), Panicum (15), and Juncus (13). Thirty-six of the species were primarily Coastal Plain in distribution, and thus represented disjunct populations on the Cumberland Plateau. These Coastal Plain species included the following taxa considered to be rare in the state: Woodwardia virginica (L.) Smith, Platanthera integra (Nutt.) Gray, Lobelia canbyi Gray, and Zigadenus leimanthoides Gray. New sites were reported for 15 of

Tennessee's listed rare species. Rare species were found in all four habitat types but were least common in the aquatic beds. Coastal Plain species were more common in emergent wetlands and aquatic beds than in shrub swamps or forested wetlands.

240

STALTER, RICHARD¹. and ERIC LAMONT². St. John's University¹ The New York Botanical Garden²--Vegetation of Assateague Island, Virginia.

The vegetation of Assateague Island, Virginia, a barrier island located at 37° 55'N, 75° 00'W off the eastern shore of the DelMarVa peninsula was sampled from October 1986 to October 1988. The vascular flora consists of 89 families, 265 genera, and 414 species of which 318 are native. The Poaceae with 37 genera and 77 species and Asteraceae with 36 genera and 56 species are the largest families. Other large families are: Cyperaceae (9 gen., 22 spp.), Fabaceae (7 gen., 18 spp.), Rosaceae (10 gen., 14 spp.), Chenopodiaceae (6 gen., 10 spp.), Brassicaceae (7 gen., 9 spp.), and Scrophulariaceae (7 gen., 9 spp.). The largest genera are: Panicum (15 spp.), Juncus (7 spp.), Eupatorium and Cyperus (both with 6 spp.), and Aristida, Festuca, Trifolium and Plantago (each with 5 spp.). Seventy nine species are present in the dune and swale community, 107 occur in the forest community (including freshwater wetlands), 37 occur in the salt marsh community, while the great majority, 191, occur in various disturbed habitats.

241

SUTTON, PAT and RICHARD STALTER. St. John's University--The vegetation of Cape May Point State Park, New Jersey.

Cape May Point State Park encompassing ± 94 hectares is located on the Cape May peninsula, New Jersey (38 53N 74 53 W). The vegetation of the Park was collected from May 1984 to October 1988. Three hundred fifty five taxa in 83 families have been identified. The Asteraceae (63 species) and Poaceae (58 species) are the largest families in the flora. Other families with large numbers of species are Fabaceae (26 species), Rosaceae (15 species), Brassicaceae (13 species) and Cyperaceae (10 species). The largest genera are Panicum (11 species), Solidago (9 species) and Juncus (9 species). One-hundred five species (27 percent) are not native to the United States. Two species are endangered 5 species are rare and 4 are designated Special Concern for New Jersey (Snyder and Vivian 1983 or Snyder 1984). The vegetation and ecology of 5 major community types: forest, shrub thicket, old field, dunes/beach and marshes will be discussed.

242

MORRIS, M. WAYNE. University of Florida—New reports of rare, threatened, or endangered vascular plants from northern Mississippi.

Recent field studies in northern Mississippi have resulted in discoveries of 37 rare, threatened, or endangered species of plants, as well as populations of four taxa previously unknown in Mississippi: Equisetum arvense, Dryopteris X australis, Cyperus lancastricensis, and Angelica atropurpurea. The following regions were surveyed: Yazoo-Mississippi Delta Region in northwestern Mississippi; Loess Bluff Region, North Central Plateau Region, and eastern extremity of the Yazoo-Mississippi Delta Region in Grenada County in north central Mississippi; and the transition area of the Pontotoc Ridge and Black Prairie regions in Oktibbeha County, located in the northeastern quarter of the state. New reports of vascular plant species with a rare, threatened, or endangered status in the state include: Carex gracilescens, C. stricta, Lilium superbum, Melanthium virginicum, Nemastylis geminiflora, Cypripedium pubescens, Platanthera cristata, P. lacera, P. peramoena, Spiranthes ovalis, Juglans cinerea, Schisandra glabra, Lindera melissifolia, Apios priceana, Pachysandra procumbens, Celastrus scandens, Euonymus atropurpureus, Staphylea trifolia, Panax quinquefolium, Fraxinus quadrangulata, and Aster puniceus. Pertinent data on populations of these plants have been forwarded to the Mississippi Natural Heritage Program (MNHP) so that their demographic status can continue to be monitored. This work was supported in part by the Mississippi Wildlife Heritage Fund Research Grant Program.

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ASB CANDIDATES FOR OFFICE—1989

The Nominating Committee composed of C. J. Biggers, C. R. Hupp, and Donald J. Shure, Chairman, has selected the following slate of nominees for the ASB offices to be filled in 1989. Additional nominations will be received from the floor. Voting will take place at the Annual Business Meeting 7 April 1989 (Friday) at 11:30 A.M. Please plan to attend.

President-Elect: **Frank P. Day**, Old Dominion University, Norfolk, VA
Rudolph Prins, Western Kentucky Univ., Bowling Green

Vice-President: **Sandra T. Bowden**, Agnes Scott College, Decatur, GA
Courtney T. Hackney, Univ. of North Carolina at Wilmington

Executive Committee: **James Fralish**, Southern Illinois Univ., Carbondale
(Two Positions) **Ken R. Marion**, Univ. Alabama at Birmingham
Raymond D. Semlitsch, Memphis State Univ.
Donald C. Tarter, Marshall Univ., Huntington, WV

PRESIDENT-ELECT



Frank P. Day



Rudolph Prins

Frank P. Day—Dr. Day is Professor of Biological Sciences and Director of the Ecological Sciences Ph.D. Program at Old Dominion University in Norfolk, Virginia. He received his B.S. (1969) in Botany from the University of Tennessee, Knoxville and M.S. (1971) and Ph.D. (1974) in Botany Ecology from the University of Georgia. Dr. Day's research interests center around productivity and nutrient cycling in forested ecosystems. His current research is focused on the effects of hydroperiod

on below ground dynamics in wetlands. His graduate research was conducted at Coweeta Hydrologic Laboratory in North Carolina, and since joining the Old Dominion faculty in 1974, he and his 18 M.S. and 3 doctoral students have carried out projects in the Great Dismal Swamp, at the Savannah River Ecology Laboratory, and in the Sudan. Dr. Day has been an active member of ASB and is currently serving as Vice-President of ASB (1988), Chair of the Southeastern Chapter of the Ecological Society of America (1988–90), and Vice-Chair of the South Atlantic Chapter of the Society of Wetland Scientists (1987–89). He is a member of the ASB Student Research Award Committee (1987–90) and the ESA Program Committee (1988–90). He has served as Vice-Chair of the SE Chapter of ESA (1983–85) and Secretary, Vice-Chair and Chair of the Botany Section of the Virginia Academy of Science (1981–84). He is also a member of the Botanical Society of America, the Torrey Botanical Club, the Southern Appalachian Botanical Club, and the American Institute of Biological Sciences.

Rudolph Prins—Dr. Prins is Professor of Biology at Western Kentucky University, with special interests in Invertebrate Zoology. He received his B.A. from Calvin College in Grand Rapids, MI (1958), M.A. from Western Michigan University, Kalamazoo (1962) and Ph.D. from The University of Louisville (1965). He was Assistant Professor of Entomology and Zoology at Clemson University from 1965–68, after which he joined the faculty at Western. He has been on the teaching staffs of The University of Oklahoma Biological Station on Lake Texoma (2 summers) and the Upper Cumberland Biological Station Consortium on Center Hill Reservoir in Tennessee (14 summers) where he taught courses in Freshwater Invertebrates, Limnology and Stream Ecology. He is currently Western's representative on the consortium board. As a Fellow of the Organization of American States and Guest Professor of Zoology at The University of Austral de Chile, Valdivia, Chile in 1984, he worked on characterizing streams in southern Chile and taught a course in Freshwater Invertebrates. He has conducted short courses in Marine Invertebrates in the Florida Keys and on San Salvador Island in the Caribbean (11 years). As reflected by more than 18 publications, his research interests have focused on taxonomy and ecology of aquatic invertebrates, particularly crustaceans. He has served in several offices of the Kentucky Academy of Science, including Secretary, Vice President, and President. Since becoming a member of ASB in 1963, he has been active on various ASB committees, including the Executive Committee (1977–79).

VICE-PRESIDENT

Sandra T. Bowden—Dr. Bowden is Professor of Biology and former Chair of the Department of Biology at Agnes Scott College, Decatur, Georgia. She received a B.S. from Georgia Southern College and the M.A. and Ph.D. (1968) in botany from the University of North Carolina at Chapel Hill. Dr. Bowden has been a member of ASB for many years. Recently she served as Chair of the Meritorious Teaching Award Committee, and she was ASB Secretary from 1985–88. She is a member of Sigma Xi, the Botanical Society of America, the Southeastern Branch of the American Society for Microbiology, AIBS, and AAAS. Research interests include the developmental biology of *Polytrichum commune*, plant tumor induction by *Agrobacterium tumefaciens*, and, currently, the microbial ecology of granite outcrop communities. In August 1988, Dr. Bowden and colleagues at Agnes Scott were awarded matching funds by the National Science Foundation for instrumentation and laboratory improvements in the areas of cellular and molecular biology.

Courtney T. Hackney—Dr. Hackney is a Professor of Biological Sciences at the University of North Carolina at Wilmington. He received his B.S. from the University of South Alabama, his M.S. from Emory University, and his Ph.D. from Mississippi State University. He has conducted research on the Atlantic, Gulf, and Pacific coasts on a range of ecological topics involving coastal communities. His interests are varied and range from the response of tidal marsh communities to fire and oil spills to invertebrate taxonomy. Dr. Hackney has served on various ASB committees including a term on the Executive Committee (1984–87). In addition, he has served as vice-chairperson of the Southeastern Section of the Ecological Society (1985–87), Vice President (1985–86), and President (1986–87) of the Society of Wetland Scientists, Associate Editor of *Estuaries* (1978–83) and Associate Editor of *Wetlands* (1981–86). He is currently the Technical Editor for *Wetlands* and is an Associate Editor of the Aquatic Volume of Biotic Communities of the Southeastern United States. He served as Program Committee Chairperson for three national meetings of the Society of Wetland Scientists and for the 1979 Gulf Estuarine Research Society Meeting. He has published numerous papers in refereed scientific journals, but considers his greatest accomplishment the success of his undergraduate and graduate students.

EXECUTIVE COMMITTEE

James S. Fralish—Dr. Fralish is an Associate Professor of Forest Ecology and has been on the faculty of Southern Illinois University, Carbondale, since 1969. He received B.S. and M.S. degrees in Forestry from Michigan State University and a Ph.D. in Botany (plant ecology and soils) from the University of Wisconsin, Madison. He previously taught at Wisconsin State University—Stevens Point. A member of ASB since 1973, he received the Faculty Research Award in 1986 and is Chairperson of the Faculty Research Award Committee. Research projects have included studies of National Natural Landmarks in the Central Lowlands, wilderness on the Shawnee National Forest, fire in prairie restoration and on forest communities in southern Illinois, Kentucky, and Tennessee. He presently is a consultant for the Center for Field Biology—Land Between The Lakes, Austin Peay State University and co-principal investigator for the Holcomb Research Institute—SIU central states gradient study on acid precipitation. Publications have appeared in *American Midland Naturalist*, *Journal of Forestry*, *Canadian Journal of Forest Research*, and the *Illinois Academy of Science*. He initiated the Central Hardwood Forest Conference and edited the proceedings of the first conference at SIU. He is currently a member of the ESA Certification Committee.

Ken R. Marion—Dr. Marion is Professor of Biology at the University of Alabama at Birmingham. Ken received his B.S. and Ph.D. in Biology from Washington University (St. Louis) in 1966 and 1970. He was a Visiting Assistant Professor at the University of Missouri at St. Louis for one year before joining the Biology Department at UAB. His main research interests center around population dynamics and reproductive biology, primarily of reptiles. Peripheral research interests include biological indicators of estuarine disturbance. He is a member of 13 professional societies and has published 50 scientific papers in numerous journals, including *Ecology*, *Oecologia*, *Copeia*, *Herpetologica*, *Journal of Herpetology*, and *The Bulletin of Marine Science*. He is a past president of the Southeastern Division of the American Society of Ichthyologists and Herpetologists and has served on the Board of Trustees for the Alabama Academy of Science. A member of ASB since 1972, he has presented numerous papers at the meetings and is the current chairman of the Student Research Award Committee.

Raymond D. Semlitsch—Assistant Professor of Biology at Memphis State University, Memphis, Tennessee. He received a B.A. (1975) in Biology at State University College at Buffalo, a M.S. (1979) in Zoology at the University of Maryland, and a Ph.D. (1984) at the University of Georgia. He was a Post-doctoral Research Associate at Duke University from 1984–86. Since 1986 he has been an Assistant Professor of Biology at Memphis State University. His research focuses on the evolution and maintenance of complex life cycles, especially population differentiation due to local environmental conditions. He has been the Associate Editor of Ecology and Behavior for *Herpetologica* since 1986, he is on the Board of Governors for the American Society of Ichthyologists and Herpetologists (1986–90), and has served as an officer in the Southeastern Division of ASIH (Secretary-Treasurer 1986–87, Vice-president 1987–88, President 1988–89). He is a member of seven national scientific organizations and served as an ad hoc reviewer for National Science Foundation and 10 scientific journals. Finally, he is the author of 46 reviewed scientific papers and book chapters.

Donald C. Tarter—Dr. Tarter is Professor of Biological Sciences at Marshall University, West Virginia. Donald received his B.S. in Biology and Chemistry from Georgetown College, his M.A.T. in Zoology from Miami University, and his Ph.D. in Zoology from the University of Louisville. His research interests are in the taxonomy and ecology of benthic macroinvertebrates and fishes. He has authored/co-authored 96 papers in aquatic biology. Donald has served as the thesis advisor for 65 M.S. students. He regularly attends ASB meetings and has presented 18 papers in aquatic biology. He has served on the ASB Awards Committee (Chairman, 1984–85) and the ASB Committee for Graduate Student Awards. Additionally, he served as Chairperson in aquatic biology sections (1982, 1986). At Marshall University, he was presented the outstanding research board award in the College of Science between 1977–79 and 1984–86. He is a member of eight professional and honorary societies. He is a reviewer for *Entomological News* and an Associate Biology Editor for the West Virginia Academy of Science. He is the President-Elect of the West Virginia Academy of Science.

REVIEWS

Ruppert, Edward E. and Richard S. Fox. 1988. Seashore Animals of the Southeast. University of South Carolina Press, Columbia, SC. \$34.95 (cloth); \$24.95 (paper). 429 p.

This is an exciting book. The illustrations, helped immeasurably by the many colored plates, have aided the quick identification of many of the common invertebrates found on our southeastern Atlantic coast. For one like myself, who in becoming specialized with a particular group has lost an awareness of many other possible interacting groups, it is stimulating to suddenly see identified, illustrated invertebrates, familiar and common to our faunas, about which I knew little or was unable to identify. The stated purpose of this guide is to popularize an interest in coastal invertebrates and, by stimulating such an interest, to gain increased support for safeguarding our threatened marine ecosystems.

I recommend the book strongly as a high-school or college reference-text for biology, invertebrate, and marine ecology courses; as a text in college-graduate level marine invertebrate courses; and to anyone interested in the marine ecology of our southeastern and neighboring Atlantic coastal regions. I agree with its advertisement that it can be "an indispensable guide and reference for all seashore enthusiasts including beachcombers, fishermen, natural history lovers,"

The book deals specifically with the shallow-water invertebrate fauna of the Atlantic portion of the Carolinian Province but is also useful in the Gulf of Mexico, the Florida transition zone, and the Virginian Province. The Carolinian Province concepts of the authors are simplified traditional ones that have the province as extending from Cape Hatteras to Cape Canaveral and on the Gulf of Mexico coast from Florida to west Texas. The Gulf of Mexico coast area is not covered in this book.

Approximately 370 common Carolinian Province invertebrates are shown with original illustrations; 140 are in color, 110 are figured drawings, and about 128 species are black and white photographs. There is some overlap and a few of the black and white photographs are of little aid in identification. Illustration methods are shown. To me, one of the most exciting features of the book is that almost 40 figures and plates, some in color, show groups of species in their own symbiotic relationships.

Eight parts comprise this book: Illustrated Key to Seashore Animals; Identification; Major groups of Marine Animals; Water, Currents, Waves and Tides; Marine Ecology; Glossary; Selected References; and Animal Classification. An index is also present.

The "Illustrated Key," using 18 steps, has grouped the marine organisms by their overall appearance. Each step is represented by a number of boxes, each containing a figure of a specific group. With each of the 81 figured possibilities, a few characteristics may be given, the group named, and an appropriate reference page included. This section has been well thought out and should be of immense aid in separating animals within the higher taxa—phylum, class, or order. The key was not intended to and will not separate out the lower taxa—genus or species.

The "Identification" section comprises the major portion of the book. Animal groups are presented in a classification scheme based on the "Animal Classification" section found at the end of the book. A few species in each of the animal groupings, common to the southeast Atlantic coastal fauna, are illustrated and their identifications discussed. Similarities with less common closely related species are frequently addressed. Notes on the biology or ecology of these species and associated species are provided. A considerable portion of these notes stem from observations made by the authors. These notes frequently relate to observed interrelationships between the various species and species in other taxa. Specific figures, placed within the discussion of each species or species group, are rarely referred to by number unfortunately.

To this reviewer, two areas of the "Identification" section are most significant. The material on sea slugs was especially interesting as it included many recent ecological observations on these poorly understood molluscs. Color photographs of eight different nudibranchs and sacoglossa plus a discussion relating to 21 different southeastern Atlantic nudibranch and sacoglossan species made this especially outstanding. Noteworthy also, in the main body of this book, are the many comments or observations on symbiotic relationships present between many of the invertebrates.

The remaining sections were placed following the "Identification" section as additional material for the serious reader who wishes more information than contained in the "Identification" section. Figures, some repeated from the "Identification Key," aid the "Major Groups of Marine Animals" section.

The "Selected References" section presents a taxonomic and distributional listing that is helpful in going beyond the identifications possible in this book.

The order used in the "Animal Classification" section is arranged phylogenetically reflecting "the evolutionary relationships of the invertebrates as perceived by the authors"; genus and species within each family are arranged alphabetically. This method is opposed to conventional listings which are arranged phylogenetically from the most primitive to the most advanced forms. There are some minor differences between the order in the "Identification" and the "Animal Classification" sections versus the "Major Group" section.

There are not nearly enough cross-references within the main body of the book. Comments on a species relating to its association with a species in another group frequently include no reference page or figure number to the latter species. True, these page or figure numbers are in the index, but, repeated attempts to find the correct reference number from several possibilities in the index often downgraded my interest in that section.

There is no way to differentiate between original observations of the authors and information from the published literature. It is realized that the flow of the writing is considerably smoother without frequent interruptions of who found what and where. However, many readers are interested in who published various observations, particularly those made in areas that they, the readers, have low expertise.

Several headings are not as inclusive as they should be—note pages 78, 116, 218, 228; i.e. page 116 here *Conus delessertii*, *Pleuroploca gigantea*, and *Phalium granulatum* are placed under the heading "Marginellas."

The authors are to be commended for this fine book. They are well respected marine invertebrate ecologists and teachers. Their stated purposes for the book are well fulfilled. The listing of biologists and systematists who reviewed appropriate sections of this guide is impressive. This book is an excellent description of our southeastern coastal Atlantic fauna and its interrelationships. If I were teaching courses in malacology or marine ecology, I would use it as a required text. Having observed the authors in the field and viewed many of their molluscan notes, I am impressed by the meticulousness of their observations. It is hoped that the authors will continue in their ecological observations of the southeastern Atlantic invertebrate fauna and add their findings to subsequent editions of this book.

HUGH J. PORTER, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Duncan, Wilbur H., and Marion B. Duncan. 1988. **Trees of the Southeastern United States.** University of Georgia Press, Athens, GA. \$19.95. 322 p. 281 color photos; distribution maps.

The Duncans have again written an excellent book on the plants of the southeastern United States. They are also coauthors of the "Smithsonian Guide to Seaside Plants" and Wilbur is coauthor with Leonard E. Foote of "Wildflowers of the Southeastern United States."

Described as a manual for identification of trees reproducing naturally in the southeastern United States, this book admirably fulfills the purpose. It covers 306 different trees regularly found in the area. Easy-to-use identifying keys, utilizing leaf and stem characters, lead the user to 11 major groups of trees. A key to the genera included in each group, also based on vegetative character, separates the genera and additional keys identify the species. The use of leaf and stem characters is especially helpful because flowers and fruits are often unavailable.

Identification of most trees can be confirmed by the 281 excellent color photographs selected to show identifying features. A description of each species is given along with information on the tree's abundance, habitat, and flower or pollen-shedding period. Additional information on certain species include value to wildlife, uses by humans, and susceptibility to disease, insects, and fire.

Technical terminology is avoided, when possible, and a complete glossary is provided making the book very useful to persons not familiar with botanical keys and descriptions.

Distribution maps of most species show the range in adjacent states and Canada. When appropriate, distribution dots are placed in a specific location within a state. This helps one to see the distribution along higher mountains, etc.; smaller dots are used to show rare distributions within a state.

The book is printed with easy-to-read type on high quality paper. It is durable enough to withstand

field work. It is a beautiful, well-written book that will be a valuable addition to the libraries of both amateur and professional botanists.

ROY B. CLARKSON, *Biology Department, West Virginia University, Morgantown, WV 26505.*

Grainge, Michael, and Saleem Ahmed. 1988. **Handbook of Plants with Pest-control Properties.** John Wiley & Sons, New York, NY. \$44.95. 470 p.

For those who are wary of synthetic pesticides, this volume is a godsend. It provides valuable information about 2,400 plant species which contain natural plant products effective in controlling a wide variety of pests. Although they have not yet been tested an additional 1,000 plants are listed because their poisonous or medicinal compounds may also act as pest-control compounds. The data are based upon literature references gathered from around the world.

Section I is a list of plants with pest-control properties; Section II is a list of pests and the plants which reportedly control them; and Section III is a list of plants that are poisonous or medicinal. Section I contains a list of 41 plant species which have broad-spectrum pest control. Sections II and III are simply lists. Section I contains detailed coded information about 2,400 plant species. Among these is the broad-spectrum species *Melia azedarach*, commonly called "Chinaberry" and widely escaped from cultivation in the southeast United States. Fifty-four pests have been effectively controlled by "Chinaberry," including such general categories as cockroaches, fleas, and termites. Literature citations are provided for each claim. By using codes, further information may be gained: activity is maintained in the field for two weeks; an aqueous extraction, or powdering of the plant, or chemical extraction with petroleum ether may be used; application is by surface spreading, dusting onto the crop, or mixing with stored products; it is an oral poison; economical uses are for making tools, providing medicine/drugs, making soap, wood carving/carpentry, and beads for jewelry; and leaves and fruits are used medicinally. Five references indicate that active ingredients are alkaloids (azadirine, margosine, etc.) found in bark, stems, leaves, fruit and seeds. Six other references refer to "Chinaberry" as an antinematode, antiviral-X, fish poison, and poisonous.

The print was obviously computer generated. Fortunately, a high quality printer was employed. Unfortunately, the type style chosen was not proportional and names in bold print are difficult, but not impossible, to read. The only typographical error noted was a misspelling of 'calcareous' in the coding about problem soils to which the plant species is adapted. The information was accurate and apparently thorough for the 10 random species that were checked. It would have helped to have had a heavy quality removable insert page with the codes listed so one would have the coded information immediately available and remove the present need to flip back and forth as one reads.

This volume should be useful for integrated pest management, to consultants for Third World agriculture, to those who are concerned with growing fruits and vegetables without synthetic pesticides, as a supplement to Kingsbury's *Poisonous Plants*, and as an excellent reference volume.

LITERATURE CITED

Kingsbury, John M. 1964. *Poisonous Plants of the United States and Canada.* Prentice-Hall, Inc. Englewood Cliffs, NJ. 626 p.

NANCY CRAFT COILE, *Department of Botany, University of Georgia, Athens, GA 30602.*

Anderson, Paul J., and Scientific Illustration Committee. 1987. **Illustrating Science: Standards for Publications.** Council of Biology Editors, Bethesda, Md. \$49.95. 296 p.

The primary consideration of the reviewer offering an appraisal of this book is the degree to which it fulfills its purpose, that of aiding the scientist who is preparing to publish information gained through investigations. Overall, it has done a good job.

It begins with a complete listing of all the steps involved—the planning of the manuscript and illustrations, consultations with illustrator and photographer, preparation of manuscript and artwork, sending to editor for review and finally to printer for printing. A description of the publishing process is given with insight into the various printing methods and papers used. Readers are made aware of mistakes to be avoided which ultimately result in higher printing costs.

Much space in this book is devoted to the preparation of illustrations and photographs. Guidelines and criteria are listed by which all artwork is judged. A listing of illustrative techniques and media is given as well as a discussion of the use of color in illustrating. Advantages of using a drawing instead of a photograph are discussed and a section on the use of lettering in illustrations describes different types of lettering, lettering techniques, and the need to consider reduction in printing when lettering art work.

The book has a section on the preparation of graphs and maps that lists the many types of charts, graphs, and maps used. Simplicity of design is encouraged, and that may be the reason why a description of the three dimensional graph is omitted. This reader feels that there are times, however, when three ratio scale variables need be presented in one graph and a three dimensional graph is necessary.

Computer graphics are explored in depth, with present capabilities compared to future possibilities. The authors note the rapid advancement in computer graphic technology that makes expensive systems quickly obsolete. Advantages of using computer graphics are listed as: speed in graphing information and flexibility in changing graphic design and lettering. It also allows researchers the capability of viewing data sets in a comprehensive way not previously available. Advantages have to be weighed against limitations in illustrative quality rendered by current systems.

A chapter on camera ready copy and the desktop publishing system explains the meaning of the terms and how they result in publishing costs savings. In a chapter on continuous tone photographs and halftone printing, the authors discuss tone reproduction from a photographic viewpoint, prints from color slides, cathode-ray tube photography, and photographic prints from radiographs. In a chapter on color illustrations, color reproduction is dissected into the various steps involved in reproducing colored artwork. Readers learn why some colors rendered by the artists cannot be duplicated by the printer.

Illustrating Science will be a valuable addition to every scientific library. It is illustrated throughout with a variety of good, scientific illustrations and photographs which greatly compliment the printed matter. Because the book has been prepared by a committee of experts in the publishing and printing field, it draws on the knowledge and skills of many individuals instead of just a few. This is its greatest asset.

HERBERT R. GORDY, *Scientific Illustrator, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Beaufort, NC 28516.*

Carter, J. G. et al. 1988. **Fossil Collecting in North Carolina.** Department of Natural Resources and Community Development, Geological Survey Section, Raleigh, NC. \$5.25 tax included. 89 p.

At last, a delightful and thoroughly comprehensive 8½ × 11", 89 page publication on fossil collecting in North Carolina, fulfills the needs of the student, layman, geologist, and amateur fossil hunter. For far too many years questions have persisted unanswered of where can I go in search of fossils in North Carolina, where are the best beds or formations, what fossil is this or how old is this fossil. Comments on fossils and fossilization lead into finding and collecting fossils. A list of references on identifying fossils is enhanced by a six page glossary of terms while an eight page bibliography directs the reader to other pertinent works on invertebrate and vertebrate fossils. Little is said about plant fossils, other than two ferns are depicted, or of fossil sites in the western part of the state. We are enlightened by information on the stratigraphic record and the fossils one finds associated with various epochs: Eocambrian through Late Pleistocene. Thirty-four selected good collecting sites, located in the Piedmont and Coastal Plain of North Carolina, are treated by age and formation, access, fossils expected, and references for further reading. A quadrangle map helps the fossil hunter easily locate each locality and collecting site. Comments also indicate whether access is best by foot or boat. The back outside cover locates each discussed locality on a state-county map. Two pages detail 11 museums or Universities where fossil collections are stored or may be viewed by the public. All is climaxed by 10 plates of fossils, organized by epoch from oldest to the youngest. Few figures are duplicated, i.e. *Procarcharodon auriculatus* appears twice because that shark's teeth can be found in two different fossil strata. Lastly, for those who have a hard time remembering the sequence of or which epoch is younger or older, the back inside cover graphically depicts all the epochs treated by age, species, and includes the extent of the formation, from south to north, along with site numbers that cross reference to the localities in the text.

What more can be said except get out there and have fun collecting fossils before you become one

yourself. Be sure to respect property rights (as the authors caution) so you and others can continue to enjoy future fossil excursions. I recommend this book highly, not only because of its contents and price, and predict that it will serve as a model for similar information productions, so badly needed, in adjacent states of the southeast and the Atlantic Coast.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Frankel, M. S. (ed.). 1988. Science, Engineering, and Ethics: State-of-the-Art and Future Directions. AAAS Office of Scientific Freedom and Responsibility. 1333 H St. N.W. Washington, DC 20005. Free. 100 p.

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

FLORIDA

University of Florida, Department of Botany. Dr. William Louis Stern has recently been elected Treasurer of the Society for Economic Botany. George E. Bowes was elected a Fellow of the Institute of Biology in the United Kingdom, and received a \$100,000 grant from the USDA for work on "CO₂ Concentrating Mechanisms in Photosynthesis." Francis E. Putz served as co-organizer of an international symposium on "The Biology of Vines" at Puerto Vallarta, Mexico. John J. Ewel was one of three university-wide recipients, of the Distinguished Faculty Award, given annually by Florida Blue Key.

KENTUCKY

Western Kentucky University, Department of Biology. Dr. Blaine R. Ferrell, Associate Professor, has been named the first recipient of the L. Y. Lancaster Professorship. The honor, which is set for five year renewable terms, provides unrestricted use of funds from an endowment to support research, travel, student help or other scholarly activities in biology. The professorship was established by former students, friends and alumni in honor of the late L. Y. Lancaster, who was a significant developer of the pre-med and basic biology programs at the University, during his tenure at the Bowling Green campus from 1923 to 1960. Dr. Ferrell joined the faculty in 1978. His Ph.D. is in Zoology from Louisiana State University.

LOUISIANA

Louisiana State University, Department of Botany. Dr. Janet Deough, a research associate with the Botany Department, has taken a position with the U.S. Fish & Wildlife Service, National Wetlands Research Division, Slidell, Louisiana. Dr. Jim Grace has become the new Chairperson of the Ecological Section of the Botanical Society of America. Susan Langevin was the winner of the 1988 Best Student Paper Award for the Ecological Section of the Botanical Society of America. Her paper "Hybridization between red rice and cultivated rice (*Oryza sativa* L.)" was presented at the AIBS meetings and was co-authored by Dr. Jim Grace and Dr. Keith Clay (Indiana University). Dr. G. Bruce Williamson and Dr. Nikolaus H. Fischer (Chemistry) received \$185,000 from the Department of Agriculture, for a project entitled "Mechanisms of allelopathy in pine forests of the Southeastern Coastal Plain."

MISSISSIPPI

Delta State University, Department of Biological Sciences. Dr. William Hayes has joined the faculty as an Associate Professor. He received his Ph.D. from Texas A&M University. Dr. Hayes' area of expertise is behavioral and physiological ecology with special interest in crayfish. His teaching emphasis is in comparative physiology. Dr. John D. Tiftickjian assumed the duties of the *Journal of the Mississippi Academy of Sciences* as of 1 July for the 1989 volume.

Gulf Coast Research Laboratory, Ocean Springs. GCRL has received \$125,856 from the National Marine Fisheries Service to continue the Mississippi Gulf Coast Monitoring and Assessment Program. Dr. Thomas D. McIlwain and Dr. Robin M. Overstreet are the principal investigators. The Laboratory is embarking on a new cooperative project with Mississippi Power Co., the Bureau of Marine Resources, and the Sea Grant Advisory Service, to determine if a mixture of coal ash and concrete can replace

clam shells as a low cost alternative for building oyster reefs. *Dr. Lionel N. Eleuterius*, head of the botany section, will be inducted into the Mississippi Gulf Coast Community College Hall of Fame on 5 November 1988. *Dr. Stuart G. Poss*, head of the systematic zoology section, is in Japan conducting research on the systematic biology of scorpionfishes in conjunction with ongoing research funded by the National Science Foundation.

Dr. Joanne Lyczkowski-Shultz, assistant biologist involved in ichthyoplankton research spent the month of September in Poland as part of a scientific exchange program. *Dr. Thomas F. Lytle*, analytical chemistry section head, and *Dr. Julia S. Lytle*, head environmental chemistry section, are currently conducting research on Omega-3 fatty acids in Gulf of Mexico seafood, as part of a three-year study funded by a \$220,095 grant from the National Marine Fisheries Service. These fatty acids found in fish oils are reported to minimize the risk of heart disease by lowering the cholesterol and triglyceride levels in the blood.

NORTH CAROLINA

The University of North Carolina at Charlotte. *Dr. Larry J. Leamy* became chairman of the Department of Biology on 1 July 1988. *Dr. Leamy* works in population genetics and evolution. He previously served as Chairman of the Department of Biology at California State, Long Beach.

The Department is saddened to announce the death of *Dr. Russell L. Kologiski* on 4 December 1988. *Rusty* was an adjunct professor in the department, teaching courses in endangered species as well as directing the biology component in the Math-Science Education Center.

TENNESSEE

University of Tennessee, Department of Ecology. *Dr. Frank McCormick* was appointed Honorary Research Professor of the Nanjing Botanical Garden, People's Republic of China. *Professor Li, Qing-Kai*, of the Chinese Academy of Sciences, made the presentation during opening ceremonies of the International Symposium on Botanical Gardens held in Nanjing, September 1988. This appointment reflects extensive and enduring cooperation in teaching and research involving faculty and students of the University of Tennessee and several institutions in China.

ABOUT MUSEUMS AND BOTANICAL GARDENS

GEORGIA

The Columbus Museum, Columbus. The grand opening of the second largest Museum in Georgia will open its doors to the public in April 1989. The official Grand Opening ceremony will be followed by a Family Arts Day festival, which will include traditional Native American dancers, musicians, actors, and other artisans. To commemorate the occasion, an exhibition of national significance will be on display: *Lost and Found Traditions: Native American Art, 1965-1985*. A number of other displays will be on hand throughout the 86,000 square foot facility. The Museum is designed in an Italianate style reminiscent of Classical and Renaissance architectural forms.

Emory University Museum, Atlanta. Activities of the Museum include: ancient art and archaeology from the Mediterranean and Near East; the Americas and Asia, and the Carlos Collection, the largest collection of ancient Greek Art in the Southeast. Also from 8 February 1989 through 13 May, the exhibit "In the Shadow of the Pyramids: The Shelton Expedition to Egypt" will be available to the general public. "The Fragrant Past: Perfumes of Cleopatra and Julius Caesar," will be exhibited from 5 April through 24 June 1989. This show will focus on the research of the Italian chemist who has created seven kinds of perfume used in the first century B.C.

KENTUCKY

Museum of History and Science, Louisville. *Dr. William M. Sudduth* has been elected to a second term as president of the Association of Science Technology Centers. ASCT is composed of 271 science centers and allied institutions around the world. Executive offices are located in Washington, D.C. *Ms. Bonnie Van Dorn* is the Executive Director. The Museum recently announced the eight middle schools selected to participate in a STEAM grant from General Electric Corporation through the

Association of Science Technology Centers. STEAM—Science Teacher Education at Museums—funds are awarded based on the quality of the program proposed for their use. The funds would be used to develop middle-school-age-appropriate discovery activities at the Museum.

LOUISIANA

Lafayette Natural History Museum, Lafayette. The exhibit, "Louisiana: The Insect's Paradise," opens on 23 February 1989 and runs to 28 November 1989. The display will define exactly what an insect is, explore the ways in which insects function in natural communities, and discuss mankind's alliances with these creatures. Also included will be a variety of resident insects in the "insect zoo," hundreds of exotic roaches, insect fossils, and audio/visual elements to demonstrate the color, structure, and adaptation of insects.

MISSISSIPPI

The Crosby Arboretum, Picayune. The Arboretum has received a major grant from the Institute of Museum Services. The grant will be used to establish a permanent system for monitoring changes in the 11 natural areas managed by the Arboretum.

NORTH CAROLINA

The McMillan Academic Greenhouse, part of the Botanical Garden complex at the University of North Carolina at Charlotte, has just completed construction of a tropical rain forest conservatory room. The area contains large artificial rocks constructed out of cement-covered styrofoam and polyurethane and has a small stream flowing through it. It will be planted with selected tropical plants to represent the diverse species and life-forms to be found in the world's disappearing tropical rain forests. Part of the purpose of the new addition is to help call attention to the plight of these endangered forests and to allow study of the types of plants that are found there. The construction was made possible by a gift from long-time supporters and benefactors *Dr. and Mrs. Thomas M. McMillan, of Hawaii.*

APPLICATION FOR ASB MEMBERSHIP

Give copies of this to your students, colleagues, and your school librarian.

Fill out blanks and enclose check or money order for one year's dues and mail to Dr. R. L. Beckmann, Dept. of Botany, N.C. State Univ., Raleigh, N.C. 27695-7612. **Please include phone number on application** _____.

Name in full _____ Date _____

Title _____ Department _____

Institution _____

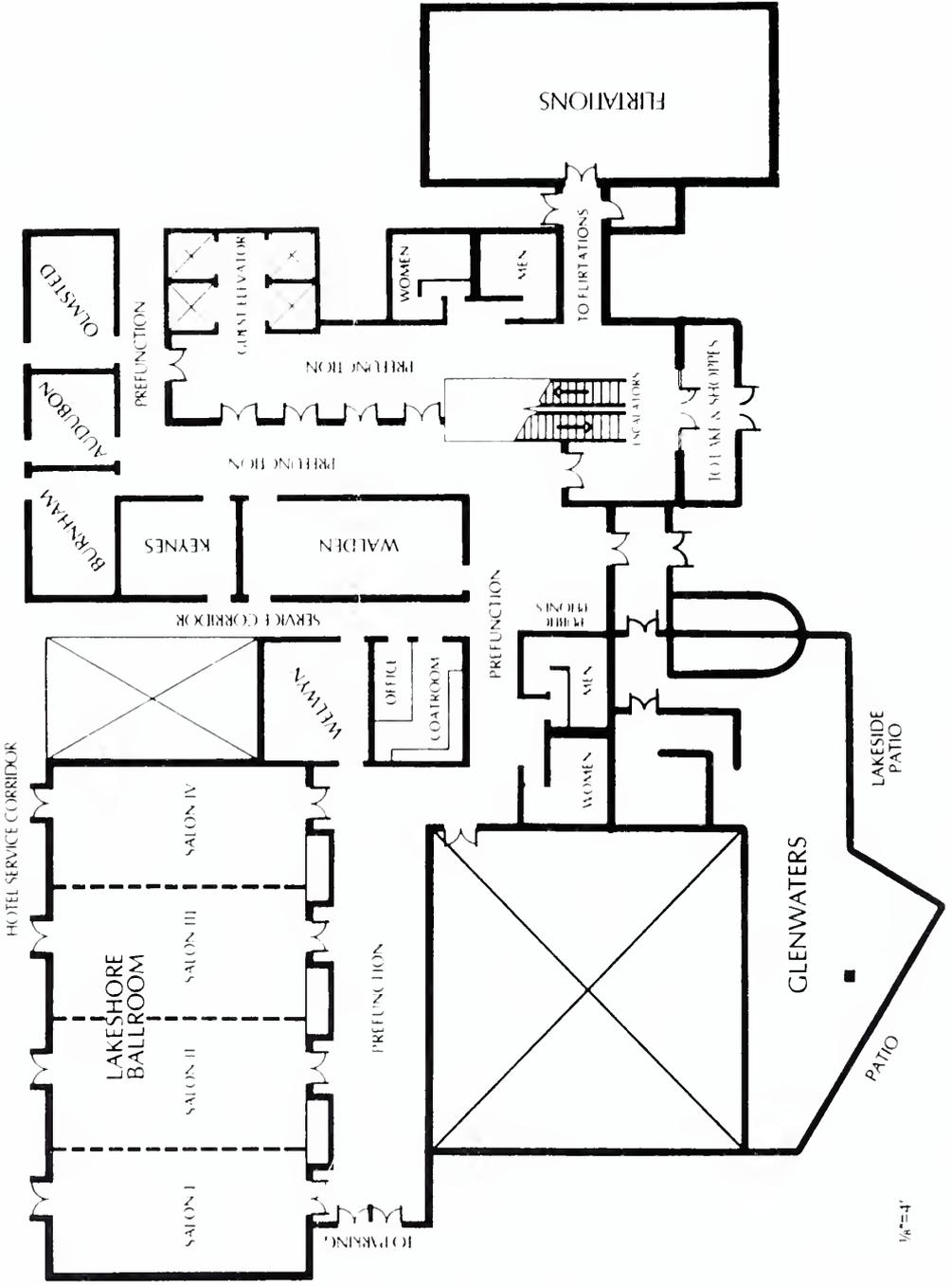
City _____ State _____ Zip _____

Degrees (institutions and dates) _____

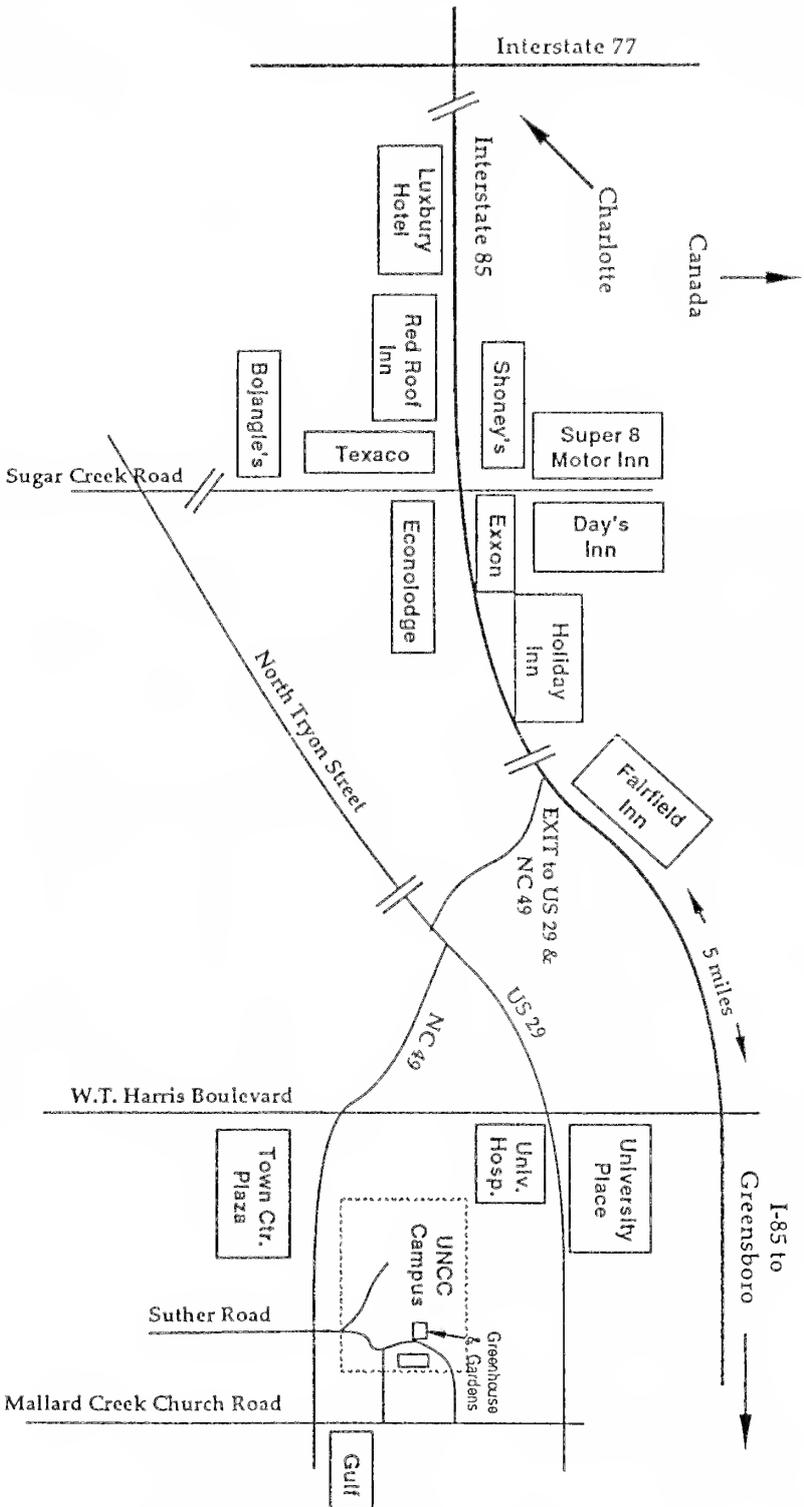
Recommended by member _____

Annual Dues: ___ Regular \$15.00 ___ Graduate Student \$8.00
 ___ Contributing \$50.00 ___ Sustaining \$100.00
 ___ Family \$20.00 ___ Library Subscription \$25.00
 ___ Patron \$300.00 ___ Business Affiliate \$100.00
 ___ Emeritus \$10.00

Optional Enrichment Fund Contribution \$ _____



1/4" = 1'



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59.06

The ASB BULLETIN

Volume 36, Number 3

July 1989



**The Official Quarterly Publication of
The Association of Southeastern Biologists**

ASB BULLETIN
(ISSN 0001-2386)

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News Editor: Jon Fortman, Division of Science and Mathematics, Mississippi University for Women, Columbus, MS 39701

Circulation Manager: Dorothy Hubbard, 2215 Hillthorpe Avenue, Roslyn, PA 19001

OFFICERS OF THE ASB

President — Joe E. Winstead, Dept. Biology, Western KY, Univ., Bowling Green, KY 42101

President-elect — Frank P. Day, Dept. Biol. Sci., Old Dominion Univ., Norfolk, VA 23529

Vice-President — Sandra T. Bowden, Biology, Agnes Scott College, Decatur, GA 30030

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Secretary — C. Ross Hinkle, Bionetics, Bio-2, Kennedy Space Center, FL 32819

Treasurer — Robert L. Beckmann, Department of Botany, North Carolina State University, Raleigh, NC 27695

Archivist — Madeline P. Burbanck, Box 15134, Atlanta, GA 30333

Executive Committee Members-at-Large:

1990: J. Whitfield Gibbons, Savannah River Ecology Lab, Aiken, SC 29802

Diane R. Nelson, East Tennessee State University, Johnson City, TN 37614

1991: Kenneth W. McLeod, Savannah River Ecol. Lab., Drawer E, Aiken, SC 29802

Jim Ross, Dept. Biology, Cumberland College, Williamsburg, KY 40769

1992: James S. Fralish, Forestry Dept. So. Illinois Univ., Carbondale, IL 62901

Ken R. Marion, Biol. Dept., Univ. Alabama-Birmingham, Birmingham, AL 35294

The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1990	April 19-21	Towson State University, Towson, MD
1991	April 10-13	Appalachian State University, Boone, NC
1992	April	University Alabama-Birmingham, Birmingham, AL
1993	April	Old Dominion University, Norfolk or Virginia Beach, VA

PATRON MEMBERS

Breedlove, Dennis and Associates, Inc., Orlando, FL

Carolina Biological Supply Co., Burlington, NC

Martin Microscope Co., Easley, SC

1989 MERITORIOUS TEACHING AWARD.



Dr. L. Frederick presenting the 1989 Meritorious Teaching Award, supported by the Carolina Biological Supply Company, to Dr. J. M. Herr, Jr., of the University of South Carolina. Tim Atkinson of Carolina Biological Supply Company, sponsor, looking on.

The 1989 recipient of the Meritorious Teaching Award of the Association of Southeastern Biologists is Dr. John M. Herr, Jr., Professor of Biology at the University of South Carolina, in Columbia, SC. This award consists of a handsome inscribed plaque and a check for \$1,000 generously provided by the Carolina Biological Supply Company. This award is the highest and most prestigious honor that the ASB confers on one of its members. It is an award that recognizes teaching of the highest quality and magnanimous service to students and the academic program of the applicant's discipline. The recipient must be nominated and strongly supported by students and colleagues and competes for this distinction with distinguished peers from colleges and universities throughout the southeastern region. Dr. Herr is a native of Virginia. He received his B.S. and M.S. degrees in biology from the University of Virginia and the Ph.D. degree in botany from the University of North Carolina. Prior to his appointment to the Department of Biology at the University of South Carolina, he held teaching positions at Washington and Lee University and Pfeiffer College, and visiting professorships at the University of Delhi, Appalachian State Teachers College, University of Mississippi, University of North Carolina, Columbia College, and Western Carolina

University. In addition, Dr. Herr has been an Alternate International Nickel Fellow and a Fulbright Fellow. He assumed his present position at the University of South Carolina in 1959 and his service at this institution extends over a span of 30 years. During this period of time Dr. Herr has directed the research of 21 M.S. and Ph.D. students, and has made botany alive and fascinating for hundreds of undergraduates. A former student stated, for example, that "It was exciting to go to his classes. I never wanted to miss them, no matter what." Another stated that he "Knows how to motivate the marginal student, involve the withdrawn, and excite the overachiever." These statements strongly characterize the attributes of a master teacher, a characterization that Dr. Herr richly deserves.

Coupled with Dr. Herr's extraordinary teaching prowess have been his substantial contributions to new knowledge in his field, plant embryogeny, through his research endeavors. He is the author of 28 publications, a textbook, several book reviews, and he has presented numerous papers at regional and national meetings of professional societies. His contributions to improve histologic techniques for the study of plant materials have particularly been frequently and widely cited. The impact of Dr. Herr's endeavors extend to the teaching of science at the secondary school level where he has given unstintingly of his time to assist high school teachers in improving their courses and high school students with a variety of science projects.

The recipient has been a consummate teacher, warm, encouraging, and inspiring friend of students, helpful associate of colleagues, and productive scholar in his chosen field of specialization.

1989 RESEARCH AWARDS

The **ASB FACULTY RESEARCH AWARD** was presented by Dr. J. Fralish to Dr. E. Clebsch of the University of Tennessee-Knoxville (see abstract 111 in ASB Bulletin Vol. 36, No. 2, 1989) who coauthored a paper with R. Busing entitled: Secondary succession, gap dynamics, and community structure in southern Appalachian mesic cove forest. The award consisted of a plaque and a check for \$500.00.



Dr. J. Fralish (right) presenting Faculty Research Award to Dr. E. Clebsch (left).

STUDENT RESEARCH AWARD, supported by the Martin Microscope Company of Easley, SC, was presented by Dr. K. Marion following a competition of 14 submitted manuscripts to Steven Broyles of the University of Georgia. His paper, coauthored with R. Wyatt was on: Influx size and reproductive success in milkweed: evidence against the pollen donation hypothesis (abstract 123 in ASB Bulletin Vol. 36, No. 2, 1989). The award consisted of a plaque and \$500.00.



Dr. K. Marion (right) presenting Student Research Award to Steven Broyles (left).

EUGENE P. ODUM AWARD was presented by Dr. C. Hackney to Steven Broyles of the University of Georgia. His paper was as noted under the Student Research Award. The award is sponsored by the southeastern chapter of the Ecological Society of America and consisted of a plaque and a check for \$100.00.



Dr. C. Hackney presenting the Eugene P. Odum Award to S. Broyles (right).

THE NORTH CAROLINA BOTANICAL GARDEN AWARD of \$100.00 was presented by Dr. L. Mellichamp to John G. Rae of the Florida Department of Natural Resources and Francis Marion College: Growth and reproduction in the endangered fragrant Prickly-apple Cactus, *Cereus eriophorus fragrans* (see abstract 178 in ASB Bulletin Vol. 36, No. 2, 1989).

THE SOUTHERN APPALACHIAN BOTANICAL CLUB, ELIZABETH ANN BARTHOLOMEW SERVICE AWARD was presented by Dr. L. Mellichamp to Jack Sharp of the University of Tennessee.

SOUTHERN SOCIETY OF PARASITOLOGISTS, BYRD/DUNN AWARD was presented by Dr. Sharon Patton to Constance Bell of the University of North Carolina, Chapel Hill who along with J. Hall and R. Tidwell coauthored the paper: *In vitro* activity of penta-midine and related amidines and imidazolines against *Giardia lamblia* (see abstract 98 in ASB Bulletin Vol. 36, No. 2, 1989). The award consisted of a certificate and \$100.00.

AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS, SOUTHEASTERN DIVISION AWARDS were presented by Dr. R. Semlitsch for Ichthyology to R. A. Blaylock of Virginia Institute of Marine Sciences (see abstract 204 in ASB Bulletin Vol. 36, No. 2, 1989) and in Herpetology to Joanne H. McGregor of Furman University (see abstract 28 same issue). Each recipient received \$100.00 from the Society.



Dr. R. Semlitsch (right) with winners of the American Society of Ichthyologists and Herpetologists Society, Southeastern Division Awards: R. Blaylock (left) and J. McGregor (center).

GRADUATE STUDENT SUPPORT AWARDS were presented to 35 applicants to help them with costs associated in attending the annual meeting. The number following each name refers to the abstract number as found in ASB Bulletin Vol. 36, No. 2, 1989.

Affronti, Lewis F., Jr. (28)
 Atkinson, Robert B. (129)
 Bellerud, Blane L. (41)
 Blaylock, Robert (204)
 Burk, Sandra (156)
 Carr, Karen K. (94)
 Compton-McCullough, Dana (144)
 Cox, Patricia B. (124)
 Cross, David C. (93)
 Curran, Ann (5)

Cypher, Ellen (125)
 Davis, Sara (102)
 Davison, Paul G. (33)
 Denette, Phil (214)
 Figiel, Chester R., Jr. (197)
 Flinchum, Renee Y. (132)
 Giovanetto, Laine (87)
 Hernandez, David (6, 212)
 Hicks, Kathy (11, 137)
 Jackson, Mary E. (29)

Joo, Gea-Jae (200)
 Johnston, Carol G. (45)
 Long, Alice (117)
 Mills, Edward (131)
 Mooney, Richard L. (224)
 Morris, Wayne (242)
 Orvos, David R. (72)
 Papay, Michael J. (91)

Porch, Susan Scott (172)
 Riehardson, Terry D. (222)
 Schorr, Mark S. (90)
 Taylor, Cindy L. (88)
 Termon, Sharon (150)
 Warren, Mark A. (215)
 Winner, Brent (209)

COMMERCIAL EXHIBITORS 1989

Associated Microscope and Service, Elon College, NC	Fisher Scientific Co., Norcross, GA
Baxter Scientific Products, Charlotte, NC	Forestry Suppliers, Inc., Jackson, MS
Benjamin/Cummings Publishing Co., Addison- Wesley, Redwood City, CA	Halco Instruments, Inc., Atlanta, GA
Ben Meadows Company, Inc., Atlanta, GA	Martin Microscope Co., Easley, SC
Bredlove, Dennis and Associates, Inc., Orlando, FL	Orion Research, Boston, MA
Cambridge Instruments, Lithonia, GA	Patricia Ledlie—Bookseller, Buckfield, ME
Carolina Biological Supply Co., Burlington, NC	Savannah River Ecology Laboratory, Aiken, SC
Conviron, Asheville, NC	Vashaw Scientific, Inc., Norcross, GA
	Wadsworth Publishing Co., Belmont, CA
	Worth Publishers, Inc., New York, NY

NECROLOGY

Jeannine S. Angerman
 Lawrence Gilman
 Roland Schoenike
 Thomas E. Powell, Jr.

OTHER BANQUET ACTIVITIES

A total of 681 members attended the ASB meetings at Charlotte, North Carolina. Fourteen Past Presidents (see photo page 138) were recognized along with two founding father members, Wilbur Duncan and Lewis Williams (see photo page 138). Retiring president Rebecca R. Sharitz's banquet address was entitled: Issues and Responsibilities.



Fourteen Past Presidents that attended the ASB meetings at Charlotte, NC.



Dr. W. Duncan (left) and Dr. L. Williams (right), society founding father members holding forth and onward.

Dr. Joe E. Winstead was installed as the new ASB President for 1989-90.



Dr. Joe E. Winstead of Western Kentucky University following installation as President of ASB for 1989-90.

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS TREASURER'S REPORT

1 January 1988-31 December 1988

I. SAVINGS ACCOUNT

A. Merrill-Lynch Ready Assets Trust	
Balance 1 January 1988	\$ 9,647.45
Net Transfers to/from Checking	2,300.00
Interest Earned 1988	608.99
	12,556.44

II. CHECKING ACCOUNT

Balance on Hand, 1 January 1988	418.78	
A. Receipts		
Regular Dues/Subscriptions	16,356.00	
Annual Meeting	5,790.79	
Bulletin Page Charges (N.C. Nature Conservancy)	2,200.00	
Honorarium Reimbursement (Bot. Soc. America)	250.00	
N.C. Botanical Garden	100.00	
Committee on Education (Carolina Biol. Supply)	500.00	
Miscellaneous	15.00	
Interest	100.62	
	\$25,312.41	
TOTAL RECEIPTS		
TOTAL RECEIPTS & BEGINNING BALANCE		\$25,731.19

B. Disbursements		
1. Membership Cultivation		
Printing & Mailing, Call for Papers	<u>147.80</u>	\$ 147.80
2. Publication		
ASB Bulletin (Vol. 35), Printing	18,183.47	
Roll Maintenance for Bulletin Mailing	<u>464.80</u>	
		\$18,648.27
3. Office Expenses		
Editor	32.10	
Other Officers	612.11	
Bank Charges	<u>73.61</u>	
		\$ 717.82
4. Travel and Related Expenses		
Student Travel Awards	1,500.00	
Speaker Honorarium/Travel	908.50	
N.C. Botanical Garden Award	100.00	
Plaques	<u>122.70</u>	
		\$ 2,631.20
5. Research Awards		\$ 500.00
6. Alliance for Environmental Education		\$ 100.00
TOTAL		\$22,745.09
NET TRANSFERS TO/FROM SAVINGS		<u>2,300.00</u>
TOTAL DISBURSEMENTS		25,045.09
BALANCE IN CHECKING 31 December 1988		686.10
SUMMARY		
CASH IN CHECKING		686.10
CASH IN SAVINGS		<u>12,556.44</u>
TOTAL ASSETS		\$13,242.54
ENRICHMENT FUND		\$ 3,568.14

EDITOR'S REPORT FOR 1988

Volume 34 of the ASB Bulletin for 1988 contained 240 pages of material related to the society and the southeast. The largest single contribution of 86 pages was devoted to the symposium on the Ecology, Flora, and Fauna Associated with Interdunal Ponds of Nags Head Woods Ecological Preserve, North Carolina. The symposium was sponsored and supported by the North Carolina Nature Conservancy—a Chapter of the Nature Conservancy. Sixty pages were also devoted to Abstracts, etc., of the April meeting issue while 14 dealt with the only major paper submitted during 1988. Other efforts revolved around the preparation of a membership directory issue to be published in 1989. The Journal continues to be well received and is expanding through contributions and symposia submissions.

ASB OFFICERS, COMMITTEES AND REPRESENTATIVES 1989–90

President—Joe E. Winstead, Dept. Biology, Western KY, Univ., Bowling Green, KY 42101.

President-Elect—Frank P. Day, Dept. Biol. Sci., Old Dominion Univ., Norfolk, VA 23529.

Vice-President—Sandra T. Bowden, Biology, Agnes Scott College, Decatur, GA 30030.

Past President—William H. Martin, Natural Areas, Eastern Kentucky University, Richmond, KY 40705.

Secretary—C. Ross Hinkle, Bionetics, Bio-2, Kennedy Space Center, FL 32819.

Treasurer—Robert L. Beekmann, Department Botany, North Carolina State University, Raleigh, NC 27695.

Executive Committee Members-at-Large—

1990: J. Whitfield Gibbons, Savannah River Ecology Lab, Aiken, SC 29802.
Diane R. Nelson, East Tennessee State University, Johnson City, TN 37614.

1991: Kenneth W. McLeod, Savannah River Ecol. Lab., Drawer E, Aiken, SC 29802.

1992: James S. Fralish, Forestry Dept., So. Illinois Univ., Carbondale, IL 62901.
Ken R. Marion, Biol. Dept. Univ. Alabama-Birmingham, Birmingham, AL 35294.

Editor, ASB Bulletin—Frank J. Schwartz, Institute of Marine Sciences, University of North Carolina, 3407 Arendell Street, Morehead City, NC 28557 (919/726-6841).

News Editor—Jon Fortman, Division of Science and Mathematics, Mississippi University for Women, Columbus, MS 39701 (816/373-3668).

Archivist—Madeline P. Burbanck, Box 15134, Atlanta, GA 30333 (404/373-1413).

AAS Representative (Section G)—Jerry C. Ritchie, USDA-ARS Hydrology Laboratory, BARC-W Bldg. 007, Beltsville, MD 20705 (301/344-1717).

Enrichment Fund Board of Trustees—*Chair*: Grover C. Miller, Zoology, North Carolina State University, Raleigh, NC 27695 (919/737-2011); Robert L. Beekmann (ex-officio), Botany, North Carolina State University, Raleigh, NC 27695 (919/737-3341); Steve C. Dial (1990), Biology, Pfeiffer College, Misenheimer, NC 28109 (704/463-7343); Sharon Patton (1990), Pathobiology, University of Tennessee, Knoxville, TN 37916 (615/546-9230); James F. Matthews (1991), Biology, University of North Carolina, Charlotte, NC 28223 (804/547-2315); Donald J. Shure (1991), Biology, Emory University, Atlanta, GA 30322 (404/727-4209).

Auditing Committee—*Chair*: Thomas R. Wentworth, Botany, North Carolina State University, Raleigh, NC 27695 (919/737-2168); Grover C. Miller, Zoology, North Carolina State University, Raleigh, NC 27695 (918/737-2011); W. C. Grant, Zoology, North Carolina State University, Raleigh, NC 27695 (919/737-2011).

Conservation Committee—*Chair*: Mark M. Brinson, Biology, East Carolina University, Greenville, NC 27858 (919/757-6307); Katherine Gregg, Biology, West Virginia Wesleyan College, Buckhannon, WV 26201 (304/473-8000 x 8124); T. E. Weiss, Jr., Christopher Newport College, Newport News, VA 23606.

Education Committee (ADHOC)—*Chair*: W. Dean Coeking, Biology, James Madison University, Harrisonburg, VA 22807 (703/568-6225); David J. Cotter, Biological and Environmental Sciences, Georgia College, Milledgeville, GA 31061 (912/453-4246); Luerecia Herr, Biology, Spring Valley High School, Columbia, SC 29223 (803/788-3350); Janice Coffee Swab, Science, St. Mary's

- College, Raleigh, NC 27611 (919/828-2521); Andrew N. Ash, Biology, Pembroke St. College, Pembroke, NC.
- Finance Committee**—*Chair*: Robert L. Beckmann, Botany, North Carolina State University, Raleigh, NC 27695 (919/737-3341); William Martin, Natural Areas, Eastern Kentucky University, Richmond, KY 40775 (606/622-1476); Frank P. Day, Biological Sciences, Old Dominion University, Norfolk, VA 23508 (804/440-3595).
- Graduate Student Support Award Committee**—*Chair*: Gerhard W. Kalmus, Biology, East Carolina University, Greenville, NC 27834 (919/757-6204); Donald C. Tarter, Biological Sciences, Marshall University, Huntington, WV 25701 (304/696-2706); Larry P. Elliott, Biology, Western Kentucky University, Bowling Green, KY 42101 (502/745-3696).
- Local Arrangements Committee for 1990**—*Chair*: James Hull, Local Committee, Towson State, Baltimore, MD 21204 (301/321-3128); Katherine Denniston, Program Chair, Biology, Towson State University, Baltimore, MD 21204 (301/321-3128); Phil Creighton, Don Windler, Biology, Towson State University, Baltimore, MD 21204 (301/321-4117).
- Meritorious Teaching Award Committee**—*Chair*: Stewart A. Ware, Biology, William and Mary College, Williamsburg, VA 23185 (804/253-4458); Dorothy Broek, Biology, North Georgia College, Dahlonega, GA 30597 (404/864-3391 x 219); Sam B. Jones, Jr., Botany, University of Georgia, Athens, GA 30602 (404/542-1802).
- Nominating Committee for 1990**—*Chair*: Rebecca R. Sharitz, Savannah River Ecol. Lab., Aiken, SC 29202 (803/725-2472); G. W. Esch, Biology, Wake Forest University, Winston-Salem, NC 27109 (919/771-5323); Tim Atkinson, Carolina Biol-Supply, Burlington, NC.
- Past-President's Council**—*Chair*: William Martin, Natural Areas, Eastern Kentucky University, Richmond, KY 40745 (606/622-1476).
- Place of Meeting Committee**—*Chair*: Don C. Forester, Biological Sciences, Towson State University, Towson, MD 21204 (301/321-2385); George Murphy, Middle Tennessee State University, Murfreesboro, TN 37132 (615/898-2847); John Harley, Biology, Eastern Kentucky University, Richmond, KY 40745.
- Priorities in Public Affairs**—*Chair*: George A. Middendorf, III, Zoology, Howard University, Washington, DC 20059 (202/636-6933); Muriel Poston, Botany, Howard University, Washington, DC 20059 (202/636-6929); G. Ronnie Best, Center for Wetlands, Phelps Laboratory, University of Florida, Gainesville, FL 32611 (904/392-2424).
- Publications Committee**—*Chair*: J. Whitfield Gibbons, Savannah River Ecology Laboratory, Drawer E, Aiken, SC 29802 (803/725-2472); James Ross, Biology, Cumberland College, Williamsburg, KY 40769 (606/549-2200 x 4383); James S. Fralish, Forestry, Southern Illinois University, Carbondale, IL 62901 (618/453-3341).
- Research Awards Committee—Faculty**—*Chair*: Eloise B. Carter, Biology, Emory University, Atlanta, GA 30322 (404/727-6292); Courtney T. Hackney, Biology, University of North Carolina at Wilmington, Wilmington, NC 28406 (919/395-3759); Gary Shaffer, Louisiana State University, Coastal Ecology Institute, Baton Rouge, LA 70803 (504/388-8303).
- Research Awards Committee—Student**—*Chair*: George E. Stanton, Biology, Columbus College, Columbus, GA 31993 (404/568-2065); G. T. Weaver, Wrights

Ferry Rd., Louisville, TN 37777 (615/970-7719); S. K. Ballal, Biology, Tennessee Technical University, Cookeville, TN 38501.

Resolutions Committee—*Chair*: William Martin, Natural Areas, Eastern Kentucky University, Richmond, KY 40475 (606/622-1476); Nancy Coile, Botany, University of Georgia, Athens, GA 30602 (404/542-1823); Donald R. Windler, Biology, Towson State University, Baltimore, MD 21204 (301/321-4117).

RESOLUTIONS COMMITTEE REPORT

RESOLUTION ON BIOLOGICAL DIVERSITY

WHEREAS biological diversity is an important component of the functioning of ecosystems, provides raw materials, products, and ideas for human civilization, and provides pleasure and emotional well-being for many;

WHEREAS the Earth's biological diversity is now being reduced at a rate without precedent in human history and this rate appears likely to increase greatly over the next several decades;

WHEREAS the deterioration of the Earth's biological diversity is a significant concern of scientists, and a serious problem for humanity;

WHEREAS the United States is being asked to take a leadership role internationally, but does not have a Federal policy toward conservation of biological diversity;

WHEREAS scientific understanding of the components of biological diversity must be increased for their conservation and sustainable utilization;

THEREFORE BE IT RESOLVED THAT the Association of Southeastern Biologists asks the Congress of the United States to approve legislation that will:

- 1) make the conservation of biological diversity a national goal and a national priority;
- 2) require biological diversity to be a paramount consideration in land-use planning;
- 3) support efforts to develop a coherent scientific program for research on biological diversity;
- 4) put scientific knowledge to use in developing a Federal Biodiversity Strategy by coordinating the policy efforts of federal agencies;
- 5) increase support for public education on the importance of preserving biological diversity.

RESOLUTION OF APPRECIATION

WHEREAS the University of North Carolina at Charlotte in its role as host institution for the 50th annual meeting of the Association of Southeastern Biologists has extended to the Association the utmost hospitality, courtesy and cooperation, and;

WHEREAS the Local Arrangements Committee Chairman, Dr. James F. Matthews, and the Program Committee Chairman, Dr. T. Lawrence Mellichamp, as well as all other members of those committees, have generously given time, thought and effort to organizing the meeting;

THEREFORE BE IT RESOLVED THAT The Association extends its sincere appreciation.

RESOLUTION OF APPRECIATION

WHEREAS Thomas and Dorothy McMillan have generously contributed to the activities of the Association of Southeastern Biologists and to the success of the 50th annual meeting;

THEREFORE BE IT RESOLVED THAT The Association expresses its sincere appreciation.

APPRECIATION

The Carolinas Collections Colloquium met with ASB, but the meeting was at the McMillan Greenhouse and Conservatory on the UNCC Campus on Thursday afternoon. The Carolinas Collections Colloquium wishes to acknowledge the support of Herbarium Supply Co., San Francisco, CA. John and Sandra Ayers continue to supply the botanical community with quality products and service, both of which are appreciated.

NOTICE OF RESEARCH AWARDS FOR 1990

ASB FACULTY AND STUDENT RESEARCH AWARDS (\$500 each). Rules are as follows: (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting; in order to qualify for presenting the paper, the author(s) must submit an abstract by the 1 December deadline. Papers submitted for the competition must be received in triplicate and in their entirety by 1 January and must be journal-ready manuscripts worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission. (b) Only ASB members are eligible (this applies to all authors). (c) Papers may be in press but not published prior to the previous annual meeting. (d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Faculty and Student Research Award Committees, the award may be withheld or it may be split in case of a tie. (f) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. Send to (faculty): Dr. Eloise B. Carter, Dept. Biology, Emory University, Atlanta, GA 30322 (404/727-6292); (student): Dr. George E. Stanton, Dept. Biology, Columbus College, Columbus, GA 31993 (404/568-2065).

THE EUGENE P. ODUM AWARD—\$100 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points: (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) The title and abstract of the paper must be submitted to the Award Coordinator by 1 February. This can be a copy of the abstract submitted to ASB 1 December. Submit to Dr. W. D. Cocking, Dept. Biology, James Madison University, Harrisonburg, VA 22807 (703/568-6225).

THE NORTH CAROLINA BOTANICAL GARDEN AWARD—\$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is given for an especially meritorious paper presented in the areas of plant systematics, evolution or conservation. The paper will be evaluated by a panel of judges at the time of presentation, on the following points: (a) significance of ideas, (b) creativity, (c) quality of methodology, (d) validity of results, and (e) clarity of presentation. The actual prize will be presented at the ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award;
- (b) The paper must deal with the systematics, evolution, species biology (including population biology), or conservation of vascular plants that are native or naturalized to the southeastern United States;
- (c) The paper must be presented in a regular Plant Systematics contributed-paper session; papers presented in poster sessions or in symposia are not eligible;
- (d) The title and abstract of the paper must be submitted to the Award Coordinator by 1 February 1990. This may be a copy of the abstract submitted to ASB 1 December. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. L. Mellichamp, Biology, Univ. North Carolina, Charlotte, NC 28223 (704/547-4055).

SOUTHERN APPALACHIAN BOTANICAL CLUB, ELIZABETH ANN BARTHOLOMEW SERVICE AWARD—Worthy candidates should be brought to the attention of Dr. Donna Ware, Biology, College William and Mary, Williamsburg, VA 23185 (804/253-4458).

ANNOUNCEMENT

THE EDUCATION SECTION OF THE ECOLOGICAL SOCIETY OF AMERICA
announces a symposium:

ECOLOGY EDUCATION—STRATEGIES FOR REACHING THE PUBLIC

- Date: Tuesday afternoon 8 August 1989
- Location: The University of Toronto
Annual Meeting of the Ecological Society of America and the American Institute of Biological Sciences
- Schedule:
- 1:05 ALAN R. BERKOWITZ, Institute of Ecosystem Studies. Introduction.
- 1:15 PAUL R. EHRLICH, Stanford University. Using the media to inform the public on complex ecological issues.
- 1:45 KAREN S. HOLLWEG, Denver Audubon Society. Ecology education through private environmental groups.
- 2:15 CHUCK HOPKINS, Toronto Board of Education. Ecology education at environmental education centers.
- 2:45 Recess
- 3:00 VALERIE C. CHASE, National Aquarium in Baltimore. Ecology education through exhibits, programs, and curriculum development at living museums and other informal education institutions.
- 3:30 MARIANNE E. KRASNY, Cornell University. Ecology education through Cooperative Extension.
- 4:00 JAMES A. MACMAHON, Utah State University. Ecology education for the non-major undergraduate.
- 4:30 ALAN R. BERKOWITZ, Institute of Ecosystem Studies. Discussion and wrap-up.

REVIEWS

Hodges, E. R. S. (ed.). 1989. The Guild Handbook of Scientific Illustration. Van Nostrand Reinhold, NY. \$79.95. 575 p.

This compendium of the world of natural science illustration is a landmark reference for scientific illustrators, other artists, professional or beginner, as well as for scientists who do their own drawings or work closely with an illustrator. The book is a tribute to the efforts of the editor, Elaine Hodges, the 45 contributing authors, and the many additional editors and reviewers who assisted in this major project. There is a real lack of professional courses or adequate texts on scientific illustration. This handbook goes a long way in filling this gap.

The Guild in the title refers to the Guild of Natural Science Illustrators that financed the book. The Guild is an organization of top professional scientific illustrators, many of whom have contributed to the volume. As one would expect from this echelon, the quality of the illustrations is superb and inspirational making this volume not only informative, but handsome as well, with over 600 figures in black and white and color.

The book is divided into five sections. The first covers the basics of preparation and care of specimens, approaches to preliminary sketches, final rendering, graphic materials and equipment for a studio, and an extensive discussion on light on form—the very essence of making a “life-like” illustration. The next section addresses in detail the various rendering techniques traditionally used in natural science illustrations. It is well done with separate chapters for each medium—pen and ink, pencil, carbon dust, etc.—written by an illustrator particularly adept in that medium. This how-to section of the book is, perhaps, the most valuable for the widest audience.

The third major section walks one through the illustrating of different classes of subjects such as birds, mammals, and fishes. There are even chapters on fossil and archeological drawings. With each of these special subject chapters written by different authors, a certain unevenness can be expected. For example, the chapter on fish illustration would provide even the novice sufficient insight for doing a credible job, although I did miss instructions for drawing fish eggs and larvae. The chapter on invertebrates does an excellent job on insects covering 13 pages, but the part of the chapter on mollusks is only four pages long, with all but a half column on cephalopods. Such biases can be explained by the interests of individual authors. Elaine Hodges, an entomological illustrator at the Smithsonian Institution, wrote the chapter on invertebrates. However, I do not want to nit-pick, the sometimes uneven coverage does not take away from the overall value of this publication.

The remaining sections deal with charts and graphs, copy photography, the printing process, and the business end of running a professional studio. There is an especially informative chapter on cartography.

This handbook is an invaluable reference that should be in the hands of every serious illustrator and in the library of anyone, scientist or otherwise, who wants to learn to portray biological subjects clearly, accurately, and artistically. The price should not be off-putting. It is well worth it.

Alice Jane Lippson, *Scientific Illustrator and Author, Bozman, MD 21612.*

Tichy, H. J. 1989. Effective Writing for Engineers, Managers, Scientists. Second Edition. Wiley Interscience, NY. \$29.95. 580 p.

One would hope that a text on “effective writing” would in itself be effective; but deep down in our inner recesses we would fear this not be true. “Effective writing” is bound to be a euphemism for a grammar text, with a sprinkle or two of literary strategy to justify its title. Eureka! It’s not so. Our inner fears are confounded, and indeed this work is effective. Not only is it effective, it’s enjoyable, readable, subtly pedagogic, and one absolutely essential resident of the bookshelf for anyone who engages in serious technical writing.

This book is organized into four major sections, sandwiched between an intriguing “prologue” and a debunking “epilogue.” The prologue is subtitled: Slaughter of the Language, a Whodunit. This pithy little intro reveals at the outset that the book is hardly a dry treatise on grammar and syntax, but rather a philosophical approach, perhaps with a taste of the crusade, toward potent written communication. Enough of the rules and regs are thrown in to insure comprehensive treatment, but style and attitude are the real messages.

The four sections comprising the body of the text are: Steps to better writing; Standards of correctness; Style; Advice on common forms. The first of these begins with a psychological analysis of starting and stalling, laced with caveats and parables with which most any writer can identify. This is followed by techniques to counter these negatives, and insertion of positives of organization. The section ends by offering specifics on outlining and beginning drafts. Throughout, the message is supplemented by both good and bad examples from the literature, evenly chosen from various disciplines.

The second section is short, and summarizes the grammatical rules of our language. Even this section is easily readable, as the frequent deployment of examples colors the text. These are usually presented in pairs or triplets, demonstrating good and bad, or something in between. This section ends with the standard but necessary pages devoted to Proofreader's marks.

The third section, Style, is likely to be the most rewarding for the writer whose training has provided him with the raw essentials but little in the way of experience or technique. This section deals with the many literary ruts and ditches into which we fall too often: the pervasive passive, the evasive "I," and telegraphic style. This section is especially useful in its succinct evaluation of proper and improper usage of such style techniques as clichés, split infinitives, analogy, euphemisms, and a score more.

Section four, advice on common forms, addresses a number of specifics, including appropriate forms of letters, memoranda, instruction manuals, resumé's. This section is one likely to be referenced often for both professional and personal needs. For example, letters of condolence, or writing style of a resumé are treated in detail, and with pragmatic pointers throughout.

The epilogue is a section likely overlooked, as it appears to be oriented toward editors. However, for those of us charged with directing writing skills of aspiring scientists, this section is well worth the quarter hour required to read through it. It stresses writer motivation and understanding, considerations worth remembering when assessing research papers by undergraduates.

I find the appendices perhaps as useful as any other part of the book. The first is entitled Fallacies to Forget, and is a brief debunker on commonly accepted "rules" of good writing. The second addresses problem words, and the final appendix documentation and citation format.

I expect this book will become as worn as my copy of the American Fisheries Societies "Checklist of Fishes," or for that matter my Webster's. I would consider it required reading for the active scholar, especially in the biological sciences.

ROBERT L. SHIPP, *Biological Sciences, University of South Alabama, Mobile, AL 36688.*

Robison, Henry W. and Thomas M. Buchanan. 1988. **Fishes of Arkansas.** University of Arkansas Press, Fayetteville, AR. \$50.00 (hard); \$30.00 (soft). 536 p.

This handsomely designed compendium is the most important work on freshwater fishes yet available for any southern state. Henry and Tom are to be commended for taking the best features from previously published state books, adding some of their own, and incorporating them into their Arkansas ichthyology. The number of color photographs is unprecedented in a North American ichthyofaunal work and this sets a high standard for others to follow. There is a generous supply (I count 29) of aquatic habitat shots in color, 149 fish species are illustrated with excellent underwater and posed color pictures (many by William N. Roston, Richard T. Bryant, John L. Harris and others), and each family account is clearly demarcated from others by uniquely colored pages, thereby making the book more user friendly.

As with any state natural history book, the bulk of the text is devoted to accounts of the 215 fish species (both native and alien) and 27 families found in Arkansas. Each account provides a black and white or color picture, distinguishing characters, comparisons to similar species, a statement on variation and taxonomy (where appropriate), a distributional statement, total and state range maps, and a modest amount of information on habitat and biology (i.e. largely food habits and reproduction). Keys to species follow each family account. There are introductory sections on the history of ichthyology in Arkansas, including the first picture I have seen of an early contributor to Arkansas ichthyology, John D. Black; a thorough covering of the environmental setting; and keys to the families. An appendix on making collections of fishes and on further aids to identification follow the species accounts. A useful glossary of eight double-column pages, a literature cited section with over 800 references, many of them from 1985-86, and a 6-page index to fish names complete the volume. Ten tables summarizing, for example, information on Arkansas rivers, threatened species, and commercial fishery catch data, are interspersed throughout the introductory chapters and at the end of the appendix.

In books that treat specific animal groups from politically bound areas the most useful and original data usually are the range maps of the species covered. In a thorough treatise of this nature, questionable

distributional records are clarified, misidentifications corrected, and new range extensions or range shrinkages reported. This book serves these purposes well. More than 3,000 collections from more than 1,000 locations are mapped for the period between 1960 and 1987! Spot distribution maps show with different symbols the pre- and post-1960 range of each fish in the state; a map of the United States with the general range of each species is shown with zipatone. The only difficulty in using the maps is that they are a bit too small. Furthermore, county lines are not shown (for reference points) and the symbols used to indicate collection localities of a species are too small to be spotted readily when only one to three record stations are available (e.g. pallid sturgeon, p. 80). I had to search for some time to discover that the distribution map of the Arkansas River shiner has no records plotted on it despite the statement in the text (p. 213) that a 1939 collection is available from Piney Creek, Logan County. At least 15 maps have small dots nearly obscured by the thickness of the river lines.

The photographs of fishes (and habitats) generally are of very high quality and several species are illustrated in color for the first time (e.g. chub shiner, Caddo madtom). A few of the black and white photographs are of marginal quality (e.g. alligator gar, sauger). The picture labeled *Ilybognathus nechalis*, Mississippi silvery minnow (p. 179), and credited to the New Hampshire Fish and Game Department actually represents the eastern silvery minnow, *Ilybognathus regius*. Roston's underwater shot of the gilt darter (p. 449) represents an undescribed eastern subspecies of *Percina evides* not the undescribed subspecies typically found in the Ozarks.

The authors have followed recent suggestions for changes in family names based on phylogenetic reassessment (e.g. Moronidae is used for Percichthyidae, Elasmomatidae is treated as distinct from Centrarchidae and Fundulidae as distinct from Cyprinodontidae) but have been conservative regarding use of some genus-group names (e.g. retainment of *Ameiurus* as a subgenus rather than a genus). Most species-group names follow the 1980 AFS checklist (Robins *et al.* 1980), for example, *Percina ouachitae* rather than *Percina vigil*; *Salmo gairdneri* rather than *Salmo mykiss* or *Oncorhynchus mykiss*. *Atractosteus* (vs. *Lepisosteus*) is used as the genus name for the alligator gar and *Fundulus blairae* and *F. dispar* are considered distinct species rather than synonyms of *F. notti* (a la Robins *et al.* 1980). The undescribed and weakly diagnosed *Percina* from the Ouachita River is treated as a separate species. Keys to species are standard and accurate, although not extensively illustrated.

The sections in the species accounts pertaining to "biology" are, according to the authors, abbreviated (p. 65) and are primarily concerned with diet and reproduction. In general, coverage on those specified topics is adequate and is drawn from the entire literature (not just Arkansas), but several accounts do not include recent papers that probably should have been cited. For example, I examined the fundulid accounts in some detail and found the following pertinent literature missing: Fisher (1981) for northern studfish, Atmar and Stewart (1972) for blackstripe topminnow, and Thomerson and Woolridge (1970) for both blackstripe and blackspotted topminnows. Under the account of the black crappie (p. 389) we are told that Hansen (1951) studied its life history. In reality, Hansen's (1951) classic study was of the white crappie.

The "Fishes of Arkansas" is rich with information, attractive, virtually free of typographical and factual errors, biologically sound, and serves a useful purpose. In fact, Arkansas is the only southern state that can now boast of a top-rated ichthyological compilation. Surely this book will be popular within its own and neighboring states, and ichthyologists everywhere will want to have this reference in their library. My sincere congratulations to the University of Arkansas Press and the authors for their support and devotion to this welcome faunal work.

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- Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. 4th ed. Amer. Fish. Soc. Spec. Publ. 12: 1-174.
- Thomerson, J. E. and D. P. Woolridge. 1970. Food habits of allotopic and syntopic populations of the topminnows *Fundulus olivaceus* and *Fundulus notatus*. Amer. Midl. Nat. 84: 573-576.

Dundee, Harold A. and Douglas A. Rossman. 1989. **The Amphibians and Reptiles of Louisiana.** Louisiana State University Press, LA. \$29.95. 300 p.

The contents and physical layout (26 × 20 cm, hard bound) of this book suggest that it was intended for a more astute audience interested in knowing more about the biology of amphibians and reptiles than might be suggested by strictly an identification guide. This is surely a strong point as there are sufficient guides, and large sectors of the audience are willing and capable of a herpetological awareness if provided with information in proper form.

The dark green cover has a snake embossed on the front so one can in fact detect the front of the book (opening a book backwards is a pet peeve of mine) and an attractive dust cover of muted tones dominated by a painting of an alligator. The binding seems sturdy, and the paper is a sturdy, low-gloss grade. Several short sections (e.g. Species and Subspecies; Common and Scientific Names) each starting on a separate page seem to waste space in Part I. Species accounts are tailed-in and make better use of space. Keys that appear to be easily understood precede each group, and informative dot maps with county boundaries for each species provide quick checks on distributions. Information in each account is divided into sections (e.g. Recognition, Distribution, Habitat and Habits, and Reproduction) that again allows easy comparisons. A glossary and a rather extensive source of literature for additional reading follow the species accounts. The writing appears clear and concise, and the fact that we are informed of the differences that the authors have on the use of turtle, terrapin, and tortoise adds an amusing personal touch. The sections I chose to read in detail appeared virtually free of typographical and other such errors.

The use of paintings versus photographs for identification is always debated; modern photographic techniques provide reasonably easy access to good reproductions, although proper drawings are probably better for identification. For example, the well executed drawings of the anterior sections of snakes (all figures are on glossy paper) are attractive and informative in details beyond what photographs usually show; conversely, I cannot be as appreciative of the amphibian illustrations. The drawings surely will serve their purpose for identification, but they are not entirely accurate or as pleasing to the eye.

State faunal books seem to range from data-rich volumes, such as the Illinois manual by Philip Smith, to strictly identification guides that contain no new information. The Louisiana book resides somewhere nearer the former, and I applaud this choice. I presume that one motive of state manuals is to educate persons about a given part of the fauna. To do this properly, identification must be coupled with information on the biology of the organisms. In summary, I find this book to be well-prepared and a good compromise between scientific and popular information that should serve various factions of the academic and public sectors very well.

RONALD ALTIG, *Department of Biological Sciences, Mississippi State University, Mississippi State, MS 39762.*

Odum, Eugene P. 1989. **Ecology and Our Endangered Life-Support Systems.** Sinauer Associates, Inc., Publishers, Sunderland, MA. \$14.95 paper. 283 p.

Those who have read and used the earlier ecology books by Dr. Odum will be pleasantly surprised not only by the updated textbook *Ecology*, but also by the hybrid nature of this book to numerous other environmentally related disciplines. The broad connections of these fields to the major principles of ecology are found throughout the book; all are well documented with numerous choices for contemporary and selected historically important references. Throughout, Dr. Odum refers to and explains the many historical concepts that tend to be given short-shrift in many newer books. The tables and figures are unusually clear and contain meaningful captions. This is a well written scholarly book.

The short prologue compares the global life-support system to the life-support system of the spacecraft Apollo 13, its damage because of an explosion just before it reached the moon, its moon landing abortion, the makeshift cannibalization of a space suit, the rigging of the power unit from the lunar module, and the successful return to earth. This life-support system of the Apollo 13 and its failures, problems, and solutions are used by the author to illustrate that similar situations exist on earth where neither do we always know exactly the available life-support consumables nor do we understand how they interact or how long they can maintain us. This prologue explains what an "experimental" ecological biosphere should teach us and what real-world life-support systems should be.

Broad overviews of these vital support processes are given in the first three chapters. Environmental

systems of landscapes can be described as “developed,” “cultivated,” and “natural” sites which vary widely by the amount of energy density given them compared to their area occupied.

The “free” parts of the world-wide life-support systems are well illustrated by sewage systems as well as by the usual list of soils, air, water, etc. The need to emphasize attention to efficiencies of the deleterious impacts of the fabrication and domesticated sites of the environment need a “holistic ecological” approach, in Dr. Odum’s view.

The levels of organization of both large- and small-scale biological units and the necessity of knowing the properties of each are given in Chapter 2. To handle any complex formidable ecological system, the author gives a clear need for the modeling of the basic components of ecosystems. Here in Chapter 3, just what is meant by “ecosystem” is well explained and how the “energy language” can be used in functional models. To utilize the ecosystem as a function to understand species diversification loss, and incorporation of monocultural crops, a large series of ecological concepts are each briefly explained and interrelated.

The single common denominator energy relates the ecological concepts which have been admirably presented in their broadest terms in Chapter 4. The use of the various physical and other disciplines are related clearly to economics. The author makes a strong point of the energy-based classification of ecosystems, the partitioning of energy, and especially the dissipation of energy and how very costly that may be for artificial recycling (e.g. cleaning up pollution). An excellent explanation is given for production (and costs) of photosynthetic responses to differences in temperature and light intensities by C_3 and C_4 plants.

Making the interrelationships of material cycles and physical conditions of existence into easily understandable concepts for most of the commonly taught cycles—and quite a few besides, is given in Chapter 5. But these cycles are explained clearly with energy input-output considerations. While some cycles involve soil alterations, tropical deforestation, toxic wastes, “resources out of place,” among others, all involve great energy costs for abatement conducive to recovery of the damaged environment.

Chapter 6 covers the more straightforward part of ecological biology-population ecology as a series of population growth forms, with simple explanations that are not too mathematically involved for beginning college level students. Concise explanations of r- and K-selection and “carrying capacity” in various ecological communities are easy to read and understand. The amount of space devoted to genetic diversity and many of the manifestations are necessarily short but concise. There are brief discussions and figures or drawings of such concepts as interactions among species, competition, competitive exclusion, predator-prey relationships, parasites and hosts, commensalism, cooperation and mutualism, and the ecological feed-backs of many of these concepts.

Chapter 7, on development and evolution, begins with the ideas of several kinds and timing of ecological succession theory and the energetics involved. The development and evolution of the biosphere is noted to be shaped by the interaction of the geological and climatic forces with those of the living components. Several of the current concepts of mechanisms of evolution, coevolution, speciation, group selection, and genetic engineering (artificial selection) are briefly presented. The major ecosystems of the world are examined and described in Chapter 8: terrestrial biomes, freshwater and marine ecosystems, and “domesticated” ecosystems.

The epilogue: the transition from Youth to Maturity is a thoughtful chapter that makes some predictions for the world-wide ecological future. Many of the major contemporary ideas of widely-read authors who have attempted to predict future global models are discussed, including their assumptions and basis in the ecological successional framework of human societies as they go from pioneer to mature status. The environmental ethics and aesthetics are basic in this context for the maintenance of nature’s life-support systems.

The book is excellent and readable for beginning students. It is also largely “non-technical” and is usable by the general public when understanding principles in ecology.

DONALD E. WOHLISCHLAG, *The University of Texas Marine Science Institute, Port Aransas, TX 78373.*

Moreton, R. S. (ed.). 1988. Single Cell Oil. Longman Scientific and Technical, Essex, England, co-published in the U.S.A. by John Wiley and Sons, NY. \$61.95. 165 p.

The concept of “single cell oil” (SCO) is similar to the concept of “single cell protein” (SCP); that is, the use of microbes, particularly yeast, to produce edible oils, similar to the production of edible

protein in SCP. The production of edible oils in the world is large (ca. 60×10^6 metric tons in 1986) which is worth about 150 billion dollars (in 1986). Most commercial oils come from plants (soybean, palm, corn, olive, etc.) and yet there is still a world wide demand for oils which continues to grow. Consequently, there could be a profitable market for SCO if the economics of production were favorable. This little book explains the problems and potential for SCO to help supply commodity oils to world markets.

The editor introduces, in the first chapter, the reader to the use of oils in world markets and gives us a good idea of its potential. It is then learned that yeasts store oils during growth when nitrogen is limiting but carbon is in excess. The author also describes various ways in which the growth environment of the yeasts can be manipulated to optimize production of stored oils. Moreton also describes the current patents on strains of yeast and their processes of producing oils.

Ratledge, a very prominent worker in the field, describes in chapter 2 the fundamental biochemistry, metabolic pathways, stoichiometry, substrate choices, and calculated economics for the production of SCO. This is a most readable, straight-forward and interesting chapter for a researcher wishing to pursue this area of work.

The next chapter describes attempts to produce edible oils in plant and algal cell cultures. After much work, it appears that using these organisms is not as efficient as yeast for oil production.

R. J. Davies describes in great, but readable detail, a pilot plant study of a SCO production facility in New Zealand which would use dairy whey waste as a fermentable substrate. It seems that the Kiwis have a process which could be profitable if the price was currently a bit higher. The advantages of using dairy waste are that it is cheap, readily fermentable, can produce a SCP by-product for animal feed, and it helps to dispose of an organic waste material which would have to be treated before disposal into a receiving water. After reading this chapter, one concludes that SCO can be a viable alternative to plants for edible oil production.

The final chapter describes a variety of extraction and analysis procedures for isolating the oil from yeast cells and determining the quality of its content. This chapter describes analytical methods which have been used in the past, but which have been improved upon recently. No mention is made of a classic and basic book used by lipidologists everywhere (**Techniques in Lipidology** by M. Kates), which would have made this chapter more useful.

One of the major problems with this book is that it ignores research into the use of modern genetic methods to manipulate strains of yeast to produce more and better oils. It seems that this type of research will create better strains which should make the commercial production of SCO easier and more profitable.

Overall, this book will be useful for those interested in this subject, those who may consider pursuing this type of research, or for those interested in the commercial production of SCO. Considering the small size of the book and the large size of the price, this reference will probably not make it to the shelf of the casual science, or even microbiology, reader.

J. ROBIE VESTAL, *Department of Biological Sciences, University of Cincinnati, Cincinnati, OH 45221.*

Menell, Ann C. and Michael J. Bazin. 1988. **Mathematics for the Biosciences.** John Wiley & Sons, NY. \$39.95. 231 p.

This short text has as its goal the introduction of those aspects of mathematics that are likely to be of value to high school and undergraduate college biologists. The subject matter has a classical approach—elementary functions, trigonometry, series, and introductory calculus. The authors state that their aim is to provide biological examples, exercises, and problems in so far as possible since the target audience is the life scientist. Although they have done this in part, some of the chapters and many of the divisions of chapters lack biological examples and problems. The presentation of the subject matter is very good although the introduction to each chapter is very brief or, in some cases, entirely lacking.

The examples for each mathematical concept are carefully presented step-by-step so that the student can understand the solution. The problems for the student to work are challenging and, for the most part, interesting.

Most of the examples used are from the field of microbiology (the second author is a microbiologist), but there is a good treatment of the mathematics of the thermal stratification of lakes, and an admirable section on population dynamics. Their explanation of binomial expansion is not as easy to understand as that found in American textbooks.

The authors are not clear in their preface about whether this book is intended as a self-study text or as a text to be used in a short course for biologists. If it is intended as a self-study text, there have been other texts in the last 20 years which are superior to this one. A text for self-study needs a more adequate definition of terms and better introductions to the subject matter.

Although this text does not have any particularly unique features, it has few flaws and one might consider its use in a short semester course with a highly interested life science group needing more education in the field of mathematics.

ROBERT R. BRYDEN, *Editor, Journal of the Elisha Mitchell Scientific Society, Morehead City, NC 28557.*

Ritchie, William, Michael Wood, Robert Wright, and David Tait. 1988. **Surveying and Mapping for Field Scientists.** Longman Scientific and Technical, Essex, England, with John Wiley and Sons, Inc., NY. \$34.95. 180 p.

The stated aim of *Surveying and Mapping for Field Scientists* is to serve as an introduction and guide to field scientists that are occasionally faced with the tasks of measuring field observations and presenting the observations on a map or map series. The book emphasizes traditional techniques and methods, assuming that most scientists engaged in field studies will not have access to equipment and materials that are based on recent innovations in surveying and mapping techniques.

The book contains 5 chapters. The first chapter is a brief overview of the factors that affect the selection of surveying/mapping techniques, which include resources such as time, money, personnel, and equipment as well as the characteristics of the desired end product. This chapter also describes sources of maps, photographs, and digital image data for use in surveying and mapping.

Chapters 2, 3, and 4, which form the core of the book, discuss the three main conventional surveying techniques that may be employed to obtain measurements of features in the field. Chapter 2, *Ground Surveying Techniques*, is an aptly illustrated guide to measuring features directly in the field. The processes of obtaining planimetric data and slope and height values are presented in terms of basic theory, equipment, field procedures, and applications. Chapter 3, *Aerial Surveying Techniques*, describes the equipment and methods used in analysis of aerial photographs to identify and measure features, and Chapter 4, *Remote Sensing Techniques*, focuses on the use on non-photographic remotely sensed imagery from satellites.

The final chapter, *Cartographic Presentations*, provides a treatment of the methodology used in construction, design, and reproduction of maps to portray field observations. This chapter of the book, consistent with previous chapters, presents conventional cartographic techniques.

Surveying and Mapping of Field Scientists very ably covers the fundamentals of traditional surveying and mapping. It will be a practical and valuable handbook for the professional who is engaged in field studies and who must conduct surveying and mapping activities on an occasional basis. The book is well written, includes sufficient illustrations to convey the processes described, and is consistent with the high quality publications produced by the publishers. Excellent color plates of photographs and satellite imagery are included in the text.

My major disappointment with this book is the brief treatment of recent technology, especially in the areas of digital image analysis and digital cartography. Although the authors suggest references for further reading, the book would benefit from an expanded discussion of modern techniques. I would argue that field scientists will very soon have access to modestly priced computer based tools for surveying and mapping and will be increasingly called upon to prepare data that are suitable for entry into computer systems.

Another minor limitation of the book, at least to U.S. readers, is the emphasis on U.K. data sources for surveying and mapping. The discussion of published maps available from the U.S. Geological Survey omits reference to the recently published 1:100,000 scale topographic map series, which is rapidly becoming the most widely used series in the country. Incidentally, this map series is also available in digital form. The book's reference to U.S. aerial photography is also slightly out of date as the NHAP (National High Altitude Photography) Program has been superseded, first by the National Aerial Photography Program and now by an irregularly scheduled contract program.

A few mildly disappointing features aside, this book is a practical guide to measuring and displaying field observations. The softcover edition, priced at \$34.95, should prove useful to a wide variety of professionals and scientists.

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Huffman, D. M., L. H. Tiffany, and G. Knaphus. 1989. **Mushrooms and other Fungi of the Midcontinental United States.** Iowa State University Press, Ames, IA. \$19.95. 326 p.

I have some good news and some bad news. First the good news. For the first time we have a guidebook specifically for fungi of "the Midcontinental United States." In a sturdy, plastic-covered volume of 326 pages, it provides an introduction, keys, descriptions, commentary and illustrations (mostly color plates) for about 250 fungi, from agarics to slime molds. Overall coverage, although admittedly limited, is adequate.

Now for the bad news. There are so many caveats involved in this review that not only the buyer but the reader must beware. The first caveat is that the title states it is a mushroom guidebook for the "Midcontinental" states. I cannot find the limits of this area, but all three authors reside in Iowa. The second caveat is whether a book written by amateur mushroomers should be reviewed by a professional in a professional journal. Yes, I know that all three authors hold Ph.D.'s in botany, and that at least two are mycologists, but that does not make them experts in agaricology, or even in higher fungi (Basidiomycotina, ascomycetes, etc.), much less toxicology or gastronomy. This caveat is real, for their presentation of descriptive text and illustrations is often amateurish. I don't mean incorrect or inaccurate—those aspects are adequate—I mean amateurish. First the illustrations: most are adequate, although not exciting or artistic enough to compete in today's market, but some (e.g. *Lactarius volenus*, really some member of the *Camphoratae*; *Hydnum scrobiculatum*, really *Phaeocol schweinitzii*) are misinformative. Others are marginally too dark for much interpretation, and a few are out of focus. Second, the text. Sometimes (e.g. *Hericium coralloides*) the key does not match its illustration; and sometimes (e.g. *Phallus impudicus* vs. *P. ravenelii*) descriptions do not separate the taxa. Keys and descriptions cover only the genera and species within the book, so 91 agarics and 12 boletes are described from a flora which should number at least 1,200 species. Chances are nine out of 10, therefore, that the mushroom you have in your hand will not be in the book; par for the course in amateur-aimed guidebooks. Then there is unevenness in discussion level. For example, basidial morphology in the jelly fungi (p. 243) is dismissed as "significant for the professional student of fungi but . . . of less concern for field recognition," while anatomical details are related elsewhere (cf. the Russulaceae, p. 98), and spore measurements are given in almost all descriptions.

All in all, then, this book fulfills the old adage, "In the land of the blind, the one-eyed man is king." It also represents, I'm sure, many hours of hard work, and I count two of the authors as scientific friends. So I offer my apology, but the book deserves no more than a grade of C.

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Darbre, Philippa D. 1988. **Introduction to Practical Molecular Biology.** John Wiley and Sons Ltd., NY. \$24.95. 117 p.

Here is yet another entry in a growing list of molecular biology laboratory manuals. This contribution purports to provide the basics of molecular biology for the bench scientist who wants to learn and apply this technology for the first time. It is intended to provide only very basic techniques for the relative novice. More advanced techniques and cloning procedures are not covered in this manual. The manual is divided into six chapters, including an introduction, each covering a specific topic. Each chapter contains a complete description of how to carry out the technique described making cross referencing to other chapters unnecessary. Although this is cumbersome at times, it is probably useful for someone who does not carry out these procedures on a routine basis.

The first chapter is an introduction to the basic structure and chemistry of DNA and RNA. In addition, several enzymes and their interactions with these polynucleotides are discussed. The chapter concludes with a brief description of hybridization and cloning. Although lacking in specific details, the chapter does provide a short overview of some fundamental aspects of molecular biology. The chapter should be read by anyone using the techniques covered in this manual for the first time so that some of the basic chemistry is understood. Molecular biology is, after all, rooted in the chemistry of nucleic acids and their enzymes.

Chapter two describes the isolation of DNA from tissues and cells in culture. It begins, as do all the chapters, with a very brief synopsis of the principles involved in applying the technique. This includes a flow diagram of the specific steps to be carried out and a tentative schedule for carrying out the procedure. The schedule is probably quite useful for someone who is carrying out the protocol

for the first time. It is particularly helpful in that it points out places where the procedure can be halted without jeopardizing the outcome. The individual protocols to be followed at each stage of the isolation are presented in simple to follow steps preceded by a short description of what is to be accomplished. The solutions and equipment required or recommended are clearly described. A complete recipe for making each solution is given except for the more routine solutions. In fact, a complete recipe for these routine solutions is given in one of the appendices leaving very little to question. The protocols presented are "tried and true" and should be expected to work the first time. The chapter ends with a method for determining both the concentration and the integrity of the DNA prepared. Primary references are provided at the end of each chapter for the researcher who wants to go back and read the original method.

Chapter three covers analysis of the DNA prepared in chapter two by restriction endonuclease digestion and Southern blotting. Potential sources for enzymes and chemicals required in each protocol are given. However, these are clearly meant for the reader in England. Many companies in the U.S. also supply these reagents at comparable quality. Unfortunately for the U.S. reader these sources are not provided. This chapter includes a description of how to pour an agarose gel when commercial gel casting supplies are not available. This description is complete and should be expected to work. The procedure described for Southern blotting is complete but somewhat complex. Easier methods for transfer exist but are not presented. The description of how to make a radioactive probe for detecting specific sequences on the Southern blot is quite good. The source of the DNA used in the labeling reaction is not discussed in this chapter but is described in a later chapter. The hybridization procedure presented is also more cumbersome than required but will work and is clearly described. The chapter concludes with a protocol for making radioactively labeled markers for the Southern blot. This is a real plus as this is often overlooked in other manuals describing Southern blots.

Chapter four describes the preparation of RNA from culture cells or tissue by two methods. The relative merits and problems with each method are described allowing the individual to decide which method best suits his/her situation. The introduction to this chapter correctly points out the need to minimize ribonuclease activity at all stages. In general the suggestions made for doing this are good. However, the author fails to point out that autoclaving is generally less than satisfactory in removing RNase contamination from solutions and glassware. For this reason, the procedures described here notwithstanding, the protocols provided are complete and easy to follow. A method for assessing the concentration and integrity of the isolated RNA is provided and is easy to perform. The chapter concludes with a method for isolating polyA⁺ RNA.

Chapter five describes the analysis of RNA by Northern blotting. A convenient graph for estimating size in nucleotides from S values is given in the introduction. Since size on Northern blots is often determined relative to rRNA present in the RNA preparation, this graph can be quite useful in estimating the size of the transcript detected by Northern hybridization. The procedure described for running the agarose gel to separate the RNA molecules on the basis of their size is clearly presented as is the hybridization protocol. A description of how to make a radioactive probe is provided, in full, making it unnecessary to go back to chapter three for this protocol. If the integrity of the RNA preparation is maintained these protocols should be expected to produce useful Northern blots.

The final chapter describes the preparation of DNA for use in making radioactive probes for both Southern and Northern hybridizations. It begins by describing the transformation of bacteria with a plasmid containing the DNA sequence of interest. A procedure for large scale isolation of plasmid DNA and isolation of the sought after DNA sequence on an agarose gel is included. The protocols provided are complete. There are easier ways to isolate the cloned DNA sequence of interest but the method provided should be expected to work.

The appendices provided at the end of the book should be quite useful to someone doing molecular biology for the first time. They include some common abbreviations used by all molecular biologists, sources of reagents and recipes for making routine solutions. Unfortunately, the sources appendix will be of limited use for the U.S. researcher since only British companies and their addresses are given. The recipes for routine solutions are quite good since they assume no previous knowledge of how to make the solution in question. Regrettably this manual lacks any direction for troubleshooting of the techniques covered. This aspect is of extreme importance to someone using these techniques for the first time.

In summary, this manual does a credible job of presenting some basic techniques in molecular biology in an easy to read fashion. However, it will quickly be outgrown by anyone needing these techniques in their research. For this reason more complete manuals such as **Molecular Cloning: A Laboratory Manual** by Maniatis, Fritsch, and Sambrook, **Basic Methods in Molecular Biology** by Davis *et al.* or **Current Protocols in Molecular Biology** edited by Ausubel *et al.* are probably better

buys. These manuals provide all the techniques covered in this introductory manual and many more. Although each of these manuals is more expensive (Current Protocols is approximately 10-fold more expensive), they cover a much wider range of molecular biological protocols.

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Phillips, Pamela. 1989. **The Great Ridley Rescue.** Mountain Press Publishing Company, Missoula, MT. \$19.95. 180 p.

This book is a thorough and enjoyable account of past and present efforts to save the Kemp's ridley sea turtle from extinction. Ms. Phillips has done a remarkable job in covering the wide circle of individuals who have been involved. The author begins with the early attempts of Professors Archie Carr and Henry Hildebrand to find the unknown nesting beaches of Kemp's ridley. They finally view a film made in 1947 of 40,000 Kemp's nesting at a spot on the east coast of Mexico called Rancho Nuevo. Upon visiting the beach in the early 1960's, the excitement of the film is replaced with the grim realization that the number of nesting females has dropped to under 1,500.

The book then goes on to describe the plan, directed by an international team of Mexicans and Americans, to recover the species. First, protect all of the nests, hatchlings and adult females at Rancho Nuevo from predators and poachers. Second, "imprint" about 2,000 hatchlings at Padre Island each year to try and establish a new nesting colony there. Third, "head-start" the Padre Island, imprinted hatchlings at the National Marine Fisheries Service Lab at Galveston for about a year. This provides them with a better chance of surviving marine predators who devour smaller hatchlings.

The author intersperses descriptions of the primitive living conditions at Rancho Nuevo with personal accounts of the workers who endured them. There are also humorous stories of the often dangerous flights to transport eggs from Mexico to Texas. The book is beautifully illustrated by Janie Lowe and many of the characters in the pictures are easily recognizable to members of the close-knit sea turtle conservation community.

A fictional account of the adventures of four head-started turtles, Tina, Juanita, Jose, and Timoteo is presented where they learn to eat new food, survive a shark attack, and become cold-stunned in Long Island Sound. Although these accounts are written for the younger reader, they are based on true situations and are accurate descriptions of the behavior and natural history of this species.

The final portion of the book addresses other hazards to sea turtles, especially drowning in shrimp trawls. This is seen by most sea turtle biologists as the reason for their continued decline to now under 500 nesting females. The book has an excellent account of the controversial TED regulations (Turtle Excluder Device) as they made their way through the courts and the U.S. Congress. It also describes how the organization HEART (Help Endangered Animals-Ridley Turtles) raises money for head-starting, lobbies Congress for TED regulations and informs thousands of adults and children about the plight of Kemp's ridley. The author is donating one third of the royalties from the book to HEART for Kemp's ridley conservation.

In conclusion, this book is a most enjoyable way of learning the complete Kemp's ridley story to date and what others can do to help save the species from extinction.

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Turgeon, D. D., A. E. Bogan, E. V. Coan, W. K. Emerson, W. G. Lyons, W. L. Pratt, C. F. E. Roper, A. Sheltema, F. G. Thompson, and J. D. Williams. 1988. **Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks.** American Fisheries Society Special Publication 16. \$30.00 (cloth); \$24.00 (paper). 277 p.

This is an excellent beginning. Its stated purpose is to "provide a checklist of species and to recommend selected common names for North American mollusks, thereby achieving uniformity and avoiding confusion in molluscan nomenclature." The checklist was developed by the Committee on Scientific and Vernacular Names of Mollusks of the Council of Systematic Malacologists [CSM] and the American Malacological Union [AMU] in response to a decision by the American Fisheries Society [AFS] in 1981 to prepare checklists of the common and scientific names of all aquatic invertebrates.

Preparation of this checklist began in 1983. By 1985, this checklist had been developed and submitted to the CSM, AMU, and FSC for approval. This is the published result of that endeavor.

It would seem unfair to compare this molluscan checklist with the Checklist of Common and Scientific Names of Fishes from the United States and Canada (Robins *et al.* 1980). That checklist is the latest result of 50 years of development and review; whereas, the molluscan checklist is the product of only three years of much controversy and development. With this in mind particularly, this molluscan checklist is an excellent beginning.

The checklist, developed following closely the experience and style of the checklist of fishes, contains the following sections:

Alphabetical list of families.

Phylogenetic list by class, order, and family.

Introduction.

Dedication [to Dr. Robert F. Hutton].

Names of mollusks [includes scientific name, occurrence, and common name for each species].

Endangered and threatened mollusks of North America.

Possibly extinct mollusks of the United States.

Index.

Portfolio of mollusk diversity [illustrated by 35 colored plates].

The introduction discusses the history and background of this listing. The area of coverage by the checklist is also discussed. The principles by which common names are to be selected and used are enumerated—these follow closely those in use to select common names for fishes. Included are the published specific resolutions, unanimously accepted at the 1983 meetings of the CSM, AMU, and AFS, regarding use of scientific and common names. Methods by which new common names or revisions to already accepted names can be proposed are given. It is also stated that the second edition of this molluscan checklist will be published five years following publication of the first checklist. Following publication of the second checklist, revisions will be published every 10 years. The list, including all persons contributing to this molluscan listing, is a clear indication of the inclusiveness of the American and Canadian Malacologists having a part in development of this molluscan checklist.

There are approximately 5,700 molluscan species in the checklist—about double the number in the fish species checklist. Besides aquatic mollusca, the listing also includes land mollusca. The area of coverage duplicates that covered in the fish checklist—all waters to a 200 m depth on the continental shelf, Arctic Ocean, Canada, United States, and northern Gulf of Mexico to mouth of Rio Grande River. Hawaii, Greenland, Iceland, Bermuda, the Bahamas, and the West Indies are excluded.

There seems to be a wide variation between several of the molluscan groups in interpretation of several of the principles used governing the making of a common name and the species to be given a common name. For example:

Principal #6, concerning common name formation states: “*Names intended to honor persons . . . are discouraged in that they are without descriptive value. . . .* However, some patronymics are already well established in literature, agency regulations, and industry. . . .” The latter portion of the principle seems to express a possible acceptance for some well established common names that are based on the name of a person. The question then is—how many? For example: 1% or less of the common names assigned to the freshwater bivalves, gastropods and chitons seem named after a person while about 4% of the cephalopods and 12% of the marine bivalves are named after a person. While the listing of common fishes names contains almost no names honoring a person, it is this reviewer’s hope that a few of the names honoring a malacologist of note will be retained.

Principal # 7 states: “Only clearly defined and well-marked taxonomic entities (usually species) shall be assigned common names.” Again there is a difference of opinion between those making up the checklists of the various malacological groups, note: Common names are given for most solenogasters, bivalves, scaphopods, cephalopods, and freshwater and land gastropods. However, about 38% of the listed chitons and marine gastropods are without a common name.

This listing of accepted molluscan common names will be of considerable use to those persons publishing endangered or threatened species materials. It is hoped here that the scientific community and the general public will use this as a basis when common molluscan names are needed. While there are some inconsistencies in how the different groups are handled, as noted above, these certainly can be addressed in the second edition.

The editors of this checklist are to be commended for the large amount of work they have done on this report. The AFC, AMU, and CSM are also commended for seeing that this compilation was begun, carried through, and published.

LITERATURE CITED

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1980. *A List of Common and Scientific Names of Fishes from the United States and Canada* (Fourth Edition). American Fisheries Society Special Publication 12.

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Alcock, John. 1989. **Animal Behavior: An Evolutionary Approach**, 4th Ed. Sinauer Associates, Inc., Sunderland, MA. \$34.95. 652 p.

Alcock's fourth edition of *Animal Behavior* is, like the previous editions, an exciting, interesting, and thought-provoking introduction to the field. I've used this text in my introductory course because of its coverage, and because students found his style clear and informative, even when he dealt with difficult topics. This edition, like those in the past, is well illustrated with simple graphs, clear line drawings, and appropriate photographs.

The book is divided into 16 chapters. The first sets the stage for what will follow by distinguishing clearly between proximate and ultimate explanations of behavior, a distinction whose significance occasionally eludes even professional biologists. Then follows an explanation of how natural selection operates and the contributions made by Darwin, Tinbergen, Lorenz, and von Frisch to the development of animal behavior as a subdiscipline in evolutionary biology. The chapter concludes with a discussion of three important concepts: group selection (and its weaknesses), the "adaptationist" approach to hypothesis testing (Alcock quickly dispatches the criticism of S. J. Gould that adaptationists generate nothing but "just-so" stories), and "certainty" in science, as illustrated by weak and strong hypothesis testing procedures. The last two topics, completing this chapter, are new to this edition. They provide students with important insights not only into what constitutes good science, but to why answers to scientific questions are never final.

The next five chapters emphasize proximate questions (mechanisms) underlying learning and instinct, the genetics and development of behavior, stimulus filtering, and the organization of the nervous and endocrine system. What emerges is an up-to-date understanding of how organisms interpret important sensory messages in their world, how they orchestrate appropriate responses to immediate and anticipated changes, and how they establish priorities when the information received is conflicting. These chapters are much more complete than in past editions.

Ten chapters then follow dealing with ultimate (evolutionary) analyses of behavior. These begin by explaining how historical patterns of behavioral change can be deduced, both from fossil evidence and comparative study. The latter topic is covered in greater detail in the next chapter, where its strengths and limitations are considered. Again, the "adaptationist approach" is discussed but now, after a consideration of what comparative studies reveal about the adaptations. These are shown as less than perfect behavioral modifications because of past evolutionary constraints and their vulnerability to exploitation by conspecifics and/or predators. Additional chapters cover habitat selection, foraging strategies, antipredator behavior, sexual reproduction and mating systems (three chapters), and the ecology of social behavior with special emphasis upon the evolution of altruism. The uncertainties surrounding how altruistic behavior evolved, especially in the social insects, are well documented.

The final chapter deals with human behavior. Alcock asks if the evolutionary approach used so successfully to answer ultimate questions about animals, could be used to provide useful hypotheses concerning human evolution. The chapter begins with a spirited defense of the sociobiological approach to such an analysis. Then follows the application of this approach to hypothesis testing in key areas: sexuality (including mate choice, parental care, homosexuality, and rape), child abuse, inheritance rules, and warfare. I, for one, am convinced that the approach has led to a number of provocative hypotheses, many of which might never have been formulated by scientists in other fields: some, indeed, receive support from data gathered in totally different contexts.

These days, those of us teaching introductory courses in *Animal Behavior* have available many good texts. But in my opinion, none present such an array of concepts as clearly or in as interesting a manner as this book. One reads Alcock knowing that he is genuinely in love with animals and what they do. His enthusiasm is infectious. Most students take *Animal Behavior* because they are interested in what "whole" animals do. When they finish this book, they not only can share what we've learned; they will also retain that interest. The challenge is for the course instructor to do as well at the podium.

The book comes with an Instructor's Manual (which I have not yet seen) that includes a list of recommended films, questions for short quizzes and longer exams, and answers to all discussion questions posed at the end of each chapter.

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NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
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ABOUT PEOPLE AND PLACES

ALABAMA

Tuskegee University, Department of Biology. The department recently received a Department of Education Minority Institution Science Improvement Program grant to upgrade laboratory courses. The money will be used to benefit the Environmental Biology thrusts of the curriculum, add computerized data acquisition modules to the Physiology course, and close the gap generally between a Biotechnology course at the upper end of the curriculum, and the modernized freshman laboratory experience at the beginning. *Dr. Carl Sagan*, the *David Duncan* Professor of Astronomy and Space Sciences, and Director of the Laboratory for Planetary Studies at Cornell University, spoke at the 1988–89 Annual Scholarship Convocation. His talk, entitled “Two Futures,” emphasized the importance of education in understanding and eventually solving the problems facing the planet Earth. A four year grant has been received from the Packard Foundation to assist in retention of students in engineering and the sciences.

FLORIDA

Tall Timbers Research Station, Tallahassee. The Research Station and The Nature Conservancy cosponsored a Fire Ecology Conference on 18–20 May 1989. The meeting focused on habitats which burn catastrophically or with high intensity. The conference included invited papers plus discussions. Results will be published by the Research Station as the Proceedings of the 17th Fire Ecology Conference.

Florida Southern College, Division of Science and Math. *Dr. John L. Griffiths, Jr.*, has joined the faculty in the Department of Citrus and Sub-Tropical Horticulture. He received his Ph.D. at the University of Florida. *Dr. Griffiths* has had practical experience on research staffs of subtropical nurseries and tissue culture firms.

Archbold Biological Station, Lake Placid. *James L. Wolfe*, Executive Director 1985–88, left the Station in August to become Dean of Graduate Studies and Research at Emporia State University, Emporia, Kansas. He was replaced by *John W. Fitzpatrick*, Chairman, Zoology Department, Field Museum of Natural History, Chicago. *Eric S. Menges* joined the scientific staff as a Research Biologist in Plant Ecology. He earned his graduate degrees at the University of Wisconsin's (Madison) Botany Department. One of Eric's major scientific interests is the demography and life history of rare plant species. *Glen Woolfenden* was appointed Graduate Research Professor at the University of South Florida. He gave an invited paper on “Scrub jay dynasties” at the Centennial meeting of the German Ornithological Society in Bonn, and he was elected to be a Corresponding Fellow of the society.

GEORGIA

Oxford College of Emory University, Department of Natural Science and Mathematics. *Dr. James F. Landt* died on 28 March 1988.

Valdosta State College, Department of Biology. *Dr. Michael E. Smith* has joined the faculty as an Assistant Professor. He received his Ph.D. from the University of Wisconsin–Milwaukee. *Dr. Smith's* area of expertise is aquatic invertebrate biology with special interest in Oligochaeta. *Dr. Richard Carter*, Assistant Professor of Biology and Curator of the Herbarium, will be on leave for six months beginning 15 June 1989. He will be at Missouri Botanical Garden in St. Louis as a research associate to participate in the treatment of cyperaceae, particularly *Cyperus*, for the Flora of North America Project. During

his absence, *Dr. Wayne Faircloth* will coordinate the Herbarium activities to make specimens available to researchers.

Georgia Southern College, Department of Biology. The following new faculty joined the department this past year: *Olushola A. Adeyeye* (Ph.D. University of Georgia), Chemical ecology of insect-plant interactions; tick ecology and physiology; *William S. Irby* (Ph.D. North Carolina State University), Vector-host-pathogen interactions in arthropods. Also new to the staff are *John W. Parrish* (Ph.D. Bowling Green State University), Professor and Head of the Department, Avian and mammalian visual mechanisms, avian bioenergetics and nutrition; *Lisa K. Wagner* (Ph.D. University of California, Berkeley), Director, Georgia Southern College Botanical Garden. Research interests are the life history strategies, resource allocation patterns, and population biology of plants, especially in weedy species. *Dr. Jim Oliver*, Callaway Professor, is President-Elect of the Entomological Society of America.

KENTUCKY

Western Kentucky University, Department of Biology. *Dr. Robert Hoyt* has been selected as a scientist in residence at the Scottish Marine Biological Station in Oban, Scotland, for a nine week stay this summer to examine receptor organ development in larval fish. *Dr. Valgene Dunham*, Professor and Head of the Department, has been awarded a \$106,300 NSF Young Scholars Program grant to provide research experiences in molecular biology for high school students over the summers of 1989 and 1990. Other faculty associated with the program are *Dr. Martin Houston*, *Dr. Pat Pearson*, *Dr. Claire Rinehart* and *Dr. Frank Toman*. The Department also received a gift in excess of \$50,000 from McCrone Environmental Associates for installation of a high resolution JEOL electron microscope, bringing the total operational electron microscopes up to four in the department's newly expanded EM facility directed by *J. R. McCurry*.

LOUISIANA

Louisiana State University, Department of Botany. *Dr. Janet Keough*, a research associate with the Botany Department at LSU, has taken a position with the U.S. Fish & Wildlife Service, National Wetlands Research Division, Slidell, LA. *Dr. Jim Grace* has become the new Chairperson of the Ecological Section of the Botanical Society of America. *Dr. G. Bruce Williamson* and *Dr. Nikolaus H. Fischer* received support for a \$185,000 project entitled "Mechanisms of allelopathy in pine forests of the Southeastern Coastal Plain" from the Department of Agriculture. *Susan Langevin* was the winner of the 1988 Best Student Paper Award for the Ecological Section of the Botanical Society of America. Her paper, "Hybridization between red rice and cultivated rice" was presented at the AIBS meetings, and was co-authored by *Dr. Jim Grace* of LSU and *Dr. Keith Clay* of Indiana University.

MISSISSIPPI

Mississippi College, Department of Biological Sciences. *Dr. Bill P. Stark* is co-author, with *Dr. Kenneth Stewart* of the University of North Texas, of *Nymphs of North American Stonefly Genera (Plecoptera)* which was recently released. The book was published by the Entomological Society of America through the Thomas Say Foundation and is considered a sequel to *Peter W. Claasson's* classic *Plecoptera Nymphs of North America* published by the Thomas Say Foundation in 1931.

Gulf Coast Research Laboratory, Ocean Springs. The Laboratory has been awarded a \$249,976 contract to study the effects of anti-fouling paint on the estuarine environment and related organisms. Another grant from NSF will support a project which aims to increase minority presence in the marine sciences. *Dr. Harold D. Howse*, GCRL Director, and *Dr. Dirk Frankenberg*, marine science coordinator at the University of North Carolina at Chapel Hill, are the principal investigators. *Dr. Harold Howse* received the Outstanding Contributions to Science in Mississippi award for 1988-89 from the Mississippi Academy of Sciences during its annual meeting in Jackson. *Dr. Julia S. Lytle*, head of the environmental chemistry section, will serve as president of the Mississippi Academy of Sciences for 1989-90. The Laboratory offers a wide range of courses relating to the marine environment during the summer term. Additional information on courses, schedules, fees and prerequisites may be obtained from *Dr. David W. Cook*, GCRL, P.O. Box 7000, Ocean Springs, MS 39564-7000 or call (601) 872-4201.

NORTH CAROLINA

University of North Carolina at Greensboro, Department of Biology. Dr. Bruce Kirchoff has received an NSF grant to support two students in his laboratory from May 1989 to 1990. The students will work on several problems in the plant order Zingiberales. Dr. John Lepri joined the department in January 1989, coming from Princeton University where he was a Lecturer in Biology. His research focuses on the role of odors in the coordination of mammalian reproduction. Dr. Robert Stavn gave a paper at the Annual Meeting of the American Society of Limnology and Oceanography, Alaska, entitled, "Hydrologic Optics of South-eastern Lakes and Reservoirs."

SOUTH CAROLINA

Francis Marion College, Department of Biology. Dr. Larry McCumber and Dr. David Stroup were recently awarded \$49,085 for the first year of a three year \$103,157 study of "The Cellular Basis of Inflammation in the Crayfish." Dr. McCumber has studied the invertebrate immune system for the past 15 years, and is internationally recognized as an authority on the crustacean immune system.

University of South Carolina, Department of Biological Sciences. A new reading room was dedicated on 29 March 1989 to the late Dr. James T. Penney who, for 35 years, was Professor of Biology at the University of South Carolina. He was one of the original organizers of ASB in 1937, and in that year he served as the first Secretary-Treasurer. He was also a former Vice President and President of ASB.

Furman University, Department of Biology. Dr. Wade B. Worthen has been hired as an Assistant Professor of Biology. He replaces Dr. Robert W. Kelly who retired in 1988.

Erskine College, Department of Biology. Janice H. Haldeman, Associate Professor and Chairman of the Department, was graduated from Clemson University with a Ph.D. in Plant Physiology. Her dissertation is entitled "Application of Tissue Culture Techniques to Tea, *Camellia sinensis*." Dr. Doug Facey, Assistant Professor of Biology, has received funding to spend the summer studying the distribution and abundance of stream fishes in the southern Lake Champlain Basin. Dr. Mary Lang Edwards will join the faculty as an Assistant Professor of Biology in September 1989.

College of Charleston, Department of Biology. Professor Zhang Zhinan, Dean of the Department of Marine Biology of the Ocean University of Qingdao, People's Republic of China, has been a visiting professor in the Biology Department during the Spring semester. Dr. Zhang's research focus was on the biology of marine meiofaunal nematodes.

TENNESSEE

Memphis State University, Department of Biology. Tennessee officials announced recently the finalization of agreements to fund and initiate a three to five year fresh water mussel project on Kentucky Lake. The goal of the project is to characterize the chemodynamics associated with the movement of chemicals from contaminated sediments into the water column and the subsequent toxicity of the indigenous fresh water mussels. Dr. Kent Gartner was awarded a grant from the Heart, Lung, and Blood Institute of the NIH for \$100,000 to support his platelet research program. Dr. Steve Klaine has been named to the Sigma Xi College of Lecturers for 1989-91. The first "Chair of Excellence" established in the state has been filled by Dr. S. Edward Stevens, Jr., a microbiologist and molecular biologist who comes from the Pennsylvania State University. Dr. Stevens received his Ph.D. in Botany from the University of Texas at Austin. Most of his research has been on cyanobacteria. Dr. Stevens has also worked extensively on the microbial desulfurization of coal and on the use of constructed wetlands for the abatement of acid mine drainage resulting from the mining of coal. New faculty are Dr. Charles Lessman, a cell physiologist, coming to Memphis State as an Associate Professor. He earned his Ph.D. at the University of Minnesota, and was awarded a Mellon Foundation Postdoctoral Fellowship at Johns Hopkins. Beverly Collins (Ph.D. Rutgers University) joins the staff as a plant ecologist. She served a postdoctoral fellowship at the Savannah River Ecology Laboratory. Dr. King-Thom Chung, the newest member of the faculty, works in microbiology and his research interests are in the metabolism of azo dyes and nitrated polycyclic aromatic hydrocarbons by intestinal microflora. He earned Ph.D. degrees from the University of California, Santa Cruz and Davis.

VIRGINIA

Mountain Lake Biological Station, University of Virginia. The following courses will be taught at the Station during the summer of 1989: 11 June-15 July 1989, Plant Taxonomy, instructor Spencer

Tomb, Kansas State Univ.; Ornithology, instructor *James R. Karr*, Virginia Tech; Behavioral Ecology, instructor *Jerry D. Wolff*, Villanova Univ.; Workshop in Allozyme Techniques, instructor *Charles T. Werth*, Texas Tech Univ. The second term (16 July–19 August 1989) courses are: Community Ecology, instructors *Joseph Travis*, Fla. State Univ., and *Henry M. Wilbur*, Duke Univ.; Mammalogy, instructor *Jack I. Cranford*, Virginia Tech; Workshop in Mitochondrial DNA (16 July–29 July), instructor *D. Colin Stine*, Johns Hopkins Univ.; Workshop in Molecular Techniques for Field Biology (30 July–19 Aug.), instructors *Daniel J. Burke*, Univ. of Virginia, and *Michael P. Timko*, Univ. of Virginia. Scholarships are available. Contact for further information, Director, Mountain Lake Biological Station, Rm. 251, Gilmer Hall, University of Virginia, Charlottesville, VA 22901.

Lynchburg College, Biology Department. Dr. *William Sherwood* will be retiring at the end of the 1988–89 academic year. Dr. *Orrie O. Stenroos* will be resigning as Chairman of the Department at the same time. Dr. *Ralph I. Peters*, from Wichita State University, will be Dr. *Sherwood's* replacement, and will take over as Chairman of the Department.

James Madison University, Department of Biology. *Grace A. Wynngaard* received a grant from the Savannah River Research Parks Program to study "Diapause in Cyclopoid Copepod Communities in Rainbow Bay and Flamingo Bay and its Relationship to Population Dynamics and Species Composition." The University has recently acquired an AMRAY 18201 Scanning Electron Microscope. The JMU Arboretum was dedicated on 28 April 1989.

ABOUT MUSEUMS AND BOTANICAL GARDENS

GEORGIA

Emory University Museum of Art and Archaeology, Atlanta. The following is the University Museum exhibition calendar for 1989–90. From 8 February through 13 May 1989, "Monuments and Mummies: The Shelton Expedition to Egypt." April 5 through 24 June 1989, "The Fragrant Past: Perfumes of Cleopatra and Julius Caesar." May 31 through 29 July 1989, "Works on Paper: Selections from the Permanent Collection." September 13, 1989 through 14 April 1990, "Syracuse, The Fairest Greek City: Ancient Art from the Museo Archeologico Regionale Paolo Orsi." December 6, 1989 through 19 March 1990, "Radiance in Stone: Ancient Sculptures in Colored Marble from the Museo Nazionale Romano."

KENTUCKY

Museum of History and Science, Louisville. The Museum recently received a three-year grant of \$45,000 from the National Science Foundation, Informal Science Instruction division. This money will be used to start a new outreach program of urban ecology in downtown Louisville. The program will promote outdoor education in parks, schoolyards, recreation centers and after schools. The dinosaurs are back! From 2 September 1989 until 19 November 1989, the Museum will have on display the herd of six roaring, moving, animated dinosaurs. This will be their fifth triumphant appearance in Louisville, courtesy of Dinamation. The Museum has received a two-year grant totalling \$150,000 from the Department of Education, Washington, D.C. for TIPS—Teacher Internship Program in Science. The museum was one of only two museums in the country to receive grant money from this special fund. The Museum recorded a record 353,467 visitors in 1988. In comparison, calendar 1987 ushered in 154,251 Museum patrons.

SOUTH CAROLINA

Brookgreen Gardens, Murrells Inlet. *Brad Batdorf* is a new Education Coordinator. *Batdorf* holds a B.S. in Biology Education from Bob Jones University, and a M.A. Education degree in Biology from The Citadel. He is one of two Coordinators who develop and implement education programs, and manage the Volunteer program.

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The ASB BULLETIN

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The Association of Southeastern Biologists***

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1990	April 19-21	Towson State University, Towson, MD
1991	April 10-13	Appalachian State University, Boone, NC
1992	April	University Alabama-Birmingham, Birmingham, AL
1993	April	Old Dominion University, Norfolk or Virginia Beach, VA

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PRESIDENT'S CORNER

A VIEW FROM HERE

Each member of *ASB* can take pride in the activities and accomplishments of our organization when one looks at the collective record that has been attained over the past 51.5 yr. The accomplishments are those of volunteers who serve on committees and offer their services in coordinating the annual meeting. Individuals who share their research interests by presenting papers, posters, and contribute to our special symposia and workshops also share in the credit of a society rich in tradition and camaraderie. Those who bring and sponsor the undergraduate and graduate student participants at the annual meeting contribute to our legacy. Submission of papers and research reports as well as news and notes for publication in the *Bulletin* enhances the role of *ASB* as the umbrella organization for biology in the region we primarily serve. The numerous individuals who let it be known that they are willing to serve in various capacities also sustain that important spirit of *ASB* that contributes to the lasting professional relationships enjoyed by the members. The type of participation listed above is what encourages the elected and appointed officials of *ASB* to pursue the goals and aims of our society.

For several years two issues have surfaced from discussions among the membership and from society at large that require our collective attention and collective action. The two issues are: (1) the public's understanding (or misunderstanding) of science and (2) the continued loss of biodiversity, not only in the southeast but on a global scale. The members of *ASB*, as well as the members of any profession in the sciences, require no message about the significance of the issues and it is not incorrect to state that scientists, biologists in particular, know how to contribute the knowledge and expertise to both improve scientific literacy and to develop meaningful programs to preserve the earth's remaining biota. Past *ASB* forums, plenary sessions, Conservation Committee activities and resolutions adopted by the membership have focused on these types of issues. At the April 1989 meeting a resolution on biological diversity was passed by the membership and copies along with a cover letter about *ASB* concerns in regard to the issue have been sent to 33 United States Congressmen and Senators from the southeast who serve on committees that address legislation relating to environmental and biological programs. It is anticipated that a significant thrust of our April 1990 meeting, being in close proximity to Washington, will focus on how southeastern biologists can have positive impact on biological diversity legislation. The *ASB*

Education Committee is reviewing the 1989 AAAS publication Project 2061 Panel Report "Biological and Health Sciences" which focuses on what type of biological sciences curriculum should serve as a central role in the education of a democratic society. A preview of the AAAS program indicates that scientific societies will be significantly involved in programs to improve the scientific literacy of future generations. On a regional basis, organizations such as *ASB* will probably be called upon to provide support and advice in assuring that educational establishments at all levels have access to new approaches in science education. In January of this year I asked each state Governor within the *ASB* region to respond with their views on the significance of the two issues listed above in regard to their state. At the time of this writing (June) detailed responses were still coming in and a synthesis of the Chief Executive's responses is planned for the January issue of the *Bulletin*.

It appears to me however (a view from here), that as individuals we have the opportunity and obligation to express our concerns and support for programs and legislation relating to scientific (or biological) literacy and biological diversity to the general public but it is difficult to express in concise enough terms why such support (often viewed as expensive) is not only deserved but needed. I would like to propose that we capitalize upon an ingrained acceptance that the American public has for the necessity of paying insurance premiums. This is not an original thought on my part but was expressed by William Ruckelshaus when addressing costs to reduce global warming during this May's Forum on Global Change and Our Common Future, sponsored by the National Academy of Sciences, Smithsonian Institution, AAAS, and Sigma Xi. The majority of individuals and corporations accept the fact that premiums must be paid to insure against a variety of disasters that they hope will never happen and that there are no financial gains on returns if the insurance is not used. In obligating increased costs (increased premiums) to improve our nation's scientific literacy or to insure preservation of the variety of our earth's biota real gains are accrued. In the former a more scientifically literate public will enhance our technology's competitiveness on an international scale, and better understanding of basic biological functions will reduce health costs (and perhaps health insurance premiums) as the upcoming generations better recognize the interrelationships between the human species and the environment. In the latter, insurance premiums paid to reverse, retard or eliminate the accelerating loss of biological diversity, which we biologists feel is a certain disaster, will pay dividends in preserving for future generations a more stable and diverse environment. In this regard perhaps the insurance argument is at its best. To those who disagree that loss of biological diversity in the southeast is courting disaster we retort that perhaps we will be wrong but that the premiums paid to insure against our feared biological accident will still pay for environmental improvements in addition to providing peace of mind.

ASSOCIATION AFFAIRS

ON ISSUES AND RESPONSIBILITIES

From the address of the Past President presented at the ASB annual meeting
7 April 1989

Rebecca R. Sharitz

Savannah River Ecology Laboratory and
Department of Botany, University of Georgia
Aiken, SC 29802

“Sophisticated observers on Mars could note not only our cities, our highways, and the great wall of China, but also the disappearance of tropical forests, rapid changes in the composition and radiative characteristics of our atmosphere, and the dramatic annihilation of our protective ozone layer over the Antarctic. They might speculate that further changes could eventually affect the planet’s ability to sustain life. They might further suppose that a species clever enough to produce such changes would be astute enough to worry about them.”

This claim was made recently by Hal Mooney in the preface to a document on global change prepared by the U.S. National Committee for the International Geosphere-Biosphere Program (1). But I’m not so sure that Hal and the Martians are right. Neither am I convinced that our society is acting on these issues. As a busy professional, with too many responsibilities and too little time, I feel an urgency to identify responses—things that I can do within the framework of my own resources, skills, energy, and time.

Let me take two major examples of biological and ecological issues that are becoming widely recognized. Both have been the subject of symposia and workshops at major scientific meetings, and we’ve talked a lot about them at this annual meeting. Both have caught the attention of the media and the public. Both have prompted some legislative action. And both are becoming increasingly important to us here in the Southeast. These two issues are: (1) the loss of diversity, as land uses change, industrial and urban activities expand, and the population continues to increase; and (2) the potential effects of future climate change, especially increasing temperatures and levels of CO₂.

My interests in these issues stem from my own research during the past 20 years at the Savannah River Ecology Laboratory and elsewhere in the Southeast. During this time, I have conducted studies that have documented the loss or change in diversity of aquatic and wetland species when water temperatures increased as a result of industrial activities on the Savannah River Site. I have also studied the effects of altered hydrologic patterns, such as might result from changes in climate conditions, on dispersal, seedling establishment, and juvenile recruitment of swamp forest tree species in the floodplain of the Savannah River. Likewise, during these 20 years, I have also witnessed the continued loss or conversion of wetlands in the Southeast. But tonight I want to focus, not on research, but on issues and responsibilities.

Prior to this meeting, the ASB co-sponsored a workshop on biodiversity with the US Forest Service and the Southeastern Chapter of the Ecological Society of America. It was an excellent two day session that brought together participants with different backgrounds and viewpoints. We began with some basic concerns: that species extinction rates throughout the world are increasing, that major portions of our natural habitats (especially our tropical forests) are being lost each year, and that uncontrolled or accidental releases of contaminants are taking their toll, especially on aquatic and marine life. Since the early 1600's, more than 500 species or subspecies of native plants and animals have become extinct in North America, and the US Fish and Wildlife Service currently lists almost 1,000 taxa as endangered or threatened.

Ecologists, foresters, and land managers, in the Southeast, are still wrestling with the definition of biodiversity. We are searching for ways to evaluate and to manage for biological diversity at all levels—landscape, community, species and genetic—and at various scales. We have talked about effects of processes such as disturbance, and we have discussed how the changing climate may interact with landscape fragmentation to pose a major threat to the maintenance of diversity.

Public concern over the loss of biodiversity has risen during the last decade, and fortunately this has brought the initiation of some regulatory action. For example, Representative James Scheuer of New York introduced a bill into the 100th Congress last year, the "National Biological Diversity Conservation and Environmental Research Act." The bill was not passed, but it was referred to subcommittee and received some debate. This spring, it was reintroduced by Rep. Scheuer as House bill HR 1268. This bill was referred to the House Science, Space, and Technology Committee, which recently completed hearings, and the Merchant Marine and Fisheries Committee, which has not yet scheduled hearings. Of even greater interest to us in the Southeast was the introduction by Senator Albert Gore of Tennessee in February of his bill, the "World Environment Policy Act," Senate bill S.201. Title VIII of this bill is the Senate version of the biodiversity bill. This bill was referred to the Senate Environment Committee, where initial hearings have recently been held.

These biodiversity bills have provisions that cover several major issues. They would establish the conservation of biodiversity as a national goal. They would require that impacts on biological diversity be considered in the preparation of environmental impact statements. They would require a coordinated federal program to restore and maintain biodiversity in the United States. They also would create a National Center for Biological Diversity and Conservation Research to improve our knowledge of resource management to protect biodiversity. These bills do not address planetary issues, and in this they fall short; but they are an important step in the right direction.

The second issue I want to address, global climate change, has recently received widespread attention. The drought of 1988 has done more to awaken public awareness to the earth's role in human density than any event in many years. Although we biologists may fear that the public's interest is a fad, the threat of global environmental change has brought together diverse national ideologies and economic interests.

Here are some facts and predictions from global circulation models. We already know that the levels of CO₂ have increased approximately 25% since 1900. Today most atmospheric scientists will agree that, even if fossil fuel emissions are re-

duced, CO₂ levels will double by the second half of the 21st century (2). Such doubling of concentrations of these radiative gases in the atmosphere is expected to lead to a rise in global temperatures of about 3 C by the end of the next century. In addition, it is predicted that global temperatures will rise rapidly, between 0.1 and 0.8° C per decade. This is an important observation: not only will predicted temperatures be higher than any during the last several million years, but the rates of change will be more than an order of magnitude faster than any recorded in Quaternary history (1). Human beings have never experienced such rapid global temperature increases! Ecological systems will be required to respond to quite different temperatures from those under which they evolved; this raises serious questions about their potential adaptive responses. Precipitation patterns may also change; portions of North America may experience up to a 40% decrease in rainfall by the middle of the 21st century. This drop in precipitation, coupled with elevated temperatures and increased evapotranspiration, could exacerbate drying conditions (3).

The US National Committee for the IGBP identified, in its 1988 report, critical gaps in our understanding that need to be addressed. Five major areas include: (1) water-energy-vegetation interactions—the coupling of the climate, especially hydrologic processes, with the dynamics of terrestrial vegetation; (2) fluxes of radiatively active trace gases and nutrients to and from the terrestrial biosphere; (3) biogeochemical dynamics of the oceans that influence their ability to sequester or release radiatively active gases such as CO₂ and organic sulphur species; (4) studies of the earth's history as recorded in ice cores, sediment deposits, and other indicators of change, to reconstruct the record of the past and use it in predicting future changes; and (5) studies of human interactions with the global environment, to document and analyze land use changes and changes in industrial production and consumption during the last several hundred years, and to use this information to understand the effects of human activities on the processes that drive global change.

One encouraging move for research is the interagency cooperation between NSF, NASA, NOAA, DOE, USGS, and the Office of Naval Research to participate in the International Geosphere-Biosphere Program. The Bush Administration's FY 1990 budget request also shows some increase in funding for research on global change in several federal agencies.

The global circulation models that are useful for predicting global weather patterns are not easily applicable for predicting long-term climate changes in a region or a locality; there is a problem of scale. Some predictions of changes that could drastically affect the Southeast are: (1) temperatures will increase, and these increases will be coupled with more arid conditions; (2) there will be a rise in sea level associated with increasing global temperatures that will result in inundation and erosion of low-lying coastal areas; and (3) there will be changes in precipitation patterns, especially in the timing and intensity of major storms (1). To predict the effects of such major changes on southeastern ecosystems and biota, we need to study the physiological responses of plants and animals to multiple stresses. We need to determine patterns of genetic variability in order to predict evolutionary responses to rapid change, and we need to identify characteristics that enable some species to adjust their geographical ranges rapidly in the face of change, while other species become extinct.

It is encouraging that climate change issues are rising from obscurity to assume

a place on legislative agenda. There are several bills recently introduced into Congress that have some bearing on this issue, and I am pleased that our southeastern Congressmen are taking a lead. I have already mentioned Senator Gore's bill, the "World Environment Policy Act of 1989." This bill addresses not only the biodiversity issue, but contains provisions for several major environmental initiatives. It would replace the Council on Environmental Quality with a new Council on World Environment that would absorb the responsibilities of the old CEQ and take on additional international responsibilities. The bill calls for phasing out the use of CFC's by the year 2000. It calls for study of ways to reduce methane emissions, and it would raise vehicle fuel efficiency standards. This is an important piece of environmental and ecological legislation, which deserves our strongest support.

Senator Hollings of South Carolina has reintroduced his 1988 bill to establish a "National Global Change Research Act," that would mandate a plan to coordinate federal research on global climate change; this is Senate bill S. 169. The bill has been reported out of the Senate Commerce Committee and is waiting for a vote by the full Senate. A companion bill introduced into the House by Rep. Walter Jones of North Carolina would amend the National Environmental Policy Act to require federal agencies to consider the effects of their activities on global warming in the environmental impact statement preparation process; this is House bill HR 980. This bill would also establish a Council on Global Environmental Policy. It has been referred to several House committees and is currently undergoing hearings.

These are vital issues on a global scale. I feel that it is important to consider what we in the Southeast can do about them—as the Association of Southeastern Biologists, as professional scientists, and as individual members of our communities. The Southeast is a region of increasing potential, of increasing economic growth. We should expect major changes in this region over the next years. But are we conserving our biological resources? Are we developing and maintaining our competitiveness? Are our schools teaching ecological and evolutionary issues? Are we serving on regional, national, and international committees, study groups, and planning organizations that make decisions about environmental programs and policies? These are questions that need to be considered by all of us, as members of ASB, as professional scientists, and as private citizens.

As an organization, ASB can support state and federal legislative activities and take a stand on these issues. We, the scientific community, are urgently challenged with providing decision makers with the best possible assessments of the future course of the global environment—assessments upon which policies to mitigate, control or adapt to changes can be made. The situation that surrounds the making of laws is such that the guidance of professional biologists and ecologists is urgently needed. We have the knowledge and understanding that decision makers need.

ASB took a strong position when we passed the resolution supporting legislation for the maintenance of biodiversity at our business meeting. This was a very timely and perceptive step, and I congratulate the Association on this action. As an affiliate of AIBS and AAAS, ASB can stay abreast of current issues and give its endorsement and support to federal activities.

As professional scientists, there is much we can do. As teachers, we play critical roles. We can bring these issues into the classroom and go beyond the contents

of our current texts to make our students aware of these problems and concerns. We have an extremely important audience. Our students are not only the work force and decision makers of tomorrow, but they are also the ones who will be left with the legacy of today's actions and will have to deal with these problems in the 21st century. They will have to continue to take action on these issues, so we must give them the scientific training and perspective they need.

This is a good time to mention ASB's recent association with the Alliance for Environmental Education. The goal of AEE is to foster the teaching of environmental sciences at all levels. Through AEE we can support "The National Environmental Education Act" (S. 1076) which has been introduced by Senator Quenton Burdick of North Dakota. The bill's provisions create an Office of Environmental Education at the EPA, which is designed to increase public awareness and understanding of environmental issues and to support environmental education and training.

As professional scientists, we can also focus our research on these issues of diversity and global change. One thing that we must do as researchers is to take into account levels of scale. We must carry out our studies in the context of their application to global problems. The demands of global change studies require that we shed our tradition of narrow disciplinary study and together attack problems that are both exceedingly difficult and surpassingly urgent.

Finally, as community members we can undertake important action. Most of us are recognized members of our local communities. We serve on school boards, we are active in our churches, we serve on town councils and in local community activities. We have many interactions back home and here's the chance to talk about these issues. We can write articles for local papers. We can get involved in local environmental issues. The important thing is that we need somehow to build grass roots support. This won't get a rapid global response, but we can make people aware. Only if our society becomes aware of the environmental consequences of human activities will positive action be taken.

I have come full circle, back to the hypothetical Martian observers who questioned our awareness. We need to recognize that these are issues of global concern, but they have local implications and local points of action. As professional scientists and members of ASB, we can participate at all levels in addressing these problems. We, as a nucleus of trained biologists in the Southeast, have the responsibility to act.

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1. US National Committee for the International Geosphere-Biosphere Program. 1988. *Toward an Understanding of Global Change*. National Academy Press. Washington, DC. 213 pp.
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3. Peters, R. L. and J. D. S. Darling. 1985. The greenhouse effect and nature reserves. *BioScience* 35: 707-717.

RESULTS OF THE PUBLICATION COMMITTEE'S ASB BULLETIN QUESTIONNAIRE SURVEY

To determine the direction the ASB should pursue in relation to the Content of the ASB Bulletin approximately 1,350 questionnaires were sent to the general membership. The evaluations given below are based on 308 (235) that were returned.

The following scale was used to indicate the importance: 1—Very Important 2 3 4 5—Not Important Leave blank for no opinion.

A low number indicates that the component was considered to be important. The HI% indicates the proportion of responses that were in the 1 (Very Important) category. The LO% indicates the proportion in the 5 (Not Important) category.

	Mean Importance	HI%	LO%
Annual meeting			
Abstracts	<u>1.40</u>	<u>77</u>	<u>2</u>
General program	<u>1.40</u>	<u>75</u>	<u>2</u>
News and information about the meeting	<u>1.49</u>	<u>72</u>	<u>3</u>
Subject, title and author indexes	<u>1.59</u>	<u>68</u>	<u>3</u>
News of Biology in the Southeast (people, places, courses, field stations, etc.)	<u>1.69</u>	<u>59</u>	<u>3</u>
Deadlines and Calls for Nominations	<u>1.91</u>	<u>51</u>	<u>5</u>
ASB membership application form	<u>1.95</u>	<u>44</u>	<u>5</u>
Instructions to contributors to <i>Bulletin</i>	<u>2.03</u>	<u>46</u>	<u>6</u>
ASB Membership list	<u>2.08</u>	<u>44</u>	<u>8</u>
Profiles of candidates for office	<u>2.19</u>	<u>35</u>	<u>7</u>
Memorial tributes and obituaries	<u>2.31</u>	<u>27</u>	<u>4</u>
Symposium proceedings	<u>2.33</u>	<u>28</u>	<u>6</u>
Profiles of teaching and research award winners	<u>2.43</u>	<u>24</u>	<u>5</u>
Primary research articles	<u>2.46</u>	<u>35</u>	<u>14</u>
Officers, Committees, and Representatives	<u>2.59</u>	<u>26</u>	<u>9</u>
Featured research laboratories and programs	<u>2.60</u>	<u>16</u>	<u>8</u>
“Views from Here” (and President’s columns)	<u>2.79</u>	<u>15</u>	<u>11</u>
Index of Current Plant Systematics and Ecological Research in the Southeastern United States	<u>2.72</u>	<u>19</u>	<u>14</u>
Long feature (not primary research) articles	<u>2.82</u>	<u>16</u>	<u>11</u>
Book reviews	<u>2.82</u>	<u>13</u>	<u>12</u>
Resolutions	<u>2.90</u>	<u>18</u>	<u>15</u>
Treasurer’s reports	<u>2.96</u>	<u>21</u>	<u>18</u>
Lists of Exhibitors and Patrons	<u>2.98</u>	<u>16</u>	<u>17</u>

Response to the following question was Yes or No.

If the ASB developed a policy of dedicating its journal to the publication of more primary research, would you submit manuscripts, realizing that authors now pay all page charges?

	Number	%
Yes	<u>150</u>	<u>57</u>
No	<u>111</u>	<u>43</u>

Responses to these categories were Approve or Disapprove.

Category	Approve		Disapprove	
	N	%	N	%
Publishing research notes	214	89	27	11
Publishing the complete proceedings of selected symposia presented at annual meetings as complete, separate issues of the <i>Bulletin</i>	205	85	36	15
Publishing news and announcements of affiliate societies	195	82	43	18
Publishing paid advertising	190	79	51	21
Publishing more primary research articles	176	74	61	26
Publishing abstracts as a complete separate volume, not a part of any issue of a volume	176	73	66	27
Publishing news, meeting information, and association affairs in newsletter format, not a part of any issue of a volume	168	68	79	32
Cover design				
Black and white photographs	185	87	27	13
Plain cover without photograph	91	51	89	49
Color photographs	56	29	134	71

Questionees were asked to give their opinion of the following general attributes of the ASB *Bulletin*, using the following scale:

Attribute	Leave blank for no opinion		
	Mean Opinion	HI%	LO%
design/format	2.21	19	1
overall quality	2.45	11	2
general reputation	2.96	9	8

The responses to questions about frequency of publication of certain items are summarized as follows:

Item	Total Number of Responses	Every Issue	Twice a Year	Once a Year	Every Two or Three Years	Less Often than
						Every Three Years
ASB Membership list	275	0	9	94	112	60
ASB Membership application form	223	55	39	124	5	—
Index of Current Plant Systematics and Ecological Research in the Southeastern United States	275	2	6	81	45	141

GUIDELINES FOR ORGANIZATION AND PUBLICATION OF ASB SYMPOSIA

The Association of Southeastern Biologists (ASB) has a long history of actively promoting and sponsoring symposia at its annual meetings. ASB also wishes to encourage the publication of the papers presented in appropriate symposia in regular issues of the ASB *Bulletin*. Such issues would identify a unique attribute and contribution of the *Bulletin* and the organization.

Because special issues (or dedicated portions of a regular issue) are costly to produce, the following guidelines for publication of symposium papers are established.

1. Symposia for an annual meeting can be organized by the ASB Executive Committee, ASB affiliates, or interested individuals or groups. Symposia should meet these criteria: a) The topic is relevant to the field of biology. b) The topic should be of general interest to the membership. c) The topic should be relevant to the southeastern region. d) Each symposium planned for publication in the ASB Bulletin must be approved and sponsored or co-sponsored by ASB with approval of the Publications Committee.
2. The ASB Executive Committee can identify a particular symposium topic, invite selected people to be the organizers and convenors, and suggest possible participants.
3. A standing Publications Committee will be established within the ASB Executive Committee, consisting of three at-large members. Each year, one of the newly elected at-large members will be appointed to the Committee by the President to serve a three-year term. This person will be the Publications Committee Chair in the final year of his term. Appointments to The Publications Committee will be made following the annual meeting and announced in the July issue of the Bulletin. The responsibility of the Publications Committee ends when the Bulletin Editor has received the final draft of manuscripts, in cases where the symposium papers are published by ASB.
4. The Publications Committee of the ASB Executive Committee shall: a) assist in coordinating the organization of ASB-sponsored symposia; b) assist the organizers and the Bulletin Editor in the publication of papers in a designated issue of the Bulletin; c) shall inform the treasurer of the financial arrangements for publication.
5. Organizers of approved symposia with published papers have the responsibilities of: a) providing the materials necessary for the Publications Committee to give initial approval; b) contacting the speakers, setting manuscript deadlines, arranging the order of presentations, and determining the location and time of the symposium with the Local Arrangements Chair and the Publications Committee; c) writing the Introduction for the designated issue to address the relevance of the topic; d) identifying the contacting agencies who might be willing to underwrite the cost of publication of a symposium issue; e) finalizing the agreement by an agency (or agencies) to provide the determined level of support; this should be a written statement that simply affirms the agreement; f) arranging for payment of a substantial portion of the publication costs *prior to* publication and for full payment at the time of publication.

The Cedar Glades Symposium Issue (ASB Bulletin 33(4); October, 1986) can be used as a model of symposium organization, length of published papers, and a general estimate of costs.

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REVIEWS

Wallace, Arthur. 1988. **A Theory of the Evolution of Development.** John Wiley & Sons, NY. \$34.95. 94 p.

Arguably the most exciting and important area left to explore among the biological sciences is that of development. The fact is especially highlighted by recent funding of the human genome project. With advances in molecular techniques, we are on the threshold of mapping the entire human genetic code down to the last nucleotide. However, as is often pointed out, the genotype is not a simple blueprint. The gap between genes and morphology is a wide one, spanned by processes of development that involve spectacularly complex linkages of causal events. It is the job of developmental biologists to define these processes and linkages so that we can understand how a single cell becomes a pinetree, a starfish, or a person.

These questions of differentiation and development are important to many fields of biology; to evolutionary biologists, however, a more interesting puzzle is the role played by development in the evolution of the pinetree and the person. Wallace Arthur asserts that, while we did a good job at integrating genetics into evolutionary theory with the modern synthesis, a most glaring gap is the lack of a unifying theory of development and evolution. His little book, *A Theory of the Evolution of Development*, takes a stab at just such a unification in an amazingly concise 94 pages, and, yet, detailed manner.

The book is actually a compilation and reworking of the morphogenetic tree model which Arthur published previously in *Mechanisms of Morphological Evolution* (1984). The new book, however, expands on that work with a more detailed model of the morphogenetic tree, how this model fits in with other theories of evolution, and an expanded treatment of the predictions of the model relative to case studies in the evolution of higher taxa.

The morphogenetic tree model treats ontogeny as a branching pattern in which hierarchies of "morphogenetic heterogeneities" (such as a tissue gradient of some diffusable morphogen) are causally linked through developmental processes (e.g. inductions). The tree starts at some initial heterogeneity (a fertilized egg with its inherent maternal heterogeneity, for example). As development proceeds, heterogeneities at each level may lead to multiple new heterogeneities at later stages. Thus, the theory proposes a branching pattern of developmental states (heterogeneities) linked in a hierarchy of developmental events (causal links) that form the branches of the tree.

This model of the causal structure of development provides an approach to studying the interactions of natural selection and development. Arthur outlines three ways in which the morphogenetic tree for an organism may evolve. A causal link in the tree, which you can think of as a set of instructions being transmitted from one developmental stage to another, can be changed (by a mutation, for instance) so that its information is altered, but these new instructions occur in the same timeframe and relationship with other causal links, i.e. the end product changes, but the size and shape of the "tree" stays the same, retaining the same number of branches (causal links) and stages (heterogeneities). Arthur calls this a *phase change*, such as the switch from a left-handed to a right-handed twist in a snail shell, or a color change which preserves all of the steps in producing a pigment, but alters the final product.

He attributes much of the ordinary variation that we see among related organisms to these phase changes. Two further ways in which the morphogenetic tree can be altered are by *structural* and *distortional* changes. The former involves the addition or deletion of causal links and their associated heterogeneities to either increase or decrease the complexity of the organism; the latter implies no fundamental modification of the instructions within links, but rather, a shift in timing between links at each level of the hierarchy, thus, producing heterochrony.

Arthur goes on to develop some thought-provoking discussion of how developmental processes can constrain the ways in which natural selection may work to cause change. His basic theory of a linked hierarchy strongly supports the notion that organisms and their molecules are not infinitely plastic so that any morphology may evolve, with natural selection waiting in the wings to execute the least optimal. Instead, this hierarchy necessitates that only certain changes can happen, i.e. the effects of mutation are not random in developmental time. For example, changes occurring early in the hierarchy, since they would affect the greatest number of succeeding stages, should be rarest. Most change should, thus, occur by additions to the end of development (structural changes of the morphogenetic tree).

While this is logical, and may indeed often be the case, we, as yet, have little hard developmental data upon which to assume this with confidence.

Arthur points out that at this stage his tree model has to be an oversimplification that will wait upon more detailed knowledge of specific developmental controls before we can expand the flat, two-dimensional trees to the multidimensional trees that must truly exist. Arthur's primary goal, which I feel he outlines admirably in this clear and readable text, is to place developmental biology into a theoretical framework from which we can derive evolutionary questions to test.

Theoretical work such as this and others (see the recent work of Leo Buss), however incomplete or hampered by lack of specific mechanisms, will help lift us from the often mind-boggling morass of molecular data to at least ask the right questions.

SUSAN E. PETERS, *University of North Carolina-Charlotte, Charlotte, NC 28223.*

Brown, Luther and Jerry F. Downhower. 1988. Analyses in Behavioral Ecology: A Manual for Lab and Field. Sinauer Associates, Inc., Sunderland, MA. \$12.95 (paper). 194 p.

The stated purpose of Brown and Downhower, in *Analyses in Behavioral Ecology*, is to provide a series of exercises which expose students to the process of scientific discovery, by encouraging them to investigate and formulate solutions to numerous questions in animal behavior. To this end, the authors have assembled a collection of 27 different exercises divided into four main categories (Sensory Capabilities, Feeding Patterns, Spacing Patterns, and Reproduction), each containing a variety of laboratory and field studies with a wide array of animals. The emphasis throughout the book is on the asking of focused questions and the testing of hypotheses. *Analyses in Behavioral Ecology* therefore offers a valuable mechanism for introducing students to the thinking process integral to scientific investigations.

Each exercise follows a well developed format, beginning with a summary of the goals, an introduction which places the particular exercise within the broader perspective of a given area in behavioral ecology, a brief description of the study animal, and methods. These sections are followed by useful, concise listings of the hypotheses to be tested, recommended methods of analyses and presentation, and, lastly, a series of questions designed to encourage students to interpret the results from a variety of perspectives.

Several of the exercises are elegantly designed, requiring a limited amount of set-up time, yet allowing students to collect within a reasonable time period sufficient data to assess a series of hypotheses. The exercises on oviposition in apple maggot flies and cabbage butterflies (Chapters 6 and 23), feeding niches in birds (Chapter 10), foraging and resource partitioning in bumble bees (Chapters 12 and 14), and the reproductive behavior of male guppies (Chapters 25 and 27) are particularly useful.

For many of the remaining exercises, however, the variety of different animals utilized, and the amount of time required for set-up and data collection will limit their usefulness in a standard behavior course. Furthermore, in some exercises the authors fail to give sufficient information on the study animal to allow the instructor and students to successfully carry out the experiment. For example, the exercise on color perception in honeybees requires that bees be trained to feeding stations, yet no directions are provided as to how such training is accomplished. Likewise, in the experiment on perceptual abilities of bats, the information provided on the capture and care of bats is insufficient for anyone not familiar with these animals. The exercise on the orientation of pigeons seems unrealistic, since it recommends that the study animals come from a pre-existing university loft and be experienced in displacement experiments.

The weakest part of this book is the final section, which deals with data analysis and provides instructions on the use of 19 different statistical tests. The rationale for statistical analysis provided in this section is insufficient to give students an understanding of exactly what the different tests demonstrate and when it is appropriate to use each test. If there are future editions of *Analyses in Behavioral Ecology*, the section on analysis must be expanded. Conversely, the authors might do better to delete much of this portion of the text, and instead recommend that the book be used in conjunction with an elementary statistics manual.

The authors are to be commended for an excellent attempt at generating a series of exercises which

expose students to the processes of scientific investigation in behavioral ecology. However, while the experiments generate many good ideas for a lab course, for the reasons listed above the book may not be as useful to instructors and students as it could have been. Nevertheless, *Analyses in Behavioral Ecology* will serve as a good reference for instructors in designing their own courses in animal behavior.

STANLEY SCHNEIDER, *University of North Carolina—Charlotte, Charlotte, NC 28223.*

Hart, C. W., Jr. and J. Clark. 1989. An Interdisciplinary Bibliography of Freshwater Crayfishes (Astacoidea and Parastacoidea) from Aristotle through 1985, Updated through 1987. Smithsonian Inst. Press, Washington, DC. \$35.00. 498 p.

Hart and Clark have admirably accomplished most of their aims in compiling the *Interdisciplinary Bibliography of Freshwater Crayfishes*. The 1989 version contains a total of 12,489 references. The original version published in 1987 as Smithsonian Contribution to Zoology, Number 455, containing 437 pages was rapidly exhausted. The present compilation contains the original 437 pages of citations and has added 1,287 references including 412 originally missed and 444 and 431 for 1986 and 1987 respectively.

The authors graph the phenomenal growth of the worldwide literature pertaining to crayfishes, with most of the literature being published since 1958 and plateauing at about 400 references/year since 1976. Likewise, they note that neurophysiological references account for about 30% of the papers published annually since 1970; the present volume contains 8,399 (67.3%) such references on that subject alone.

Their aim was for completeness yet they soon realized that many pitfalls awaited them (as it does for any bibliophile) such as: when to stop compiling citations in order to get the job done and published. Other problems were caused by incorrect references, unavailable although cited references, new fields unheard of just a few years ago, subject categories such as mythology, art, postage stamps, etc. They also found that some papers simply mentioned the word crayfish with no further details, yet they had to be listed. Each citation was coded into one of 124 alphanumeric subject codes. A citation number follows each entry by which it can be found in the alphanumeric code indices that follow the original and added citations sections. Likewise, the codes used may not always please all researchers, i.e. physiologists versus neurophysiologists. The format of each citation contains author, date, title of paper or book, journal or publisher, and pagination. Each journal is spelled out to alleviate problems with foreign references to journals that, when abbreviated, are nearly similar.

It is interesting to note that Horton Hobbs, Jr., the dean of American crayfish researchers, has published 167 crayfish papers while Horton Hobbs III has 40, Fitzpatrick 35, and Momot 31 or 1.3% the overall papers cited. The compilation is very complete but, as the authors found, references still escaped their attention, i.e. Schwartz and Meredith, 1959, Crayfishes of Maryland, Maryland Tidewater News Suppl. 12, 15(1): 1-2, Schwartz and Meredith, 1960, Maryland crayfishes. Maryland Dept. Res. Ed. Ser. 46, 32 p.; Schwartz and Kendall, 1964, Salinity tolerances of two Maryland crayfishes. Ohio J. Sci. 64(6): 403-409.

A beautiful complete color photograph of the longpincered crayfish, *Orconectes longidigitus*, a species known only in the White River from southern Missouri and northern Arkansas, graces the jacket but not the black hardback cover. I find this refreshing for I have long hoped crayfish researchers would include the complete crayfish in their papers in addition to the many segmented parts of the crayfish usually depicted. Even Horton Hobbs, Jr. finally succumbed to my urgings by including a complete crayfish, in black and white, in his Crayfishes of Georgia (1981) Smithsonian Contr. Zool. 318, 549 pages on p. 467. Let us hope others will follow his lead.

Hart and Clark have helped all of us by continuing to compile the world literature to crayfishes. It is a better list than one can obtain with a modern computer search. More power to them as they try to keep up and ahead of the avalanche of new literature that awaits them.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Godfrey, Robert K. 1988. **Trees, Shrubs, and Woody Vines of Northern Florida and Adjacent Georgia and Alabama.** The University of Georgia Press, Athens, GA. \$50.00. 734 p.

Until recently anyone who tried to identify the flora of southwestern Georgia, north Florida or south Alabama quickly became aware that there was not an adequate manual for this purpose. However, *Trees of Northern Florida* (Kurz and Godfrey 1962) was an excellent resource for identifying trees of the area because it confronted variation rather than ignoring it. The plant taxonomic community in the southeast was delighted to learn that "Dr. Bob" was planning to publish an updated version of the Kurz and Godfrey book and that his book would include shrubs and woody vines. We waited with anticipation. It is my belief that the wait was worthwhile. Dr. Godfrey is one of the best field botanists in the southeast. He has organized his field knowledge into an excellent manual.

Most of the line drawings are by Melanie Darst. They are among the best diagnostic illustrations this reviewer has seen. For example, the drawing of Sycamore shows the node with a piece of the petiole drawn at the side to indicate that the petiole base covered the axillary bud. The variously shaped leaves of Paper Mulberry (and several other species) are illustrated. Enlarged surface details are given when pertinent.

The keys are concise and discriminating. Vegetative characters are used whenever possible. The Artificial Keys at the beginning lead to families and their page numbers. The families are positioned alphabetically within the Gymnosperms first, then the Angiosperms which are divided into Monocots and Dicots. While this positioning does not trouble most of us in the least, some persons may prefer the families to be listed in a phylogenetic order. Descriptions are given for genera when there is more than one species. The species descriptions are quite good and include habitats and distribution ranges. National champions and their locations are described. Other special notes may be provided, such as the information that *Albizia julibrissin* Durazz. is susceptible to a fungal blight which kills larger trees. Synonyms from Small (1933) are provided when necessary. Reasons are often given for using a particular nomenclature or classification. This allows the user of the manual to understand and to make a more rational decision concerning the problem taxa.

One feature for which all taxonomists bless Dr. Bob is his inclusion of complete scientific names (*i.e.* with authors) in the index. Names in synonymy are in italic print. There is a separate index for common names.

Reading back over this review, only positive statements are found. Searching desperately for a negative aspect, it is noted that the poisonous properties of *Aleurites fordii* Hemsl. (Tung-tree) are not listed.

This book will be extremely useful for anyone who is interested in the identity of native and naturalized woody plants of the area listed in the title. Furthermore, it will be useful to the adjacent areas of the southeast because of Dr. Bob's insightful observations on the taxa which are widely distributed in the southeast.

Kurz, Herman and Robert K. Godfrey. 1962. *Trees of Northern Florida.* University of Florida Press, Gainesville, FL. 311 p.

Small, John K. 1933. *Manual of the Southeastern Flora.* Reprint. New York: Hafner, 1972.

NANCY CRAFT COILE, *Department of Botany, University of Georgia, Athens, GA 30602.*

Vardaman, James M. 1989. **How to Make Money Growing Trees.** John Wiley and Sons, NY. \$29.95. 296 p.

This book is a revision of *Tree Farm Business Management*, first published in 1965 with a second edition appearing in 1978. In spite of the author's claim that the changes in forestry in recent years have been so great as to demand a "complete rewriting," the scale of repetition from the earlier editions, as compared to the amount of new material, compels the reader to call this a revision.

Like the first two editions, this volume is intended for those forest owners whose objective is profitable timber management. Its intended readership is the private forest owner who has less than 4,000 acres. There is little information here for the large and growing group of owners whose objectives do not center on timber or profit and whose management decisions may therefore involve tradeoffs of timber income for one or more other forest products. Indeed, the dropping of "tree farm" from the title may have been in part the result of the author's recognition that many tree farmers, perhaps most, own forest land for reasons other than growing timber for sale.

A second limitation of the book is its focus on forest management in the southeastern states. In describing forestry as a long-term investment, it is pointed out that it takes "18 years to produce the first income and 35 years to produce the big payoff." Only in pine forests of the South can the "long term" be so short.

But the title is true to the author's focus and the book is comprehensive within its subject. There are chapters on available forestry services, selling timber and timberland, income from non-timber commodities such as minerals, inventory, management costs, taxes, and financial forecasting. The author discusses relationships with the big timber companies and the need for professional help of a lawyer and consulting forester, the latter being the author's profession. For the forest landowner, the book offers a good deal of practical information on the technical, financial, and legal aspects of the business, but this useful information is interspersed with bits of pedantry such as (on the subject of selling timber), "Things sell for what they are worth, and the sooner you get the money the better." The book's organization leaves something to be desired. For example, it's not clear why the sale of timber is discussed in Chapter 3 while the sale of timberland is postponed until Chapter 11.

The significant changes in this volume include elimination of a chapter on capital gains and revision of the text dealing with income taxes, changes which were no doubt prompted by the tax reform act of 1986. A second change is in the use of some recent research findings having to do with the biological and economic aspects of timber management. Third, the author has added a chapter entitled "Long-Term Investment with Annual Cash Flows" in which he presents a case study of financial analysis of a forest tract using a computerized growth prediction model and discounted cash flow.

Two final changes worth mentioning are those apparent in the Author's opinions about timber scarcity and large industrial timber companies. Whereas in 1965 the author wrote of "barely adequate" timber supplies and "pressure on the raw material base," he now refers to "the myth of timber scarcity" and states flatly, "timber is not scarce . . . the picture is one of increasing abundance."

Regarding large industrial forestry companies, the reader detects a sense of alienation on the part of the author in the 24 years since the first edition was published. Under a chapter heading called, "The Large Industrial Tree Farm," the 1965 edition treated the large companies as rightful members of the group (tree farmers) and emphasized the similarities and common ground between them and the nonindustrial, private owners: "A corporation is an individual created by law, and is just as much an individual as you are . . ."; "Another reason for studying big companies and their problems is to enable you to lend them a helping hand from time to time." There was an obvious effort to foster a mutual understanding between the two. This new volume, on the other hand, changes the chapter title to, "The Big Timber Companies," and emphasizes the difference between these "bureaucracies" and the nonindustrial forest "entrepreneur." Industrial foresters are specialists who "rarely see the big picture." "Most company foresters spend money, but do not generate income, so they rarely know how much annual income is consumed by costs and how little remains as net return to the investor. That is, they rarely know what this book is all about." This reviewer was left with the impression that the primary reason for the author's change in attitude toward industrial forestry and industrial foresters may have been the development in the 1970's of landowner assistance programs by many of the large companies. Such assistance programs often compete with forestry consulting firms such as that of the author. Lopping public and industrial assistance programs together under "free services" (as opposed to fee services), the author states, "Free advice is worth what you pay for it."

This book has benefitted from the author's lifetime of experience as a forestry consultant. He is able to illustrate his points with cases that reflect this vast experience. In addition, he makes skillful use of interviews with clients and other professionals with whom he has come in contact. His limited focus detracts from the value of the book, as does his bias against forestry professionals in public or industrial employment. The book should be a good investment for anyone who owns a small forest and wants to make it pay.

DAVID E. WHITE, *Division of Forestry, West Virginia University, Morgantown, WV 26506.*

Chemical and Pharmaceutical Press. 1989. **Crop Protection Chemicals Reference**, 5th (ed.) Chemical and Pharmaceutical Press, a joint venture of John Wiley and Sons, New York, NY and Chemical and Pharmaceutical Publ. Corp., Paris. \$70.00 by subscription or \$90.00 for individual orders. 2,266 p.

This volume, updated annually, contains everything anyone should ever want or need to know about agricultural chemicals. It is essentially a reproduction of all information contained on the labels

of all agricultural chemical products of 23 agricultural chemicals manufacturers. Since its inception, this publication has attained a reputation as the standby for label and use information about agricultural chemicals.

In addition to all of the information provided by the manufacturer on the label of each product, the publisher has added a number of very helpful and useful indices and appendices. The indices contain sections on (1) Brand Names, (2) Manufacturers, (3) Common and Chemical Names, (4) Product Category, (5) Crop and Non-Crop Uses, and (6) Pest Uses.

Appendix I contains sections on (1) Calibrations and Conversions, (2) General Information on Handling and Storage of Pesticides, (3) Storage and Temperature Requirements by Product, and (4) DOT Information Tables. Appendix II lists (1) Poison Control Centers, (2) Solid and Hazardous Waste Agencies by State, (3) Pesticide Regulatory Officials by State, and (4) State Extension Pesticide Leaders/Coordinators. This information should be very helpful to biologists who might need more information on use or regulation of agricultural chemicals. Appendix III is an excellent five-page summary of safety information. Each section is set off in a different color paper.

The only shortcoming is that it would be impossible to keep any published reference on agricultural chemicals completely up to date. The publisher makes the volume as up to date as possible by including a Supplement covering changes up to 15 November of the year before publication.

The book is 3½ inches in thickness and would seem to be a bargain compared to many textbooks costing over \$100.00. The reference would be very useful to anyone using, researching, regulating, or interested in agricultural chemicals.

A. DOUGLAS WORSHAM, *Weed Science, Crop Science Department, North Carolina State University, Raleigh, NC 27695-7620.*

Mayden, R. L. 1989. **Phylogenetic Studies of North American Minnows, with Emphasis on the Genus *Cyprinella* (Teleostei: Cypriniformes).** Univ. Kansas Mus. Nat. Hist. Misc. Publ. 80, Lawrence, KS. 189 p.

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
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ABOUT PEOPLE AND PLACES

KENTUCKY

Eastern Kentucky University, Department of Biological Sciences. Dr. Ronald Jones has received a Hesler Award from the Botany Department, University of Tennessee, for his project entitled "Continued Studies on the Vascular Flora of Cumberland Plateau Wetlands in Tennessee." The EKV Herbarium, curated by Dr. Jones, has recently been moved to a larger facility. Exchanges or gifts of vascular plant specimens, especially woody plants, aquatics, and Asteraceae of the southeastern U.S. are welcome.

LOUISIANA

Louisiana State University, Cooperative Extension Service. A call for papers has been issued by the International Association of Astacology for their 8th International Symposium, to be held at the Baton Rouge Hilton Hotel, Baton Rouge, Louisiana, 22–26 April 1990. The Association was founded in Minterthal, Austria in 1972. Its members are dedicated to the advancement of the study and wise utilization of all freshwater crayfishes. Officers for 1987–1990 are *James F. Payne*, President, Department of Biology, Memphis State University, *David Holdich*, Dept. of Zoology, University of Nottingham, England, *Jay V. Himer*, Sec./Treas., University of Southwestern Louisiana. For information contact: *Mr. L. W. de la Bretonne, Jr.*, Louisiana Cooperative Extension Service, Knapp Hall, Louisiana State University, Baton Rouge, LA 70803. Phone: (504) 388-2180.

Louisiana State University, Department of Botany. Dr. *William J. Luke*, a retired associate professor of botany, has donated funds to establish a cash award recognizing outstanding teaching by graduate students in the department. The annual award will promote excellence in teaching and, because most of the graduate assistants are employed to teach undergraduate laboratory classes, the new award will also benefit undergraduate education at LSU. Dr. Luke joined the Department of Botany in 1968 and taught numerous courses until his retirement in 1980. Dr. *James V. Moroney*, an assistant professor, has been selected as a 1989 Presidential Young Investigator by the National Science Foundation. Moroney, a plant photosynthesis specialist who joined LSU in 1986, will receive a base award of \$25,000 annually for five years. This year, 197 awards were made nationally by the NSF in all areas of science and engineering. The award, which recognizes research and teaching achievements as well as academic potential, is designed to encourage quality scientists and engineers to serve in university faculty positions. In addition to the base award, the NSF will match other gifts from industry and individuals toward Moroney's research. The award can amount to \$500,000 over a five year period, provided matching funds can be obtained from industrial sources or non-profit foundations. Drs. *Janet Keough*, *Jim Grace*, and *Glenn Guntenspergen* recently received an award from the National Wetlands Research Center for a project entitled, "The Effect of Waterlogging and Salinity on Competitive Ability in Coastal Marsh Plant Species." *E. A. Zimmer*, *D. P. Pashley*, and *R. M. Zink* have received a \$50,000 NSF-Epscor Grant for "Development of an Interdisciplinary Program in Molecular Evolution." Congratulations to *Dr. Bruce Williamson*, who was honored along with other researchers of distinction from LSU, Southern University, and the Louisiana State Department of Education by Phi Delta Kappa. He was also reelected to a third term as Vice-President of Education of the Organization for Tropical Studies at its annual meeting in Costa Rica. Dr. *S. P. Wasser* from the Institute of Botany in Kiev, arrived on 25 April 1989 to work with *Dr. Lowy* on some Amazonian collections in the LSU Mycology Herbarium. *Mike Arnold* has accepted an appointment as Assistant Professor in the Department of Genetics at the University of Georgia.

MISSISSIPPI

Mississippi State University, Department of Biological Sciences. Dr. Janice Chambers has received a Research Career Development Award from the National Institutes of Health. John E. Snawder, doctoral graduate student, received the Fisher Scientific Award at the Mississippi Academy of Sciences annual meeting for the best graduate student presentation in the Division of Cellular, Molecular, and Developmental Biology.

NORTH CAROLINA

North Carolina State University, Department of Horticultural Science. New faculty include: Dr. Jim Burton, Weed Science Research; Dr. Michael Parker, Tree Fruit Extension; Dr. Jonathan Schultheis, Vegetable Extension; and Dr. Mary Jo Wannamaker, Potato Breeding Research Associate. Drs. Todd Wehner, Dennis Werner, and Eric Young were promoted to Professor, and Dr. Sylvia Blankenship was promoted to Associate Professor. Inducted into honor societies included Dr. Frank Blazich, Sigma Xi and Phi Kappa Phi and Drs. Paul Nelson, J. C. Raulston, and George Wilson, Gamma Sigma Delta. Research awards include: Dr. Todd Wehner, the 1988-89 Sigma Xi Research Award; Dr. Gus De Hertogh, the National Award for Agricultural Excellence from the National Agri-Marketing Association and the Certificate of Merit for research achievement from Gamma Sigma Delta; Leslie Bjelk, first place in the Ecological and Physiological Aspects of Weed Control section at the Southern Weed Science Meeting; and David Wolff, Ph.D. candidate, first place in the Weed Control for Horticultural Crops section at the Southern Weed Science Meeting. Teaching awards include: Mr. Bryce Lane, NCSU 1989 Alumni Distinguished Professor, and NCSU Agricultural Institute Outstanding Alumni Award, and the University of Massachusetts Outstanding Alumni Award; Dr. J. C. Raulston, NCSU Academy of Outstanding Teachers; and Dr. Paul Fantz, Teaching Fellow, National Association of College Teachers of Agriculture. Ms. Tracy Traer has begun a one year leave of absence, travelling world wide visiting gardens gathering data for a book. Dr. Barclay Poling will visit France participating in the "North Carolina in the World Project."

Western Carolina University, Department of Biology. Roger Lumb has received a six month fellowship from INSERM to do research on PAF metabolism in Toulouse, France, from 1 July until 31 December 1989. James W. Wallace will be presenting an invited seminar at the International Symposium on "Present and Future Perspectives of Pteridology" at the University of Rajasthan, Jaipur, India on 4-6 August 1989. The title of his paper is "A Phytochemical Approach for Gaining Insights into Pteridophyte Phylogeny."

University of North Carolina at Wilmington, Department of Biological Sciences. Dr. Ronald K. Sizemore was appointed chairman of the department on 1 January 1989. Dr. Martin Posey, previously with the Smithsonian Environmental Research Center, joined the faculty this past Fall. Dr. Posey's research interests are in the area of coastal ecology.

SOUTH CAROLINA

Winthrop College, Department of Biology. Joining the faculty in August 1989 will be: Dr. Carol P. Durham (Ph.D. Howard University) specializing in parasitology; Dr. William Rogers (Ph.D. University of California, Berkeley) in behavioral ecology, and Dr. Julian P. S. Smittle, III (Ph.D. University of North Carolina, Chapel Hill) in invertebrate zoology.

VIRGINIA

Washington and Lee University, Department of Biology. Dr. L. R. Emmons has left the University to join his wife, Dr. Rebecca P. Emmons, in Basel, Switzerland. He will be replaced by Dr. Darcy L. Russell, a molecular geneticist from the University of North Carolina. Dr. Maryanne C. Simurda from S.U.N.Y.-Buffalo, will be joining the department and teaching in the areas of microbiology/immunology. Dr. C. P. Hickman will be on a sabbatical leave during the 1989-90 academic year, and will be replaced by Dr. Charles E. Williams of the Virginia Polytechnic Institute and State University.

Old Dominion University, Department of Biological Sciences. Three new faculty have joined the department in 1989. They are: Dr. Barbara Hargrave (reproductive physiology), Dr. Mark Butler (Biometry), and Dr. Deborah Waller (Entomology).

Eastern Mennonite College, Department of Biology. The department is in the process of revising

the freshman course for majors. The course will be named "Biology as Inquiry." Reflecting the religious commitment of the college, serious consideration is being given to using Richard Wright's *Biology through the Eyes of Faith* as a way of exploring philosophy of science and scientific methodology in biology. NSF Disciplinary Workshops on Undergraduate Education will also be followed. Advice from other colleges considering a revision of similar courses will be appreciated. *Kenton K. Brubaker*, Dept. of Biology, Eastern Mennonite College, Harrisonburg, VA 22801.

WEST VIRGINIA

Fairmont State College, Department of Biology. Dr. Steve Stephenson, Professor of Biology, has been awarded a research grant by the National Geographic Society to study myxomycete ecology in the high-latitude ecosystems of North America. He will be working at the University of Alaska in Fairbanks during the 1989 field season.

ABOUT MUSEUMS AND BOTANICAL GARDENS

ALABAMA

State Museum of Natural History, Tuscaloosa. Brown Hawkins, a third year graduate student in Structural Geology, was the Scientific Director of the Museum's 11th annual Expedition, a month-long dig in the ancient Zeuglodon Beds in southwest Alabama near the Mississippi border. The expedition was co-sponsored by the Choctaw County Historical Museum. *Dr. John Hall*, assistant director of the Museum, explained that the purpose was to search for the giant zeuglodon, a type of giant toothed whale that lived in this area of Alabama 40 million years ago when the Gulf of Mexico covered the southern one-third of the state. This shallow gulf was also home to giant pre-historic whales, some measuring over 60 ft long, who died in the shallow waters along the ancient coast. These fossil beds, first discovered in the early 19th century, were explored for the first time in 1845. The Zeuglodon Beds are composed of a limey clay, up to 12 ft in some places. *Kenneth Gaddy* was the expedition leader, and also the State Museum's Curator of Collections and an instructor in geology. Joining him were museum scientists, high school students, teachers, and other interested adults.

KENTUCKY

Museum of History and Science, Louisville, Kentucky. The Museum's newest permanent exhibit takes a light approach to serious scientific subject matter. "Bubbles," now open, uses soap and string, air, and light to demonstrate surface tension, material thickness, and efficiency of matter. Bubbles reveal to visitors their own set of scientific rules. As part of National Science and Technology Week, 23-29 April 1989, the Museum sponsored a "My Invention" contest, holding hands-on science workshops for teachers, honoring two Kentucky science teachers in Washington, DC, and presenting daily demonstrations to teach the public more about science. "My Invention" contestants, grades 1-12, are asked to imagine and draw an invention that will improve the quality of life—theirs or others. The Museum announced today the promotion of *Ms. Susanne J. Wright* from the position of IMAX film theater manager to project manager for the Heart and Health exhibit. *Ms. Wright* joined the museum in 1986, and prior to that she worked for Actors Theater and Stage One, the Louisville Children's Theater. She is a graduate of Juniata College, and received her Masters in Education from Temple University.

LOUISIANA

The Lafayette Natural History Museum, Lafayette. Thirteen mechanized dinosaurs, a nest of dinosaur eggs, and hatching dinosaur babies took up residence in the Cajundome from 23 September to 7 December 1989. These realistic reptiles stand at half or better their original size and perform life-like movements through a computerized system using compressed air. The realistic skin of the dinosaurs is created from plastics, silicon rubber, and synthetic fibers. Kokoro Company, developer of the dinosaur exhibit, through the use of robotics and other space-age technology, has brought to life one of the most fascinating mysteries of our planet. *Jun Shimizu*, President of Kokoro's Los Angeles office, said the models are revamped almost every year, due to new information scientists are continually gathering on dinosaurs.

NEWS FROM AFFILIATE SOCIETIES OF ASB

Southeastern Chapter, Ecological Society of America. At the recent ASB meeting in Charlotte, the Chapter sponsored several symposia and the highly successful Workshop on Biodiversity, and presented the Odum Award for the best student paper in ecology to Steven Broyles of the University of Georgia. A new vice-chairperson, Ken McLeod of the Savannah River Ecology Laboratory, was elected to replace outgoing Ross Hinkle. The Chapter will continue its involvement in Biodiversity issues in the coming year. A Chapter luncheon is scheduled for the AIBS meeting in Toronto this summer, and the annual fall field trip has been organized by Dan Pitillo for September in western North Carolina.

South Atlantic Chapter, Society of Wetland Scientists. In Charlotte, a new vice-chair, Ross Hinkle of Bionectics Corp. at the Kennedy Space Center, was elected to replace Frank Day (Old Dominion University), who became chair. The Chapter has established a network of state contacts to gather wetland news and information on job openings for the Chapter newsletter. The Chapter is hosting the national SWS meeting in Orlando, Florida this summer.

Southern Appalachian Botanical Club. New officers of the Southern Appalachian Botanical Club, elected at the ASB meeting in Charlotte were: President-elect, Janice Coffey-Swab, St. Mary's College, Raleigh, NC and the new member of the editorial committee in ecology, Hal DeSelm, Botany Dept., University of Tennessee-Knoxville, TN.

Southeastern Association Chapter of American Society of Ichthyologists and Herpetologists. New officers are: President, Robert C. Cashner, University of New Orleans, New Orleans, LA, Vice President, Don Forester, Towson State University, Towson, MD, and Secretary-Treasurer, Malcolm Pier-son, Alabama Power Co., Calera, AL.

NOTICE

Note that the *Odum Award* submission deadline is 1 December 1989, not 1 February 1990.

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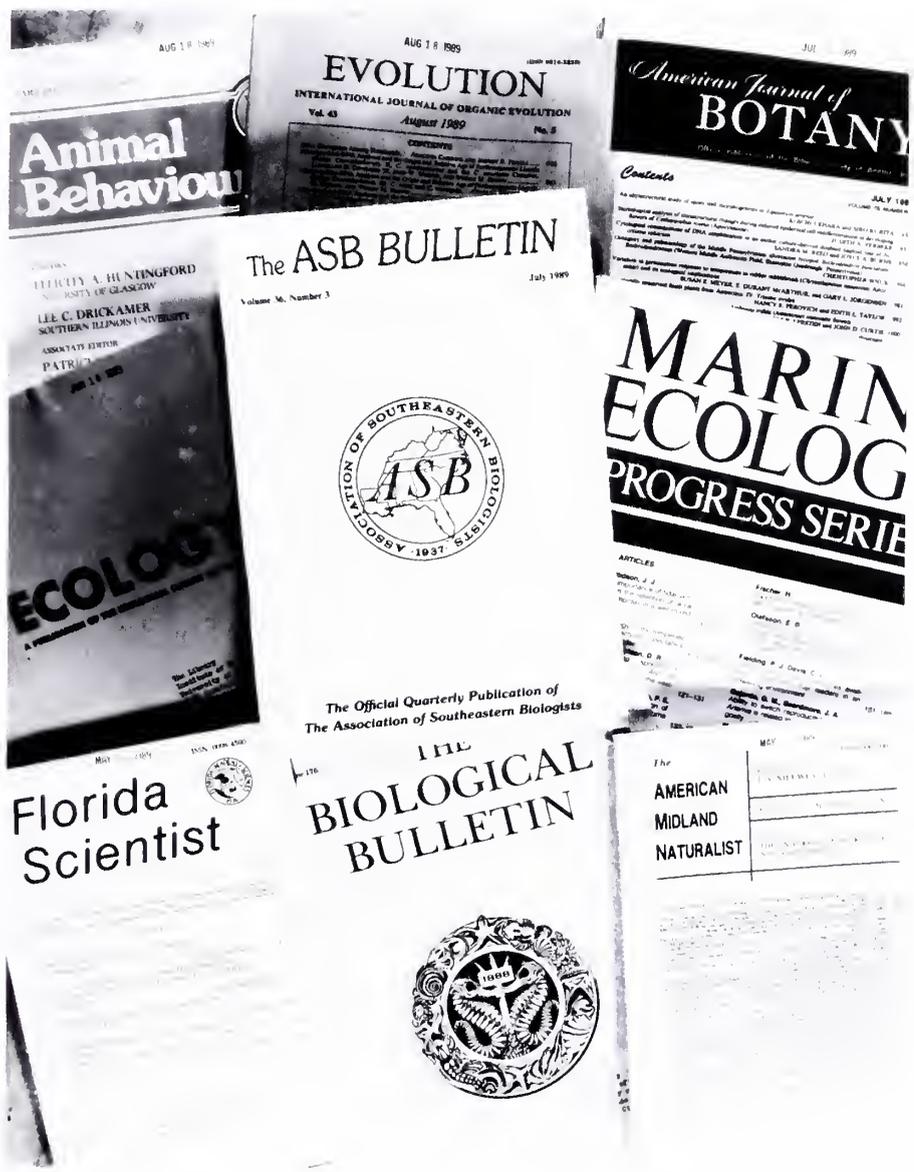
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The ASB BULLETIN

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In which to publish—THAT IS THE QUESTION?

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1990	April 19-21	Towson State University, Towson, MD
1991	April 10-13	Appalachian State University, Boone, NC
1992	April	University Alabama-Tuscaloosa, Tuscaloosa, AL
1993	April	Old Dominion University, Norfolk or Virginia Beach, VA

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A. M. N. H.

In this issue the overall outline of the April meeting in Baltimore should spur individuals to make every effort to attend our 51st Annual Meeting and to particularly plan to bring a contingent of students to take advantage of the biological and historical setting. Each ASB meeting of the past has special memories for the participants and each meeting has added something significant to the profession of biology. In support of that statement an excerpt of a letter received this past August from Dr. John Cairns, Jr. of VPI is offered:

“As you all know, the field of restoration ecology is now growing at an unbelievable rate. Some years ago, I organized for ASB with the collaboration of the officers then a small symposium on the recovery of damaged ecosystems. Some colleagues and I had a paper in that symposium (Cairns, J., Jr., J. S. Crossman, K. L. Dickson, and E. E. Herricks. 1971. The Recovery of Streams. *Assoc. Southeast. Biol. Bull.* 18(3): 79–106). At that particular time, I was wondering whether the field now called restoration ecology would be worthwhile and whether or not to invest a substantial amount of effort in it. The favorable response of the ASB members encouraged me to continue work in this field, which has resulted in six books, over 30 chapters in books written by others, and nearly 100 papers and other publications all related to colonization and the rehabilitation and recovery of damaged ecosystems. I have not been able to determine whether this was the first such symposium on this subject but it was certainly one of the first! ASB definitely had a role in the genesis of the field now called restoration ecology.”

Our meetings do make a difference in the status of our profession in so many positive ways. Be a part of the 1990 meeting with its special workshops, symposia, paper sessions and field trips.

In the October, 1989 ASB Bulletin, I mentioned that each governor of the 13 southeastern states had been written and asked what type of interstate interactions would be most beneficial to address biodiversity loss problems and the public's understanding of science. To date (September, 1989) there have been nine acknowledgements and seven detailed responses. Some of the major points or suggestions concerning biodiversity actions included: (1) participation by state natural resource agencies in conferences and workshops on regional biodiversity including a comparison of state statutes directed toward the protection of biodiversity that have proven effective, (2) analysis of what alternatives are available for preserving biodiversity and determination of means to fund preservation activities including tax credits for individuals at the state level, (3) greater state participation in Nature Conservancy activities and establishment of State Natural Heritage Programs and (4) the need to “sensitize” the public and policy makers to biodiversity issues. Comments from state chief executives relating to the public's understanding (or misunderstanding) of science focused on: (1) defining the role of science in con-

temporary society, (2) increased multi-disciplinary conferences and workshops with civil or agricultural engineers, biochemists, soil scientists, wildlife managers, and ecologists and (3) stronger commitment of natural resources agencies to public education.

Past ASB activities have addressed many of the points mentioned by the responding governors and it seems to me that the goals of ASB outlined inside the front cover of each issue of the Bulletin encompass their concerns.

NEWS

51st ANNUAL MEETING in BALTIMORE, MARYLAND

Towson State University will host the 51st annual meeting of the Association of Southeastern Biologists 18-21 April, 1990 at the Lord Baltimore Radisson Plaza, about ten miles from the University campus. Registration, paper and poster sessions, exhibits, and general sessions will be held at the Lord Baltimore. Also scheduled are a social hour on Wednesday at the Lord Baltimore, a buffet dinner on Thursday evening at the National Aquarium in Baltimore, and the traditional Friday evening banquet and awards ceremony at the Lord Baltimore.

SOCIETIES MEETING WITH ASB IN BALTIMORE

Beta Beta Beta

**Botanical Society of America, Southeastern Section
Ecological Society of America, Southeastern Chapter
Ecological Society of America, Washington, D.C. Chapter
Society of Wetlands Scientists, South Atlantic Chapter
Society of Wetlands Scientists, Northeastern Chapter
Southern Appalachian Botanical Club**

BALTIMORE, THE LORD BALTIMORE AND TOWSON STATE UNIVERSITY

We welcome you to join us for the 51st Annual Meeting of ASB. Baltimore is located on the Fall Line in central Maryland on the Chesapeake Bay about two hours from the Catoctin Mountains and four hours from the Appalachian Mountains to the west and about four hours from the Atlantic Ocean to the east. The Baltimore area has a wealth of historic sites, including the homes of Babe Ruth and Edgar Allan Poe, Fort McHenry, the site of the famous battle that inspired Francis Scott Key to write the National Anthem, and the home of Mary Pickersgill, who sewed the flag that flew over Fort McHenry during the battle. The city of Baltimore has undergone a tremendous revitalization during the last decade. This has included the transformation of the inner harbor from an industrial wasteland into an area of shops and museums where one can enjoy a spectacular water front view.

The Lord Baltimore, which will serve as the headquarters for the ASB meeting, has been restored to the splendor and elegance of its glory days nearly 60 years ago. The recent restoration combines the incomparable features of an historic grand hotel with modern amenities and conveniences. The Lord Baltimore offers 440 guest

rooms, 22 parlor suites, and 4 spacious one and two-bedroom Tower suites with kitchens and a view of the harbor. In addition, there are two fine restaurants, a health club with spa, and a sauna. The hotel is located in the heart of the Baltimore business district, only four blocks from the Inner Harbor with its many shops, restaurants, and museums. It is connected to the Inner Harbor by a series of pedestrian skywalks. Please plan to stay at the Lord Baltimore and be at the center of the meetings activities. *ASB has had to guarantee sufficient rooms to offset the cost of the meeting facilities.*

Established in 1866, Towson State University is located on a beautifully landscaped campus just north of Baltimore. The 326 acre campus combines modern and traditional architectural styles. Towson State is the second largest of Maryland's state universities, with over 16,000 students and 1900 faculty and support personnel. The eight colleges and schools of the university offer 40 undergraduate degrees and 21 graduate degrees. The university's commitment to excellence is reflected in the fact that in the last three years, TSU has been voted among the top ten comprehensive universities in the nation by a panel of college and university presidents.

The Department of Biological Sciences of Towson State University has a faculty of 26 with 6 support personnel. Bachelor's and Master's degrees in biology are offered with areas of concentration that include Animal Anatomy and Physiology, Biocommunications, Botany, Ecology, Microbiology, Premedicine/Pre-dentistry, Secondary School Biology and General Science Teaching, Marine Biology, Molecular Biology, and Zoology. Specialized facilities include photographic rooms, a tissue culture laboratory, a zoology museum, an herbarium, a greenhouse complex, preserved research collections, an electron microscope facility, and live animal rooms.

POINTS OF INTEREST IN THE BALTIMORE AREA

BALTIMORE MUSEUM OF ART - Art Museum Drive, Charles and 31st Sts., 396-7101. The museum houses many permanent and special art exhibitions. It includes among its holdings the famed Cone Collection of 20th century works by Cezanne, Picasso, and Matisse. Open 10:00 a.m. - 4:00 p.m., Tuesday, Wednesday, and Friday, 10:00 a.m. - 9:00 p.m. Thursday (free), and 11:00 a.m. - 6:00 p.m., Saturday and Sunday. Admission charged if over 21.

THE BALTIMORE ZOO - Druid Hill Park, Phone, 366-LION. The 150 acre zoo is home to more than 1200 exotic birds, mammals, and reptiles and features an innovative new Children's Zoo. The African black-footed penguin was first bred in captivity in the Baltimore Zoo, which boasts the largest collection of these birds in captivity. Open 10:00 a.m. - 4:30, Monday - Friday and 10:00 a.m.-5:30 p.m. on Saturday and Sunday. Admission charged.

THE B & O RAILROAD MUSEUM - Pratt and Poppleton Streets, Phone 237-2387. Baltimore is the home of the nation's first common carrier railroad. This 1884 roundhouse is the oldest in the country. The original tracks and wooden turntable are beautifully preserved as is the Mount Clare station. It includes an exciting collection of railroad artifacts, locomotives, and other railroad cars. Open 10:00 a.m. - 4:00 p.m. Wednesday through Sunday. Admission charged.

FORT McHENRY NATIONAL MONUMENT AND HISTORIC SHRINE - At the end of East Fort Avenue, Phone 962-4290. This star shaped fort was the site of Baltimore's victory over the British during the War of 1812. The flag flying over the

fort during the British naval bombardment inspired Francis Scott Key to write the "Star Spangled Banner". Open 8:00 a.m. - 5:00 p.m.

MARYLAND SCIENCE CENTER - 601 Light Street, Phone 685-5225. This museum has captivating hands-on exhibits which explain the mysteries of science for all ages. The incredible IMAX theater features larger than life films. Be sure to visit the world-renowned Davis Planetarium. Open 10:00 a.m. - 5:00 p.m. Admission charged.

U.S.S. FRIGATE CONSTELLATION - Inner Harbor, Constellation Dock, Phone 539-1797. Launched from Baltimore Harbor in 1797, this sister ship of Boston's U.S.S. Constitution was the first commissioned ship of the U.S. Navy and is the oldest American warship continuously afloat. Open Daily 10:00 a.m. - 4:00 p.m. Admission charged.

BABE RUTH MUSEUM - 216 Emory Street, Phone 727-1539. Babe's birthplace has been restored recently and features exhibits on Babe Ruth, the Baltimore Orioles, and Maryland's baseball heritage. Open Daily 10:00 a.m. - 5:00 p.m. Admission charged.

EDGAR ALLAN POE HOUSE - 203 Amity Street, Phone 396-7932. This tiny house includes the garret chamber in which Poe lived and wrote from 1832-1835. Open Wednesday - Saturday 12:00 noon - 4:00 p.m.. Admission charged.

EDGAR ALLAN POE GRAVE - Fayette and Greene Streets, Phone 328-7228. The grave is within the Westminster churchyard (1700's). Each year since Poe's death a mysterious admirer has placed a rose and a bottle of cognac on the grave on the anniversary of his death. Tours available every first and third Friday evening and Saturday morning.

STAR SPANGLED BANNER FLAG HOUSE - 844 East Pratt Street, Phone 837-1793. This house was the home of Mary Pickersgill who sewed the flag that flew over Fort McHenry during the battle that inspired Francis Scott Key to write the national anthem. Open Monday through Saturday, 10:00 a.m. - 4:00 p.m. Admission charged.

MARYLAND HISTORICAL SOCIETY, MUSEUM AND LIBRARY OF MARYLAND HISTORY - 201 West Monument Street, Phone 685-3750. Home of the original "Star Spangled Banner", the museum has one of the largest collections of 19th century silver in the world. It boasts the finest decorative arts collection on the East Coast. Open Tuesday through Friday 10:00 a.m. - 5:00 p.m., Saturday, 9:00 a.m. - 5:00 p.m., and Sunday, 1:00 p.m. - 5:00 p.m.

WALTERS ART GALLERY - Charles and Centre Streets, Phone 547-ARTS. An internationally famous museum of over 30,000 works of art spanning 5,000 years of artistic achievement. The original has recently reopened after a three year renovation. Open Tuesday - Sunday, 11:00 a.m. - 5:00 p.m. Admission charged. Wednesday free.

FELL'S POINT PRESERVATION SOCIETY - Broadway, south of Eastern Avenue to the harbor, Phone 675-6750. Fell's Point is one of Baltimore's oldest and most significant portside neighborhoods, dating back to 1730. There are 350 original residential structures, cobblestone streets, and a diversity of restaurants, shops and pubs.

INNER HARBOR - Pratt and Light Streets. This has been heralded as urban renewal at its best. There is a broad promenade around the water's edge that leads

past the Maritime Museum, the National Aquarium, Harborplace, the Maryland Science Center, and many other sites.

WILLIAM DONALD SCHAEFER CONSERVATORY - Swan Drive in Druid Hill Park off of the 2800 block of McCulloh Street, Phone 396-0180. Built in 1888, the Conservatory houses a permanent collection of tropical plants and features special displays at Easter, Christmas, and in the Fall. Daily 10:00 a.m. - 4:00 p.m.

SHERWOOD GARDENS - Stratford Road and Greenway, Phone 366-2572. The peak season for thousands of tulips, azaleas, and flowering bulbs is the last week of April to first week of May.

CYLBURN ARBORETUM - 4915 Greenspring Avenue, Phone 396-0180. 167 acres of nature trails and horticultural plantings. AAS Garden. Monday - Friday 8:00 a.m. - 4:00 p.m.

CARROLL MANSION - 800 E. Lombard Street, Phone 396-3523. Maryland patriot and signer of the Declaration of Independence, Charles Carroll, wintered here during the last 12 years of his life (1820-1832). The mansion illustrates the elegant lifestyle of wealthy Baltimore families of the time. Tuesday - Saturday 10:00 a.m. - 4:00 p.m. and Sunday 12:00 - 4:00 p.m.

CENTER FOR URBAN ARCHAEOLOGY - 800 E. Lombard Street, Phone 396-3156. The Center features "Archaeologists as Detectives: Solving History's Mysteries," an exhibit that entertains and educates. Various artifacts are on display and a working archaeological laboratory is seen. Tuesday - Saturday 10:00 a.m. - 4:00 p.m. and Sunday 12:00 - 4:00 p.m.

COURTYARD EXHIBITION CENTER - 800 E. Lombard Street, Phone 396-9910. This museum features the exhibit "Rebuilding an American City: Baltimore Today," tracing the City's celebrated renaissance from 1930 to the present. Tuesday - Saturday 10:00 a.m. - 4:00 p.m. and Sunday 12:00 - 4:00 p.m.

ENTERTAINMENT IN BALTIMORE

BALTIMORE ORIOLES - You may wish to stay over an extra night to take advantage of a Baltimore Orioles game. They will be playing a series with Detroit from 19-22 April. The games on 19-21 April are night games; the game on 22 April begins at 1:35 p.m. Tickets will not be available until the beginning of the 1990 season. Phone (301)-338-1300.

THE MORRIS A. MECHANIC THEATRE - From 10 April-6 May, 1990, Stephen Sondheim's Tony Award winning Broadway play "Into the Woods" will be playing. The theatre is directly across the street from the Lord Baltimore. Phone (301)-625-1400.

CENTER STAGE THEATRE - A new comedy by British playwright Caryl Churchill entitled "Serious Money" will be playing. The theatre is located at North Calvert and Monument Streets. Phone (301)-332-0033.

TRAVEL TO BALTIMORE

Automobile: From Interstate 95 North follow the signs for I-95 North which will become I-395 North once inside the Baltimore City limits. Do NOT take any tunnel exits. Take exit 53 which is I-95 North, Memorial Stadium, Inner Harbor, and

Downtown. Once in the downtown area, 395 becomes Howard Street. Turn right onto Baltimore Street, go two blocks and turn left onto Hanover Street. The hotel's main entrance is on the right.

From I-295 North (the Baltimore-Washington Parkway and the route used to get from the airport), follow signs for I-295 North, to Downtown Baltimore. Do NOT take any tunnel exits. Once inside the city limits, I-295 becomes Russell Street. Take Russell Street and follow signs for Downtown and Memorial Stadium. The street will automatically bear to the right and for one block you will be on Paca Street. Take the first right on Pratt Street. It is advisable to get into the left lane quickly. Go two blocks and make a left onto Howard Street. Go three blocks and make a right onto Baltimore Street. Go two blocks and make a left onto Hanover Street. The hotel is located at the intersection of Baltimore and Hanover Streets.

From US Route 40, I-70, or I-370, take Exit 16 for the Beltway (I-695) in the direction of Catonsville. Go one exit to Exit 15, which is US Route 40, also called Edmondson Avenue. Take Edmondson Avenue all the way into the downtown area where it becomes Mulberry Street. Make a right onto Greene Street and go approximately five blocks and make a left onto Baltimore Street. Go five blocks and make a left onto Hanover Street. The hotel's main entrance is on your right.

Air Travel: Baltimore is served by 17 major airlines through the Baltimore Washington International Airport. However, USAir has been designated as the official carrier for those attending the Association of Southeastern Biologists Meeting, 18-21 April, 1990. A convention fare is available offering a 5% discount off any published USAir promotional round trip fare, excluding First Class and Government Contract Fares. This discount is valid providing all rules and restrictions are met. For attendees unable to meet the restrictions for promotional fares, a 40% discount off the standard round trip day coach fare for travel within the continental United States is available. All special fares must be purchased 7 days in advance. These special convention discounts are valid between 16 and 24 April, 1990. It is important for ASB members to take advantage of this special offer, because ASB will receive one free airfare for every 40 special fare tickets sold for the meeting. This can help to defray future travel expenses for officers and speakers.

SPECIAL AIRFARE INSTRUCTIONS

To obtain this discount, **you or your travel agent** must call USAir Meeting and Convention Sales office at 1-800-334-8644, Monday through Friday, 8:00 a.m.- 5:00 p.m. eastern time. When calling from North Carolina or Canada the number is 1-800-251-5720, extension 2224. REFER TO GOLD FILE 264049.

Airport Shuttle Service: There is a regular airport shuttle service that departs the Baltimore-Washington International Airport at 20 minute intervals, Monday through Friday beginning at 5:40 a.m. and ending at 12:00 midnight. The shuttle also operates at 20 minute intervals from the Lord Baltimore, beginning at 6:15 a.m. Saturdays and Sundays the shuttle operates at 30 minute intervals. It departs from the hotel beginning at 6:35 a.m. It is about a 35 minute ride from the airport to the Lord Baltimore. The tariff is \$5.00 one way. There is no charge for children under the age of 6. Phone numbers for the airport shuttle are (301)-850-0305 and (301)-850-0306.

ACCOMMODATIONS

Rooms will be available at the Lord Baltimore Radisson Plaza, which is offering special convention rates. **Please plan to stay at the Lord Baltimore and be at the center of the meeting activities. ASB has had to guarantee sufficient rooms to offset the cost of the meetings facilities.** Please make your reservations before 18 March, 1990. After that time rooms can be obtained only on space available basis.

The special convention room rates are as follows: single room, \$65.00 per night (\$72.15 including tax), double room, \$75.00 per night (\$83.25 including tax). There is a charge of \$5.00 for each additional person (\$5.55 including tax).

The Lord Baltimore Radisson Plaza
Baltimore and Hanover Streets
Baltimore, MD 21202
(301)-539-8400

Please make reservations directly with the Lord Baltimore Radisson Plaza using the enclosed room reservation card. To ensure that you receive the special room rates be sure to indicate that you are an ASB participant.

There are many other hotels within five blocks of the Lord Baltimore. Please check with them directly for room reservations and rates.

Parking: The Lord Baltimore Radisson Plaza has valet parking available at a cost of \$9.00 per day with in and out privileges. Other parking facilities in the area include the following:

Arrow Parking Garage 210 W. Baltimore St. (301)-685-2554	Weekday Rates: \$5.00 up to 12 hr \$6.00 maximum Weekend Rates: \$4.00 maximum
Arrow Parking Garage 315 W. Baltimore St. (301)-752-3910	Weekday Rates: \$4.00 maximum Weekend Rates: Closed
Omni Garage 5 N. Liberty St. (301)-237-5805	Weekday Rates: \$7.00 up to 10 hr \$8.00 maximum Weekend Rates: \$7.00 up to 10 hr \$8.00 maximum
Downunder Garage 110 W. Lombard St. (301)-752-6828	Weekday Rates: \$8.00 maximum Evening Rates: \$3.00 maximum

PRE-REGISTRATION AND REGISTRATION

A PRE-REGISTRATION FORM is provided with this copy of the bulletin. The **deadline for pre-registration is 30 March, 1990.** Your pre-registration will allow us to plan facility needs and services for the upcoming meeting. Pre-registration packets and late registration will be at the Lord Baltimore on Wednesday from 12:00 noon until 10:00 p.m. and on Thursday from 8:00 a.m. to 5:00 p.m. and on Friday

from 8:00 a.m. to 12:00 noon. **PRE-REGISTRATION** is necessary to ensure the most effective planning for field trips, special meals, and social events. Late tickets for social events *may not* be available at the registration desk.

Please bring to the meeting your April, 1990 ASB Bulletin containing the detailed program and abstracts. Copies will be sold at the registration desk for \$3.50.

This year registration for members of **Beta Beta Beta** is included on the same form as regular ASB registration.

THE NATIONAL AQUARIUM IN BALTIMORE

The National Aquarium on the Inner Harbor will be the site of the Thursday evening buffet dinner. The Aquarium has one of the finest collections of marine life in the world. It is home for more than 7,000 species of aquatic life, including sharks, whales, and sea lions, in twelve theme exhibits. The usual cost of an after hours gathering at the Aquarium is \$1800 plus \$8.00 per person. As a gesture of welcome to ASB, the Aquarium and the City of Baltimore are waiving the rental fee and reducing the admission to \$2.00 per person. Including the price of a meal prepared by one of the Aquarium's most highly recommended caterers, the cost of the evening is only \$16.00. You don't want to miss this unique experience.

GENERAL SCHEDULE

ALL EVENTS AT THE LORD BALTIMORE
EXCEPT WHERE NOTED

WEDNESDAY: 18 APRIL, 1990

Registration	12:00-10:00 PM
Field Trips: See descriptions of Field Trips and Pre-registration form.	1:00-5:00 PM
ASB Executive Committee Meeting	2:00-6:00 PM
Continuation of ASB Executive Committee Meeting (if needed)	8:00-10:00 PM
SABC Council Meeting	5:00-7:00 PM
Symposium - Teaching Update: "Exploring Plant Growth and Development with Wisconsin Fast Plants"	6:00-7:30 PM
Presented by Dr. Paul H. Williams, Professor of Plant Pathology, University of Wisconsin, Madison.	
<i>Sponsored by the SE Section-Botanical Society of America</i>	
ASB Social Hour: (Cash Bar)	7:30-10:00 PM

THURSDAY: 19 APRIL

Past Presidents' Breakfast	7:00-8:00 AM
Registration	8:00 AM-5:00 PM
Exhibits: Calvert Ballroom	8:00 AM-6:00 PM
General Plenary Session: Versailles Ballroom	8:30-9:45 AM
Welcome by Dr. Hoke L. Smith , President of Towson State University	
Announcements by the Local Committee	
Featured Address by Dr. Thomas Lovejoy , Assistant Secretary for External Affairs, Smithsonian Institution	
Title: " Integrity of the Global Environment: A Washington View "	
Paper and Poster Sessions	10:00 AM-5:00 PM
Symposium: "Endemism and Extinction in United States Plants and the Red Data Book of Endangered United States Plants"	10:00-11:30 AM
Led by Dr. Robert Mohlenbrock , Southern Illinois University, Carbondale	
<i>Sponsored by</i> North American Plant Specialist's Group of the Species Survival Commission of the International Union for the Conservation of Nature.	
Society of Wetland Scientists, Luncheon Meetings:	12:15-1:45 PM
Tri-Beta Field Trip to Fort McHenry	1:00-5:00 PM
Symposium: "Ecology, Conservation, and Environmental Protection in China"	1:00-5:00 PM
Organized by Dr. J. Frank McCormick and Dr. Xinyuan Wu , University of Tennessee.	
<i>Sponsored by</i> the SE Chapter of the Ecological Society of America	
ASB Reception and Buffet Supper at The National Aquarium in Baltimore	6:30 PM

FRIDAY: 20 APRIL

Registration	8:00 AM-12:00 PM
Breakfast and Business Meeting: Southern Appalachian Botanical Club and Southeastern Section, Botanical Society of America.	7:00-8:30 AM
Exhibits: Calvert Ballroom	8:00 AM-12:00 PM
Paper and Poster Sessions	8:00 AM-5:00 PM
Symposium: "Protecting Biological Diversity in the Southeast: The Role of Propagation in Botanical Gardens in the Protection of Native Plant Species"	9:00-11:30 AM

Chaired by **Dr. R.D. Sutter**, North Carolina Department of Agriculture and **Dr. E.E.C. Clebsch**, University of Tennessee
Co-sponsored by SE Chapter of the Ecological Society of America, Southern Appalachian Botanical Club, SE Chapter of the Botanical Society of America and the Eastern Native Plant Alliance.

Tri-Beta, Business Meeting	10:30 AM-11:30 PM
Association of Southeastern Biologists: Business Meeting and Election of Officers.	11:30 AM-12:30 PM
Southeastern Chapter, Ecological Society of America, Luncheon Meeting	12:30-2:00 PM
Tri-Beta Paper Sessions	2:00-5:00 PM
Symposium - "Teaching the Limnology Laboratory" Organized by Dr. James F. Payne , Memphis State University, Dr. Joe King , Murray State University, and Dr. Luther Knight , University of Mississippi	1:30-5:00 PM
Social Hour (Cash Bar)	6:00-7:30 PM
ASB Banquet: Calvert Ballroom	7:30 PM-

SATURDAY: 21 APRIL

ASB Executive Committee Meeting and Breakfast	8:00 AM
Field Trips: Departures from the Lord Baltimore	8:00 or 9:00 AM

FIELD TRIPS

Transportation will be provided for all tours. Departures will be from the main entrance of the Lord Baltimore. Please note that the first two field trips are on Wednesday afternoon; Tri Beta field trip is on Thursday; and all others will be on Saturday.

1. McCORMICK SPICE COMPANY Wednesday, 18 April, 1:00-5:00 PM

The McCormick-Schilling Spice Company, located in Hunt Valley, Maryland, is one of the largest manufacturers of spices and extracts in the world. The facility at Hunt Valley houses the spice mill and processing plant, warehouse area, and quality control laboratories. After a brief slide presentation on the origins of exotic spices, we will tour the facilities. Led by Ms. Cheryl Bermel (Towson State) and McCormick-Schilling tour guide. (301-830-4109)

Maximum: 12 persons

Cost: \$5:00

2. BELTSVILLE U.S.D.A. RESEARCH CENTER Wednesday, 18 April, 1:00-5:00 PM

Visits to both Plant and Animal Sciences Sections of one of the largest agricultural research centers in the world will touch on a multitude of on-going projects. Our professional tour guide will give us meaningful and interesting insights into research ranging from plant and animal genetics, disease and population control through aspects of horticulture, floriculture and animal husbandry including new work with meat and milk production. An informative, brief film addressing the vast scope of the Beltsville effort will be shown. Led by Dr. Howard R. Erickson (Towson State) and our Beltsville Tour Guide (301-830-3120).

Maximum: 12 persons

Cost: \$5.00

3. CHESAPEAKE BAY FOUNDATION'S BALTIMORE HARBOR TRIP

Saturday 21 April, 9:00 AM - 4:30 PM

Participants have a hands-on opportunity to study an urban watershed's impact on the Chesapeake Bay aboard one of the Foundation's working vessels. Experienced guides will involve you in extensive sampling procedures and techniques as well as give understanding to the workings and environmental challenges of this major shipping port. Led by Dr. Richard Lainhart (Towson State) and CBF guides. (301-830-2443)

Minimum: 20 persons (This trip must be cancelled if there are fewer than 20 participants).

Cost: \$50.00, boat rental, box lunch, and transportation included.

Pre-registration and payment must be received no later than February 15, 1990.

4. SOLDIERS DELIGHT SERPENTINE AREA Saturday 21 April, 9:00 AM-4:00 PM

Maryland's largest serpentine area (800 ha) supports little bluestem grasslands, Virginia pine savannas and woodlands, and pine/oak forests collectively supporting at least 30 rare and endangered plant species. Emphasis will be placed on major presettlement, settlement, and recent environmental conditions controlling grassland coverage, and on current research in "slash and burn" management of woody plant succession. Led by Dr. Wayne Tyndall, Maryland Natural Heritage Program (301-974-2870).

Maximum: 12 persons

Cost: \$10.00, includes transportation and box lunch

5. LONGWOOD GARDENS, CHESTER, PA. Saturday 21 April, 9:00 AM-4:00 PM

This world famous 350 acre facility includes a large conservatory with 20 indoor gardens, shops, displays and visitor's center. The outside gardens include an Italian water garden, a rose arbor, heaths and heathers, waterlilies, giant and dwarf conifers

and a topiary garden. There are large areas with azaleas and rhododendrons, a spring flower walk, a forest walk, and the historic Pierce House. Lunch is available at the Longwood cafeteria. Led by Dr. Frits Morsink (Towson State) (301)830-3395
 Maximum: 40 persons Cost: \$18.00, admission and transportation included

6. SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER **Saturday 21 April, 9:00 AM-3:00 PM**

The Center, located on the Rhode River near Annapolis, is a 3,000 acre facility. A subestuary of the Chesapeake Bay, the area includes a wide variety of upland, wetland and estuarine habitats. Most of the diverse research projects are long-term and are designed to determine how land-use patterns influence the movement of water, nutrients and organisms through the landscape. After coffee, participants will be given an overview of research activities at SERC. Later, a variety of activities including field excursions and a tour of laboratory facilities will be available led by Dr. Dennis Whigham (SERC), (301)-830-3042.
 Maximum: 12 persons Cost: \$10.00, transportation and box lunch included.

7. PATUXENT WILDLIFE RESEARCH CENTER **Saturday, 21 April, 9:00 AM-2:30 PM**

This U.S. Fish and Wildlife installation is well known for its work with endangered animals and with environmental contaminants. Our tour will include visits to various research projects currently in progress. The Patuxent Research Center is famous for its work with whooping cranes and bald eagles. It's findings dealing with environmental contaminants have had worldwide impacts. Led by Dr. Howard R. Erickson (Towson State) and our Patuxent Center Tour Guide. (301-830-3120).
 Maximum: 12 persons Cost: \$10.00, transportation and box lunch included.

8. TRI-BETA TRIP TO FORT McHENRY **Thursday, 19 April, 1:00 PM-5:00 PM**

A tour of the grounds, star-shaped fort, barracks, officers quarters, guard houses and powder magazine of the historic Fort McHenry. This is the site of the battle following which, on the morning of September 13, 1814, Francis Scott Key penned the lyrics to the Star-Spangled Banner after the British bombardment of the Fort in an attempt to capture Baltimore. Led by Dr. Richard Hilton (Towson State). (301-830-3124).

Cost: \$6.00 includes transportation and admission

NOTICE OF RESEARCH AWARDS FOR 1990

ASB Faculty and Student Research Awards (\$500 each). Rules are as follows:

- (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting. In order to qualify for presenting the paper, the author(s) must submit an abstract by the **1 December** deadline. Papers submitted for the competition must be received in triplicate and in their entirety by **1 March** and must be journal-ready manuscripts worthy of

publication. A short biographical sketch of each author must accompany the manuscript at the time of submission.

- (b) Only ASB members are eligible (this applies to all authors). The student award is given to the senior author if he/she is a graduate or undergraduate student at the time of presentation.
- (c) Papers may be in press but not published prior to the previous annual meeting.
- (d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses or objectives, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Research Award Committee, the award may be withheld or it may be split in case of a tie.
- (e) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin.

Send to: Faculty - Dr. Eloise B. Carter, Dept. of Biology, Emory University, Atlanta, GA 30322 (404)-727-6292; Student - Dr. G. E. Stanton, Dept. of Biology, Columbus College, Columbus, GA 31993 (404)-568-2065.

Eugene P. Odum Award - \$100 and a plaque given by a Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated on the following points by a panel of judges at the time of presentation: (a) significance of ideas; (b) creativity; (c) quality of methodology; (d) validity of results; (e) clarity of presentation.

Eligibility Requirements.

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology.
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) The title and abstract of the paper must be submitted to the Award Coordinator by **1 December**. This can be a copy of the abstract submitted to ASB **1 December**. Submit to: Dr. W. D. Cocking, Dept. of Biology, James Madison University, Harrisonburg, VA 22807 (703)-568-6225.

North Carolina Botanical Garden Award - (\$100) - given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is given for an especially meritorious paper presented in the areas of plant systematics, evolution, or conservation. The paper will be evaluated by a panel of judges at the time of presentation, on the following points: (a) significance of ideas, (b) creativity, (c) quality of methodology, (d) validity

of results, and (e) clarity of presentation. The actual prize will be presented at the ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award.
- (b) The paper must deal with the systematics, evolution, species biology (including population biology), or conservation of vascular plants that are native or naturalized to the southeastern United States.
- (c) The paper must be presented in a regular Plant Systematic contributed-paper session; papers presented in poster sessions or in symposia are not eligible.
- (d) The title and abstract of the paper must be submitted to the Award Coordinator by **1 February 1990**. This may be a copy of the abstract submitted to ASB 1 December. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. Larry Mellichamp, Department of Biology, University of North Carolina, Charlotte, NC 28223, (704)-547-4055.

Meritorious Teaching Award Nomination. Each year the ASB recognizes one of its members for especially meritorious teaching. This award of \$1000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the July ASB Bulletin.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a southeastern institution for at least ten years, and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his or her institution (important assignments and other contributions specifically related to effective teaching, and teaching awards) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially who later received advanced degrees.

Members are urged to nominate outstanding teachers for this award, using the form in the ASB Bulletin 32: 122, 1985, and include supporting documentation (biographical sketch or CV, supporting letters, photograph of candidate, etc.). Send all of this, once compiled, to: Dr Stewart Ware, Dept. of Biology, William and Mary College, Williamsburg, VA 23185, (804)-253-4458.

" Travel" Support awards for Graduate Student Members of ASB. Limited funds are available to defray partially the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be members of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

- (a) Give information as to whether you submitted a title and abstract for a paper or poster.
- (b) Give a conservative, itemized estimate of meeting expenses excluding transportation.
- (c) In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications which have appeared or are in prepa-

- ration, degree sought, name of major professor, and any other pertinent professional details.
- (d) Give your source(s) of support while in graduate school; e.g. NSF, NIH, USDA, Teaching Asst., Research Asst., etc.
 - (e) Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.
 - (f) **Deadline: 1 February, 1990.** Send application, with supporting letter, all in triplicate, to: Dr. G. W. Kalmus, Dept. of Biology, East Carolina University, Greenville, NC 27834 (919)-757-6204.
 - (g) Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

Guidelines for Poster Sessions

Poster sessions have been incorporated as a regular means of scientific presentation at the annual ASB meetings. This type of presentation provides a more informal environment that encourages a direct interchange of ideas and discussion between presenter and audience. Adherence to the following guidelines will help ensure the effectiveness of the poster sessions.

Poster sessions will be held in the Lord Baltimore on the balcony above the Calvert Ballroom. Consult program for time and location. Posters will be organized by subject matter and numbered sequentially in accord with abstract listings in the ASB Bulletin. All posters will be on display for one and a half days, although authors or co-authors are required to be with their posters only during a specified session. Thumb tacks, tape, backing paper, scissors, and other special display materials will not be provided and should be supplied by each presenter.

Posters should be carefully planned to maximize clarity and simplicity in conveying information. Poster boards 4' in width and 6' in height will be available for each paper. Arrange for a heading including title, author(s) and institution to be placed at the top in letters no less than 3 cm high. The body of the poster should be self-explanatory and should include figures, tables, graphs, maps, or photographs displayed in a well organized and coherent sequence from top to bottom. Do not crowd the display. All materials including text legends, and captions on figures or tables should be legible from a distance of about 2 m. Each illustration should be captioned. A limited degree of text can be included, but care should be taken not to overwhelm the audience. Authors may choose to post a large typeset copy of the abstract at the top of the poster and include a clear listing of specific conclusions at the bottom.

LOCAL ARRANGEMENTS COMMITTEE

CHAIRMAN:	James C. Hull	(301)-830-4117
PROGRAM:	Katherine J. Denniston	830-3128
REGISTRATION:	James Ewig	830-2405
AUDIO-VISUALS:	Gerald Robinson	830-2373
EXHIBITS:	Donald R. Windler	830-2121
FIELD TRIPS:	Howard Erickson	830-3120
SOCIAL ACTIVITIES:	Don C. Forester	830-2385
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 Richard Hilton, Chair
 Towson, MD 21204-7097

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**ASB Annual Meeting -- 18-21 April, 1990
PRE-REGISTRATION FORM**

(Type or print; one form per registrant; duplicate as needed)

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Name Tag Information (if different from above):

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Pre-Registration deadline is March 30, 1990

Affiliation (Check where appropriate):

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Registration:

Regular \$20.00..... \$ _____

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ASB Past Presidents: \$9.00 x _____ Tickets \$ _____

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\$50.00 x _____ Tickets \$ _____

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Optional Contribution to ASB Enrichment Fund..... \$ _____

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Make checks payable to "ASB Local Arrangements Committee"

Mail by March 28, 1990 to:

Dr. James Ewig
ASB Registration
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ASSOCIATION AFFAIRS

ENRICHMENT FUND REPORT

Contributions to the Fund is gaining momentum. The October issue of the *Bulletin* contained the names of 30 contributors who had given to the Fund as of June 12, 1989. The amount given from the inception of the Fund to that date was about \$3,000. As a result of our letter to every member we now have over \$6,300 with 75 members contributing. The Board of Trustees wishes to thank all those whose names were listed in the October *Bulletin* and to those listed below who gave between June 12 and September 22, 1989. Contributions given after September 22, 1989, also will be properly acknowledged in a later *Bulletin*. Still only about seven percent of our members have given and our goal is \$10,000 by the annual meeting so please consider the Fund when paying your dues and thank you.

You may send your contributions to the Fund at the following addresses:

Grover C. Miller, Chr. A.S.B. Enrichment Fund
Box 7617 Zoology
North Carolina State University
Raleigh, NC 27695-7617

or include with your dues to:

Robert L. Beckmann, A.S.B. Treasurer
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Errata to the October 1989 issue list of ASB Enrichment Fund contributors. On p.172, the names Steve and Elsie Dial should have read Steve and Carolyn Dial- G. Miller, Chairman.

PRE-DOCTORAL FELLOWSHIP
SAVANNAH RIVER ECOLOGY LABORATORY
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Basic and applied research in ecology and environmental science has been conducted on the Southeastern Coastal Plain for over 30 years by the faculty at the UGA's Savannah River Ecology Laboratory. Applications are now being solicited for a new fellowship program that will support Ph.D. students at their home institutions during completion of course work and prior to full-time residence at SREL to conduct their dissertation research. It is expected that an SREL faculty member will serve on the student's doctoral committee, preferably as major or co-major professor. Support includes stipend and tuition and is contingent on acceptance into a Ph.D. program. All applicants must be U.S. citizens. For further information and application forms contact: Ms. Janell Gregory, Savannah River Ecology Laboratory, P.O. Drawer E, Aiken, SC 29802. Deadline for applications is 1 February 1990. An Equal Opportunity/Affirmative Action Employer.

ASB SPONSORED SYMPOSIUM ON
BIOLOGICAL DIVERSITY IN THE
SOUTHEASTERN UNITED STATES

The Association of Southeastern Biologist (ASB) will sponsor a symposium entitled "Biological Diversity in the Southeastern United States: Case Studies" at the annual meeting of American Association for the Advancement of Science (AAAS) in New Orleans, Louisiana, on Saturday 17 February 1990 at 8:30 am. The symposium will be one of four symposia on biological diversity held during the Annual Meeting of AAAS in New Orleans between 15-20 February 1990.

Biological diversity is an important component of the functioning of ecosystems. Biological diversity provides raw materials, products, and ideas for human civilization, and provides pleasure and emotional well-being for many. With the ever increasing pressure on the landscape to feed, house, and entertain the world's growing population, the Earth's biological diversity is being reduced at a rate without precedent in human history and this rate appears likely to increase greatly over the next several decades. This deterioration in biological diversity is of significant concern to scientists, and a serious problem for humanity in general, that requires a better understanding of the components of biological diversity for their conservation and sustainable utilization. The purpose of this symposium will be to use the wide range of ecological communities in the southeastern United States as case studies of the importance of biological diversity on the landscape. Speakers will discuss communities in terms of their biological diversity, their ecological importance to the landscape, issues related to the importance of the communities in maintaining biological diversity across the total landscape, and management responses and alternatives which can help maintain biological diversity of the communities on the landscape.

Dr. Arthur W. Cooper, Chairman, Department of Forestry, North Carolina State Univ., Raleigh, NC will moderate the symposium for ASB. Speakers will be: Dr. Peter S. White, Professor of Botany, Univ. of North Carolina, Chapel Hill, NC, "Historical Prospective of Biological Diversity in the Southeast." Dr. William Odum, Professor and Chairman of Environmental Sciences, Univ. of Virginia, Charlottesville, VA, "Biological Diversity in Southeastern Estuary Ecosystems." Dr. Rebecca R. Sharitz, Professor of Botany, University of Georgia, Aiken, SC, "Biological Diversity in Southeastern Floodplain Forest Ecosystems." Dr. William H. Martin, Director of Natural Areas, Eastern Kentucky Univ., Richmond, KY, "Upland Deciduous Forests of the Southeastern United States: Centers of Diversity in the Temperate World." and Dr. Larry Harris, Professor, Wildlife and Range Sciences, Univ. of Florida, Gainesville, FL, "Managing Biological Diversity."

The symposium was organized for ASB by Dr. Jerry C. Ritchie, ARS Hydrology Laboratory, Beltsville, MD.

PRESTIGE AND IMPACT VS. USEFULNESS
IN BIOLOGICAL JOURNALS
OR
AM I JUST A REGIONAL KIND OF GUY?

Stewart Ware

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ABSTRACT

The impact factor and citation half-life for scientific journals, as calculated by Science Citation Index, is used by some college administrators and department chairs to indicate the prestige of a journal, and thus the “significance” of articles published in these journals by faculty members. Regional journals, published by associations or societies interested in the botany or natural history of specific geographical areas, are likely to have lower impact factors and thus lower prestige than journals with national or international geographical coverage. Evidence is presented that from the standpoint that the journals (a) regularly have articles pertinent to one’s research, (b) are likely to be cited in one’s articles, (c) are likely to cite one’s articles, and (d) are seen by a readership interested in one’s research, regional journals may be as useful or even more useful to field biologists than some far more prestigious journals. Administrators and department chairs who are not aware of this need to be enlightened.

The merit review policy at the College of William and Mary has long required that faculty members show “evidence of continuing contribution to scholarship” through publication in peer-reviewed journals. Most of the Department of Biology faculty have been quite happily complying with that requirement, publishing from time to time in various journals, both alone and jointly with graduate or undergraduate students. Several years ago, all faculty members received a request from the Dean that they provide him with a ranking “in order of prestige” of the journals in their research area. The implication was clear. “Evidence of continuing contribution to scholarship” would no longer be meritorious in itself; one would now have to make this contribution through “prestigious” journals.

Difficulties arose immediately in trying to provide a ranking of journals in my field, for there is often a difference between the defined content of a journal and the usual content of its issues. The *American Journal of Botany* and *Botanical Gazette* are both prestigious general botanical journals covering many botanical subject areas. There are, however, relatively few articles in either dealing with forest vegetation (my primary area of interest). This is not because either refuses to accept vegetation papers, for excellent vegetation papers do appear (at long intervals) in both of them. However, custom and readership interest have directed their usual contents away from the vegetation area. Therefore, both in terms of finding articles directly pertinent to one’s research and in terms of being assured of a readership particularly interested in vegetation ecology, these two journals would be less *useful* to a vegetation scientist than the general botanical journals *Bulletin of the Torrey Botanical Club*, *Castanea* (in the east) and *Madroño* (in the west), or the natural history journal *American Midland Naturalist*. These four journals are quite likely to have articles on vegetation in each issue, and on the assumption that this means an interested readership will see the article, vegetation

ecologists may be more likely to submit their manuscripts to one of these four journals than to the first two.

Should the Dean be told that the *American Journal of Botany* is perhaps the most prestigious general botanical journal, but that I never submit vegetation articles there, thus perhaps giving him the impression that I don't think my work is of prestige quality? Should he be told that this is the most prestigious general botanical journal, but that it rarely publishes articles on vegetation, perhaps giving him the impression that my entire field is unprestigious? Should he be provided with an explanation of the difference between prestige and usefulness, even though this may be perceived as making lame excuses for my failure to even submit manuscripts to perhaps the most prestigious journal in my general academic area? None of these options is very attractive.

There are similar situations in other fields. *Ecology* would certainly be considered by any Dean as a prestigious outlet for any ecologist on his faculty. However, articles in the field of physiological plant ecology are far more likely to be published in general purpose botanical journals (like *Bulletin of the Torrey Botanical Club*, *Botanical Gazette*, or *American Journal of Botany*) than in *Ecology*. In fact, one very productive physiological plant ecologist whom I know has even discontinued receiving *Ecology* and *Ecological Monographs* because he feels they are so unuseful in his research area. Yet, a Dean might consider a specialty journal like *Ecology* more prestigious than general journals like these three botanical ones, and one would be hard-pressed, without invoking the usefulness argument, to explain why one's publications, however numerous, were rarely in *Ecology*.

A few years ago a committee charged with interviewing candidates for our Arts and Sciences deanship was told by one candidate, already an associate dean of a major southern state university, "We don't just look at the publication list of a faculty member. We look up how often the publications are cited in *Science Citation Index*, and that tells us how significant the publications are." Under that system, the prestige of the journal in which the article appears is not so critical; what matters is how often other workers cite it.

While my students are frequently sent to *Science Citation Index* (SCI) to locate articles for their term papers or thesis research topics, we had not been using it as a mechanism to see whether work was "significant." The next day I stopped by the library to see how my work had fared. SCI did list some citations of articles I had authored or co-authored, but fewer than expected, and several citations I knew about were not listed. Further investigation revealed that those citations of my articles did not show up in SCI because they had been cited in the botanical journal *Castanea*, a journal SCI does not cover.

Inquiry to SCI revealed why *Castanea* isn't covered: its "impact" is too low. "Impact" or "impact factor" is the ratio of the number of citations of articles from a journal during the most recent two years to the number of articles published in the journal during that two years (SCI 1987). It is an attempt to measure the likelihood that articles in the journal will be cited by other researchers. A journal with a high impact factor is providing articles that other researchers feel a need to cite in their writing, so it clearly is useful to a large number of researchers. In fact, "impact" as measured by SCI is sometimes used as a means of determining prestige among journals. Numerical value of the impact factor for a given journal varies from year to year, and thus the journal's rank based on impact may vary also. For instance, *American Journal of Botany* had a higher impact factor in 1987

than *New Phytologist*, but in 1986 these were reversed; and in 1987 the *Bulletin of the Torrey Botanical Club* had a higher impact factor than *Botanical Gazette*, while in 1986 the reverse was true (SCI 1986, 1987). However, if over a period of years a journal's impact factor is so low that SCI doesn't even include the journal in its coverage, then that journal is unlikely to be called "prestigious," and is probably not very useful either—or so one might think. *Castanea* is not alone in falling into this low impact category. Other journals used by field botanists, such as *Sida*, *Madroño*, *Southwestern Naturalist*, the long important systematics journal *Brittonia*, and even the venerable botanical journal *Rhodora* are likewise omitted from SCI's coverage because of their lack of "impact." Citation of one's work in articles published in these or other such (largely regional) journals will therefore not be picked up by SCI.

It should be noted that there is a time element in the calculation of the impact factor; cited articles more than two years old do not enter into the calculation. For convenience I will refer to this element as "quickness," related to how soon after publication articles are cited. On reflection, one would hardly expect a lot of "quickness" in journals in which the primary subject matter is field and museum or herbarium systematics or field ecology. It takes a long time to gather data in studies of this type, and such studies don't lend themselves to periodic progress report articles. Thus, when an article is ultimately published, it is unlikely to cite previously published progress reports of the just preceding years. Therefore, even if a newly published article inspires a researcher to start a related study, it will likely be more than two years before the second study is completed, written up, and shepherded through the review process to publication. By this time, citation of the first, initiating article is too late to count toward the impact factor for the journal in which it was published. Field biology journals thus might be expected to have lower impact factors.

On the other hand, the data published in field, herbarium, and museum studies does not quickly become obsolete, so an article may be worthy of citation many years, and even decades, after the original publication. Thus, even if an article is rarely cited in the first two years after publication, this does not mean it is unimportant or lacking in significance, for other articles in which it will ultimately be cited it may still be years away from publication. The lag in "quickness" in systematics and field ecology studies may well be compensated for by long-time worth in articles in those disciplines.

The New Phytologist, trying in its advertising circular to persuade botanists to subscribe, reports that it has the "most favorable half-life" of broad-spectrum botanical journals. Half-life in this case refers to the median number of years since publication of the articles cited in the journal (SCI 1987). A short half-life would presumably mean that the authors publishing in that journal are keeping up on the very latest literature and cite mostly very recent articles. No doubt this is the point the editors of *The New Phytologist* had in mind. The other side of this, however, is that a short half-life may mean that in the fields covered by a journal, the information in articles more than a few years old is usually so outmoded that there is no reason to cite those articles. Such early obsolescence is not often the case in field biology studies. Therefore, journals which regularly publish articles on systematics or field ecology would be expected to show frequent citation of older articles, and thus a long half-life.

In the 12 papers I have authored or co-authored in this decade, 34 out of 173

Table 1. Sources of articles cited in twelve articles authored or coauthored by S. Ware 1980–1989 (journal citations only; books, theses, documents excluded). An asterisk means the journal is not covered by SCI.

Scientific journal (N = 21)	Number of times cited (N = 116)
Ecology	23
Ecological Monographs	19
*Castanea	15
Bulletin of the Torrey Botanical Club	14
American Midland Naturalist	12
*Virginia J. of Science	7
*J. Elisha Mitchell Scientific Society	4
*Jeffersonia	3
Vegetatio	3
American Naturalist	2
*ASB Bulletin	2
J. Forestry	2
*Rhodora	2
8 others, each	1

entries in the “Literature Cited” were less than five years old at the time of citation. However, more than half the entries were more than 15 yr old when cited, and almost a quarter (22.5%) were over 30 yr old. The half-life of cited articles is greater than 15 yr, well beyond the ≥ 10 yr cutoff for “unfavorable” half-life of SCI. In contrast, the median half-life for all CSI citations is 6 yr, and less than 5% of the citations are older than 30 yr (CSI 1988). In my articles older entries were cited not because of unfamiliarity with more recent work, but because, despite the passage of years, the information in the older articles was still pertinent to the studies being done. Is a long half-life “unfavorable” in this case? Probably not.

No matter what its prestige or impact to other parts of the biological research community, a journal is *useful* to the individual researcher only if it regularly publishes articles which help that researcher keep up with the latest developments in his or her specialized field. There are, for instance, certain journals of which I have chosen to receive personal copies (by becoming a member of the professional societies which publish them). I want my own copies of those journals because any issue is likely to contain articles pertinent to my research and teaching. Other journals which may, from time to time (but not regularly), contain articles pertinent to my research I generally choose not to subscribe to. Rather, I depend upon occasional examination of the copies in the University library to keep up with any articles in my research field published in those journals. Interestingly, many of the journals I choose to receive, because they are most useful to my research, are not high impact journals. Prestige as measured by SCI’s impact figure does not necessarily coincide with *usefulness* as I have judged it in selecting which journals to receive.

In an effort to get some quantitative measure of which journals have been most useful in my research, frequency of citation of various journals in the 12 papers of mine mentioned earlier were examined (Table 1). While *Ecological Monographs* and *Ecology* are high impact journals by SCI’s measurement, the third most frequently cited journal is one with such low impact that SCI doesn’t even cover

Table 2. Sources of articles cited in a review chapter on rock outcrop plant ecology by Baskin and Baskin (1985).

Scientific Journal (N = 36)	Number of times cited (N = 89)
Bulletin of the Torrey Botanical Club	12
Ecology	7
American Midland Naturalist	5
Evolution	5
J. Ecology (British)	5
American J. of Botany	4
Botanical Gazette	4
Canadian J. of Botany	4
Castanea	4
J. Agriculture Research	4
J. Tennessee Academy of Science	4
Contributions of the Gray Herbarium	3
New Phytologist (British)	3
Oecologia	2
Weed Research	2
Ecological Monographs	1
Science	1
19 others, each	1

it, and this is also true of the sixth and seventh journals. In contrast, the prestigious (higher impact) botanical journals *American Journal of Botany* and *Botanical Gazette* and such prestigious European ecological journals as *Oecologia*, *Oikos*, and *Journal of Ecology* did not make my list. There was not a single citation from any of those five journals. This of course does not mean that these journals are not useful to me. I consult all of them regularly, and even receive a personal copy of *American Journal of Botany*. Still, there clearly is not a good correlation between SCI's "impact" in botany or ecology as a whole and usefulness as measured by citation in my published research.

The sample on which Table 1 is based is very biased, since 11 of the 12 papers dealt with forest vegetation. The remaining article dealt with the other area of plant ecology in which I do research, rock outcrop ecology. To get a view of what the most useful journals might be in that research area, the sources of literature cited in a recent review chapter (Baskin and Baskin 1985) dealing with autecology of rock outcrop plants were examined (Table 2). The greater representation of *American Journal of Botany*, *Botanical Gazette*, and *Canadian Journal of Botany* in their cited literature, and the relatively lower representation of *Ecology* and *Ecological Monographs* than in Table 1 is consistent with the earlier suggestion that articles on physiological plant ecology are more likely to appear in one of the general purpose botanical journals than in these two ecological journals. In this case also, usefulness as measured by frequency of citation and impact as measured by SCI do not correlate well. Only two journals are cited more often than *American Midland Naturalist*, which has only a moderate SCI impact factor. The regional journal *Castanea* is cited as often as *American Journal of Botany*; the *Journal of the Tennessee Academy of Science* is cited as often as *Botanical Gazette*. *Science*, regarded by many as the most prestigious American journal, provided only one citation.

Journals are useful not just for the information they provide a researcher, but

also for the interested readership they provide for the researcher's writings. Now that almost all researchers have easy access to a photocopying machine, it is probable that a smaller percentage of biologists request reprints than was once the case. Still, if the number of reprint requests per article is any indication of the size of the interested readership, then *Castanea* (a low impact journal), *Bulletin of the Torrey Botanical Club* (intermediate impact), and *Ecology* (high impact) are of approximately equal usefulness in providing interested readers for my work.

Perhaps a better indication that a journal provides an interested readership is the more frequent citation of one's articles in that journal. If this is true, *Bulletin of the Torrey Botanical Club* and *Castanea* (in that order) are providing the best readership for my work, *American Midland Naturalist* is third, and *Ecology* and *Virginia Journal of Science* are competing for fourth.

Two years ago I underwent a periodic (six-year) re-evaluation, which is required of all tenured faculty in my department. The evaluation committee (composed of five of my colleagues) decided my performance merited by continuance and they even gave me some mild praise for my "continuing contribution to scholarship." They commented, however, that too many of my publications were in regional journals. The implication was, of course, that however meritorious my "continuing contribution" was, it would be even more so if more of it were in national and international (read "more prestigious") journals. It was no false accusation that I had been publishing in regional journals. The journals published in most often are *Castanea* (6), *Bulletin of the Torrey Botanical Club* (5), *Virginia Journal of Science* (5) and *Ecology* (3). *Castanea* plainly states that it invites articles relating to the flora and vegetation of the southern Appalachians and the southeastern United States, because that is the field of interest of its readership. The *Virginia Journal of Science* has no stated geographical limitations on its subject matter, but in practice its content, like that of most state academy journals, is heavily weighed toward the field biology and field geology of that state.

Why publish so often in these regional journals? I have long been interested in the distribution, abundance, and phytosociology of vascular plants (particularly of forest trees) and in the environmental factors which control these. Climate, geology, topography, and their interactions usually control the distribution and phytosociology of forest trees. Since climate, geology, and topography all vary from region to region, vegetation also varies from region to region. While certain general principles are applicable everywhere, the details of relative abundance and phytosociological relationship among species are often only valid for a given region. It is risky to extrapolate findings in one region to another region where the levels of the controlling factors are different. Thus, vegetation studies, like studies of flora and fauna, tend to be regional in extent and in applicability, at least at the level of detail, and that is why almost all vegetation, floristic, and faunistic studies have a geographical term in their titles. The most interested readership for such studies will usually be other field biologists in that general region. This is in fact the very reason for the existence and usefulness of regional journals like *Castanea*, *Southwestern Naturalist*, *Prairie Naturalist*, *Great Basin Naturalist*, *Madroño*, *Northwest Science*, and most state academy journals.

If a vegetation ecologist were reporting on the existence of a new plant community process, or a major geographical extension of a vegetation type, then this might well be of great enough interest to readers on a national scale to be published in *Ecology* or *Bulletin of the Torrey Botanical Club*. If it is the first modern detailed

study of the vegetation of a large portion of a physiographic province or of a major disjunct outlier of a widespread vegetation type, perhaps *Bulletin of the Torrey Botanical Club* or *American Midland Naturalist* would be the journals of choice. If the study is of the differences between two different portions of the same physiographic province in the southeastern U.S., then one might send it to *Cas-tanea*. If the research involves the comparison of relative abundances of certain tree species above and below the scarp of a Coastal Plain terrace, then the appropriate choice might be a state Academy of Science journal, such as *Journal of the Elisha Mitchell Scientific Society* (North Carolina). While it makes sense to publish in the most prestigious journal one can, the choice of the journal should be determined in large part by where the interested readership is to be found.

For workers in research areas such as molecular biology or plant or animal physiology, there is no geographic constraint on applicability of the results. For them, publication in a state academy journal might be regarded as “invisible,” in the sense that it will almost certainly be overlooked by other workers in their specialty. Because of the regional nature of so many vegetational, floristic, and faunistic studies, the appropriate state academy journals are routinely consulted by most field biologists, and thus these journals are not as “invisible” as they are in other subdisciplines. Because of an interest in the ecology of limestone outcrop plants, I routinely consult the *Journal of the Tennessee Academy of Sciences*, where pertinent articles occur from time to time (Table 2). Apparently other field ecologists also consult such state journals, for three titles my students and I published in the *Virginia Journal of Science* have since been cited in books, and none of the three citing authors were from Virginia.

SCI doesn't regard some of the regional journals in which I publish as very prestigious, because they have low impact factors. A Dean who counts SCI citations will perhaps underestimate the significance of my work, for he will never know my work was cited in these journals, since they are not covered by SCI. My departmental colleagues may not esteem sufficiently the work I publish in these journals, because they are merely regional. Yet, when one considers which journals (a) regularly have articles pertinent to my research, (b) are most likely to be cited in my articles, (c) are most likely to cite my articles, and (d) seem to have a readership likely to be interested in my research, then these regional journals rank right up along with ones of broader geographic coverage like *Ecology* and *Bulletin of the Torrey Botanical Club*. Given the geographical distribution of the plant communities I find particularly interesting, regional journals are likely to remain useful to me as both a reader and a contributor, despite any lack of prestige, impact, or esteem from some of my colleagues outside of field biology. I guess I'm just a regional kind of guy.

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REVIEWS

Bonham, Charles D. 1989. **Measurements for Terrestrial Vegetation.** John Wiley & Sons, New York, NY. \$49.95. 338 p.

Charles D. Bonham has done a good job of compiling his 20 years of experience teaching and conducting field studies into a useful reference for others in the area of vegetation science. Bonham uses many examples and clear explanations of the measurement techniques discussed. The examples are oriented toward measurements most common to range scientists, but the information provided is pertinent to all vegetation scientists.

The text is divided into seven chapters and a two-page appendix of unit conversion tables. Chapter 1 provides a brief history of vegetation measurement and sets the stage for more detailed discussions of units of measurements (Chapter 2), statistical concepts for field sampling (Chapter 3), frequency and cover measurements (Chapter 4), density measurements (Chapter 5), biomass measurements (Chapter 6), and monitoring for evaluation of vegetation changes related to natural resources management (Chapter 7).

Considerable effort is given to explaining the parameters and units used in vegetation measurement (i.e. cover, density, biomass, and tree measurements such as height and diameter) and the statistical concepts important to successful field studies (e.g. data characteristics, sample size, data distributions, transformations). Although much of the statistical information presented may be found in general statistical texts, Bonham has done a good job relating the discussion to vegetation measurements.

The specific discussions about measurements of frequency, cover, density, and biomass are supplemented well with equations for calculating the various indices. However, I was disappointed by the absence of references to computer programs that are available to do the calculations associated with many of the techniques described. Line drawings and photographs of equipment used in the field are used throughout. Discussions with tabulated examples that compare methods, sample size, etc. of the various techniques will prove to be very informative to most readers of this book.

The last chapter provides a useful discussion on vegetation monitoring oriented toward quantifying the characteristics of the vegetation at a given site and estimating past changes as well as those that may occur in the future. Much of the discussion is related to range management and based on changes brought about by grazing or browsing. However, Bonham emphasizes the requirement for understanding the "vegetation condition" which is important to a wide audience of resource managers concerned with trends in vegetation changes.

This book will be useful as a teaching supplement in field courses that deal with methods of vegetation measurement. It is a good reference for the professional planning to conduct vegetation studies, especially for purposes of natural resources management. The author is to be congratulated for developing a well organized book that will surely be added to the bookshelves of many vegetation scientists.

C. ROSS HINKLE, *Manager, Ecological Programs, The Bionetics Corporation, John F. Kennedy Space Center, FL 32899.*

Burton, W. G. 1989. **The Potato**, 3rd Ed. Longman Group UK Limited, Essex, England. \$152.00. 742 p.

The white or Irish potato went to Europe from the Andes in the sixteenth century and after a struggling beginning there became accepted as a food crop, first in Ireland and later in other parts of Europe. Today, of course, it ranks as one of the world's five most important food plants. In a book of this length entitled *The Potato*, some might expect to find nearly everything about the potato, but the author claims that "a single volume can only give a bare outline of the subject." The preface tells us that the book concerns the nature, production, nutritive value and storage of the potato and with its quality as a food and as a raw material for an important processing industry, emphasizing general principles not practices. To this it should be added that the book opens with some comments about the origin and spread of the potato and that the second chapter treats potato varieties, breeding and propagation. The bibliography contains some 2,000 entries. Obviously the author should hardly be

criticized for omissions, but this reviewer felt that perhaps there should have been some reference to the work of Paul Grun on the cytoplasm of the potato. Burton's more than 40 years of experience with this plant places him in an excellent position for writing this work. He is to be congratulated for this book, and the publishers too, not only for bringing out a third edition but for their other fine works dealing with agricultural crops as well.

CHARLES B. HEISER, *Department of Biology, Indiana University, Bloomington, IN 47405.*

Boschung, H. 1989. **Atlas of Fishes of the Upper Tombigbee River Drainage, Alabama-Mississippi.** Southeast. Fishes Council. Proc. no.19. \$7.50. 104 p. Available from M. Stevenson, Univ. New Orleans, New Orleans, LA.

The atlas of fishes of the upper Tombigbee river drainage of Alabama-Mississippi treats 116 fishes known to have occurred there prior to its connection to the Tennessee river system via the Tennessee-Tombigbee waterway as well as the effects since the waterway's opening. A dot distribution map treats each species' distribution. Comments are provided on the species captured by the Tennessee river drainage following completion of the waterway and list the potential immigrants from the Tennessee. The most recent genus names have been employed throughout.—FJS.

Lockhart, Gary. 1988. **The Weather Companion, an Album of Meteorological History, Science, Legend, and Folklore.** J. Wiley & Sons, NY. \$12.95. 230 p.

You feel the approaching changing weather in your bones; the fisherman scans the sky to see if he should fish tomorrow; the silvery upturned leaves of the poplar tree call for rain; the woolly bear caterpillar is blacker or browner depending on how cold the winter will be; early migrations of birds are harbingers of spring or winter; rings around the moon mean a frost is likely; the mullet fish will run following a strong northeasterly wind; the shad will run when the shad bush (*Amalanchier canadensis*) blooms; and you're more irritable on a rainy day. On and on it goes as to what one uses or depends upon to predict the weather. Such primitive approaches, in most cases, are just as or more accurate than the modern weatherman (meteorologist) who predicts a probably good day, only to have it rain.

Other weather standbys are: the *Farmer's Almanac*, used by farmers and many as a source of what the weather will be like in order to know where or when to plant or harvest a crop; we note with much pomp and ceremony the appearance of Punxsutawney Pete, the groundhog, whose shadow foretells spring, for he is never wrong, or six more weeks of winter; or the "glass," the seaman's barometer, which indicates an approaching or passing storm.

Man has, since antiquity, relied on observations of plants, animals, the winds, waters, and the sky as a way of predicting the weather. He has devised primitive methods and sophisticated instruments to help him refine his weather predictions, yet no absolute method or instrument exists.

G. Lockhart's line drawing illustrated *The Weather Companion* brings folk and natural lore together in a delightful album of meteorological history, science, legend, and folklore. Seven chapters cover: the weather past, weather tools, weather phenomenon, storm warning, weather and wildlife, botanical weather, and weather, you, and me. A myriad of methods and facts about weather are packed into this 230 page booklet. A very helpful bibliography provides additional sources that deal that particular aspects about weather—as seen by the common man.

Lockhart doesn't venture into the complicated and intricate realm of the "true" meteorologist. He leaves them to their isobars, computers, and other aids as they pursue their quest to predict the weather.

Meanwhile, most of us will continue to scan the morning papers or listen to the TV weatherman oblivious that all to often all one needs to do is look about, for the signs of weather are all about us. Such signs can and do predict the weather more accurately than knowledgeable man. The chirp of the cricket will give us the temperature, if we use the formula $T = 50 + (N - 40/4)$, where N = chirps/minute. The closed leaves of a leguminous plant or tree will tell us to prepare for rain. Those of us that take the time to notice will be richly rewarded and awed over how accurately nature can predict the weather. Man can produce the atom bomb, yet the ability to predict the weather continues to elude him.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

ALABAMA

University of South Alabama, Department of Biological Sciences. J. F. Fitzpatrick, Jr., is completing a review and compilation of the status and distribution of all species and recognized subspecies of North American crawfishes for inclusion in the central tracking databases of the Nature Conservancy. The list will be singular in that it will contain for each species a list of the states and/or provinces in which it occurs; the accepted scientific and common (if any) names; its taxonomic standing; and global, national, and state "ranks" and supporting information documenting the rarity status of the species. Interested parties can obtain access to the information through their respective state Natural Heritage programs or write to Natural Heritage Headquarters Office, 1815 N. Lynn St., Arlington, VA 22209. Phone: 703-841-5300.

Auburn University, Botany and Microbiology Department. A new program has been initiated in Plant Molecular Biology. The Departmental Graduate Committee is now accepting applications from students who wish to be considered for Graduate School in 1990. Please respond to Dr. Joe H. Cherry, Botany and Microbiology, Auburn University, AL 36849-5407.

University of North Alabama, Biology Department. Dr. Donald H. Roush has recently joined the department as an assistant professor. He completed his graduate studies at the University of Mississippi and has been teaching at Auburn University at Montgomery for the last seven years. His specialty is microbiology. The center for endangered species research, which is part of the biology department, has entered its third year of study of a funded project from E.P.A. and the Tennessee Wildlife Resources agency. The project title is "Endangered Mussel Culture and Reintroduction."

GEORGIA

Agnes Scott College, Department of Biology. Dr. Frances Kennedy has joined the Department as Instructor and Coordinator of Laboratories. Dr. Kennedy is responsible for the Introductory Biology and Botany laboratories, and for the Ecology and Plant Taxonomy courses.

The University of Georgia, University of Georgia Herbarium. Mike Moore has been appointed curator of the Herbarium. He replaces Nancy Coile who has taken a teaching position at North Georgia College. Mike is in the final stages of completing his Ph.D. dissertation on *Vitis* under the direction of Dave Giannasi. The Herbarium has 180,000 specimens housed in a modern compactor system and is actively involved in research, teaching, and service activities.

West Georgia College, Department of Biology. Robert K. Lampton has been awarded Professor Emeritus status. Dr. Lampton served the college as Head of Biology in the 60's. Dr. Lampton was a specialist on Bryophytes. He had accumulated a large collection which is deposited at Valdosta State University.

University of Georgia, Savannah River Ecology Laboratory. Dr. Gary K. Meffe, assistant ecologist, is the co-editor of a new book *The Ecology and Evolution of Livebearing Fishes (Poeciliidae)*. Dr. Ronald K. Chesser has joined the faculty as an associate ecologist in the Division of Stress and Wildlife Ecology. Dr. Domy C. Adriano has published the first book in a series titled *Advances in Environmental Science. Acidic Precipitation* is the first volume in the series. Cathy Fox, a Ph.D. student from the University of Georgia, is working with Dr. Gary Mills on a funded project to study the biological treatment of organic hazardous waste. Jeffrey E. Lovich, a student studying under Dr. J. Whitfield Gibbons, received runner-up for the best student paper from the Herpetologists' League. Dr. Eugene Shupp joined the staff in October as the Alexander Hollander Distinguished Postdoctoral Fellow. He will work in the Division of Wetlands Ecology.

KENTUCKY

Georgetown College, Biology Department. Dr. Barbara Rafail (Ph.D. Southern Illinois University, plant ecology) will assume the position of Assistant Professor in the Fall Semester, 1989. In addition to teaching the general biology and botany courses, Dr. Rafail will continue her research on vegetational features of abandoned and artificially revegetated surface mines in the Cumberland Mountains.

Western Kentucky University, Department of Biology. Dr. Valgene Dunham is head of the Young Scholars Program, which involves 20 highly talented Kentucky high school students who are being exposed to areas of molecular biology as a career field. Through a \$106,400 grant from NSF, the students were selected for their high ability and potential. They are experiencing hands-on research in molecular biology in the hope that they might chose this as a career area later in their academic life. In addition to Dunham, four other WKU faculty are involved in the program. They are Drs. Martin Houston, Patricia Pearson, Claire Rinehart, and Frank Toman. The NSF program, now in its second year, is aimed at showing students in grades 8 through 12 that careers in science, math, engineering and technology can be exciting and rewarding. Dr. Claire A. Rinehart has been awarded an NSF Instrumentation Laboratory Improvement grant of \$43,000 for improving biology curricula with computer aided approaches. This will provide new MacIntosh SE-30 computers which will be used by over 800 students per year. For the 13th consecutive year, Dr. Larry P. Elliott's program of medical technology internship training has been funded. The program allows 10-15 junior and senior students in medical technology to be funded during their summer clinical experiences at hospitals in Kentucky.

LOUISIANA

Louisiana State University, Department of Zoology and Physiology. Dr. Thomas D. Dreesen is a new faculty member in the department. He obtained his Ph.D. in biochemistry from the University of Mississippi Medical Center in Jackson. He held a postdoctoral position at the Fred Hutchinson Cancer Research Center in Seattle, Washington. Dr. Dreesen's research interests involve the molecular genetics of the white, brown, and scarlet genes of *Drosophila melanogaster*. The protein products of these 3 loci form two transmembrane permease systems responsible for the uptake of precursors of pigments of the compound eye.

NORTH CAROLINA

Appalachian State University, Department of Biology. Dr. Howard Neufeld has been awarded a \$73,000 TVA grant to study the decline of the red spruce in the Southern Appalachians. Dr. Neufeld will be a Visiting Scientist with the Hawaiian Sugar Planters Association for the Fall Semester of 1989. Dr. Wayne Van Devender has been named co-editor for the salamander section of the Catalogue of American Amphibians and Reptiles sponsored by the Society for the Study of Amphibians and Reptiles. New faculty members include Dr. Dru Henson (Cell Biology/Immunology), who received her degree from the Bowman Gray School of Medicine, Dr. Kelly Steele (Plant Systematics), Ph.D., University of California at Santa Barbara, and Dr. Gary Walker (Plant Ecology/Populations Genetics), Ph. D., University of Tennessee. Dr. Walker is presently spending 6 months at the Nanjing Botanical Gardens, Nanjing, China. The Second Boone Chromosome Conference will be held at Appalachian State University 11-13 October 1989. Dr. Kenneth Shull (Appalachian State), Dr. Terry Ashley (University of Tennessee), Dr. Dwayne Wise (Mississippi State University), and Dr. Steve Stack (Colorado State University) are organizers. Drs. Mary Connell and Skip Sedvec were awarded an NSF Instrumentation and Laboratory Improvement Grant of \$43,000. Dr. Matthew Rowe and Howard Neufeld have received a North Carolina Board of Science and Technology Grant for professional development (\$30,000). Todd Radenbaugh received a Lerner-Gray Fund for Marine Research Grant from the American Museum of Natural History to support his graduate research on fossil and living pen shell communities.

North Carolina State University, Department of Zoology. Two new faculty members have joined the department. Dr. W. James Fleming started in January 1989, and Dr. Jaime Collazo will start September 1989.

North Carolina State University, Department of Horticultural Science. New faculty include Dr. Jim Burton, Weed Physiology, Dr. Tom Ranney, Ornamentals Research, and Dr. David Monks, Weed Science Extension Specialist.

Highlands Biological Station, Highlands. The following summer courses will be offered at the Station in 1990: The Biology of Mosses, team taught by *Drs. Ann Stoneburner* and *Robert Wyatt* (U. of Ga.), 18–29 June. Fleshy Fungi of the Southern Appalachians, *Dr. Ronald H. Petersen* (U. of Tenn.), 9–20 July. Biology of Spiders, team taught by *Drs. Fred A. Coyle* (Western Carolina U.) and *William A. Shear* (Hampden-Sydney College), 23 July–3 August. For further information, contact Highlands Biological Station, P.O. Drawer 580, Highlands, NC 28741. (704-526-2602).

University of North Carolina at Greensboro, Department of Biology. *Dr. Robert E. Gatten, Jr.*, Professor and Head of the Department, has received the first annual Research Excellence Award during the Honors Convocation on 2 May 1989. The award was given in recognition of his research in comparative and environmental physiology of reptiles and amphibians. Also recognized by a similar award was *Dr. Russell Harter* of the Department of Psychology. *Dr. Parke Rublee* joined the department in December. He is currently studying microbial food webs in Alaskan arctic aquatic systems with NSF support. *Dr. Robert H. Stavn* has received a grant of \$68,000 to model light penetration in the ocean based on the known optical properties of suspended sediments and algae. The modeling will lead to eventual meteorological and ecological energy budgets. *Dr. Elizabeth P. Lacey* received a NSF grant of \$60,726 to continue her 3-year study of changes that take place between generations of the common lawn weed. She is measuring how parental generations influence offspring beyond the obvious genetic material that is passed on.

VIRGINIA

Virginia Military Institute, Biology Department. *Dr. Oscar W. Gupton* has retired and has been replaced by *Dr. Thomas S. Baur*, an exercise physiologist most recently working for the U.S. Army as a civilian employee in Indiana. *Dr. Louis R. Hundley* will retire at the end of the Fall semester after being affiliated with ASB for 28 years.

ABOUT MUSEUMS AND BOTANICAL GARDENS

GEORGIA

Emory University Museum of Art and Archaeology, Atlanta. New exhibits for '89-'90 include: "Syracuse, The Fairest Greek City: Ancient Art from the Museo Archeologico Regionale Paolo Orsi" (1 Nov. 1989–14 May 1990); "Radiance in Stone: Sculptures in Colored Marble from the Museo Nazionale Romano" (6 Dec. 1989–8 April 1990); "National Academy of Design: Selections from the Permanent Collection of Painting and Sculpture" (30 May–15 July 1990); "African-American Abstraction in Printmaking" (25 July–2 Sept. 1990); "Temple and Tomb: Ancient Art from the Museo Egizio, Turin" (26 Sept.–24 Feb. 1991). The National Endowment for the Humanities has awarded the Museum \$133,087 to mount an unprecedented exhibit of the ancient art and architecture of the Sicilian city, Syracuse. The exhibit will be on display from 1 Nov. 1989 through 14 May 1990. The art display will present an artistic portrait of what was considered in antiquity the greatest of Greek cities, even greater in its time than Athens. The 54 objects chosen for the exhibition were all discovered in archaeological contexts within the five districts of ancient Syracuse.

Savannah Science Museum, Savannah. *Catherine Hendricks* has left the Museum to enter a Masters Program at the University of Georgia's School of Social Work. Catherine was associated with the Museum for the past six years, and was Acting Director for one year, following the retirement of *Gerald Williamson*. She has a BA degree in English and Sociology from Mercer University and a second undergraduate degree in Journalism from the University of Georgia. She was the editor of the Museum's newsletter, developed publicity for programs and special events, and provided general assistance support to the Director.

KENTUCKY

Museum of History and Science, Louisville. This year's recipient of the Outstanding Volunteer Service Award was *Dottie McNair*, the President-Elect of Friends of the Museum. During this fiscal year, Dottie has volunteered nearly 400 hr at the Museum. She has served as President-Elect for Friends of the Museum, been involved with fund-raising and has been a very positive public relations person for the Museum.

MISSISSIPPI

Mississippi Museum of Natural Science, Jackson. Ronald G. Wieland has been hired to fill the position of Plant Community Ecologist. Mr. Wieland is a graduate of Washington State University with a M.S. in Range Ecology and a M.S. in Plant/Soil Science. Mr. Clifton Eakes has been hired by the Museum as Natural Areas Steward and Botanist. Mr. Eakes recently graduated with a M.S. from the University of Southern Mississippi. He will work to establish an essential natural area monitoring and management dimension for the first time in our natural areas registry.

Department of Wildlife, Fisheries and Parks, State of Mississippi. Five species of freshwater mussels have been listed by the state and federal governments as endangered species, and a number of mussel and fish species are considered to be candidates for the endangered and threatened species list. One of the endangered freshwater mussels, *Pleurobema curtum*, commonly known as the Black Club shell, has not been found in over 15 years. The portion of its known habitat that was not inundated by the Tennessee-Tombigbee Waterway project is a short two-mile reach of the East Fork Tombigbee River in Itawamba and Monroe counties, Mississippi. During the first week of August, biologists working on endangered species collected the remains of three Black Club Shells in the East fork Tombigbee River. This important discovery will serve to protect this part of the River from any future federally funded projects that might cause habitat degradation. It also brings renewed hope that other rare species of aquatic animals that were severely impacted by the construction of the waterway continue to survive in the few remnants of the historic Tombigbee ecosystem.

The Crosby Arboretum, Picayune. Michelle Heidelberg, President of The Crosby Arboretum, has announced a travel program for its members. Destinations of interest are being considered, from Horn Island to the Galapagos. A wooden model of the award-winning Pinecote Pavilion is currently touring Russia as part of a two-year, nine-city exhibit sponsored by the United States Information Agency, and will be seen by an estimated two million Soviet citizens. Lynn Gammill was selected as a state winner in the 1988 Take Pride in American awards for Mississippi for her work in conceiving and developing The Crosby Arboretum.

Deadline: 1 February
Student Travel Award Application Form

Name _____

Department _____

University _____

City/State/Zip _____

Check One: _____ Member of ASB or _____ Dues enclosed

Check One: _____ Paper presentation or _____ Poster presentation

Title of Paper _____

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Mail to:

Dr. G. W. Kalmus
Department of Biology
East Carolina University
Greenville, NC 27834

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INSTRUCTIONS TO AUTHORS

Manuscripts, that have not been submitted or published elsewhere, treating botanical, zoological, and biological aspects pertaining to the southeastern portion of the United States and nearby areas are welcome for consideration and publication in the ASB Bulletin. Manuscripts should be submitted in triplicate on 8 1/2 x 11" white paper with the original on good bond paper (no FAX or computer printout paper) to the Editor, Dr. Frank J. Schwartz, Institute of Marine Sciences, University of North Carolina, 3407 Arendell St., Morehead City, NC 28557.

Manuscripts should be double spaced throughout, including tables and figures. Underline only scientific names. Keep title brief. Arrange material as follows: Abstract, Text, Acknowledgments, Literature Cited, Tables, and Figures. Literature Cited format and text style should follow that in the Nags Head Woods symposium, see ASB Bulletin Vol. 35, No. 4, 1988.

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Notes should follow the same substance and sequence as in a major paper. Issue publication deadlines for any type of submitted material are: 1 April, 1 July, 1 October, and 5 December.

NOTICE

Suitable good quality black and white pictures that can be used to enhance the front cover of ASB Bulletin issues are solicited. Submit glossy prints of 5" wide and 6 1/2" high to the Editor so no reduction will be necessary.



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The ASB BULLETIN

Volume 37, Number 2

April 1990



Stevens Hall, Towson State University

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1990	April 19-21	Towson State University, Towson, MD
1991	April 10-13	Appalachian State University, Boone, NC
1992	April 8-11	University Alabama-Tuscaloosa, Tuscaloosa, AL
1993	April	Old Dominion University, Norfolk or Virginia Beach, VA

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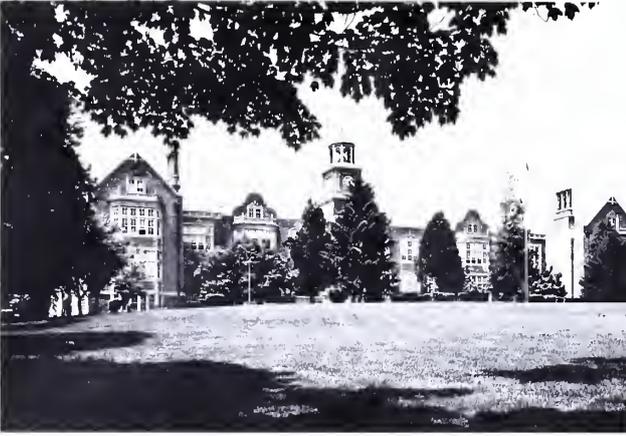
Program of the
51st ANNUAL MEETING of the
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

Hosted by
TOWSON STATE UNIVERSITY
at
Lord Baltimore Radisson Plaza
Baltimore, Maryland

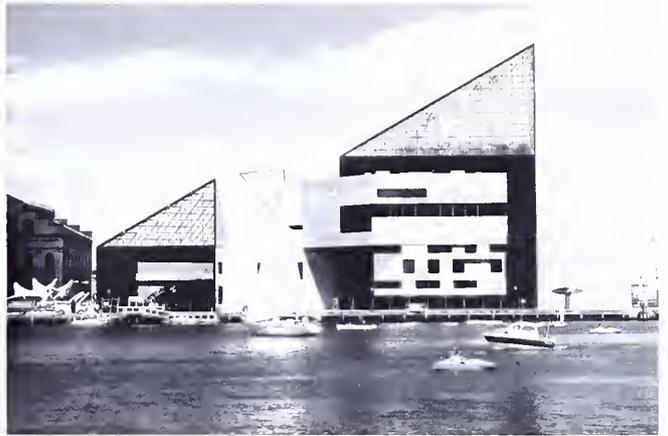
SOCIETIES MEETING WITH ASB IN BALTIMORE

Beta Beta Beta
Botanical Society of America, Southeastern Section
Ecological Society of America, Southeastern Chapter
Ecological Society of America, Washington, D.C. Chapter
Society of Wetland Scientists, South Atlantic Chapter
Society of Wetland Scientists, Northeastern Chapter
Southern Appalachian Botanical Club

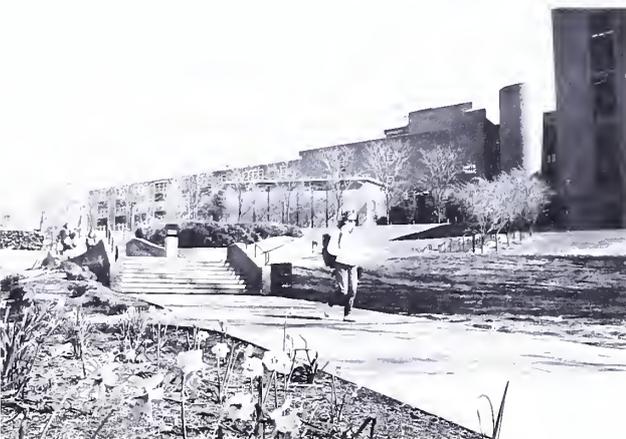
MEETING HEADQUARTERS
LORD BALTIMORE RADISSON PLAZA



Stevens Hall, Towson State University.



National Aquarium in Baltimore.



Smith Hall, Towson State University.

GENERAL INFORMATION

Registration - Registration for the 51st annual meeting of the Association of Southeastern Biologists, purchase of tickets for the banquet, National Aquarium buffet, breakfasts, luncheons and field trips have been arranged through pre-registration with the Local Arrangements Committee. Pre-registrants may pick up their registration packet with tickets and other information at the **ASB Registration Desk** on the Mezzanine Foyer of the Lord Baltimore. The desk will be open from 12 noon to 10:00 P.M. on Wednesday, 18 April; from 8:00 A.M. to 5:00 P.M. on Thursday, 19 April, and from 8:00 A.M. to 12 noon on Friday, 20 April. Late registration will be possible at these times, however tickets for special events will be limited and may not be available. See the January 1990 issue of the ASB Bulletin for pre-registration information. Please bring your April 1990 ASB Bulletin to the meeting as no free copies will be available. Extra copies may be purchased at the ASB registration desk for \$3.50 each.

Ground Transportation - From Interstate 95 North follow the signs for I-95 North which will become I-395 North once inside the Baltimore City limits. Do NOT take any tunnel exits. Take exit 53 which is I-95 North, Memorial Stadium, Inner Harbor, and Downtown. Once in the downtown area, 395 becomes Howard Street. Turn right onto Baltimore Street, go two blocks and turn left onto Hanover Street. The hotel's main entrance is on the right.

From I-295 North (the Baltimore-Washington Parkway and the route used to get from the airport), follow signs for I-295 North, to Downtown Baltimore. Do NOT take any tunnel exits. Once inside the city limits, I-295 becomes Russell Street. Take Russell Street and follow signs for Downtown and Memorial Stadium. The street will automatically bear to the right and for one block you will be on Paca Street. Take the first right on Pratt Street. It is advisable to get into the left lane quickly. Go two blocks and make a left onto Howard Street. Go three blocks and make a right onto Baltimore Street. Go two blocks and make a left onto Hanover Street. The hotel is located at the intersection of Baltimore and Hanover Streets.

From US Route 40, I-70, or I-370, take Exit 16 for the Beltway (I-695) in the direction of Catonsville. Go one exit to Exit 15, which is US Route 40, also called Edmondson Avenue. Take Edmondson Avenue all the way into the downtown area where it becomes Mulberry Street. Make a right onto Greene Street and go approximately five blocks and make a left onto Baltimore Street. Go five blocks and make a left onto Hanover Street. The hotel's main entrance is on your right.

Airport Shuttle Service - There is a regular airport shuttle service that departs the Baltimore-Washington International Airport at 20 minute intervals, Monday through Friday beginning at 5:40 a.m. and ending at 12:00 midnight. The shuttle

also operates at 20 minute intervals from the Lord Baltimore, beginning at 6:15 a.m. Saturdays and Sundays, the shuttle operates at 30 minute intervals. It departs from the hotel beginning at 6:35 a.m. It is about a 35 minute ride from the airport to the Lord Baltimore. The tariff is \$5.00 one way. There is no charge for children under the age of 6. Phone numbers for the airport shuttle are (301) 850-0305 and (301) 850-0306.

Parking - The Lord Baltimore Radisson Plaza has valet parking available at a cost of \$9.00 per day with in and out privileges. Other parking facilities in the area include the following:

Arrow Parking Garage, 210 W. Baltimore St. -- \$6.00 maximum

Arrow Parking Garage, 315 W. Baltimore St. -- \$4.00 maximum (weekdays only)

Omni Garage, 5 N. Liberty St. -- \$8.00 maximum

Downunder Garage, 110 W. Lombard St. -- \$8.00 maximum

Job Placement Message Board - A job placement message board will be made available on the Mezzanine Foyer of the Lord Baltimore.

Dining Facilities - Meals and cocktails are available at the Lord Baltimore Radisson Plaza. Many dining facilities, ranging from fast food to elegant, are found within a few minutes walk from the Lord Baltimore. Popular eateries are found in The Gallery at Light St. and Pratt St. and the Light and Pratt Street Pavilions of Harbor Place.

Thursday Evening Buffet - The Thursday evening buffet will be held at the acclaimed National Aquarium in Baltimore. The Aquarium is a few minutes walk from the Lord Baltimore. Follow the Skyway to the Inner Harbor and walk parallel to Pratt Street to Pier 3. Extra tickets will be in limited supply and may be purchased at the ASB Registration Desk Wednesday and Thursday depending upon availability. For those unable to walk, inquire at the ASB Registration desk for transportation information.

Useful Telephone Numbers - (Area Code 301)

Jim Hull (Local Arrangements) 830-4117

Kate Denniston (Program) 830-3128

Jim Ewig (Registration) 830-2405

Lord Baltimore (Reservations) 530-8400

Program Summary

WEDNESDAY, 18 APRIL 1990

- 12:00 P.M. - 10:00 P.M. REGISTRATION, Mezzanine Foyer
1:00 P.M. - 5:00 P.M. Field Trips: Patuxent Wildlife Refuge, McCormick
Spice--Depart from hotel lobby
2:00 P.M. - 6:00 P.M. ASB Executive Committee Meeting, Royale Board
Room
4:00 P.M. - 6:00 P.M. SABC Council Meeting, Fairmount Suite
6:30 P.M. - 7:30 P.M. **Symposium:** Teaching Update: Exploring Plant
Growth and Development with Wisconsin Fast
Plants, Salon E
7:30 P.M. - 10:00 P.M. ASB Social: Cash Bar, Versailles Room

THURSDAY, 19 APRIL 1990

- 7:00 A.M. - 8:00 A.M. Past Presidents Breakfast, Fairmount Suite
7:00 A.M. - 12:00 P.M. Slide Preview Room, Charles Suite
7:00 A.M. - 8:30 A.M. Poster Session set-up, Ballroom Balcony
8:00 A.M. - 5:00 P.M. LATE REGISTRATION, Mezzanine Foyer
8:00 A.M. - 5:00 P.M. **Exhibits**, Calvert Ballroom
8:30 A.M. - 9:45 A.M. **Plenary Session**, Versailles Room
10:00 A.M. - 5:00 P.M. **Poster Session**, Ballroom Balcony
4:00 P.M. - 5:00 P.M. Presenters with posters

MORNING PAPER SESSIONS

- 10:00 A.M. - 11:30 P.M. **Symposium:** Endemism and Extinction in United
States Plants and the Red Data Book of Endangered
United States Plants. Versailles Room.
10:00 A.M. - 12:15 A.M. Plant Ecology, Session 1, Salon E
10:00 A.M. - 11:00 A.M. Invertebrate Zoology, Hanover Suite B
10:00 A.M. - 12:15 A.M. Cryptogamic Botany, Perlmutter Theater
10:00 A.M. - 11:15 A.M. Wetlands, Salon B

BUSINESS AND LUNCHEON MEETINGS

- 12:15 P.M. - 1:45 P.M. **Lunchcon:** Society of Wetland Scientists, Royale
Board Room

AFTERNOON PAPER SESSIONS

- 1:00 P.M. - 5:00 P.M. **Symposium:** Ecology, Conservation and Environmental Protection in China. Versailles Room.
- 1:30 P.M. - 5:00 P.M. Plant Ecology, Session 2, Salon E
- 2:00 P.M. - 4:15 P.M. Plant Systematics, Perlmutter Theater
- 2:00 P.M. - 4:15 P.M. Herpetology, Hanover Suite B
- 4:00 P.M. - 5:00 P.M. Presenters with posters, Ballroom Balcony

SPECIAL EVENT

- 7:00 p.m. - 10:00 p.m. **ASB Reception and Buffet Supper at the National Aquarium in Baltimore**

FRIDAY, 20 APRIL 1990

- 7:00 A.M. - 8:00 A.M. **Breakfast and Business Meeting:** Southern Appalachian Botanical Club and SE Sec., Botanical Society of America. Versailles Room.
- 7:00 A.M. - 12:00 P.M. Slide Preview Room, Charles Suite
- 8:00 A.M. - 12:00 P.M. LATE REGISTRATION, Mezzanine Foyer
- 8:00 A.M. - 12:00 P.M. **Exhibits,** Calvert Ballroom
- 8:00 A.M. - 12:00 P.M. Posters, Ballroom Balcony

MORNING PAPER SESSIONS

- 9:00 A.M. - 11:30 A.M. **Symposium:** Protecting Biological Diversity in the Southeast: The Role of Propagation and Botanical Gardens in the Protection of Native Plant Species. Perlmutter Theater.
- 8:30 A.M. - 11:15 A.M. Teaching Biology and Education Committee Forum, Hanover Suite A
- 8:30 A.M. - 11:30 A.M. Plant Ecology, Session 3, Salon E
- 8:30 A.M. - 11:30 A.M. Aquatic Ecology, Salon B
- 10:00 A.M. - 12:00 P.M. Beta Beta Beta Scrapbook, Federal Hill Suite

BUSINESS AND LUNCHEON MEETINGS

- 10:30 A.M. - 11:30 A.M. **Beta Beta Beta Business Meeting,** Versailles Room
- 11:30 A.M. - 12:30 P.M. **ASB Business Meeting,** Versailles Room
- 12:45 P.M. - 2:00 P.M. **Luncheon:** SE Chapter of Ecological Society of America, Salon B

AFTERNOON PAPER SESSIONS

- 1:00 P.M. - 5:20 P.M. **Symposium:** Teaching the Limnology Laboratory.
Versailles Room.
- 1:30 P.M. - 5:15 P.M. Cytology, Genetics, Microbiology and Molecular
Biology, Perlmutter Theater
- 2:00 P.M. - 3:45 P.M. Ichthyology, Hanover Suite A
- 2:00 P.M. - 4:15 P.M. Plant Systematics, Session 2, Hanover Suite B
- 2:15 P.M. - 5:30 P.M. Plant Ecology, Session 4, Salon E
- 2:00 P.M. - 5:00 P.M. Beta Beta Beta, District 1, Royale Board Room
- 2:00 P.M. - 5:00 P.M. Beta Beta Beta, District 2, Fairmount Suite

SPECIAL EVENTS

- 6:30 P.M. - 7:30 P.M. **Social Hour** (Cash Bar), Versailles Room
- 7:30 P.M. - **ASB Banquet**, Calvert Ballroom

SATURDAY 21 APRIL 1990

- 8:00 A.M. ASB Executive Committee Breakfast and Meeting,
Federal Hill Suite
- 9:00 A.M. Field Trips Depart from Lord Baltimore Lobby



DR. THOMAS LOVEJOY
Integrity of the Global Environment:
a Washington view

Thomas E. Lovejoy received his B.S. and Ph.D. degrees in biology from Yale University. He has worked in the Amazon of Brazil since 1965, and his Ph.D. dissertation in 1971 involved the first major long-term banding study of birds in the Amazon. From 1973 to 1987 he directed the program of the World Wildlife Fund-US and from 1985 to 1987 he served as the Fund's Executive Vice President. Dr. Lovejoy is generally credited with having brought the tropical forest problem to the fore as a public issue. He conceived of the Minimum Critical Size of Ecosystems project, a joint research project of the World Wildlife Fund-US and Brazil's National Institute for Amazon Research. This project, considered a centerpiece of the newly emerging discipline of conservation biology, is essentially a giant experiment designed to define the minimum size for national parks and biological reserves as well as management strategies for small areas. For this work and many conservation initiatives in Brazil, Dr. Lovejoy was decorated by the Brazilian government in 1988, becoming the first environmentalist to receive the prestigious order of Rio Bronco. In the field of international conservation he is the originator of the innovative concept of debt for nature swaps. Several such swaps have been initiated

(including Bolivia, Costa Rica, Ecuador, and the Philippines) and others are being developed. He is the founder of the public television series Nature, and for many years served as principle advisor to the series.

In 1987 Dr. Lovejoy was appointed Assistant Secretary for External Affairs of the Smithsonian Institution. In addition he serves on scientific and conservation boards of the New York Botanical Garden, the Academy of Natural Sciences of Philadelphia, the Wildlife Preservation Trust and is President of the Society for Conservation Biology. He is a Fellow of the American Association for the Advancement of Science, the Linnaean Society of London, and the American Ornithologists Union. He is currently chairman of the United States Man and Biosphere Program, a member of the Executive committee of SCOPE (Scientific Committee on Problems of the Environment, under the aegis of the International Council of Scientific Unions). During the last administration, Dr. Lovejoy served as a member of the White House Council (the first environmental scientist appointed to the Council) and he has been reappointed to the Council in the current administration.

The global interest in conservation was underscored at last year's ASB meeting by the workshop on Biological Diversity and the banquet address by Dr. Sharitz (Past President of ASB). Dr. Lovejoy's presentation will provide insights from the perspective of one at the forefront of global conservation efforts.

ASB Paper, Poster and Symposium Sessions

WEDNESDAY EVENING, 18 APRIL

SYMPOSIUM

Teaching Update

Exploring Plant Growth and Development with Wisconsin Fast Plants

Sponsored by the Southeastern Section of the Botanical Society of America

Salon E

- 6:30 1. **Williams, Paul H.** (University of Wisconsin, Madison) Rapid-cycling Brassicas for hands-on teaching of plant biology.

THURSDAY MORNING, 19 APRIL

PLENARY SESSION

Versailles Room

- 8:30 **Hoke L. Smith**, President of Towson State University. Welcoming remarks
Joe E. Winsted, ASB President. Response
Thomas Lovejoy, Smithsonian Institution, Washington, D.C.
Integrity of the Global Environment: A Washington View

SYMPOSIUM

Endemism and Extinction in United States Plants and the Red Data Book of Endangered United States Plants

Sponsored by North American Plant Specialists Group of the
Species Survival Commission of the
International Union for the Conservation of Nature.

Versailles Room

Presiding: *Dr. Robert Mohlenbrock*, Southern Illinois University

- 10:15 2. **Mohlenbrock, Robert H.** (Southern Illinois University) Overview of the International Union for the Conservation of Nature and the Species Survival Commission.
- 10:35 3. **Mohlenbrock, Robert H.** (Southern Illinois University) North American Plant Specialists Group Action Plan.
- 10:55 4. **Mohlenbrock, Robert H.** (Southern Illinois University) The Red Data Book for North American Plants.
- 11:15 5. **Maina, Shirley L.** (in consultation with Robert A. DeFilipps) (Smithsonian Institution) Centers of United States plant endemism.

PLANT ECOLOGY, Session 1 - Salon E

Presiding: *Dr. John E. Pinder III*, Savannah River Ecology Laboratory

- 10:00 6. **Hutcherson, James D. and Howard S. Neufeld.** (Appalachian State University) Using branch chambers to study air pollution effects on red spruce.
- 10:15 7. **McCarron, James K. and Howard S. Neufeld.** (Appalachian State University) Ecophysiology of *Galax aphylla*, a clonal evergreen understory herb.
- 10:30 8. **Kelly, M.S. and J.E. Pinder III.** (Savannah River Ecology Laboratory) Interception and retention of plutonium-bearing particles by aquatic macrophytes.
- 10:45 9. **Pinder III, J.E. and T.A. Christiansen.** (Savannah River Ecology Laboratory) Comparison of the structure and net production of old-field plant communities.
- 11:00 Break
- 11:15 10. **Pinder III, J.E.** (Savannah River Ecology Laboratory) The accuracy of filtration models for predicting the interception and retention of atmospheric deposition by plant communities.

- 11:30 11. **McKenna, Mary A. and Maria Hille-Salguero.** (Howard University) Effects of acid precipitation on reproduction in alpine plant species.
- 11:45 12. **Neufeld, Howard S., Guillermo Goldstein, Frederick C. Meinzer, David A. Grantz and Gayle M. Crisosto.** (Appalachian State University, Hawaiian Sugar Planters' Association, and USDA-ARS, Aiea, Hawaii) The hydraulic architecture of sugarcane.
- 12:00 13. **DeSelm, H.R. and Edward E.C. Clebsch.** (University of Tennessee) Effects of prescribed fire on oak forest understory.

INVERTEBRATE ZOOLOGY - Hanover Suite B

Presiding: *Dr. Erik Scully*, Towson State University

- 10:00 14. **Nelson, Diane R.** (East Tennessee State University) Down under invertebrates of the Great Barrier Reef.
- 10:15 15. **McGlothlin, Karen L. and Diane R. Nelson.** (East Tennessee State University) Stability of tardigrade populations on Roan Mountain, Tennessee.
- 10:30 16. **Reitcheck, Becky G. and Blaine R. Ferrell.** (Western Kentucky University) Temporal changes in cockroach (*Leucophaea maderae*) ommatidial structure.
- 10:45 17. **Tarter, Donald C. and Diane R. Nelson.** (Marshall University and East Tennessee State University) An altitudinal comparison of the tardigrade fauna (Phylum: Tardigrada) from mosses on Spruce Mountain, West Virginia.

CRYPTOGAMIC BOTANY - Perlmutter Theater

Presiding: *Dr. Lafayette Frederick*, Howard University

- 10:00 18. **McGuire, Robert F.** (University of Montevallo) Taxonomic relationships among selected unbranched, false-branched, and true-branched Cyanobacteria.
- 10:15 19. **Petersen, Raymond L., Sheila D. Brack-Hanes and Anthony M. Greco.** (Howard University, Eckerd University and University of South Florida) The basis of salt tolerance in the mangrove fern *Acrostichum* L.
- 10:30 20. **Petersen, Raymond L. and Anthony Chestang.** (Howard University) Salt tolerance in the genus *Pestalotia* de Not. of the Fungi Imperfecti.
- 10:45 21. **Marshall, Harold G.** (Old Dominion University) Phytoplankton monitoring program in the lower Chesapeake Bay.
- 11:00 Break

- 11:15 22. **Gregory-Phillips, Christine and Harold G. Marshall.** (Old Dominion University) The seasonal phytoplankton composition and concentrations of Lake Drummond, Dismal Swamp, Virginia.
- 11:30 23. **Affronti, Lewis F. and Harold G. Marshall.** (Old Dominion University) Picoplankton dynamics in the lower Chesapeake Bay.
- 11:45 24. **Nussbaum, Francis.** (Kent State University, Tuscarawas) Variation in diurnal periodicity of fungal airspora among microenvironments.
- 12:00 25. **Frederick, Lafayette and Levester Pendergrass.** (Howard University and U.S. Forest Service) Corticolous myxomycetes and the moist chamber culture technique.

WETLANDS - Salon B

Presiding: *Dr. C. Ross Hinkle*, Bionetics Corporation

- 10:00 26. **Gammill, Steven P.** (University of North Carolina at Wilmington) Developmental study of a coastal salt marsh: southern Topsail Sound, North Carolina.
- 10:15 27. **Caiazza, Nicholas A.** (New Jersey Department of Transportation) Assessing a ten acre created wetland after one growing season: success or failure?
- 10:30 28. **Ferlow, Donald L.** (Environmental Design Associates, Wilton, CN) Does no net loss mean created wetlands within site developments?
- 10:45 29. **Hill, Brian H.** (Marist College) No net loss: are we just counting beans?
- 11:00 30. **Schmalzer, Paul A., C. Ross Hinkle, Joseph L. Mailander, and A.M. Koller, Jr.** (The Bionetics Corporation and NASA Biomedical Operations and Research Office) Recovery of *Juncus roemerianus* and *Spartina bakeri* marshes one year after fire.

THURSDAY AFTERNOON, 19 APRIL

SYMPOSIUM

Ecology, Conservation and Environmental Protection in China

Sponsored by the Southeastern Chapter of the
Ecological Society of America

Organized by
Frank McCormick and Xinyuan Wu

Versailles Room

Session 1. Presiding: *Mr. Xinyuan Wu*, University of Tennessee

- 1:00 **Wu, Xinyuan.** Introduction.
- 1:05 31. **You, Chengxia.** (University of Tennessee) Traditional ecological research in China.
- 1:25 32. **Liu, Jianguo.** (University of Georgia) Theoretical ecology in China.
- 1:45 33. **Cheng, Weixin.** (University of Georgia) Applied ecology/agro-ecology in China.
- 2:05 34. **Lin, Junda and Xi He.** (Smithsonian Environmental Research Center) Marine and fresh water ecology in China.
- 2:25 35. **Yin, Yao.** (University of Tennessee) Ecological research and education in Chinese universities.
- 2:45 Break

Session 2. Presiding: *Dr. Frank McCormick*, University of Tennessee

- 3:00 36. **Dong, Quan and Ce Huang.** (Duke University) Ecological research in Chinese research institutes.
- 3:20 37. **Guan, Weihe.** (University of Georgia) Conservation and resource management in China.
- 3:40 38. **Shen, Zhongmin.** (University of Tennessee) Environmental protection in China.
- 4:00 39. **Walker, Gary.** (Appalachian State University) Recent experiences and future opportunities for bilateral cooperation.
- 4:30 **Discussion and Summary**

PLANT ECOLOGY, Session 2 - Salon E

Presiding: *Dr. Stewart Ware*, College of William and Mary

- 1:30 40. **Pauley, Eric F. and Edward E.C. Clebsch.** (University of Tennessee) Fraser fir regeneration and seasonal understory change in a Great Smoky Mountains spruce-fir forest.
- 1:45 41. **Liu, Yan and Robert N. Muller.** (University of Kentucky) The influence of forest structure on radial growth response to drought.
- 2:00 42. **Veara, Theresa, James Fralish and Philip Robertson.** (Southern Illinois University) The effect of spring burning on hill prairie above ground biomass and woody plant invasion.
- 2:15 43. **Kettler, Steve, James Fralish and Fred Crooks.** (Southern Illinois University) Forest succession and site index patterns at Land Between The Lakes, KY and TN.
- 2:30 44. **Franklin, Scott, James Fralish and Fred Crooks.** (Southern Illinois University) The effect of soil and topography on forest stand composition and growth at Land Between The Lakes, KY and TN.
- 2:45 45. **Rudowicz, Lucy, James Fralish and Fred Crooks.** (Southern Illinois University) Forest understory vegetation at Land Between The Lakes, KY and TN.
- 3:00 46. **Long, Alice A.** (Southern Illinois University) Using indicator species and multivariate methods to identify unique forest openings in southern Illinois.
- 3:15 Break
- 3:30 47. **Cypher, Ellen A.** (Southern Illinois University) Use of site characteristics to differentiate among the subspecies of *Phlox bifida* Beck.
- 3:45 48. **Robertson, Philip A.** (Southern Illinois University) Use of the Kalman Filter in dendrochronology.
- 4:00 49. **Ash, Andrew N.** (Pembroke State University) Effects of clearcutting on litter parameters and soil moisture in a Southern Appalachian forest.
- 4:15 50. **Fralish, James and Fred Crooks.** (Southern Illinois University and Oregon State University) A comparison of presettlement, second-growth and old-growth forest communities in the Shawnee Hills of Illinois.
- 4:30 51. **Martin, William H.** (Eastern Kentucky University) Biodiversity and old-growth mixed mesophytic forests in the Southern Appalachians.
- 4:45 52. **Ware, Stewart, P.L. Redfearn, Jr., G.L. Pyrah and W.A. Weber.** (College of William and Mary and Southwest Missouri State University) Forest vegetation of the central Ozarks.

PLANT SYSTEMATICS, Session 1 - Perlmutter Theater

- Presiding: *Dr. James F. Matthews*, University of North Carolina at Charlotte
- 2:00 53. **Mellichamp, T. Lawrence** (University of North Carolina at Charlotte) The genus *Drosera* in the Cape Province of SW South Africa.
- 2:15 54. **Mellichamp, T. Lawrence** (University of North Carolina at Charlotte) Rare plants of the Cape Province of southwestern South Africa.
- 2:30 55. **Hill, Steven R.** (Clemson University) Status survey of marl forests and calcareous cliffs of the South Carolina coastal plain.
- 2:45 56. **Davenport, L.J.** (Samford University) Distribution, habitat requirements and distinct nature of *Hymenocallis coronaria*.
- 3:00 Break
- 3:15 57. **Swab, Edward C.** (North Carolina State University) Flora and vegetation of White Pines Natural Area, Chatham Co., North Carolina.
- 3:30 58. **Horn, Charles N. and Cynthia A. Aulbach-Smith.** (Newberry College and University of South Carolina) Changes in the vascular flora of South Carolina during the last 20 years.
- 3:45 59. **Matthews, James F. and Wayne R. Faircloth.** (University of North Carolina at Charlotte and Valdosta State College) An update on the genus *Portulaca* in the southeast.
- 4:00 60. **Lamont, Eric E. and Richard Stalter.** (New York Botanical Garden and St. John's University) The flora of Orient Beach State Park, Long Island, New York.

HERPETOLOGY - Hanover Suite B

- Presiding: *Dr. Don C. Forester*, Towson State University
- 2:00 61. **Ireland, Patrick H.** (Radford University) Sub-lethal cellular damage induced by free radicals associated with acid rain.
- 2:15 62. **Combs, Daniel L.** (Tennessee Technological University) Ecology of two sympatric softshell turtles in a coastal plain stream of Alabama.
- 2:30 63. **Forester, Don C. and David V. Lykens.** (Towson State University) Age structure in a population of red-spotted newts (*Notophthalmus viridescens*) from the Allegheny Plateau of Maryland.
- 2:45 64. **Middendorf, George.** (Howard University) Variation in mite load on Yarrow's spiny lizard, *Sceloporus jarrovi* (Sauria: Iguanidae).
- 3:00 Break

- 3:15 65. **Tucker, Anton D.** (Savannah River Ecology Laboratory) Natural selection for random nest distribution in leatherback turtles, *Dermochelys coriacea*.
- 3:30 66. **Little, Michael, John Wiley, and M. Dale Adkins.** (Marshall University, East Carolina University School of Medicine, and Ohio State University) Polymorphism of the 28S rRNA genes in the *Hyla versicolor* complex.
- 3:45 67. **Pauley, Thomas K.** (Marshall University) The ecology of the Cheat Mountain salamander, *Plethodon nettingi* (Green), with discussions on two sympatric species.
- 4:00 68. **Lovich, Jeffrey E. and J. Whitfield Gibbons.** (Savannah River Ecology Laboratory) Male-biased sex ratios in a South Carolina population of the turtle *Malaclemys terrapin*.

POSTER SESSION - Ballroom Balcony

- 4:00 69. **Cypher, Brian L. and Ellen A. Cypher.** (Southern Illinois University) Impact of mammalian dispersers on germination of persimmon seeds.
- 4:00 70. **Tobe, John D., Linda M. Eldredge, Albert G. Abbott and Robert Ballard.** (Clemson University) Isolation and preliminary analysis of cpDNA in North American species of *Magnolia* L.
- 4:00 71. **Luquette, Dorothy E.** (Towson State University) A phenology of the barrens and grasslands of Soldiers Delight, Baltimore County, Maryland.
- 4:00 72. **Chen, Dillion T.** (Howard University) Observations on a polycotyledonous seedling of *Ulmus americana*.
- 4:00 73. **Stephenson, Steven L. and Harold S. Adams.** (Fairmont State College and Dabney S. Lancaster Community College) A comparative study of spruce growth patterns in four different regions of the world.
- 4:00 74. **Wallace, James W.** (Western Carolina University) A chemotaxonomic approach to the Hymenophyllaceae.
- 4:00 75. **McClintock, James and Ken Marion.** (University of Alabama at Birmingham) Studies on blue crab population dynamics in a Gulf estuary.
- 4:00 76. **Bernard, John M., Franz K. Scischab and Karel Fiala.** (Ithaca College, Rochester Institute of Technology, and Czechoslovak Academy of Sciences) Root and rhizome systems of peatland plants.

FRIDAY MORNING, 20 APRIL

SYMPOSIUM

Protecting Biological Diversity in the Southeast:
The Role of Propagation and Botanical Gardens in the
Protection of Native Plant Species.

Sponsored by:

Southeastern Chapter of the Ecological Society of America
Eastern Native Plant Alliance
Southeastern Chapter of the Botanical Society of America
Southern Appalachian Botanical Club
Association of Southeastern Biologists

Perlmutter Theater

Presiding: *Dr. R.D. Sutter*, North Carolina Department of Agriculture

- 9:00 **Clebsch, Edward E.C.** (University of Tennessee) Introduction.
- 9:05 77. **Duke, James A.** (Agricultural Research Service, USDA)
Phytomedicinal forest harvest.
- 9:30 78. **Brumback, William E.** (New England Wild Flower Society, Inc.)
Eastern plants in the commercial trade--collected species.
- 9:45 79. **Bannerman, Joy E.** (The Institute of Conservation and Culture)
The extent and sociology of the collection of native plant species.
- 10:00 80. **Lighty, Richard.** (Mt. Cuba Center for the Study of Piedmont
Flora) Conservation through cultivation.
- 10:15 Break
- 10:30 81. **Olwell, Peggy.** (Center for Plant Conservation) The Center for
Plant Conservation: Its role in preserving biological diversity.
- 10:45 82. **Boyer, Marjorie W.** (North Carolina Plant Conservation Program)
The protection of Canby's cowbane through propagation.
- 11:00 **Discussion:** The role of propagation and botanical gardens in the
protection of native plant species.
- 11:20 **Sutter, R.D.** (North Carolina Department of Agriculture)
Summary

TEACHING BIOLOGY AND EDUCATION COMMITTEE FORUM - Hanover Suite A

Sponsored by the ad hoc Committee on Education

The ad hoc Education Committee of ASB has been tracking national interest in cultural literacy and, specifically, concerns about pre-college science and environmental education. This has involved representation of ASB at meetings sponsored by the American Association for the Advancement of Science in 1988 and 1989, as well as membership in the Alliance for Environmental Education. Two papers by members of the committee discuss the relationship of this participation to possible impacts that ASB might have on improved biological literacy. They also consider potential costs and benefits of this type of activity for professional biologists and ASB.

Presiding: *Dr. W. Dean Cocking*, James Madison University

- 8:30 83. **Tankersley, Richard A.** (Wake Forest University) Not-so-random walks: a computer simulation of chemo-orientation behavior.
- 8:45 84. **Gazzam, Virginia J.** (Towson State University) What writing research reveals about how college students conduct and compose original science research.
- 9:00 85. **Swab, Janice C.** (Saint Mary's College) A consideration of scientific literacy by the AAAS and possible ASB responses.
- 9:15 86. **Cocking, W. Dean** (James Madison University) Group action with the Alliance for Environmental Education to react to a common concern.

Discussion: The remainder of the session will be an open forum to gather opinions and suggestions from members concerning the importance of this activity, the appropriateness as a function of ASB, the amount of active support that might be anticipated from members, and methods which could be utilized if the Association were to more extensively enter this arena.

PLANT ECOLOGY, Session 3 - Salon E

Presiding: *Dr. Robert N. Muller*, North Carolina State University

- 8:30 87. **Saad, Zakaria A. and Frank P. Day.** (Western Sudan Agricultural Research Corporation and Old Dominion University) Effects of soil, seed source and planting density on nodulation and biomass production of *Acacia senegal* in Sudan.
- 8:45 88. **Walker, Gary L., Wei Hong-tu, and Wu Lin.** (Appalachian State University and Jiangsu Institute of Botany) Population dynamics of three species of *Pinus* in ecological reserves of Jiangsu Province, The Peoples' Republic of China.

- 9:00 89. **Muller, Robert N. and Yan Liu.** (University of Kentucky) Coarse woody debris in an old-growth deciduous forest.
- 9:15 90. **Parr, Patricia D. and Maureen Cunningham.** (Oak Ridge National Laboratory and University of Tennessee) Habitat manipulation: the effect on a declining rare plant population.
- 9:30 91. **Collins, B.S. and G.R. Wein.** (Memphis State University) Competition and coexistence of two annual *Polygonum* species.
- 9:45 92. **Zettler, Lawrence W., John E. Fairey, III and Thomas M. McInnis, Jr.** (Clemson University) The status and seed germination of *Platanthera integrilabia* (Correll) Luer, an endangered terrestrial orchid.
- 10:00 Break
- 10:15 93. **White, Joseph D., Glenn C. Kroh and John E. Pinder III.** (Texas Christian University and Savannah River Ecology Laboratory) Mapping vegetation at Lassen Volcanic National Park using Landsat-5 TM data.
- 10:30 94. **Doyle, Kathleen M. and Dorothy J. Allard.** (The Nature Conservancy, Southeast Regional Office) Applying an ecosystem classification system on national forest lands: A pilot study.
- 10:45 95. **Hupp, Cliff R. and Andrew Simon.** (U.S. Geological Survey) Riparian vegetative and geomorphic recovery following stream channelization.
- 11:00 96. **Bernard, John M.** (Ithaca College) Life history of *Phalaris arundinacea* L. (Reed Canary Grass).
- 11:15 97. **Mphande, John N.B., Brian C. McCarthy and Kenneth R. McKaye.** (Frostburg State University and Appalachian Environmental Laboratory) Browsing strategies of the African elephant in a coppice *Brachystegia* woodland: Kasungu National Park, Malawi.

AQUATIC ECOLOGY - Salon B

Presiding: *Dr. Donald Tarter*, Marshall University

- 8:30 98. **McGregor, Stuart and C.B. Coburn.** (Tennessee Technological University and Geological Survey of Alabama) Base line fishery data of the Cumberland River below Wolfe Creek Dam.
- 8:45 99. **Choi, Mcc Y., Carolyn Culp, Thomas E. Weaks and Doshia J. Webb.** (Marshall University) Changes in periphyton community structure of Beech Fork Lake resulting from artificial circulation.
- 9:00 100. **Zappia, Humbert, Dean Adkins, Robert Norman, and Donald Tarter.** (Marshall University) Effects of first and second year artificial lake destratification on benthic macroinvertebrate populations in Beech Fork Lake, West Virginia.

- 9:15 101. **Reid, Jonathan, Greg McKay and Donald Tarter.** (Marshall University) The effects of artificial destratification on age, growth, and feeding habits of the gizzard shad, *Dorosoma cepedianum*, in Beech Fork Lake, West Virginia.
- 9:30 102. **Tarter, Donald C.** (Marshall University) Recolonization of benthic populations from the effects of a catastrophic flood in Seneca Creek, Pendleton County, West Virginia.
- 9:45 103. **Ruggles, Kimberly and Donald C. Tarter.** (Marshall University) Leaf shredding, under laboratory conditions, by naiadal *Peltoperla tarteri* Stark and Kondratieff (Plecoptera: Peltoperlidae).
- 10:00 Break
- 10:15 104. **Burgess, Lisa and Donald C. Tarter.** (Marshall University) Effects of temperature and pH on oxygen consumption rates of naiadal *Potamanthus distinctus* Traver (Ephemeroptera: Potamanthidae).
- 10:30 105. **Yeager, Mindy, Tom G. Jones and Donald C. Tarter.** (Marshall University) Discovery of the central mudminnow *Umbra limi* (Kirtland), in West Virginia, with preliminary observations on the reproductive activities.
- 10:45 106. **Duobinis-Gray, L., E. Urban, J. Sickel, W. Maddox, and D. Owen.** (Murray State University) Parasites of bivalves in Kentucky Lake.
- 11:00 107. **McGregor, Monte A. and Wendell Pennington.** (Tennessee Technological University) Benthic macroinvertebrate community analyses of Kentucky Lake (Tennessee River), Tennessee.
- 11:15 108. **Parkinson, Jonathan M.** (University of North Carolina at Chapel Hill) Patch dynamics and the maintenance of species diversity on patchy ephemeral resources: Insects on stream leaf packs.

FRIDAY AFTERNOON, 20 APRIL

SYMPOSIUM

Teaching the Limnology Laboratory

Organized by

James F. Payne, Joe M. King and Luther Knight

Versailles Room

- 1:00 109. **Payne, James F., Joe M. King and Luther Knight.** (Memphis State University, Murray State University and University of Mississippi) Teaching the limnology laboratory - an introduction to the symposium.

- 1:10 110. **Wyngaard, Grace A. and Ken M. Zeidner.** (James Madison University) Genetic variation in *Daphnia* as measured by gel electrophoresis.
- 1:30 111. **Twombly, Saran.** (University of Rhode Island) Zooplankton life table response experiments.
- 1:50 112. **White, David S.** (Murray State University) "Bioturbation": an exercise in determining lake sediment turnover rates.
- 2:10 113. **Brooks, Arthur S.** (University of Wisconsin-Milwaukee) The essentials of water.
- 2:30 114. **Stevenson, R. Jan.** (University of Louisville) Channel morphology and habitat diversity in streams.
- 2:50 Break
- 3:05 115. **Groeger, Alan W.** (Southwest Texas State University) Use of *in vivo* chlorophyll fluorescence to characterize phytoplankton.
- 3:25 116. **Williamson, Craig E.** (Lehigh University) Selective predation by fish.
- 3:45 117. **Williamson, Paula S.** (Southwest Texas State University) Structural adaptations of aquatic macrophytes.
- 4:05 118. **Payne, James F.** (Memphis State University) Macroinvertebrate sampling with artificial substrates.
- 4:25 119. **Rodgers, Jr., John H. and Nicholas G. Aumen** (University of Mississippi) Periphyton production in lotic and lentic systems.
- 4:45 120. **Williamson, Craig E.** (Lehigh University) Fluid dynamics and plankton.
- 5:05 Discussion

**CYTOLOGY, GENETICS, MICROBIOLOGY AND
MOLECULAR BIOLOGY - Perlmutter Theater**

Presiding: *Dr. Katherine J. Denniston*, Towson State University

- 1:30 121. **Harris, John W., S.K. Ballal and R.N. Joshi.** (Tennessee Technological University and Marathwada University, India) Genetic variants of indoleacetaldehyde dehydrogenase.
- 1:45 122. **Ballal, S.K. and Sharon Termon.** (Tennessee Technological University) Effect of an anti-auxin (TIBA) on protein profiles of Jojoba.
- 2:00 123. **Mangurian, Luz P., R.J. Walsh and B.I. Posner.** (The George Washington University Medical Center and Royal Victoria Hospital) Prolactin transport increased capacity by the choroid plexus of hyperprolactinemic rats.
- 2:15 124. **Kimbrough, T. Daniel, Richard R. Mills and Parag Kanitkar.** (Virginia Commonwealth University) The effects of serotonin antagonism on fluid movement in the crop of the American cockroach.

- 2:30 125. **La Grenade, Cecile E. and George Bean.** (University of Maryland, College Park) The involvement of *Fusarium moniliforme* in equine leucoencephalomalacia in Maryland horses.
- 2:45 126. **Varney, D.R., D.D. Jones, L.A. Varney, M.R. Siegel, and P.M. Zavos.** (Eastern Kentucky University and University of Kentucky) Reproductive performance of mice fed diets containing endophyte-infected perennial ryegrass seed via continuous breeding.
- 3:00 Break
- 3:15 127. **Torchon, Therese M., David Morton and Wayne W. Carmichael.** (Frostburg State University and Wright State University) Effect of microcystin-LR on viability, morphology, adherence, and phagocytosis of salt-damaged erythrocytes in rat exudate peritoneal macrophages.
- 3:30 128. **Orvos, David R. and John Cairns, Jr.** (Virginia Polytechnic Institute and State University) Important factors in assessing environmental risk from genetically-engineered microorganisms.
- 3:45 129. **Mohamood, Abdiaziz S. and Broderick E. Eribo.** (Howard University) Characterization of meat-borne *Listeria* spp.
- 4:00 130. **Masters, Brian S.** (Towson State University) Structure and function of mitochondrial RNA polymerases.
- 4:15 131. **Reece, Jerry F. and Mary U. Connell.** (Appalachian State University) Comparative plasmid analysis of two varieties of *Bacillus thuringiensis*.
- 4:30 132. **Hubbard, Mark, Sriyani Rajapakse, Albert Abbott, John Kelley, and Robert Ballard.** (Clemson University) Differentiation of *Rosa* cultivars by restriction fragment length polymorphisms (RFLPs).
- 4:45 133. **Eldredge, Linda M., Robert Ballard, Wm. Vance Baird and Albert G. Abbott.** (Clemson University) Saturated RFLP linkage map construction in *Prunus persica*.
- 5:00 134. **Powers, Sean P., Matthew Meunier, Donald P. Hauber and David A. White.** (Loyola University, New Orleans) Correspondence of genetic variation with infrared reflectance patterns in *Phragmites australis* in the Mississippi River Delta.

ICHTHYOLOGY - Hanover Suite A

Presiding: *Dr. Frank J. Bulow*, Tennessee Technological University

- 2:00 135. **St. John, R. Todd and Frank J. Bulow.** (Tennessee Technological University) Population density and spawning movements of sauger (*Stizostedion canadense*) in the Fort Loudoun tailwaters, Tennessee.

- 2:15 136. **Medlin, E. Scott and Frank J. Bulow.** (Tennessee Technological University) Sauger spawning habitat analysis in the Fort Loudoun tailwaters, Tennessee.
- 2:30 137. **Brown, Keven A. and Frank J. Bulow.** (Tennessee Technological University) Life history aspects of the spawning-run sauger in the Fort Loudoun tailwaters, Tennessee.
- 2:45 138. **Fischer, Robert U., Christine Defonzio, John M. Aho, and Justin D. Congdon.** (Savannah River Ecology Laboratory and University of Georgia) Lipid and reproductive cycles in bluegill, *Lepomis macrochirus*, in nuclear reactor cooling reservoirs.
- 3:00 Break
- 3:15 139. **Nelson, Diane R.** (East Tennessee State University) Aggression in the giant Maori wrasse on the Great Barrier Reef.
- 3:30 140. **Hicks, Derrick T. and R.D. Estes.** (Tennessee Technological University) Distribution, age, growth, food habits, habitat, reproduction, and survival rate of the cherry darter, *Etheostoma etnieri*.

PLANT SYSTEMATICS, Session 2 - Hanover Suite B

Presiding: *Dr. Gerald L. Smith*, High Point College

- 2:00 141. **Smith, Gerald L., Walter S. Flory and John B. Nelson.** (High Point College, Wake Forest University, and South Carolina Wildlife and Marine Resources) Cytotaxonomic studies on *Hymenocallis coronaria* (Le Conte) Kunth in South Carolina piedmont river systems.
- 2:15 142. **Stucky, Jon M. and Milo Pyne.** (North Carolina State University) A new species of *Liatrix* (Asteraceae) from the Carolina sandhills.
- 2:30 143. **Poston, Muriel and Joan Nowicke.** (Howard University and Smithsonian Institution) Pollen ultrastructure of Loasoideae (Loasaceae).
- 2:45 144. **Crislip, Colleen D., Albert G. Abbott and Robert E. Ballard.** (Clemson University) Chloroplast DNA RFLPs in Kiwifruit (*Actinidia*).
- 3:00 Break
- 3:15 145. **Jones, Ronald L.** (Eastern Kentucky University) The taxonomy and distribution of *Aster pratensis* Raf.
- 3:30 146. **Ghandi, Kancheepuram N. and Fred E. Smeins.** (Texas A&M University) Micromorphology of the *Schizachyrium scoparium* complex.
- 3:45 147. **Pyne, Milo and Jon M. Stucky.** (North Carolina State University) Lectotypification of *Laciniaria carinata* Small (= *Liatrix carinata* [Small] Coker) (Asteraceae).

- 4:00 148. **Fairey, III, John E.** (Clemson University) Typification in the genus *Scleria* (Cyperaceae).

PLANT ECOLOGY, Session 4 - Salon E

Presiding: *Dr. Dennis Whigham*, Smithsonian Environmental Research Laboratory

- 2:15 149. **Tyndall, R. Wayne and Patricia M. Farr.** (Maryland Natural Heritage Program and Harford County Government) Vegetation and flora of two serpentine "openings" in Maryland.
- 2:30 150. **Farr, Patricia M. and R. Wayne Tyndall.** (Harford County, Maryland, Department of Planning and Zoning and Maryland Natural Heritage Program) Recolonization potential of an eastern hemlock forest in Harford County, Maryland.
- 2:45 151. **Conn, Christine and Frank P. Day.** (Old Dominion University) Belowground biomass allocation on a barrier island.
- 3:00 152. **Clebsch, Edward E.C.** (University of Tennessee) Was arbor vitae (*Thuja occidentalis* L.) native to North Carolina in historic time?
- 3:15 153. **McCarthy, Brian C. and Jose M. Facelli.** (Frostburg State University and Rutgers University) Microdisturbances in seral and mature habitats: implications for woody seedling establishment.
- 3:30 154. **Atkinson, Robert B. and John Cairns, Jr.** (Virginia Polytechnic Institute and State University) Early vegetative colonization of manmade forested wetlands in Virginia.
- 3:45 Break
- 4:00 155. **Whigham, Dennis F.** (Smithsonian Environmental Research Center) The distribution and importance of vines in Coastal Plain forests.
- 4:15 156. **Drapalik, Donald J.** (Georgia Southern College) Survival and recovery responses of flooded, vascular plants in the Big Muddy River Valley, Jackson County, southern Illinois.
- 4:30 157. **Maddox, David.** (Maryland Natural Heritage Program) Demography and habitat requirements of the rare Swamp Pink in Maryland.
- 4:45 158. **Wentworth, Thomas R., Robert K. Peet, Michael P. Schafale, Alan S. Weakley and Peter S. White.** (North Carolina State University, University of North Carolina at Chapel Hill and North Carolina Natural Heritage Program) Barrier island forests of North Carolina.
- 5:00 159. **Wilczynski, C.J. and S.T.A. Pickett.** (University of North Carolina at Chapel Hill and Institute of Ecosystem Studies) The dynamics of fine root growth in response to the creation of canopy gaps in an Allegheny hardwoods forest.

- 5:15 160. **Parker, Geoffrey G., Suzanne Hill and Laurel A. Kuchmel.** (Smithsonian Environmental Research Laboratory and Virginia Polytechnic Institute and State University) Decline of understory American chestnut (*Castanea dentata*) in a southern Appalachian forest.

BETA BETA BETA, DISTRICT 1 - Royale Board Room

- 2:00 **Triplett, Jim Keith.** (Beta Gamma, University of North Carolina at Greensboro) Some useful leaf anatomical features for phylogenetic analysis of the Zingiberales.
- 2:15 **Johnston, Todd.** (Beta Rho, Wake Forest University) Inhibition of gliding motility in the cyanobacterium, *Spirulina*.
- 2:30 **Walker, Anne L.** (Sigma Mu, Elon College) Taxonomic description of a new species of *Diplocentrus* (Scorpiones: Diplocentridae) from Jalisco, Mexico.
- 2:45 **Clark, Michelle.** (Beta Rho, Wake Forest University) The tortoise and the hair: nutrient effects on herbivory.
- 3:00 **Lott, Steven Trent.** (Tau Pi, Wofford College) The effects of dissociation on surface structures of two- and four-cell sea urchin embryos.
- 3:15 Break
- 3:30 **District Business Meeting**

BETA BETA BETA, DISTRICT 2 - Fairmount Suite

- 2:00 **Bevis, Chris B.** (Beta Zeta, University of North Alabama) A summer in southeast Alaska: A student's experience with the U.S. Forest Service.
- 2:15 **Gagliano, Lauren A.** (Eta Lambda, Loyola University, New Orleans) Comparative ontogeny of the craniofacial region in vespertilionid bats.
- 2:30 **Dunbar, Eva.** (Eta Mu, Southern University, Baton Rouge) The effect of benomyl on the body temperature and uterine metabolism during decidualized pseudopregnancy.
- 2:45 **Chumbley, Eric and D. Bhattacharyya.** (Beta Upsilon, Georgetown College and University of Kentucky) Lipid hydrolysis by porcine pancreatic lipase in homogeneous and membrane immobilized systems.
- 3:00 **Farmer, Elizabeth and D.A. Butterfield.** (Beta Upsilon, Georgetown University and University of Kentucky) Effects of polyamines on membrane structure.
- 3:15 Break

3:30 **District Business Meetings**

BETA BETA BETA, DISTRICT 1 and 2 - Royale Board Room

4:00 **General Awards Meeting of Districts 1 and 2.**

FIELD TRIP: Thursday 19 April 1:00-5:00 p.m. Fort McHenry. Departure from the main entrance of the Lord Baltimore. \$6.00, includes transportation and admission.

EXHIBITORS

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ABSTRACTS

1

WILLIAMS, PAUL H. University of Wisconsin-Madison--Rapid-cycling Brassicas for hands on teaching of plant biology.

Rapid-cycling stocks of *Brassica rapa* and five other *Brassica* species have been developed together with inexpensive self-contained growing systems that are suitable for exploratory learning in the classroom. The materials are suitable for investigations of growth and development (plants flower in 14 days and cycle in 35 days); reproduction (flowering, pollination, fertilization, embryogeny, cell and molecular biology); genetics (Mendelian, cytoplasmic, molecular, quantitative, population, breeding, selection and evolution); physiology (hormones, GA, auxin, cytokinins, photosynthesis, respiration, nutrition, water relations, tropisms and photoresponses); and ecology (chemicals and symbionts, pests, pathogens and microbes). Instructional materials and kits for classroom use can be purchased from the Carolina Biological Supply Co. Other new instructional materials and information are available from the Wisconsin Fast Plants program, UW-Madison, 1630 Linden Dr., Madison, WI 53706. For additional genetic stocks, contact the Crucifer Genetics Cooperative at the above address or at 608/262-8638.

2

MOHLENBROCK, ROBERT H. Southern Illinois University--Overview of the International Union for the Conservation of Nature and the Species Survival Commission.

History, purposes, and areas of interest of the International Union for the Conservation will be presented. The Species Survival Commission is one facet of the IUCN, and includes the North American Plant Specialists Group. The role of the Species Survival Commission is to insure the survival of organisms nearing extinction.

3

MOHLENBROCK, ROBERT H. Southern Illinois University--North American Plant Specialists Group Action Plan.

Each Species Survival Commission group is required to prepare a plan of action for the organisms under its jurisdiction. The action plan for the North American Plant Specialists Group describes the eight projects to be pursued by the group.

4

MOHLENBROCK, ROBERT H. Southern Illinois University--The Red Data Book for North American Plants.

The Red Data Book for North American Plants contains descriptions, habitat information,

known threats, and suggested management plans for 475 of the most critically endangered plants in North America. Procedures on carrying out the project are reviewed.

5

MAINA, SHIRLEY L. (in consultation with ROBERT A. DEFILIPPS). Smithsonian Institution--Centers of United States plant endemism.

Both primary and secondary areas of United States plant endemism, including their constituent threatened species and habitats, are included in this study being conducted on behalf of the North American Plant Specialists Group, an IUCN/Species Survival Commission (SSC) Committee. The study is based on an exhaustive search of the literature as well as the compilation of current field data obtained from cooperating individuals and agencies such as The Nature Conservancy, the United States Fish and Wildlife Service, the United States Forest Service, the National Park Service and the Bureau of Land Management. Principal centers of endemism occur in the Appalachians, the Atlantic Coastal Plain, the Desert Southwest, Gulf Coast, California, the Intermountain Area, the Pacific Northwest, Texas and Hawaii. Secondary regions include Alaska, the Cedar Barrens, the Great Lakes Region and the Ohio River Valley. The project is expected to reach completion in late 1991.

6

Hutcherson, James D. and Howard S. Neufeld. Appalachian State University--Using branch chambers to study air pollution effects on red spruce.

On Whitetop Mountain in Virginia, red spruce (*Picea rubens* Sarg.) trees in close proximity are exhibiting various degrees of decline symptoms. This area is subjected to greater precipitation, acidic cloud events, severe winds, and elevated ozone levels. To see if ambient air pollutants are contributing to this decline, experiments are being set up using branch chambers which are either charcoal filtered (to remove pollutants) or non-filtered (to simulate ambient levels). Analyses to be performed include gas exchange, water relations, and wax and pigment levels. Data, from November, comparing un-chambered branches from the two stands show that mean photosynthetic rate of the healthy stand ($75.1 \text{ umol gdw}^{-1} \text{ s}^{-1}$) is higher than that of the declining stand ($55.9 \text{ umol gdw}^{-1} \text{ s}^{-1}$). Rates were highest in one

year old needles followed in order by current, and three year old needles. Contact angles, a measure of leaf wettability, decreased as needles aged (83-68 degrees) and showed no differences between stands. Future measurements of chambered branches will be compared to these data to see if the exclusion of ambient pollutants affects these parameters of plant performance.

7

MCCARRON, JAMES K. and HOWARD S. NEUFELD. Appalachian State University--Ecophysiology of *Galax aphylla*, a clonal evergreen understory herb.

Galax aphylla is a common clonal evergreen herb found in the understory of forests in the southern Appalachian mountains. Little is known of the ecophysiology of galax or its adaptation to growing in the forest understory. The objectives of this study are to determine how leaf gas exchange and water relations change seasonally, and, since galax retains leaves up to two years or more, the influence of leaf age on these processes. In addition, leaves of galax turn a red color when exposed to high light in winter, and we want to determine if this color change has any adaptive value. During October, after canopy leaf fall, current year leaves had higher maximum rates of photosynthesis (1.22 $\mu\text{mol}/\text{m}^2/\text{s}$) and stomatal conductance (0.038 $\text{mol}/\text{m}^2/\text{s}$) than older leaves (0.74 $\mu\text{mol}/\text{m}^2/\text{s}$, 0.014 $\text{mol}/\text{m}^2/\text{s}$). Older leaves tended to have slightly lower pre-dawn water potentials than current year leaves (-0.2MPa vs. -0.08MPa), although mid day minimums were similar (-1.50 vs. -1.58). Anecdotal observation indicate that once pre-dawn temperatures fell below 0°C those leaves exposed to early morning sun were the ones that turned red. Future measurements will determine weather carbon gain can occur during the cold winter months, if the color is adaptive, and how various physiological process are regulated by changes in internal leaf water relations.

8

KELLY, M. S. and J. E. PINDER III. Savannah River Ecology Laboratory --Interception and retention of plutonium-bearing particles by aquatic macrophytes.

The plutonium concentrations in the water column of Pond B, an 87-ha impoundment on the Savannah River Site, show an annual cycle with maximum concentrations in the spring and minimum concentrations in the fall. The cycle appears to involve resuspension of Pu-bearing sediment particles into the water column during winter months. The decline in concentrations in the summer may be due to a number of factors

including removal of sediment particles from the water column by interception and retention on macrophyte surfaces. Macrophytes occupy $\geq 30\%$ of the pond area and have standing crops of > 100 metric tonnes. To determine the relative importance of macrophytes in reducing Pu concentrations in the water column, the Pu contents of *Brasenia schreberi*, *Nymphaea odorata* and *Nymphoides cordata* were measured in May, July and October. These data were combined with data on plant biomass and turnover rates to determine the flux of Pu from the water column to the plants.

9

PINDER, J. E., III and T. A. CHRISTIANSEN. Savannah River Ecology Laboratory--Comparison of the structure and net production of old-field plant communities.

In studies of early forb-dominated old-field plant communities on the Savannah River Site, E. P. Odum and others compared the species compositions and net productions of communities on different soil types. Studies of later successional stages dominated by grasses were largely restricted to a single soil type. To compare species composition and net production of grass-dominated communities, three old fields on representative soil types and soil fertilities were sampled in May, July and September for two years. Species compositions ranged from associations dominated by an annual grass, *Aristida tuberculosa*, to associations dominated by an introduced nitrogen-fixing species, *Lespedeza cuneata*. Species of the genus *Andropogon*, which were important in establishing grass-dominated old fields, had been replaced by *Leptoloma cognatum* and species of *Panicum*. Net production increased with increasing soil fertility in a manner similar to that for early old-field systems.

10

PINDER, J. E., III. Savannah River Ecology Laboratory--The accuracy of filtration models for predicting the interception and retention of atmospheric deposition by plant canopies. Filtration models simulate the interception and retention of atmospheric deposition by plant canopies by treating the canopy as a filter whose interception efficiency is a function of plant biomass. Single-layered filtration models, which treat the canopy as a single

filter, and multi-layered models, which treat different sections of the canopy as separate filters, were constructed for plutonium deposition onto agroecosystems. Parameters expressing filter efficiency and retention were estimated by experimental methods, and these parameters were used to predict the Pu contents observed for field grown crops in independent studies. Single-layered models were accurate for canopies of wheat and soybeans where most predictions were within a factor of 2 of the observed value. The single-layered model underestimated the Pu contents of corn, but a multi-layered model, which subdivided the corn canopy into 1-m height increments, accurately estimated the total Pu content of the canopy as well as the Pu contents of each height increment.

11

McKenna, Mary A. and Maria Hille-Saigueiro. Howard University.-- Effects of acid precipitation on reproduction in alpine plant species.

A series of experiments were designed to determine the impact of acid rain on plant reproductive processes, a critical component of a species' life history. Research was carried out in herbaceous alpine communities at the U.S.D.A. Forest Service Glacier Lakes Ecosystem Experiments Site in the Snowy Mts. of Wyoming. A range of species were surveyed to monitor the sensitivity of pollen to acidification during germination and growth, and all species demonstrated reduced in vitro pollen germination in acidified media. Field pollinations were carried out in Erythronium grandiflorum and Aquilegia caerulea to determine the reproductive success of plants exposed to simulated ambient precipitation (pH 5.6) or simulated acid precipitation (pH 3.6) prior to pollination. In Erythronium, no differences were observed in seed set and seed weight of fruits resulting from the two pollination treatments. In Aquilegia, fruits resulting the acid spray treatment produced fewer seeds and lighter seeds.

12

NEUFELD, HOWARD S.¹, GUILLERMO GOLDSTEIN², FREDERICK C. MEINZER², DAVID A. GRANTZ³ and GAYLE M. CRISOSTO². Appalachian State University¹, Hawaiian Sugar Planters' Association², and USDA-ARS, Aiea, Hawaii³--The hydraulic architecture of sugarcane.

Water moves in the xylem of plants in response to gradients in hydrostatic pressure. Under a fixed gradient, tissues with higher hydraulic conductivity (HC) will have greater xylem flow rates. As part of a comprehensive study of the water relations of sugarcane (*Saccharum officinarum*), we studied the hydraulic architecture of one commercial variety (H65-7052) by following the flow of water through various plant parts under known pressure gradients. HC varied greatly from one plant part to another. Younger stem internodes had higher HC's than older ones, while nodal segments had HC's only one half those of adjacent internodes. Areas of transition, such as stem to leaf sheath and sheath to leaf, were sites of low HC. The data suggest that maximum xylem water flow to leaves is restricted by low HC's in nodal and transition areas. Such restrictions may have evolved to prevent catastrophic xylem failure in perennating main stems during drought, at the expense of more expendable leaf tissues.

13

DESELN, H. R. and E. E. C. CLEBSCH. The University of Tennessee, Knoxville, TN 37996-1100--Effects of prescribed fire on oak forest understory.

We have examined data collected on the understory of a prescribed-burn upland oak forest at the University of Tennessee Highland Rim Forestry Station. The period is 1965 through 1989. Treatments are annual, periodic (once in five years) and no burn--each replicated three times. Species richness declines dramatically under the no-burn regime. Tree seedling establishment is inhibited and sprout size decreases in the annual and periodic burns--here the understory aspect is quite open. Tree sprout cover in the periodic burns follows the incidence of fire--it is lower in the September following each spring burn. Graminoid cover, chiefly little bluestem (*Schizachyrium scoparium*), decreases to zero in the no-burn treatment and is variable in other treatments but decreased irregularly from 1973-1975 to 1988; and 1989 established a new high. Composite, legume and other forb cover has declined to zero under the no-burn treatment. Composite cover in annual plots peaked in 1973-4 but has decreased irregularly since; legume cover has risen irregularly; annual plot other forb cover has fallen irregularly.

14

NELSON, DIANE R. East Tennessee State University--Down Under - Invertebrates of the Great Barrier Reef.

The Great Barrier Reef, which lies off the northeastern shores of Australia, is the largest complex of coral reefs and islands in the world, stretching 1260 miles from the Murray Islands in the Torres Strait south to the Capricorn cays. Extending out to sea up to 200 miles, the Reef actually consists of over 2500 separate reefs, cays, and continental islands and is inhabited by more

than 400 species of corals and 2000 species of fish. During a summer course offered by East Tennessee State University, snorkelling and scuba diving trips were made from Cairns to Michaelmus Cay, Green Island, Thetford Reef, Moore Reef, Norman Reef, Hastings Reef, and Agincourt Reef. Representative organisms were photographed underwater using a Nikon VN900 8 mm videocamera in an Ikelite housing and a Nikonos 35 mm camera with two Ikelite MV Substrobes and a close-up lens. A photographic survey of the marine organisms will be presented, and comparisons with Caribbean fauna will be discussed.

15

MCGLOTHLIN, KAREN L. and DIANE R. NELSON. East Tennessee State University--Stability of tardigrade populations on Roan Mountain, Tennessee.

Ecological distributions of tardigrade species on Roan Mountain, Carter County, Tennessee, were initially determined by D.R. Nelson in a study begun in 1971. Since then, environmental factors have resulted in significant changes in the mountain's vegetation. To ascertain whether the tardigrade populations have also been affected, 77 samples of epiphytes were collected in 1988 from beech trees (Fagus grandifolia) at the original study sites on the north-facing slope of Roan Mountain at elevations of approximately 4000' (station 4N), 5000' (station 5N), and 5400' (station 6N). Tardigrades were extracted from each sample and specimens were mounted in Hoyer's medium on slides for identification. Comparisons of the results with the initial study indicate long-term stability of tardigrade species diversity. Of the 21 species reported by Nelson, 18 have been identified in the present study. In addition, two species not previously listed have been found but are rare.

16

REITCHECK, BECKY G. AND BLAINE R. FERRELL. Western Kentucky University--Temporal changes in cockroach (Leucophaea maderae) ommatidial structure.

A circadian rhythm in eye sensitivity to light has been reported for Leucophaea maderae. As in other invertebrates studied, temporal changes in eye cell morphology that could be correlated with sensitivity changes were examined. Screening pigment organization about the rhabdom in cockroach ommatidia was the parameter measured to detect structural change. The anterior one-third of compound eyes were surgically removed at midday or midnight from roaches either entrained to a 12-hour light/12-hour dark cycle or free-running under constant conditions of darkness and temperature. All roaches received food and water ad libitum. Tissue samples were fixed, embedded, sectioned and the sections were examined using a Zeiss transmission electron microscope to test for time-related morphological differences. The extent of pigment organization was determined by counting

the number of pigment granules found within a 10 μ m diameter circle centered about the rhabdom. The number of pigment granules was much higher during the midday compared with midnight in roaches entrained to LD 12:12, this temporal difference continued for one cycle in roaches free of entrainment but dampened in subsequent cycles. Results indicate that temporal changes in screening pigment organization are not directly regulated by the biological clock.

17

TARTER, DONALD C.¹ and DIANE R. NELSON.² Marshall University¹ and East Tennessee State University²--An altitudinal comparison of the tardigrade fauna (Phylum: Tardigrada) from mosses on Spruce Mountain, West Virginia.

Seventeen species of tardigrades, representing 10 genera (Diphascoen, Hypechiniscus, Hypsibius, Isohypsibius, Itaquacon, Macrobiotus, Milnesium, Minibiotus, Pseudechiniscus, Ramazottius) were collected from Spruce Mountain, Pendleton County, West Virginia. Five species (28%) (Hypechiniscus gladiator, Pseudechiniscus suillus, Macrobiotus occidentalis, Hypsibius maculatus, Diphascoen scoticum) were found only at the low altitude of 2800 ft (853 m). Ramazottius oberhaeuseri and Diphascoen prorsirostre were collected only at the highest altitude of 4800 ft (1481 m). Seven species (39%) (Macrobiotus hufelandi, M. harmsworthi, M. richtersi, Minibiotus intermedius, Hypsibius convergens, Isohypsibius macrodactylus, and Milnesium tardigradum) were found at 2800 ft (853 m), 3800 ft (1158 m), and 4800 ft (1481 m). Hypechiniscus gladiator, Pseudechiniscus suillus, Minibiotus intermedius, and Hypsibius maculatus were found only on the north slope. Based on the Fisher Exact Probability one-tailed test, the distribution of Milnesium tardigradum was significantly ($p < 0.05$ CL) different between 2800 ft (trees) versus 4800 ft (trees), 3800 ft (trees) versus 4800 ft (trees), 4800 ft (trees) versus 2800 ft (non-trees), 4800 ft (trees) versus 3800 ft (non-trees), and 4800 ft (trees) versus 4800 ft (non-trees). The distribution of Isohypsibius macrodactylus was significantly different from 2800 ft (trees) to 3800 ft (trees).

18

MCGUIRE, ROBERT F. University of Montevallo--Taxonomic relationships among selected unbranched, false-branched, and true-branched Cyanobacteria.

Thirty-four strains of Cyanobacteria from Nostoc, Scytonema, Calothrix, Fischerella, and Chlorogloeopsis were investigated in light of 20 traits from previously published literature. All of these filamentous strains reproduce by hormogonia and possess heterocysts; several produce akinetes. The problem was to investigate by numerical taxonomic methods the

relationships among these selected strains and to determine if 20 traits would be sufficient to separate these strains into their respective genera. Character states were assigned to each character for each strain; simple matching coefficients were calculated and these converted into Euclidean Taxonomic Distances for the construction of a dendrogram. The 20 traits were sufficient to cluster the 13 *Nostoc*, the single *Scytonema*, the 11 *Calothrix*, the 7 *Fischerella*, and the 2 *Chlorogloeopsis* strains independently and within their respective genera. The true branching strains of *Fischerella* and *Chlorogloeopsis* clustered together and were widely removed from the others. The false branching strain of *Scytonema* and the tapering strains of *Calothrix* showed a close relationship; the unbranched strains of *Nostoc* were closely related to the latter cluster. Akinete production and the type of habitat proved to be important traits.

19

PETERSEN, RAYMOND L., SHEILA D. BRACK-HANES, and ANTHONY M. GRECO. Howard University, Eckerd College, University of South Florida at St. Petersburg.--The Basis of Salt Tolerance in the Mangrove Fern *Acrostichum L.*

Populations of *Acrostichum aureum L.* and *A. danaeifolium* Langsd. & Fisch. of the neotropical mangrove community, as it is found to occur in Florida, were screened for tolerance to salt, based on percent of spore germination, analyzed for elemental content employing energy-dispersive X-ray (EDX) analysis, and cultured in the presence and absence of the calcium channel blocker Verapamil. Tolerance to NaCl directly correlated with the salinity of the soil water for the particular populations sampled. The tolerance ranged from low for freshwater populations to high for spores collected from high salinity sites. EDX analysis of *Acrostichum* plants revealed that they contain little to no sodium but do have a high concentration of both potassium and chloride. In addition salt tolerance in *Acrostichum* can be eliminated by culturing the spores in the presence of the Ca-channel blocker Verapamil. Thus, it is hypothesized that the basis for salt tolerance in *Acrostichum* is a Na/K pump working in tandem with a counter-current Ca channel.

20

PETERSEN, RAYMOND and ANTHONY CHESTANG. Howard University. --Salt Tolerance in the Genus *Pestalotia* de Not. of the Fungi Imperfecti.

A fungal isolate of the genus *Pestalotia* de Not., obtained from

a spore sample of the mangrove fern *Acrostichum aureum L.*, collected in the Florida Everglades, was assessed semi-quantitatively for salt tolerance based on the incidence of fundament and acervular formation. The fungus was cultured on malt extract agar at 25 C across a NaCl concentration gradient of from 0-7%. During the course of this routine assessment crystalline aggregates were noted in cultures in which NaCl was present in the medium. No crystalline aggregates were noted in the NaCl free cultures. The crystals, which appeared to be restricted to the fundament, a plexus of hyphae subtending the conidiomata of the fungus - the acervulus, are essentially water insoluble and through energy-dispersive X-ray (EDX) analysis have been shown to contain Na. Based on microscopic observation and (EDX) analysis, it is hypothesized that in response to sodium, *Pestalotia* synthesizes an organic compound, possibly an acid or sugar-alcohol, in the hyphae of the fundament which reacts with the sodium ion to produce a sodium salt of low solubility. This sequestering of sodium in the fundament functions as a desalination mechanism resulting in low sodium containing water entering the acervular region, allowing for the formation of conidia.

21

MARSHALL, HAROLD C. Old Dominion University--The phytoplankton monitoring program in the lower Chesapeake Bay.

Since 1985 a phytoplankton monitoring program in the lower Chesapeake Bay has been conducted. Populations were identified and concentrations noted above and below the pycnocline at seven stations. Distinct and changing assemblages were associated with changing seasonal conditions and locations in the Bay. There were seasonal summer-fall and winter-spring associations, with different assemblages noted across the Bay and along the Bay stem from its entrance northward. The spring growth was influenced by the onset and duration of the spring freshet, and phosphate limiting conditions, a potential nitrogen limiting system occurs in summer. The picoplankton were also evaluated, with peak abundance occurring in summer. The prominent phytoplankters included *Skeletonema costatum*, *Cyclotella caspia*, *Cryptomonas* spp. and several dinoflagellates. Supported by the Virginia State Water Control Board and EPA.

22

GREGORY-PHILLIPS, CHRISTINE AND HAROLD G. MARSHALL. Old Dominion University--The Seasonal Phytoplankton Composition and Concentrations of Lake Drummond, Dismal Swamp, Virginia.

A 11 month study was conducted on the seasonal phytoplankton composition and con-

centration of Lake Drummond, Dismal Swamp, Virginia. A total of 57 phytoplankton species were identified. The populations had broad seasonal distributions, with the greatest concentrations occurring in winter. The most abundant component was the picoplankton representing 81% of the total phytoplankton concentrations. Included in this group were cyanobacteria chlorophytes and several micro phytoflagellates. The diatom *Asterionella formosa* was also a dominant species and accounted for 8% of the total phytoplankton. The Chrysophyceae and the Chlorophyceae displayed a bimodal winter-summer pattern of development, while the cyanobacteria and Cryptophyceae expressed more intense development in the late summer to early fall.

23

AFFRONTI, LEWIS F. AND HAROLD G. MARSHALL. Old Dominion University--Picoplankton Dynamics in the Lower Chesapeake Bay. A 15 month study of picoplankton (0.2 μm - 2.0 μm) dynamics was made from June 1988 to October 1989 in the lower Chesapeake Bay. Annual picoplankton abundance using epifluorescence microscopy ranged from 7.26×10^6 cells/L in the winter to 9.28×10^8 cells/L during late summer. Productivity estimates using both Frequency of Dividing Cells and C14 fractionation techniques revealed picoplankton contributing up to 50% of total primary productivity during the summer season. Diel studies of picoplankton abundance and productivity revealed the influence of this component by physical features of the estuarine environment (tidal flux, pycnocline). Supported in part by the Virginia State Water Control Board and EPA.

24

NUSSBAUM, FRANCIS. Kent State University, Tuscarawas--Variation in diurnal periodicity of fungal airspora among microenvironments. To determine peak densities in diurnal fluctuations of fungal airspora, samples were collected at five sites by gravitational sedimentation on yeast-malt-agar plates three times per day at weekly intervals during June of 1988 and 1989. Combined data from the ten collection days revealed maximal densities were obtained at varying times among the collection sites. The number of days with peaks occurring during morning, midday, and afternoon, respectively were: lawn 9, 1, 0; sycamore grove 4, 5, 1; pine grove 3, 6, 1; arborvitae windbreak 2, 5, 3; asphalt parking lot 6, 1, 4. Airspora tend to maximize during the morning over unshaded lawns, to occur at midday in tree-shaded locations, and to reflect general area background conditions (control) at the parking lot. The major factors effecting variation in diurnal maxima include

temperature, relative humidity, wind speed, recent precipitation, and the dominant vegetation at the sampling site. Accumulated data will be useful for constructing predictive models for airspora maxima and minima in specific outdoor microenvironments.

25

FREDERICK, L. and LEVESTER PENDERGRASS. Howard University and U. S. Forest Service. Corticolous myxomycetes and the moist chamber culture technique. Myxomycetes from moist chamber culture of bark samples of living trees and those collected directly from standing trees have been termed "corticolous". It has been suggested that the term should be restricted to species naturally occurring on living tree bark. Myxomycete development under moist chamber conditions is therefore considered to be artificial. Their presence in moist chamber culture is presumed to be mainly the result of the air dispersal of spores from field fruitings of species on diverse substrata. Our observations have shown that species obtained in moist chamber culture and those collected in natural settings have some distinctive common features. For example, they are diminutive and inconspicuous; are typically unreported from other kinds of substrata and habitats; commonly manifest a substantial tree species-myxomycete species affinity; and represent forms in which proto- and aphanoplasmodia predominate. If species developing in moist chamber culture were the result of random spore dispersal, naturally occurring species that form abundant and conspicuous sporophores should commonly appear in moist chamber culture. In the hundreds of bark samples that we have cultured such species are absent and these species are also generally not reported from field collections on living trees. Furthermore, in instances where we have subjected exposed undisturbed bark areas of tree trunks to prolonged wetting, species found in moist chamber culture of bark from these trees also appeared in field tests. Our evidence suggests that species from moist chamber culture apparently represent the kinds of taxa that normally occur in nature in this ecological niche and that it is appropriate to regard these forms as corticolous.

26

GAMMILL, STEVEN. P. University of North Carolina at Wilmington. Developmental study of a coastal salt marsh: southern Topsail Sound, North Carolina. Southern Topsail Sound is a marsh filled lagoon located landward of Lea and Coke Islands in southeastern North Carolina. This study quantified changes that have occurred in the area of tidal marsh from 1949 to 1984 within a 643 ha study area near Old Topsail Inlet. Aerial photographs dating from 1949,

1966, and 1984 were enlarged and sample areas of salt marsh were digitized and compared. Since 1949, Old Topsail Inlet has migrated southwesterly 2.2 km. Concomitant with this migration, 27.4 ha of new *Spartina alterniflora* marsh colonized the inlet flood tidal delta and adjacent islands. Landward of the flood tidal delta, site specific gains and losses were recorded. Marsh loss ranged from 42 to 2815 m² and was generally associated with regions distant from tidal creeks. Marsh expansion occurred at some sites and ranged from 118 to 3228 m². Estimates of the total area of marsh indicate a decrease of 54.5 ha. This study provides evidence that although lagoonal marshes may be drowning as a result of reduced sediment supply and sea level rise, new marsh environments are created as inlets migrate.

27

CAIAZZA, NICHOLAS A. New Jersey Department of Transportation--
Assessing a ten acre created wetland after one growing season: success or failure?

A U.S. Army Corps of Engineers permit was granted to the New Jersey Department of Transportation in 1986, requiring that a ten acre wetland be created to mitigate the loss of existing wetlands associated with a freeway construction project (Route I-287). Wetland creation would be considered successful if a survival rate of at least 80% for planted vegetation was attained at the end of each of the first three growing seasons. Construction and planting of the wetland was completed in November, 1988 in the floodplain of the Pequannock River in Bloomingdale, N.J. Wetland hydrology is maintained at the site by river floodwater through an inlet structure. Nine different species were planted in the emergent and open pond zones of the wetland, with an approximate total of 89,000 individuals. By early summer, only minimal germination of planted vegetation was observed. However, by September a diverse plant community dominated by aquatic and emergent volunteer species had begun to develop. Extensive fish and wildlife use of the marsh has also been recorded, including the consistent presence of waterfowl. While the regulatory criterion of 80% vegetative cover has not been met in the first growing season, the created marsh is an immature but developing community that exhibits the following wetland values: Primary Productivity and Food Chain Support, Fish and Wildlife Habitat, and Flood Storage.

28

FERLOW, DONALD L. Environmental Design Associates, Wilton, Conn. --Does No Net Loss Mean Created Wetlands within Site Developments?

The recently adopted "no net loss" policy envisions the continuance of the nation's remaining wetland base systems. This study overviews parameters for development, integral with site construction, whereby the nation's wetlands may be expanded within local areas. Wetlands created as stormwater runoff management systems sediment and pollutant filters, neighborhood wildlife habitat areas and for general aesthetic and passive recreational values are presented. Design standards along with construction sequences are discussed. Examples of growth, evolution and success of created wetlands are described. Plans and photographs supplement report text.

29

HILL, BRIAN H., Marist College,
No net loss: are we just counting beans?

In response to the recommendations of the National Wetland Policy Forum, the federal government has adopted a "No Net Loss" policy in which wetland losses are to be reduced and wetland restoration increased. But are we really protecting wetland ecosystems and their services with this policy? If the policy is simply stating that acre for acre wetlands lost will be replaced by created wetlands, then "no net loss" could mean significant losses of ecosystem function. What is needed is a policy of wetland management that does not just consider wetland species composition and acreage, a statement of the condition of the wetland, but also wetland function, a statement of the performance of the wetland. Such functions as energy flow, nutrient cycling, hydrologic control, and stability are often the result of long histories of wetland development. To expect created wetlands to substitute for natural wetlands may be overly optimistic. To this end I am proposing a hierarchical, functional management strategy for wetland protection and mitigation. This "no net functional loss" strategy employs an ecosystem perspective with an emphasis on rates of carbon fixation, secondary productivity, decomposition, and nutrient cycling. It integrates these functions across trophic levels, and emphasizes species composition only when a keystone species is associated with critical function.

30

SCHMALZER, PAUL A.,¹ C. ROSS HINKLE,¹ JOSEPH L. MAILANDER,¹ and A. M. KOLLER, JR.,² The Bionetics Corporation¹ and NASA Biomedical Operations and Research Office²--Recovery of *Juncus roemerianus* and *Spartina bakeri* marshes one year after fire.

A controlled burn was conducted in November 1988 in graminoid wetlands on John F. Kennedy Space Center, Florida. Preburn and one year postburn we sampled species composition in a *Juncus roemerianus* marsh and a *Spartina bakeri* marsh using 5 permanent 15 m transects and harvested aboveground biomass on 25 plots (0.25 m²) in each marsh. In the *Juncus* marsh, *Juncus roemerianus* and *Sagittaria lancifolia* remained the dominants, but the cover of several minor species increased. Species richness increased from 3.2 to 4.8. Live biomass decreased 58% from 812.6 g/m² to 343.8 g/m² and standing dead biomass 81% from 996.5 g/m² to 185.8 g/m² one year postburn. The ratio of live to dead biomass increased from 0.82 to 1.85. In the *Spartina* marsh, cover of *Spartina bakeri* was greater one year postburn than preburn. Cover of *Sagittaria lancifolia* and *Juncus roemerianus* were ca. half their preburn values, but the cover of *Erianthus giganteus* increased. Species richness increased from 5.0 to 6.8. Live biomass decreased 58% from 772.6 g/m² to 326.9 g/m² and standing dead biomass 79% from 963.7 g/m² to 206.1 g/m² one year postburn. The ratio of live to dead biomass increased from 0.80 to 1.59. Major species recover postfire in both of these marshes, but some shifts in relative importance occur that persist for at least one year postfire. In mixed stands, fire may favor *Spartina bakeri* over *Juncus roemerianus*. Biomass recovers more slowly and is still much less than preburn at one year postfire.

31

YOU, CHENGXIA. University of Tennessee--Traditional ecological research in China.

Based on the idea of "self-conscious" ecology discussed by McIntosh (1987), China's ecological research started in 1940's. It has been influenced strongly by a few individual scholars who studied abroad and by the long history of natural resource surveys and utilization. Traditional ecological research has paid considerable attention to the relationship between natural environments and biological units and less attention to biotic factors such as competition. Most traditional practices focused on biogeographical survey, especially species and vegetation distributions. There was no independent ecology institution in China until early 1980's. Most research was conducted by ecology labs which belonged to or were tightly linked to taxonomic and floristic (or fauna) departments in major biology institutions. Research in the Kunming Institute of Botany, Academia Sinica will be used as an example to provide insight into traditional ecological research and its relationship to natural resource surveys and utilization.

32

LIU, JIANGUO. Institute of Ecology, University of Georgia--Theoretical Ecology in China.

Theoretical ecology in China has developed with very close relations to economic and environmental issues. I will present a brief overall review of theoretical studies in the past, present, and future. Then, I will review "social-economic-natural complex ecosystem theory" and "expanded niche theory" in detail.

33

CHENG, WEIXIN. University of Georgia--Applied ecology/agro-ecology in China.

Although ecology developed very slowly as a branch of science in China, applied ecology has grown extremely fast in the past decade. This fast growth in ecology was mainly attributable to the development of the "four modernization" plan and subsequent problems of over-population, resource exhaustion, and environmental pollution. During the past decade ecology in China has been characterized by its problem-solving orientation and the coupling of ecological research with decision making processes. At present, applied ecology dominates ecological research and education in China. In this presentation, I shall introduce some aspects of agro-ecology in China since agriculture has always been the number one interest of the whole country due to the importance of food production for 1.1 billion people and the connections of agriculture to problems of over-population and resource exhaustion. Topics include: (1) development of agro-ecology in the past decade, (2) regional research centers and main contributors, (3) current situation of agro-ecology, and (4) future in perspective.

34

LIN, JUNDA and XI HE. Smithsonian Environmental Research Center and University of Wisconsin--Marine and Freshwater Ecology in China.

China has a coastline of over 18,000 km with more than 5,000 islands spread across temperate, subtropical, and tropical zones. A wide diversity of inland aquatic habitats ranging from huge high altitude brackish lakes to small freshwater ponds are scattered all over the country. Due to its long civilization with a large human population, aquatic aquaculture has long been well developed for many species. As a consequence, the basic biology, life history, and ecology of these commercial species have been adequately documented. Since the 1950's, especially late 1970's, a series of large scale interdisciplinary projects have been launched to investigate biological diversity and fisheries resources along the coastline as well as in many inland lakes. China has also carried out many oceanic expeditions in the Pacific and Antarctic Oceans. Unfortunately, China's aquatic ecological

research has not kept up with international advancements in recent years. Especially weak is the ability to use experimental design and statistical analysis to test hypotheses concerning species interactions and community dynamics.

35

YIN, YAO. University of Tennessee--Ecological research and education in Chinese universities.

Ecology as an independent science didn't appear in university curricula of China until after 1976 when China opened its front door to the outside world. Having missed the most precious time of development of ecology and having been left far behind, Chinese universities were challenged with a number of problems. These include lack of well-trained ecologists, and lack of suitable education systems. Major strategies to meet these challenges include amendment of curricula, establishment of new degree-awarding stations, inviting in foreign professors and postdoctors, sending out trainees and graduate students. After ten years of rapid growth, many universities in China now have developed ecology programs which are qualified to award master degrees. A few universities are qualified to award doctor degrees. Research topics of individual universities are characteristic of the region where each university is located. A few long term and large scale projects have been started. A major problem is the unbalanced development of ecology due to the short period of development and the insufficient number of ecologists.

36

DONG, QUAN and CE HUANG. Duke University--Ecological research in Chinese research institutes

There are many research institutes in China involved in ecological researches. Some of them have departments specifically conducting ecological researches. The research institutes having the most ecological researchers and playing an important role in the ecological research in China are belong to the Chinese Academy of Science, the Chinese Academy of Environmental Science, the Chinese Academy of Agriculture Science, the Chinese Academy of Forest Science, and the Chinese Academy of Medical Science. Among these academies, the Chinese Academy of Science is relatively more pure-science oriented and the others are more application oriented. The distribution of ecological researchers in the research institutes will be discussed. One or more of the following example of research unit or projects will be discussed: the Department of Vertebrate Ecology of the Institute of Zoology, Chinese Academy of Science; the Eco-environment Research Center of the Chinese Academy of Science; the Department of Ecology of the Institute of Plant Physiology in Shanghai, Chinese Academy of Science; and the Ecological Research Station in Qinghai.

37

GUAN, WEIHE. Institute of Ecology, University of Georgia--Natural Resources Conservation and Management in China.

The number, size, distribution and protective regulations of national and regional reserves illustrates increased resource conservation over the past forty years of Chinese modern history. Natural resource conservation has increased most rapidly during the past ten years. However, various problems exist in the management of these natural reserves. The overall extent of natural resource conservation in China is still very low compared to developed countries. Forest resources are located mainly in mountainous areas in China. Heavy population pressure and the lack of consistent long-term management planning damage forest resources, both in quantity and in quality. Water resources are in serious scarcity in north China and are threatened by pollution in south China. Comprehensive water resource planning and management have just come into consideration in recent years. Examples are the Study of Beijing-Tianjin Water Resources Management (1986 - 1987), and the Study of Ningbo Water Resources Development and Management Planning (1989 - 1990). Natural resource conservation and management are being considered more and more in various land-use planning and management projects. The development and application of Geographical Information Systems helps us to realize this goal.

33

SHEN, ZHONGMIN. The University of Tennessee--Environmental protection in China.

Environmental protection in China actually started in 1973 in response to the 1972 Stockholm United Nations Conference on the Human Environment. Among the causes of environmental problems in China are the huge population (over 1.1 billion) and imperatives to enhance the people's standard of living. Also, the lack of well-defined property rights reduces incentives to maintain environmental quality. Over the past 16 years, China has promulgated a series of environmental laws and the institutional framework for environmental protection has been improved continuously. In 1984, China declared environmental protection as a fundamental national policy. This policy advocates that environmental protection should harmonize with economic development and avoid the mistake of "pollute first and then harness" which is typical of most developed countries. Two significant methods of environmental protection are the environmental impact assessment system which is project-oriented, and the principle that polluters must be responsible for an emission free control system. The following efforts can be made to improve environmental protection in China: (1) strengthen environmental

management and set appropriate priorities, (2) strictly enforce existing laws and regulations, (3) implement economic incentives, (4) encourage basic scientific research, and (5) provide training for environmental managers at every level and educate the people in order to raise public awareness of environmental problems.

39

WALKER, GARY. Appalachian State University--Recent experiences and future opportunities for scientific cooperation between the United States and China.

A long term program of cooperation in ecological science between the Jiangsu Institute of Botany, Appalachian State University and the University of Tennessee provided an opportunity for the exchange of ecologists in 1989. In China, opportunities and responsibilities included presentation of numerous lectures, site visits to several nature preserves, forests and research institutes, and extensive involvement in research. Research on forest composition, disturbance history and population dynamics of tree species was conducted in biological reserves of the Yuntai and Zijin mountains from May to December. Discussions with scientists, resource managers, foresters and students provided opportunities to compare perceptions of natural forests and the functions of natural preserves. Considerable scientific, cultural and political awareness is required of both parties if a western scientist is to work successfully in China. This exchange demonstrated that even in an unfavorable political climate scientific cooperation can be successful and can proceed without government interference. Continued and increased scientific exchanges between developed and developing nations are crucial if we are to understand and limit our global environmental crisis.

40

PAULEY, ERIC F. AND EDWARD E. C. CLEBSCH. University of Tennessee--Fraser fir regeneration and seasonal understory change in a Great Smoky Mountains spruce-fir forest.

Patterns of Abies fraseri (Fraser fir) regeneration and two seasons of understory change were quantified on Mt. Collins to determine if Rubus canadensis interferes with fir seedling survival or growth. Transect data showed that density of fir was restricted at high Rubus density. Fir seedlings were more common than expected on dead wood substrates and bryophyte-covered surfaces. Only 38% of fir seedlings were <5 years old in 1988. Height growth appeared to be unrelated to Rubus density and was increasing, partially in recovery from Adelges piceae infestation. Above-ground Rubus was removed in 7 of 14 permanent plots in June 1988 to test fir

seedling response. By August, Rubus showed rapid regrowth and Picea rubens germinated in large numbers in all plots. Fir height growth showed no first-year response to Rubus removal. In 1989, fir seedlings in Rubus-removal plots showed slightly but significantly increased height growth over that of 1988 as compared to seedlings in control plots. Cover of dominant herbs and density of major shrubs increased in summer and declined in winter; these trends did not differ between treatments. Over the 14-month study period, mortality was 4.7% for fir seedlings, 7.7% for established Picea seedlings, and 94.5% for 1988 Picea germinals. No germling firs have appeared in any plots despite 1987 seed production. Fir recruitment is likely to be insignificant in the near future. Rubus may restrict early seedling survival and decrease height growth.

41

LIU, YAN and ROBERT N. MULLER. University of Kentucky--The influence of forest structure on radial growth response to drought.

Nine successive years of drought caused significant reduction in radial growth of forest trees in eastern Kentucky. However, structural complexity contributed to different response patterns within the forest community. Forest trees were classified into three crown position classes: canopy, subcanopy and understory trees. Canopy trees exhibited significantly greater reductions in radial growth than understory trees. Further, canopy trees exhibited a progressive decline in radial growth during the nine years of drought, while, understory trees were not influenced by the continued duration of drought conditions. On the most mesic sites, however, understory trees actually gained an advantage from the drought. Radial growth of understory trees increased continuously during the period of drought. These differential response patterns of radial growth of forest trees to drought resulted from the structural complexity of the forest which contributes to different environmental effects of drought between canopy and understory.

42

Viewara Theresa, James Fralish and Philip Robertson. Southern Illinois University--The effect of spring burning on hill prairie above ground biomass and woody plant invasion.

Four hill prairies located in Alexander County of southern Illinois were initially burned in the spring of 1975. A portion of each prairie was left as a control. The prairies were burned in 1975 and 1976 and approximately every other year since, with the final burn in 1989. The prairies were sampled before burning and after burning in 1975 and again in 1989. Nonwoody species were clipped from m² quadrats, dried and weighed; woody species were sampled by stem count. Preliminary analysis

indicates that burning increased the present prairie species, and decreased the density of invading woody species. The major prairie grasses, Sorghastrum nutans, Schizachyrium scoparium, and Andropogon gerardii, had an above ground biomass in grams of 80.89, 124.47, and 76.08 in burned and 35.26, 94.64, and, 21.45 in unburned prairies, respectively. The prairies were overgrown with Sassafras albidum and Rubus allegheniensis.

43

Kettler, Steve, James Fralish and Fred Crooks. Southern Illinois University--Forest succession and site index patterns at Land Between The Lakes, KY and TN.

A study of the forest successional pattern at LBL was conducted with support from the Center for Field Biology-LBL at Austin Peay State University, and the Department of Forestry, Southern Illinois University. An estimate of the successional direction and rate in 140 mature stands was obtained from index of similarity and composition index differences between overstory and understorey strata. All stands dominated by P. echinata are rapidly converting to Q. stellata and/or Q. alba. In most Q. alba stands found at low elevations or on north slopes, deep soils and stream terraces, Acer saccharum is a major understorey component that will eventually dominate the overstorey and exclude Q. alba. Quercus prinus, Quercus stellata and Quercus alba dominated stands found at high elevations, on south slopes or on soil of high rock volume, show little or no change to more mesophytic oak species or to A. saccharum. Stands with a low site index (Q. alba S.I. 38-60) appear to be compositionally stable while high site index stands (S.I. 60-75) are converting or will eventually convert to shade-tolerant mesophytes. Because the highly productive Q. alba stands are successional, management should more closely duplicate the natural disturbance conditions under which they were originally established.

44

Franklin, Scott, James Fralish and Fred Crooks. Southern Illinois University--The effect of soil and topography on forest stand composition and growth at Land Between the Lakes, KY and TN.

Research on forest communities at LBL was conducted under the auspices of the Center for Field Biology-LBL at Austin Peay State University and the Department of Forestry, Southern Illinois University. Analysis of data from 140 stands indicates that stand composition is largely determined by soil moisture, aspect, elevation, and history. Low site index (Quercus alba SI 38-60) xerophytic communities are dominated primarily by Quercus prinus and Q. stellata. The Q. prinus community occurs on all slope aspects but is limited to soil of high rock volume and low water holding capacity (AWC 5-12 cm). The Q. stellata community appears on ridgetops, southwest slopes, and silty soil that has a fragipan (AWC 5-12 cm). Stands of Pinus echinata are found primarily on highly disturbed Q. stellata sites. Quercus alba stands of moderate to high site index (60-75) are located on moderate to deep soil (AWC 10-20 cm), slopes of all aspects and stream terraces. Fagus grandifolia or Acer saccharum and a mixture of mesophytic species often dominate low elevations, north slopes and stream terraces. These stands are associated with soil of high water holding capacity (AWC >20 cm) often developed in limestone residuum and loess.

45

Rudowicz, Lucy, James Fralish and Fred Crooks. Southern Illinois University--Forest understorey vegetation at Land Between The Lakes, KY and TN.

Research on the composition of herbs, shrubs and mid-canopy arborescent stems of forest communities at LBL was conducted under the auspices of the Center for Field Biology-LBL at Austin Peay State University and the Department of Forestry, Southern Illinois University. Density and size class data on woody stems were collected from 540 plots in 140 stands; cover class data on herbs were collected in 40 stands. The forest community dominated by Quercus prinus located on extremely rocky soil typically has a mid-canopy of Ericaceous shrubs (Vaccinium arboreum V. vacillans, V. stamineum, and/or Gaylussacia baccata) and Amlanchier arborea. In Quercus stellata stands, the most important species was V. arboreum. This species had low importance in Quercus alba stands on slopes where only widely scattered stems of A. arborea, Cornus florida, Ostrya virginiana and Vitis rotundifolia appeared. On north slopes and in Acer saccharum

dominated stands, O. virginiana, Carpinus caroliniana and Cercis canadensis characterized the relatively sparse midcanopy strata. Asimina triloba, Lindera benzoin, and Bignonia capreolata were found on undisturbed stream terraces. A comparison of disturbed and undisturbed sites indicates that decades of human activity may have eliminated many understory species.

46

LONG, ALICE A. Southern Illinois University--Using indicator species and multivariate methods to identify unique forest openings in southern Illinois. Twenty-two natural forest openings on sandstone, limestone, shale, chert, and loess were studied using a modified Daubenmire canopy coverage method. Of these, Wolf Creek Chert Barrens is one of only two chert barrens known to exist in Illinois. Barrens, an endangered habitat in Illinois, are dominated by xerophytic oaks such as Quercus stellata and Quercus marilandica and Schizachyrium scoparium. However, Wolf Creek Chert Barrens is dominated by Quercus stellata, Ulmus alata, Fraxinus americana, and Chasmanthium latifolium with mean coverages of 30.52, 27.30, 18.77, and 13.38 percent, respectively. Although this chert area is associated with limestone, distances between groups, as calculated by Discriminate Analysis indicate that the chert barrens are more similar to sandstone and shale openings and less similar to limestone openings. Detrended Correspondance Analysis also ordinated these plots into a cluster which grades into shale and sandstone barrens and finally into limestone and loess openings. Classification techniques (Two-way Indicator Species Analysis and COMPAH) cluster all of the chert barrens plots into the same group at a 50 percent similarity indicating a relatively high degree of homogeneity. The indicator species used to identify the chert barrens include Chasmanthium latifolium, Carex spp., and Helianthus microcephalus. Discriminant Analysis shows that soil pH, potassium, percent silt, and organic matter are statistically significant ($p < 0.01$) discriminators of the group structure derived from the vegetation classification.

47

CYPHER, ELLEN A. Southern Illinois University--Use of site characteristics to differentiate among the subspecies of Phlox bifida Beck. Phlox bifida Beck comprises three subspecies, ssp. arkansana Marsh, ssp. bifida, and ssp. stellaria (Gray) Wherry, which differ in floral morphology and geographic range. Fifty-three populations of Phlox bifida were examined to determine if site characteristics differed among subspecies and whether these characteristics could be used to reliably predict the subspecies occurring in a given locality. Site factors included slope angle,

aspect, percent ground cover, shrub density, canopy cover, and soil characteristics. The three subspecies differed significantly on all non-soil site variables except ground cover; shrub density was not significantly different between ssp. arkansana and ssp. stellaria sites. Discriminant analysis based on non-soil variables revealed two significant linear combinations of variables and correctly classified 56% of observations. Only ssp. bifida and ssp. stellaria grew in areas with sufficient soil accumulation to permit collection of soil samples. Soil was analyzed for percent organic matter, pH, and concentrations of phosphorus, potassium, magnesium, and calcium. All six soil variables differed significantly between the two taxa. Discriminant analysis revealed a significant, strong relationship between subspecies and soil factors, and all soil samples were classified correctly. These results suggest that the three subspecies of Phlox bifida have distinct site requirements. Furthermore, soil and/or site characteristics can be used to predict which taxon occurs in an area when flowering plant specimens are not available for identification.

48

ROBERTSON, PHILIP A.--Southern Illinois University--Carbondale--Use of the Kalman Filter in Dendrochronology. Recently the Kalman Filter has been proposed as an alternative technique for analyzing tree-rings to determine climate-growth relationships. The advantage of the Kalman Filter is that the beta (regression) coefficients are allowed to vary with time while in standard regression techniques, the coefficients are time invariant. Tree-ring data from two species studied in the Forest Response Program were used to compare the more traditional tree-ring analysis techniques with the Kalman Filter. When post oak was used to predict pignut hickory, and vice versa, the Kalman Filter gave significantly higher R^2 values than regression. When climatic variables, May, June and July temperature and precipitation, were used to explain variation in tree-ring width, the results were similar as the Kalman Filter gave significantly higher R^2 values than did standard stepwise regression. However, because of the mathematical obscurity of the Kalman Filter and sensitivity to outliers, it should be used with caution.

49

ASH, ANDREW N. Pembroke State University--Effects of clearcutting on litter parameters and soil moisture in a Southern Appalachian forest. Previous work shows that clearcutting causes local extirpation of

populations of the salamander Plethodon jordani. Litter parameters and soil moisture of a mesic pine-hardwood forest near Highlands, NC were examined before and after logging to help determine why salamanders disappear from clearcuts. Timber harvest caused the following significant changes in forest litter: reduction in amount, reduction in depth, and reduction in moisture content. Soil moisture measured at each of three depths (0-15 cm, 16-30 cm, 31-45 cm) was not altered significantly after clearcutting. Changes in litter parameters now seem to be the most likely explanation for salamander extirpation from clearcut sites.

50

James Fralish and Fred Crooks.
Southern Illinois University,
Carbondale and Oregon State
University, Corvallis--A comparison of presettlement, second-growth and old-growth forest communities in the Shawnee Hills of Illinois.

Witness tree data from the 1806-7 original land survey records were used to reconstruct forest community patterns in the Shawnee Hills. Section and quarter corners were located on topographic maps and categorized by site type: high southwest, middle south slope, ridgetop, high north slope, low north slope and alluvial. Presettlement data were compared to data collected from 0.04 ha plots in second-growth and old-growth forest. Relative basal area was used as a species importance value (IV). Average basal area ranged from 14 to 16 m²/ha except for alluvial terraces where it averaged 21 m²/ha. Quercus stellata had the highest IV on high southwest slopes while Quercus alba and Q. velutina had the highest IV's on other site types. Ridgetops appeared to have the most open community of large Q. alba and Q. velutina trees. In 1806, Acer saccharum appeared only as scattered trees restricted to alluvial sites; at present, it dominates old-growth stands on low north slopes and alluvial sites, and is invading second-growth oak stands on most north slopes. On comparable sites, the presettlement community was substantially more similar to that of disturbed second-growth than to undisturbed old-growth forest.

51

MARTIN, WILLIAM H. Eastern Kentucky University--Biodiversity and old-growth mixed mesophytic forests in the Southern Appalachians.

Mixed mesophytic forests are globally-significant centers of biodiversity that occupy mesic

upland sites (to 1400m) throughout the southern Appalachians. The portions of the landscapes occupied by these forests are protected coves, gorges, north and east-facing slopes, lower slopes and broad valleys. The rich flora of woody, herbaceous, vascular, and non-vascular plants is well-known, and it has long been recognized that they provide a variety of foods and other habitat requirements for a number of resident and migrating animals. Several associated species of plants and animals have been indispensable to humans from the first native Americans to the present. Extensive logging that occurred throughout the Appalachians from the 1880's to the 1940's reduced old growth forests to those existing in the Great Smoky Mountains National Park, wilderness areas, and tiny scattered remnants. Characteristics of these forests are: (1) high plant species richness in all strata; (2) several canopy species sharing dominance, e.g., beech, sugar maple, tulip poplar, basswood, buckeye, northern red oak, and silverbell; (3) uneven-aged stands with several large, old trees over 200 years old and 80 cm dbh; (4) canopy densities average 250 trees/ha and basal areas $> 25\text{m}^2/\text{ha}$; (5) standing snags and down logs with 3 or more of each/ha and > 60 cm dbh; (6) single and multiple tree-fall gaps comprising 1-10% of a tract of old-growth. Recurring natural disturbances are important environmental factors that influence biodiversity, and they must be incorporated into long-term research and management programs. Recovering forests in the Appalachians provide the opportunity to protect and manage ecologically-significant areas for development of old-growth mixed mesophytic forests.

52

WARE, STEWART¹, P.L. REDFERN, JR.², G.L. PYRAH², and W.A. WEBER². College of William and Mary¹ and Southwest Missouri State University²--Forest vegetation of the central Ozarks.

Eighty-one sampled stands in the Jack's Fork and Current River drainages fell into three groups on a detrended correspondence analysis ordination: 17 floodplain stands with American sycamore importance value (I.V.) $> 10\%$; 30 basic (higher pH, lower elevation) upland stands with one or more of chinkapin oak, sugar maple, basswood, or red-cedar with I.V. $> 15\%$; and 34 acid upland stands with either white oak, black oak, or black hickory I.V. $> 15\%$. Calcareous vs. siliceous bedrock may account for the two different upland types. Further ordination of the basic upland stands revealed a gradient from high red-cedar I.V. through peaks of abundance of chinkapin oak and then sugar maple to basswood-elm-ash. This gradient was strongly correlated with direction of exposure (increasing moisture). Further ordination of acid upland stands revealed that higher values for white oak, blackgum, and dogwood were dissociated from higher values for black oak. Higher values for black hickory were dissociated from highest values of both oaks. High shortleaf pine abundance overlapped higher abundance of white oak, black oak, and black hickory, but was dissociated from higher post oak abundance. Neither pH

nor direction of exposure was correlated with species distributions in these acidic upland stands. Seedling layers showed invasion of sugar maple seedlings into even the drier basic upland stands, but did not show the invasion of sugar maple into acid upland stands which some have predicted for the Ozarks.

53

MELLICHAMP, T. LAWRENCE. University of North Carolina at Charlotte--The genus Drosera in the Cape Province of SW South Africa.

The southwestern Cape Province of South Africa is an unusually diverse floristic region. Within a relatively small area are found many contrasting habitats ranging from semi-desert to river valleys and from coastal fynbos to mountain fynbos. Throughout the country of South Africa are found some 18 species of *Drosera* growing in seasonally moist habitats. There are 15 species in the section *Rossolis*, which are not unlike our North American species. Two species comprise the section *Ptycnostigma*, characterized by thickened perennial roots (*D. cisitiflora* and *D. pauciflora*). The last one is the fantastic *Drosera regia*, discovered in 1923 on a remote mountain stream and placed in section *Psychophila* because of its unusual 3 separate unlobed styles. It is the only representative of the section in Africa; another member is in South America, and a third in Australia. It has some other anomalous features (such as linear leaves up to 70 cm. long and a multi-flowered inflorescence) and it is still unclear as to whether it really fits into this, or any established section. It is very rare, known from only three local populations. Thanks to Kirstenbosch Botanic Garden and the Compton Herbarium for their help.

54

MELLICHAMP, T. LAWRENCE. University of North Carolina at Charlotte--Rare plants of the Cape Province of southwestern South Africa.

The southwestern Cape Province of South Africa is the World's smallest floristic region and is characterized by a Mediterranean climate of cool, wet winters and hot, dry summers. The region is dominated by the fynbos vegetation type, which is recognized by the conspicuous presence of three plant groups: the Proteaceae, the genus *Erica*, and the Restionaceae. In addition, there are seven endemic families, including Roridulaceae and Bruniaceae. Habitats range from winter-rainfall semi-desert to the north and west; and from coastal to mountain fynbos in the southwest. There are many rare plants which have been identified, and efforts are underway to conserve habitats and

species in traditional ways, as well as the latter by tissue culture. Rare plants to be discussed include *Aloe pillansii*, *Dioscorea elephantipes*, *Pachypodium namaquanum*, *Roridula gorgonis*, *Welwitschia mirabilis* (of Namibia) and various bulbs. Thanks to Kirstenbosch Botanic Garden and the Compton Herbarium for their help.

55

HILL, STEVEN R. Clemson University--Status survey of Marl Forests and Calcareous Cliffs of the South Carolina coastal plain.

A literature, herbarium, and field study was undertaken to determine the current extent and characteristics of South Carolina coastal plain calcareous plant communities. In addition, South Carolina rare and threatened plant species in these communities were evaluated. While all sites visited showed disturbance in varying degrees, most have escaped cultivation due to rugged terrain. Site maps and locations, a prioritization for protection of 11 primary sites, and a list of local community indicator species was presented to the South Carolina Heritage Trust Survey. The three most important controlling factors on these communities are soil pH, mineral composition, and slope. Among the rarest species still extant in the communities are *Adiantum capillus-veneris*, *Asplenium resiliens* and *A. heteroresiliens*, *Thelypteris* spp., *Trillium maculatum*, *Elytraria carolinensis*, *Cornus asperifolia*, *Carya myristiciformis*, *Collinsonia tuberosa*, *Lindera melissifolia*, and *Litsea aestivalis*. There is a great percentage of overlap in species with upper Piedmont plant communities rather than with surrounding coastal plain plant communities. This may represent an actual relict nature of the communities or may merely result from the controlling factors indicated above.

56

DAVENPORT, L. J. Samford University--Distribution, habitat requirements and distinct nature of *Hymenocallis coronaria*.

Hymenocallis coronaria is an emergent aquatic plant native to South Carolina, Georgia and Alabama. It is known from the major river systems of those states, including the Catawba, Congaree, Savannah, Broad, Flint, Chattahoochee, Tallapoosa, Coosa, Cahaba and Black Warrior rivers. In these systems it is restricted to shoal areas, at or above the Fall Line, where foliated rocks provide the crevices necessary for the anchoring of bulbs and seeds. Leaves emerge from the substrate in mid-April; the three-inch broad white flowers appear from early May to mid-July, with peak flowering during late May. The inch-long seeds sink to the stream bottom and are swept by the current into rock crevices, where germination occurs. Due to similarities in floral morphology, *H. coronaria* has often been

treated as a mere variant of more wide-ranging species. However, based on a constellation of characters--leaf length, width and apex; fruit size, shape and color; the very specific nature of its habitat requirements; and flowering time--H. coronaria should be maintained as a separate entity.

57

SWAB, EDWARD C. North Carolina State University--Flora and Vegetation of White Pines Natural Area, Chatham County, North Carolina.

The White Pines Natural Area, Chatham County, North Carolina, contains a disjunct population of white pine, Pinus strobus. This is unusual for its eastern Piedmont location, approximately 115km east of its normal range. The floristic study of the area also revealed a number of other species with mountain affinities. In addition, long leaf pine is growing sympatrically with white pine. The unusual mixture of vegetation is probably due to a diversity of habitats associated with complex geology, varied topography and microclimates. Classification into community types will be discussed and explanations for the disjunctions will be presented.

58

HORN, CHARLES N. and CYNTHIA A. AULBACH-SMITH. Newberry College, and University of South Carolina--Changes in the vascular flora of South Carolina during the last 20 years.

Since the publication of Radford, Ahles, and Bell's Vascular Flora of the Carolinas in 1968 an additional 395 new taxa have been recorded as occurring in South Carolina. Of these, 31 records are a result of taxonomic splitting, hence cannot truly be considered new to the state. The geographical affinities of the remaining taxa were recorded and as a result five distinct patterns were revealed: 1) species with a wide distribution in the eastern USA (48%), 2) introduced species which have become naturalized recently (19%), 3) coastal plain species with northern range extensions into South Carolina (17%), 4) mountain species with a minimal distribution into South Carolina (12%), and 5) rare endemic species of South Carolina and adjoining states (4%). The specimen records are a result of efforts by the participants in the South Carolina Atlas project.

59

MATTHEWS, JAMES F., and WAYNE R. FAIRCLOTH. University of North Carolina at Charlotte and Valdosta State College--An update on the genus Portulaca in the southeast.

Traditionally, Portulaca umbraticola HBK. (Syn. P. coronata) has been considered to be

a species with small, yellow flowers confined to granitic and sandstone outcrops. In 1997 the horticultural trade introduced P. umbraticola 'Wildfire Mixed' as a ground cover and for use in hanging baskets. It is widely grown in the Carolinas and has been seen in the Bahamas and the Dominican Republic. The flowers are large, up to 2.5 cm. in diameter and the petals colors range from white to yellows, pinks and red. The introduction of this more variable gene pool almost guarantees its future appearance as part of the naturalized flora, if the species can become established and reproduce in habitats other than outcrops. A recently reported species new to the United States, growing and spreading in Coffee and Jeff Davis counties Georgia appears to be Portulaca biloba Urban. The species is mostly cleistogamous, producing copious seeds. Occasionally a plant will have several chasmogamous flowers, while neighboring plants will remain cleistogamous. Three flowers have been analyzed. All are dark red-purple. Comparing these sparse data with manuscript data for the Flora of Cuba shows the species is probably of Cuban origin.

60

LAMONT, ERIC E. and RICHARD STALTER. New York Botanical Garden, and St. John's University--The Flora of Orient Beach State Park, Long Island, New York.

The flora of Orient Beach State Park (OBSP) is based exclusively on collections made by the authors in April 1988 to October 1989. Altogether, 247 taxa are reported from the study site. Latham (1934) conducted a floristic inventory of OBSP and reported 232 taxa. Statistical comparisons, including floristic similarity and species richness, between the 1934 and 1989 studies are presented. Numerous rare plants and one rare plant community occur at OBSP: Ligusticum scoticum, Silene caroliniana, Quercus marilandica, Polygonum glaucum, P. tenue and maritime red cedar forest. OBSP represents the southern range limit for some circumboreal plants, and the northern range limit for some southern species.

61

IRELAND, PATRICK H. Radford University--Sub-lethal cellular damage induced by free radicals associated with acid rain.

Acid rain presents several potentially injurious free radicals to salamanders. This study was designed to elucidate the degree of cellular damage inflicted by sub-lethal exposure to some anions and cations produced from atmospheric acid deposition. Larval Eurycea wilderae were maintained for one year in molar equivalent solutions of two acids and three salts of the acids. Age pigments (lipofuscins) were spectrofluorimetrically assayed in post-mitotic cells after treatment. Accumulation of lipofuscins is a prominent age-associated cytological alteration in many post-mitotic cells. Although the relationship between lipofuscins and the process of aging is obscure,

lipofuscin accumulation is associated with both diminished cell function and dysfunction. This study suggests that lipofuscins are induced in Eurycea wilderae by exposure to free radicals present in acid rain. Lipofuscin accumulation within post-mitotic cells may be a useful fingerprint of sub-lethal cellular damage caused by acid rain.

62

COMBS, DANIEL L. Tennessee Technological University--Ecology of two sympatric soft-shell turtles in a coastal plain stream of Alabama.

Growth, population dynamics, movements, and habitat use of spiny (Trionyx spiniferus asperus) and smooth (T. muticus calvatus) softshell turtles in Upphappee Creek, southeastern Alabama, were studied from 1979-82 using mark and recapture techniques. Growth rates of spiny softshells were greater than those of smooth softshells, but growth rates did not differ from those of softshell turtles studied in lakes and large rivers. Approximately equal numbers of spiny (N=150) and smooth (N=209) softshells were marked on the study area, but smooth softshells were captured more frequently in the fall than spiny softshells (50.7% smooth softshells in May-August, N = 459; 68.3% smooth softshells in September-November, N = 284). Both species moved extensively in the stream (documented movements up to 1,988 m), but data collection methodology prevented estimation of maximum movement. Spiny and smooth softshell turtles used different microhabitats, probably reflecting differences in food habits.

63

FORESTER, DON C. and DAVID V. LYKENS. Towson State University--Age structure in a population of red-spotted newts (Notophthalmus viridescens) from the Allegheny Plateau of Maryland.

The red-spotted newt has evolved a complex life cycle which includes an aquatic larva, a terrestrial juvenile (eft) and an aquatic adult. With the exception of the larvae, the duration of each life history stage is variable. Here-to-fore, any attempt to determine the age structure of a given population necessitated a prolonged mark and recapture program.

In this study we determined the age of 32 efts and 27 adult newts using the technique of skeletochronology. There was a significant positive correlation between body size (snout-vent length) and chronological age ($r = .86$). Seventy-five percent of the variation in size was explained by age. The mean age for efts was 4.4 years; for adults 7 years. Our data indicate that efts begin metamorphosing at the end of their third year on land and all have transformed into adult newts by the end of their seventh year. The longevity of individual adult newts is unknown, but in our sample the youngest adults were four and oldest nine years of age. Efts comprising the first three annual age classes were under represented in our population subset. The most parsimonious explanation for this

discrepancy is sampling error, but we cannot discount the potential influence of environmental cataclysm. This latter hypothesis is discussed in relationship to published reports of cyclic breeding success in other montane populations of the species.

64

MIDDENDORF, GEORGE. Howard University--Variation in mite load on Yarrow's Spiny Lizard, Sceloporus jarrovi (Sauria: Iguanidae).

Members of two mite (Arachnida: Acariformes) families, Trombiculidae and Pterygosomidae, were commonly found on the lizard Sceloporus jarrovi in studies over the past three years. The total mite load on lizards in this population revealed a remarkable consistency over this period. However, comparison this past year of mite loads on lizards from three different populations showed great variation. While lizards found at high altitude generally carried fewer mites than those at low altitudes, this trend was complicated by the extraordinary variability seen within one of the two low altitude populations. Site load (mite load for different body areas) also varied greatly among the study populations; mite occupation of nuchal pockets was greater for the lower elevation populations, while hindlimb and tail sites were more frequently occupied at the higher elevations. Much of the variation appeared due to differences between the two mite families; trombiculids occupied the nuchal pockets and occurred more commonly at the lower elevations, while pterygosomids did not appear to be restricted by body site or elevation.

65

TUCKER, ANTON D. University of Georgia, Savannah River Ecology Laboratory--Natural selection for random nest distribution in leatherback turtles, Dermochelys coriacea.

All nest locations were recorded as part of a saturation tagging study for leatherback turtles at Culebra, Puerto Rico during the 1984-1987 seasons. The uncharacteristically stable nesting habitat at this rookery provided a test of the scatter-nesting hypothesis, since most leatherback beaches experience substantial erosional losses and nest destruction. Random nest dispersal was evident along the length and the width of the beach. A conservative reproductive strategy of minimizing nest loss was followed rather than one of maximizing nest success. The adaptiveness of this strategy was predicted for iteroparous organisms reproducing in an uncertain environment. Leatherbacks spread the risk of reproductive failure both temporally (by depositing up to 10 annual nests) and spatially (by depositing the nests in a random fashion). The

persistence of this spatial nesting pattern at a seasonally stable beach likely represents an evolutionarily stable strategy, since historical selection pressures for "nest-scattering" are primarily adaptive for nesting success at erosional beaches.

66

LITTLE, MICHAEL,¹ JOHN WILEY,² and M. DALE ADKINS.³ Marshall University,¹ East Carolina University School of Medicine,² and Ohio State University.³
--Polymorphism of the 28S rRNA genes in the *Hyla versicolor* complex.

The present study examines the numbers of nucleoli per nucleus and positions of 28S ribosomal genes (rRNA genes) in the tetraploid species of gray treefrog, *Hyla versicolor*, and its diploid progenitor, *H. chrysoscelis*. Ribosomal genes and nucleoli were identified by silver staining nictitating membranes and lymphocytes from 236 *H. chrysoscelis* from 15 U.S. states and 100 *H. versicolor* from 12 U.S. states. Although the number of nucleoli/nucleus has been reported to be species specific, we found specimens of each species with nucleolar numbers previously thought to be unique to the other. The number of rRNA genes per specimen was also variable but perfectly correlated ($r = 1.0$) with the number of nucleoli/nucleus. The short arm of chromosome 6 was the most common rRNA gene site in both species, but rRNA genes were also found on chromosomes 1, 2, 7, 8, and 10. All *H. chrysoscelis* from the Atlantic Coastal Plain had rRNA genes only on chromosome 8, and all *H. chrysoscelis* from the Allegheny Plateau had rRNA genes only on chromosome 6. These two chromosomal morphs intergrade near the Blue Ridge Mountains of North Carolina.

67

PAULEY, THOMAS K. Marshall University--
The Ecology of the Cheat Mountain Salamander, *Plethodon nettingi* (Green), with discussions on two sympatric species.

Plethodon nettingi (Green), a federally threatened species, is endemic to elevations above 945 m in four counties of northeastern West Virginia. Since 1976, 66 disjunct *P. nettingi* populations were found in 493 sites. In the 427 sites where *P. nettingi* was not found *P. cinereus* (Green) and *Desmognathus ochrophaeus* Cope were usually present. In nearly all *P. nettingi* populations, *P. cinereus* occupied the same areas, and *D. ochrophaeus* was found down slope but overlapping the lower edge of the *P. nettingi* populations. Laboratory and field data were examined to determine causal factors restricting the range and distribution of *P. nettingi*. Factors that did not influence distribution were vegetation types, slope aspect, insolation, air temperature and soil characteristics (pH, chemistry, composition, and temperature). Soil moisture, relative humidity at capture sites, and body moisture

requirements, food items, and nesting sites were found to be critical factors influencing its distribution.

68

LOVICH, JEFFREY E. and J. WHITFIELD GIBBONS. Savannah River Ecology Laboratory -- Male - biased sex ratios in a South Carolina population of the turtle *Malaclemys terrapin*.

Numerous explanations have been offered for biased sex ratios including sampling bias, skewed primary sex ratios, differential mortality, differential immigration and emigration, and differential maturity of sexes. We observed a strongly male-biased population of the turtle *Malaclemys terrapin* in South Carolina. The overall adult male:female sex ratio was 1.78:1. Although males predominated numerically, the probability of recapturing either sex was the same. Sex ratios were consistently male biased when based on monthly and yearly samples. This bias was not altered by the use of different collecting techniques or restriction of the sample to major habitats within the study area. The excess of males in our population appears to be a result of differences in the timing of maturity between the sexes. Male *Malaclemys* mature after their third year and females after their sixth year. Assuming a minimal effect from the other potential factors and regular juvenile recruitment, we expect that male *Malaclemys* will maintain numerical superiority in most populations. We propose that sex ratio variation in turtles, and other organisms with sexual differences in the timing of maturity can be explained with a simple model: the earlier maturing sex will predominate numerically.

69

CYPHER, BRIAN L. and ELLEN A. CYPHER. Southern Illinois University--Impact of mammalian dispersers on germination of persimmon seeds.

Germination rates of persimmon (*Diospyros virginiana*) seeds collected from feces of coyotes (*Canis latrans*) and raccoons (*Procyon lotor*) were compared to those of seeds from unconsumed persimmons to determine the effects of gut passage. Raccoon-ingested seeds had significantly higher germination rates than non-ingested seeds whereas rates for coyote-ingested seeds were significantly lower. Furthermore, persimmon seeds digested along with animal matter by coyotes had reduced germination rates relative to those from fruit-only meals. Germination rates of seeds remaining enclosed by fruit tissue at the time of defecation did not differ from those of non-ingested seeds, but had higher germination

rates than those in which the seed coat had been exposed. Results reflected the coevolution between historically sympatric raccoons and persimmons. Simultaneous ripening of large numbers of persimmon fruits may mitigate the harmful effects of coyote ingestion by increasing the likelihood of a meal composed primarily of fruit, leading to faster passage through the digestive tract and retention of protective fruit tissues around the seeds.

70

TOBE, JOHN D., LINDA M. ELDREDGE, ALBERT G. ABBOTT and ROBERT BALLARD. Clemson University--Isolation and preliminary analysis of cpDNA in North American species of Magnolia L.

Within the western hemisphere genus of *Magnolia* L. are about 30 species in the sections *Magnolia*, *Rytidospermum*, *Theorhodon* and *Tulipastrum*. In the southeastern United States *Magnolia* is represented by 7 species from these four sections. The most widespread and variable species is *Magnolia grandiflora* in the section *Theorhodon*. This species is found in dry or mesic sites throughout the southeastern coastal plain of North America from southeastern Virginia to eastern Texas. The objective of our research is to use chloroplast DNA (cpDNA) to elucidate phylogenetic relationships among these four sections. Seven species of *Magnolia* and *Liriodendron tulipifera* and *Calycanthus floridus* were included in the initial analysis. CpDNA isolated from each taxon was digested with restriction endonucleases. Agarose-gel electrophoresis demonstrated different fragment patterns for all nine taxa. These RFLPs were then examined by Southern hybridization methods using cpDNA probes shotgun cloned from *Bam* HI digested cpDNA from *Magnolia grandiflora*.

71

LUQUETTE, DOROTHY E. Towson State University--A phenology of the barrens and grasslands of Soldiers Delight, Baltimore County, Maryland.

Soldiers Delight is a serpentine barrens with regionally rare plant associations. A phenology of the barrens and grasslands was prepared from data collected during two growing seasons. The two seasons had varied conditions; 1988 was warmer and drier than normal, and 1989 was wetter than normal. Three diverse study areas were chosen and visited at seven day intervals during peak flowering, and at ten day intervals early and late in the season. Flowering and seed dispersal were noted for all the species found at these locations. Other species, local endemics found on the Maryland Endangered Species List, were also included in the study.

72

CHEN, DILLION T. Howard University Observations on a polycotyledonous seedling of *Ulmus americana*.

Young seedlings of *Ulmus americana* typically possess a single pair of cotyledons, a re-

flection of the dicotyledonous condition of this taxon. During the course of an investigation on elm seedling sensitivity to metabolites of the Dutch elm disease fungus, a seedling with four cotyledons was observed. All four of the cotyledons arose from a common nodal region. The cotyledons were all of normal size and shape and were attached at approximately the same level on the stem of the seedling. Immediately above the cotyledons a whorl of three true leaves were present. An alternate phyllotaxy, typical of *Ulmus*, began with the next successive nodes. Preliminary histological observations through the region of the cotyledonary node reveals that the cotyledonary traces of the two pairs of cotyledons are inserted at slightly different levels. The level of insertion and trace configuration for individual pairs of cotyledons are similar to those of normal seedlings that contain a single pair of cotyledons. Although polycotyledony is known to occur occasionally in several species of dicotyledonous plants, there appears to be no previous report of this condition in *Ulmus*.

73

STEPHENSON, STEVEN L. and HAROLD S. ADAMS. Fairmont State College and Dabney S. Lancaster Community College--A comparative study of spruce growth patterns in four different regions of the world.

Increment growth cores were collected from red spruce (*Picea rubens*) in the mid-Appalachians of West Virginia, Engelmann spruce (*P. engelmannii*) in the Swan Mountains of northwestern Montana, white spruce (*P. glauca*) in interior Alaska, and Himalayan spruce (*P. smithiana*) in the Himalayan Mountains of northwestern India. In addition, quantitative data were obtained for structure and composition of the vegetation and soil chemical and physical characteristics at each study site. Mean number of rings \pm SE for cored trees ranged from 96 ± 6.5 to 220 ± 13.3 . Total radial growth for the period 1900-79 varied considerably (7.6-21.8 cm), with the highest value recorded for Himalayan spruce and the lowest value for white spruce. Radial growth for the period 1960-79 represented more than 20% of the total growth since 1900 for all but red spruce. As such, our data are consistent with the results of other recent studies, which seem to indicate that red spruce in eastern North America has exhibited a recent growth-trend decline. (Supported by a grant from the National Geographic Society.)

74

WALLACE, JAMES W. Department of Biology, Western Carolina University, Cullowhee, NC 28723. USA. - A chemotaxonomic approach to the Hymenophyllaceae.

The systematic history of the filmy ferns shows them to be a well defined group; however, there have been several proposals regarding the relationship of the 650 plus species comprising the group. Historically the species of the Hymenophyllaceae were grouped into two genera; these two genera have subsequently been considered as

consisting of many (up to 46) distinct genera or subgenera etc., and various species have been given differing relationships. The present study was initiated as an attempt to supplement the morphological evidence with chemical information. The distribution of a variety of C- and O-glycosylated polyphenolics has been studied in 80 species representing most of the various subgroups of Copeland, Morton and Iwatsuki. It appears that the classic species of *Trichomanes* may be set apart from those of *Hymenophyllum* with the occurrence of flavons C- and O-glycosides in the former and C-glycosylxanthones and flavonol-O-glycosides in the latter. The distribution of polyphenolics appears to delimit various subgroups within the more inclusive genera

75

McCLINTOCK, JAMES and KEN MARION.
University of Alabama at Birmingham--
Studies on blue crab population dynamics in a Gulf estuary.

Little is known concerning population dynamics of the blue crab (*Callinectes sapidus*) in Gulf estuaries. Studies were initiated in spring, 1989, at the Weeks Bay National Estuarine Research Reserve in Alabama. Three sites, representing the river inflow, mid-bay and the estuary mouth, were sampled monthly by otter trawl. The number of crabs captured at each site, their sex, carapace width, molt condition, and gonad index were recorded. Males predominated in spring and early summer samples, particularly at the river inflow site. Females were more common in fall samples. More crabs were always captured at the lower salinity sites (mid-bay and river inflow). Mean crab size decreased slightly in fall and large females became less common. Early indications are that recruitment by megalopae into the estuary may be a "trickling" phenomenon, with surges in spring and early fall. Studies are continuing and results will be compared to data from Atlantic estuaries. This study is supported by funds from NOAA.

76

BERNARD, JOHN M., FRANZ K. SEISCHAB and KAREL FIALA. Ithaca College, Rochester Institute of Technology, and Czechoslovak Academy of Sciences--Root and rhizome systems of peatland plants.

Few data are available concerning root and rhizome systems of peatland plants. We here present values from our work in temperate zone sites in eastern United States and Czechoslovakia. All values were determined by excavation of all belowground materials to a depth of 30 cm. In addition, root distribution was determined for three species of *Carex*, *Phragmites*, and *Typha*. Both summer and winter samples were collected, washed carefully and air-dried for at least one week. Summer belowground values varied widely, even in the same species but ranged from a low 45 g/m in *Eleocharis rostellata* to a high of 8100 g/m in *Phragmites*. The

sedge species had belowground-aboveground ratios of less than 0.5. *Typha* and *Phragmites* were all over 0.58. Winter belowground weights were comparable to those of summer, the below-above ratio was much greater, being almost 2.0 for the lowest and over 21 for the highest. Most roots and rhizomes of *Carex* species were within 20 cm of the surface but those of *Phragmites* and *Typha* were 60-120 cm deep.

77

DUKE, JAMES A. Agricultural Research Service, USDA--Phytomedicinal forest harvest.

Appalachia has been and continues to be a major source of some minor and major phytomedicinals in the southeastern United States. Established adventives and Native American medicinal species still harvested today include: *Achillea millefolium* (yarrow), *Acorus calamus* (sweetflag), *Arctium* spp. (burdock), *Asarum canadense* (wild ginger), *Dioscorea* spp. (wild yam), *Echinacea* spp. (coneflower), *Hamamelis virginiana* (witchhazel), *Hydrastis canadensis* (goldenseal), *Hypericum* spp. (St. John's wort), *Lobelia inflata* (Indian tobacco), *Lycopodium* spp. (club moss), *Panax quinquefolium* (ginseng), *Passiflora incarnata* (passionfruit), *Phytolacca americana* (pokeweed), *Pinus strobus* (white pine), *Plantago major* (plantain), *Podophyllum peltatum* (mayapple), *Prunella vulgaris* (heal-all), *Prunus serotina* (black cherry), *Rumex crispus* (yellow dock), *Salix* spp. (willow), *Sanguinaria canadensis* (bloodroot), *Sassafras albidum* (sassafras), *Smilax* spp. (sarsaparilla), and *Veratrum viride* (hellebore). Markets have existed for others now or in the past decade, e.g., species of *Agrimonia*, *Alnus*, *Aplectrum*, *Aralia*, *Arctostaphylos*, *Aristolochia*, *Apocynum*, *Artemisia*, *Berberis*, *Cassia*, *Caulophyllum*, *Chimaphila*, *Cimicifuga*, *Cypripedium*, *Dryopteris*, *Equisetum*, *Euonymus*, *Filipendula*, *Frangula*, *Gaultheria*, *Geranium*, *Glechoma*, *Hedeoma*, *Humulus*, *Hydrangea*, *Juniperus*, *Medicago*, *Melilotus*, *Mentha*, *Mitchella*, *Myrica*, *Nepeta*, *Polygala*, *Polygonum*, *Sambucus*, *Scutellaria*, *Senecio*, *Solidago*, *Spigelia*, *Stellaria*, *Tanacetum*, *Taraxacum*, *Tephrosia*, *Tipularia*, *Trifolium*, *Trilisa*, *Verbascum*, *Verbena* and *Veronicastrum*. Uses and abundance of some of these native forest species and weedy invaders are discussed.

78

BRUMBACK, WILLIAM E. New England Wild Flower Society, Inc.--Eastern plants in the commercial trade--collected species.

The native plants of Eastern North America have been considered a valuable resource for ornamental horticulture since the visits of the British plant explorers in the 17th and 18th centuries. The success of these plants in gardens has resulted in their ubiquitous presence in the perennial nursery trade throughout the world, and indeed even in the U.S. some are more commonly thought of as garden plants than

as native species. Through the commercial trade, propagation methods have been developed, especially for sun-loving species which are (in general) easier to propagate. However, many others have proven too costly or too difficult to produce, and these species are available in the trade only as collected plants. Primary groups of collected plants include native terrestrial orchids; *Lilium* and other Lily family members; carnivorous plants; hardy ferns; and a wide range of typical eastern woodland species.

79

BANNERMAN, JOY E. The Institute of Conservation & Culture--The extent and sociology of the collection of native plant species. Humankind's impact on native plants is multi-dimensional. Botanicals have been used by native Americans and immigrants for centuries; a global export market has now developed. Though termed an 'invisible economy,' botanicals comprise a multimillion dollar, international market. The pharmaceutical industry consumes the most, with hundreds of south-eastern US species in demand by domestic and foreign firms. Export and trade regulations are few, inadequate, and allow access to native plants on public lands without regard to protecting future yields. Wildcrafted plants bring higher profits; gardening of many species is impossible; the result is strong pressure on many native species. Simply put, we don't know what we have, what we're losing, to whom, and for what purposes and profits. One gauge of what is on the edge of extinction comes from distributors who know when gatherers can no longer supply particular species. Often his indicator comes too late; hence, what is urgently needed is a way to 1) inventory supplies; 2) predict demand; 3) protect populations; 4) control harvesting; 5) create methods of sustainable yield, with benefits to local economies; and 6) establish a valuation for botanicals as a natural resource which, wisely utilized, contributes significantly to societal health and wellbeing. Such initiatives are also needed on a global scale, especially by developing countries which contain invaluable sanctuaries of biological diversity.

80

LIGHTY, RICHARD. Mt. Cuba Center for the Study of Piedmont Flora--Conservation through Cultivation. Gardeners have been a powerful force for the conservation of certain plants, often over hundreds of years. While problems with "difficult" plants and the "fashions" of gardening make this method imperfect as a mean to conserving species, it may well be the best available. It is proposed that non-profit institutions working with commercial plant producers and gardeners may effect the conservation of a number of natives considered rare or endangered. Examples of how this has occurred in the past with such plants as Franklinia,

Conradina, Panax, and Hexastylis illustrate the problems and promises of this approach. The likelihood of a plant being conserved in cultivation is directly related to its ornamental value, its appeal as an object of interest and its ease of propagation and cultivation.

81

OLWELL, PEGGY. Center for Plant Conservation--The Center for Plant Conservation: Its role in preserving biological diversity.

The central resource of CPC is the National Collection of Endangered Plants. This living collection of over 310 endangered, native U.S. plants is maintained under permanent protection at 20 regional botanical gardens in the CPC network. It serves to preserve species that are extinct in the wild; to provide stock for introductions or habitat restoration; to provide a source of plant material for biological research, which in turn provides vital information on habitat management; and to provide a mechanism for public education on rare plant conservation. With the focus on biological diversity, CPC, through its National Collection of Endangered Plants, is creating genetically representative assemblages of rare plants in U.S. botanical gardens.

82

BOYER, MARJORIE W. North Carolina Plant Conservation Program--The protection of Canby's Cowbane through propagation.

Canby's Cowbane (Oxypolis canbyi), a federally endangered rhizomatous perennial found in shallow wetlands in Maryland, the Carolinas and Georgia, has shown marked population declines in recent drought years. In a 1985-86 study of the reproductive biology of this little-known species, transplants of whole plants, stems with rhizomes removed, and rhizome sections were placed in beds at the NC Botanical Garden in October 1985 under inundated, saturated and intermittently dry regimes. Survival to April 1986 was 17% for rhizome sections and near 100% for intact plants and bare stems, with an 80% increase in number of stems. Forty-four percent of the 1986 stems flowered. Inundated and saturated plants did better than those intermittently dry. Seed germination trials with 1985 seed produced no germination. The results of this study were used in 1989 when in the single Maryland population only 3 plants were found. Three plants (2 live and 1 from the previous year) were transplanted for maintenance and propagation in the North Carolina Botanical Garden. This conservation project has involved the cooperation of several agencies. The 1985-86 study was funded through a Catherine H. Beattie Fellowship Grant from the Garden Club of America, while NC population monitoring and the Maryland rescue effort have been supported by the Nature Con-

servancy, US Fish & Wildlife Service, NC Plant Conservation Program, MD Natural Heritage Program, NC Botanical Garden Foundation, and the Center for Plant Conservation.

83

TANKERSLEY, RICHARD A. Wake Forest University, Winston-Salem, NC. Not-so-random walks: a computer simulation of chemo-orientation behavior.

Although studies conducted on living animals are necessary to ascertain the function and adaptiveness of orientational mechanisms, computer simulations which model the behavior of "real" animals provide insights into the mechanisms underlying observed behaviors and serve as important instructional tools. Microsoft QuickBASIC was used to develop a series of chemo-orientation programs that simulate the movement of an organism with two sensory receptors in a chemical concentration gradient utilizing either tropotaxis or klinotaxis. The program depicts the concentration gradient as a series of circles radiating out from a central source. At the outset of the program, the animal is randomly placed near the edge of a square arena and is allowed to crawl until it reaches the source. The concentration of the chemical attractant at the tips of the animal's sensory structures is computed by subtracting their distance from the source from a predetermined constant. Animals employing tropotaxis make directed turns based upon simultaneous comparisons of the chemical gradient while klinotactically oriented animals compare samples made at successive points in time (between steps). Simple algebraic and trigonometric formulae are used to compute the animal's position in reference to the source and calculate the direction of its subsequent steps. Following each step, the animal's path and new position, including the location of its sensory structures, are drawn on the screen using QuickBASIC's PSET and LINE commands. Input statements can be used to permit students to manipulate important experimental variables including step length, differential threshold, sensory structure size, and turn angle, in order to determine their effect on the animal's success in locating the source. The program also can be modified to calculate descriptive statistics, including means and standard deviations, for such variables as distance traveled, number of turns made, and number of steps taken. Similar programming principles may be used to design programs that simulate more complex orientation behaviors including orientation to moving media and electric and magnetic fields.

84

GAZZAM, VIRGINIA J. Towson State University--What writing research reveals about how college students conduct and compose original science research.

As 22 upper level biology majors conducted and composed original research papers, they saved all rough drafts, kept logs, and spoke into tape recorders. These materials were collected by an independent investigator and examined after the papers had been graded by the instructor. Subsequently a primary trait analysis of the original research paper was conducted and two other biologists ranked the research. Ethnographic data analyses focus on the strategies of successful and unsuccessful students. Five major diffi-

were identified: students constructed poor experimental designs, students failed to define operationally, students displayed and interpreted data ineffectively, students confused the order of format with the order of composition, and students were unable to distinguish significant non-experimental factors. This presentation focuses on how how students' achievement in conducting and composing original science research can be improved.

85

SWAM, JANICE C. Saint Mary's College. --A consideration of scientific literacy by the AAAS and possible ASB responses.

Scientific literacy was the focus of the 1989 American Association for the Advancement of Science Forum for School Science. When it seems that more could not possibly be said on this topic, more is. At this meeting, consultants, university administrators and faculty, AAAS staff, and even congressional representatives informed the audience. Everyone, it seems, except teachers who are actually dealing with the problems in the well-defined *trenches* spoke. Survey results were reported; historical aspects of the problems outlined; perspectives on the problems in relation to the *times* were offered; definitions of words (both meaningful and meaningless) reviewed--with very little that spoke to concrete solutions. Indeed, what is *scientific literacy*? The topic as viewed by *experts in the field* will be considered and possible answers sought to the question... What, if anything, can/should the Association of Southeastern Biologists be doing as an organization to effect changes in our geographical area to foster *biological literacy*?

86

COCKING, W. DEAN. James Madison University. --Group action with the Alliance for Environmental Education to react to a common concern.

The Alliance for Environmental Education was established in 1972 and presently includes 41 organizations in addition to ASB. (eg. American Chemical Society, American Federation of Teachers, Izaak Walton League of America, Ecological Society of America, National Science Teachers Association, and the National Wildlife Federation). As part of this coalition, the ASB co-sponsored a Washington DC public hearing with EPA in September, 1989, titled "PLANET AT RISK: Charting an Environmental Ethic." Through this relationship we also have the potential for contributing to the creation of a National Network for Environmental Education. The Alliance is also active in disseminating information between the member organizations. Thus far the ASB role has been passive as a supporter and observer. In the future, decisions will have to be made concerning the extent to which we wish to be involved financially and with respect to active participation. Is this an effective way for the Association of Southeastern Biologists to foster *ecological and environmental literacy*?

87

SAAD, ZAKARIA and FRANK P. DAY. Western Sudan Agricultural Research Corporation and Old Dominion University --Effects of soil, seed source, and planting density on nodulation and biomass production of *Acacia senegal* in Sudan.

Acacia senegal is an important component of the agro-forestry system of the African sahel. Knowledge of

conditions which result in greater N input to the soil by this legume is highly desirable. A series of experiments (4 x 4 design) were conducted on soils and Acacia senegal plants from 4 field sites in Sudan--Elobeid (E), Gedaref (G), Singa (S), and Dubeibat (D). Seeds from each site were germinated and grown in soils from each site. The seed source appeared to have little effect on nodulation or biomass production. However, the E and D soils (regardless of seed source) yielded fewer nodules per plant and less seedling biomass. A separate experiment using different planting densities was also conducted. There was a strong inverse relationship between plant density and nodulation (0 nodules at the highest density), but there were minimal effects on plant biomass.

88

WALKER, GARY L.,¹ WEI HONG-TU,² and WU LIN:² Appalachian State University¹ and Jiangsu Institute of Botany²--Population dynamics of three species of Pinus in ecological reserves of Jiangsu Province, The Peoples' Republic of China.

A research team of Chinese and American ecologists examined the population structure of Pinus densiflora Sieb. et Zucc., Pinus thunbergii Parl., and Pinus massoniana Lamb. in mountainous ecological reserves of eastern China in order to determine the present status of these stands in terms of their origins, the effects of disease, interspecific and intra-specific competition, and site conditions. All three species are reported to be susceptible to the pinewood nematode, Bursaphelenchus xylophilus. The Pinus densiflora population at Su Cheng reserve exhibited a distribution of size classes representing balanced recruitment and mortality. The absence of symptoms of infestation of the pinewood nematode in this population is attributed to local environmental factors. Populations of Pinus thunbergii and Pinus massoniana in the Zhi Jing Shan reserve are even-aged with few or no saplings and were likely established by reforestation projects. The Pinus thunbergii stand is infected with the pinewood nematode. Although seedlings are present in gaps, recruitment is slow. The Pinus massoniana stand has few seedlings and no saplings of pine and is being replaced by an all-aged population of Liquidambar formosana Hance.

89

MULLER, ROBERT N. and YAN LIU. University of Kentucky--Coarse woody debris in an old-growth deciduous forest.

Coarse woody debris (CWD) was surveyed in an old-growth forest in southeastern Kentucky. Volume of standing and fallen CWD >20 cm diameter averaged 75.5 m³/ha and mass averaged 23.6 Mg/ha. No statistically significant patterns occurred in the distribution of CWD among communities of the forest. While 23 species contributed to the accumulation of CWD, five contributed 70% of the total amount. Among these American chestnut contributed 10% of the total. The importance of American chestnut in CWD of these forests reflects its former importance throughout the Central Hardwood Forest Region and the durability of its wood, which appears to have no contemporary equivalent. Other important

species included chestnut oak (23% of the total), American beech (16%), white oak (10%), and black oak (9%). The few studies of CWD in old-growth deciduous forests suggest a pattern of accumulation dominated by temperature. At lower elevations and in warmer regions, old-growth deciduous forests accumulate a mass of approximately 20-25 Mg/ha while in cooler ecosystems at higher elevations or higher latitudes CWD may range from 30-50 Mg/ha.

90

PARR, PATRICIA D. and MAUREEN CUNNINGHAM. Environmental Sciences Division, Oak Ridge National Laboratory, and University of Tennessee--Habitat manipulation: the effect on a declining rare plant population.

A population of Delphinium exaltatum (Tennessee listed as endangered) on the Oak Ridge National Environmental Research Park, Oak Ridge, Tennessee has been monitored for 5 years following a major disturbance in 1984 when a portion of the area was partially bulldozed. The area was previously cleared by periodic mowing to maintain a powerline right-of-way which is where the majority of the Delphinium population occurs. Mowing was halted after the bulldozing. In 1985, 100 permanent plots were established on the site. Numbers of adults and immature plants have been recorded annually since 1985. Total numbers of plants declined 80% from 1985-1989. The open area was mowed in 1989 prior to the growing season. Total numbers of plants in the plots increased 60% from 1988 (39 plants) to 1989 (100 plants). While the total number of plants in 1989 was 50% less than those recorded in 1985 (197 plants), the number of immature plants increased 290% (from 32 to 93 seedlings and juveniles). In addition to the mowing, the area experienced an above average rainfall as opposed to the severe drought conditions of the four previous years. The population will continue to be monitored to determine appropriate management strategies for this species.

91

COLLINS, B. S. and G. R. WEIN. Memphis State University--Competition and coexistence of two annual Polygonum species.

Polygonum caespitosum and P. punctatum coexist along forest margins on the loess bluffs of the Mississippi river. During summer, 1989, dynamics of these species were monitored in ten 10cm x 10cm plots on ridge and bottom sites at Meeman Biological Field Station. Initially, the mean number of plants per plot was 22 on the ridge and 12.2 in the bottom. After ten weeks, plants had thinned to 7 per plot on the ridge and 5.5 in the bottom. Mean biomass per plant was

1.13 g on the ridge and 0.97 g in the bottom. The effects of intra- and interspecific competition on coexistence of these Polygonum species was investigated in a greenhouse experiment. Seeds from ridge and bottom sites were sown over a range of densities in single-species, mixed-species, and single-species/mixed-site combinations. Preliminary results indicate no effects of site on intraspecific competition. Over all densities and in both single- and mixed-species treatments, P. punctatum had greater mean biomass per plant, lower allocation to inflorescence, and greater mean seed weight than P. caespitosum. Interspecific competition does not appear to greatly inhibit coexistence of these Polygonum species.

gorize the Landsat data. Eighteen monoculture stands of five conifer species were established for the supervised classification. The unsupervised classification was produced by first creating a principle component image using all seven bands. The resultant principle components were clustered using the Earth Resource Data Analysis System (ERDAS) software. The two classifications were compared to random field sites and discrepancies modified. Mapping difficulty using this process occurred in areas with young heterogeneous vegetation, sparse vegetation cover, and long term snow cover.

92

ZETTLER, LAWRENCE W., JOHN E. FAIREY, III, and THOMAS M. MCINNIS, JR. Clemson University--The status and seed germination of Platanthera integrilabia (Correll) Luer, an endangered terrestrial orchid.

Platanthera integrilabia (Correll) Luer is one of North America's rarest terrestrial orchids, and is threatened by a number of factors including poaching and habitat destruction. Seven of 10 previously extant populations of P. integrilabia consisting of 11 to ca. 4,000 plants were found in Georgia, South Carolina, and Tennessee. Only 3.7 % of 809 plants examined in 1988 produced inflorescences. Of two populations surveyed, 6.9 % of 143, and 20.3 % of 69 flowers set seed at Habersham County, Georgia in 1988, and Greenville County, South Carolina in 1989, respectively. An aromatic attractant, linalool, was emitted by P. integrilabia flowers, but no natural pollinators were observed. Some of the natural pollinations at the Habersham County site may be attributed to a self-pollination mechanism involving pollinia membrane deterioration. Recently, the symbiotic germination of P. integrilabia seed was achieved in the laboratory using mycorrhizal fungi isolated from the roots of this orchid from natural populations. The fungi, tentatively identified as members of the genus Rhizoctonia, were grown with P. integrilabia seed on agar media. A 18.1 % germination rate was observed within five weeks. Efforts are underway to propagate this and other vanishing native orchids from seed to maturity using these fungi.

93

WHITE, JOSEPH D.,¹ GLENN C. KROH,¹ and JOHN E. PINDER III.² Texas Christian University¹ and Savannah River Ecology Laboratory²--Mapping vegetation at Lassen Volcanic National Park using Landsat-5 TM data.

A vegetation map of Lassen Volcanic National Park was produced using a Landsat-5 TM data set. A combination of supervised and unsupervised classification schemes were used to cate-

94

DOYLE, KATHLEEN M. and DOROTHY J. ALLARD. The Nature Conservancy, Southeast Regional Office--Applying an ecosystem classification system on National Forest lands: A pilot study.

The Nature Conservancy and the U.S. Forest Service are cooperating in the Southeast U.S. to establish and implement a regional classification of existing anthropogenic and natural ecosystems, based upon features such as vegetation, soils, hydrology, and topography. Information on human and natural disturbance is used in the classification of anthropogenic and successional communities. Sections of the Croatan and Uwharrie National Forests in N.C. were surveyed. Data were collected using macroplot sampling methods and analyzed using multivariate classification techniques. Methods of mapping and classifying patches on the landscape were developed using aerial photos, soil maps, topographic maps, forest service stand information and site reconnaissance. Using ARC/INFO Geographical Information System, community patches were incorporated into U.S.F.S. data bases. Ecosystem classification may improve the ability of land managers to gather information on biological diversity and to identify and implement ecologically sound land management practices on National Forests.

95

Hupp, Cliff R¹ and Simon, Andrew.² U.S. Geological Survey, Reston, Virginia¹ and U.S. Geological Survey, Nashville, Tennessee²
--Riparian vegetative and geomorphic recovery following stream channelization.

Most perennial streams in West Tennessee have been straightened and dredged since the turn of the century. Patterns of fluvial and ecological responses to channelization have been described by a six-stage model. Location, timing, amount, and rate of sediment deposition have been analyzed and interpreted by dendrogeo-

morphic (tree-ring) techniques. Channel-cross sections and ecological analyses were made at 101 locations along 12 streams, encompassing bends and straight reaches. Channel and bank processes initially react vertically to channelization through downcutting. A depositional surface forms on banks once bed-degradation and heightened bank mass-wasting processes have eased or slowed. The formation of this depositional surface marks the beginning of bank recovery from channelization. Characteristic woody-riparian vegetation begins to grow as this depositional surface develops and becomes a part of the process and form of restabilizing banks. Mean-accretion rates range from 5.9 centimetres per year on inside bends to 0 centimetres per year on most outside bends; straight reaches have a mean-accretion rate of 4.2 centimetres per year. The relatively stable, convex upward, depositional surface expands and ultimately attaches to the flood plain. The time required for this process averaged about 50 years. Stem densities generally decrease with time after an initial flush of about 160 stems per 100 square metres. Indicative pioneer species of woody riparian vegetation include black willow, river birch, silver maple, and boxelder. Dispersal by wind, water, or both, spring dissemination, ability to layer, and fast growth rates favors successful ecesis along disturbed channels and is associated with these pioneer species.

96

BERNARD, JOHN M. Ithaca College--Life History of Phalaris arundinacea L. (Reed Canary Grass).

Reed canary grass is a large perennial wetland macrophyte which usually grows along the borders of wetlands. This study was conducted in a large monotypic stand in the Cornell Ponds research facility in Ithaca, New York. Early spring growth is by shoots formed the previous autumn, some of which had emerged aboveground then. Growth is very rapid, averaging about 1 cm/day for the first two months. About 80% of these shoots flower in late spring. In July, most shoots are over 100 cm long and many fall over (lodge) in heavy winds. These shoots develop axillary shoots from the prostrate stems and contribute largely to the midsummer production in the stand. During autumn, rhizome growth is intense and many new shoots are formed, some of which emerge aboveground. The stand remains in that condition until growth commences the next spring.

97

MPHANDE, JOHN N.B.,¹ BRIAN C.,² MCCARTHY, KENNETH R. MCKAYE,¹ Frostburg State University¹ and Appalachian Environmental Laboratory²--Browsing strategies of the African Elephant in a coppice Brachystegia woodland: Kasungu National Park, Malawi.

African elephants (*Loxodonta africana*) have the capacity to reduce mature *Brachystegia* woodlands to a coppice phase. This in turn affects the distribution of selective grazers (e.g. roan and sable antelopes), reduces animal visibility, and the aesthetic appeal of the affected area. All of these factors are detrimental in an

area such as Kasungu National Park (KNP) which is primarily managed for tourism. We studied the response of trees to different elephant browsing modes in an area of coppice *Brachystegia* woodland in KNP. Permanent plots were established to monitor changes in vegetation composition and structure. Additional strip transects were established to investigate seasonal variation in modes of browsing. Separate regeneration plots were established to study tree regeneration after elephant digging. The greatest change in vegetation structure occurred within the seedling size classes (<1 m in height). Mature (>3 m) trees experienced the least change. Seedlings were subject to frequent stem pushover and uprooting. Recovery after stem uprooting was low (28%). Recruitment trees (1-3 m) suffered primarily from stem breakage. Branch breakage was the primary source of disturbance to mature trees. Elephants appear to be significantly influencing community structure and composition in KNP.

98

MCGREGOR, STUART,² C. B. COBURN,¹ Tennessee Technological University¹ and Geological Survey of Alabama²--Base line fishery data of the Cumberland River below Wolf Creek Dam.

Base line data are needed to assess future impacts of hydrolic alterations of the Cumberland River below Wolf Creek. Occurrence, food habits, reproductive readiness, reproductive success and age and growth were studied by using conventional methods. Water temperature in the Cumberland River was significantly colder than other rivers in the region and its tributaries. Walleye (*Stizostedion vitreum*), white bass (*Morone saxatilis*), and golden rehorse (*Moxostoma erythrurum*) had condition factors and growth rates similar to those from northern lakes and rivers. The condition factor and growth pattern of smallmouth buffalo (*Ictiobus bubalus*) were similar to smallmouth buffalo from other southern streams. That may have reflected the mobility of buffalo into and out of the warmer tributaries. The white bass and buffalo were evenly distributed throughout the system, walleye were concentrated near the middle of the system. Walleye fed on fish. White bass fed on small fish and macroinvertebrates.

99

CHOI, NEE Y., CAROLYN CULP, THOMAS E. WEAKS, and DOSHIA J. WEBB. Marshall University--Changes in periphyton community structure of Beech Fork Lake resulting from artificial circulation.

Factors affecting biological systems of Beech Fork Lake in West Virginia were evaluated following the initiation of artificial destratification. The methods applied have had immediate and far-reaching effects on biological habitats and community structure. These changes have resulted from the manipulations of the chemical and physical environ-

ment as well as the immediate modification of organism survival and distribution. Similarity index values for periphyton during the summers of 1986 and 1987 were relatively high and not substantially different for all combinations of water column strata. The degree of similarity suggests high habitat homogeneity for the two years. However, similarity index values for 1988 were less uniform than those of the two previous years indicating changes in habitat structure. The broad range of index values for summer 1988 suggests a shift to high habitat heterogeneity. This shift in the direction of heterogeneity is believed to be related in major part to the differential effects of artificial destratification on the widely diverse habitats of the water column within the lake. Greater habitat heterogeneity in 1988 was reflected in the appearance of increased numbers of periphyton species.

100

ZAPPIA, HUMBERT, DEAN ADKINS, ROBERT NORMAN and DONALD TARTER. Marshall University--Effects of first and second year artificial lake destratification on benthic macroinvertebrate population in Beech Fork Lake, Wayne County, West Virginia.

During 1987 and 1988, benthic macroinvertebrate populations were investigated at Beech Fork Lake, Wayne County, West Virginia, to determine the effects of first and second year operation of thermal destratification fans compared to pre-destratification (1985). Analysis of the benthic macroinvertebrate populations showed significant increases have occurred during the summer seasons based on MANOVA ($p < 0.01$), t-test ($p < 0.05$), and stepwise discriminant analysis ($p < 0.01$). These increases have occurred in total numbers, diversity, and the number of taxa. Statistical analysis of the fall season data shows no overall significant increase in total numbers, diversity, or number of taxa. There were significant increases in the fall season of first year destratification. Although there is no significant statistical difference in water quality parameters (summer or fall), the mean dissolved oxygen increased to its highest level in 1988 (summer and fall). Increased oxygen at depths below 5 ft may account for shifts from predator species to resident detritivores.

101

REID, JONATHAN E., GREG MCKAY, and DONALD C. TARTER. Marshall University --The effects of artificial destratification on age, growth, and feeding habits of the gizzard shad, *Dorosoma cepedianum* (Le Sueur), in Beech Fork Lake, Wayne and Cabell Counties, West Virginia.

Artificial destratification fans were installed in Beech Fork Lake, a 291 ha impoundment, by personnel from the U. S. Army Corps of Engineers in 1987. Detrital movement, com-

bined with inflow of water that is predominantly non-calcareous, caused the ionic concentration and buffering capacity to be very low making the lake susceptible to pH and suspended particle problems. Gizzard shad were sampled monthly from April through October in 1987 and 1988. The scale method of age and growth was used to compare 1988 data with baseline data collected in 1987. Young-of-the-year shad attained an average of 76.4 and 119.4 mm, 1988 and 1987, respectively. Shad belonging to Age Classes I, II, and III attained average lengths of 149.7, 167.4, and 227.1 mm, respectively, in 1988 compared to 184.0, 209.4, and 218.0 mm, respectively, in 1987. The greatest growth fell within the 140 and 170 mm size ranges, 1988 and 1987, respectively. Forage size shad will be available longer for the predatory fishes (e.g. hybrid striped bass) due to the slower growth rate. Generally, stomach analysis showed that diatoms dominated the diet for most age classes in 1988. These data represent a shift in feeding habits since blue-green and green algae dominated from June through July in 1987. The shift in the feeding habits and the slowdown in the growth rate is most likely the result of the artificial destratification of Beech Fork Lake.

102

TARTER, DONALD C. Marshall University --Recolonization of benthic population from the effects of a catastrophic flood in Seneca Creek, Pendleton County, West Virginia.

In early November 1985, high waters resulting from five days of steady rain (13.5 inches) from Hurricane Juan and another storm system roared down Seneca Creek, Pendleton County, West Virginia. The functional feeding group structure was dominated by collectors (Gatherers and filterers) after the flood. Predators declined sharply after the flood and never returned to pre-flood percentages. In addition to the old channel of Seneca Creek, a new channel was formed after the flood in a nearby floodplain area. Collectors also dominated the functional feeding groups in the new channel. Species richness remained constant after the flood in the old channel. Species diversity and equitability increased slightly following the flood but returned to pre-flood conditions within one year. The number of plecopteran and dipteran taxa recolonized rapidly and were fairly constant in pre- and post-flood samples. Ephemeropteran taxa increased immediately after the flood but returned to pre-flood numbers within two years. However, the mayfly *Epeorus* was never found in the samples two years following the flood. Trichopteran taxa recovered fairly rapidly. The caddisfly genera *Chimarra* and *Polycentropus* were never found after the flood. The coefficient of community similarity was lowest immediately after the flood and increased over the following 18 months. Overall, these results indicate a high degree of resiliency of benthic populations in Seneca Creek.

- 103
 RUGGLES, KIMBERLY K. and DONALD C. TARTER. Marshall University--Leaf shredding, under laboratory conditions, by naiadal *Peltoperla tarteri* Stark and Kondratieff (Plecoptera: Peltoperlidae).
 Naiadal *Peltoperla tarteri* were placed in containers with aerated stream water at 15 C and twelve species of autumn-shed leaves (American beech, ash, basswood, cucumber magnolia, pignut hickory, red maple, red oak, sugar maple, sycamore, tulip poplar, white oak, and yellow birch). Additionally, naiads were exposed to different leaf combinations to determine preferential consumption. After two weeks, the naiadal *Peltoperla* were weighed and ashed in a muffle furnace at 550 C. The leaves were dried in an oven and weighed. The tannin and lignin content of the water was determined after the experiment. The ranking of leaves according to consumption (or shredding) by *P. tarteri* naiads will be discussed along with the tannin and lignin analyses.
- 104
 BURGESS, LISA and DONALD TARTER. Marshall University--Effects of temperature and pH on oxygen consumption rates of naiadal *Potamanthus distinctus* Traver (Ephemeroptera: Potamanthidae).
 A Gilson differential respirometer was used to measure the oxygen consumption rates of naiadal *Potamanthus distinctus* Traver at two temperatures (10, 17 C) and two pH's (5.4, 7.4). Naiads were collected from Indian Creek, Monroe County, West Virginia. Following the experiment, an average oxygen consumption rate in $\mu\text{l}/\text{mg}$ dry weight/hr was calculated. Analysis of variance was used to determine if temperature or pH had a significant influence on oxygen consumption. Data were plotted to determine the influence of body weight on oxygen consumption for both pH's. Slopes of the two regression were compared with a z-distribution to determine if they were significantly different.
- 105
 YEAGER, MINDY M., T. G. JONES, and DONALD C. TARTER. Marshall University--Discovery of the central mudminnow, *Umbra limi* (Kirtland), in West Virginia, with preliminary observations on the reproductive activities.
 The central mudminnow, *Umbra limi* (Kirtland), was found in the Greenbottom Wildlife Management Area, Cabell County, West Virginia on 10 October 1989. It was collected in shallow water (7.6 - 60.0 cm) with submerged vegetation and muddy substrate. This population is the only locality record of the family Umbridae in West Virginia. The Greenbottom site lies more than 110 km southeast of the nearest locality record in Hocking County, Ohio. Preliminary observations on the gonadal somatic ratios, fecundity, seasonal development of ova, sexual dimorphism and spawning habits will be discussed.
- 106
 DUOBINIS-GRAY, L., E. URBAN, J. SICKEL, W. MAOONX and D. OWEN. Murray State University--Parasites of Bivalves in Kentucky Lake.
 A cooperative project to investigate possible causes for periodic massive mortalities of freshwater mussels was conducted during the summer of 1989. Six genera of bivalves were collected. These were *Amblema*, *Anodonta*, *Arcidens*, *Fusconaia*, *Megaloniais* and *Quadrula*. Aquatic mites of the genus *Unionicola* were recovered most often. The density of mite eggs and prelarvae in the visceral mass and mantle of *Anodonta grandis* and *A. suborbiculata* often exceeded $5000/\text{cm}^2$. Hyperplasia of subepithelial tissue was extensive in heavy infections. The intensity of adult mites ranged from 0-27/host. *Aspidogaster conchicola* and *Cotylaspis insignis* occurred in the kidney and pericardial cavity of the hosts. Panges were 0-9 and 0-10 respectively. Bigean sporocysts containing rhopalocercariae were recovered from the visceral masses of *Amblema plicata* and *Anodonta grandis*. The density of sporocysts exceeded $1000/\text{gm}$ dry wt. of host tissue.
- 107
 MCGREGOR, MONTE A. and WENDELL PENNINGTON. Tennessee Technological University--Benthic Macro-invertebrate Community Analyses of Kentucky Lake (Tennessee River), Tennessee.
 Kentucky Lake is a multipurpose impoundment of the lower Tennessee River system. Interest has focused on the fish and mussel die-offs within the reservoir due to the importance to the local economy. To assist in the determination of the quality of the Kentucky Lake fauna, a study of the macro-invertebrate community was initiated in the summer of 1988. Seven stations (Tennessee River Mile 62, 91, 100, 110, 135, 197, and Big Sandy River Mile 11) were selected in the reservoir concurrent with physiochemical monitoring ongoing by the Tennessee Wildlife Resources Agency (TWRA). Samples were collected quarterly by Ponar Grabs; Hester-Dendy samplers; and rock filled, wire baskets. More than 100 species of macro-invertebrates have been collected from Kentucky Lake. Diversity (d) values of the fauna ranged from 1.9 at TRM 62 to 3.2 at TRM 110. A marine bilvalve species, *Mytilopsis leucophaeta* (family Dreissenidae), a possible nuisance species, has been found at site TRM 91, a barge fleeting area. The principle objective of the study was to provide a data base for TWRA to

evaluate long term trends.
Funding provided by Tennessee Technological University. Water Resources Center at Tennessee Tech, TWRA, and the Tennessee River Pulp and Paper Company.

108

PARKINSON, JONATHAN M. University of North Carolina at Chapel Hill-- Patch dynamics and the maintenance of species diversity on patchy ephemeral resources: Insects on stream leaf packs.

Many theoretical models emphasize the importance of the patchy, discontinuous distribution of resources in time and/or space for the maintenance of community species diversity. Patch dynamics coexistence models, including dispersal, disturbance, fugitive species, and aggregation models, all predict that regional coexistence of competitors or of predators and their prey can occur when the populations are divided into a number of subpopulations, each inhabiting only a fraction of the available resource patches. A field test of this generalized but fundamental prediction of increasing diversity with increasing patchiness manipulated stream leaf packs as a resource for benthic macroinvertebrates. In three different patchiness treatments, sixteen grams of Red Maple leaves were divided into one 16 g, four 4 g, or sixteen 1 g leaf packs and left on the stream bed for twelve days. Individual abundance of colonizing insects was greatest on the four-pack treatment, followed by the sixteen- and one-pack treatments, respectively. Species richness, Shannon diversity, and Brillouin diversity were all highest in the sixteen-pack treatment and lowest in the single large packs.

109

PAYNE, JAMES F.,¹ JOE M. KING,² and LUTHER KNIGHT.³ Memphis State University,¹ Murray State University,² and The University of Mississippi³-- Teaching the limnology laboratory-an introduction to the symposium.

Acid precipitation, stream surveys for environmental impact statements, toxic pollutants from point and nonpoint sources, and a heightened public awareness of our delicate aquatic resources accentuate the importance of a formal course in limnology in the biology curriculum. The limnology laboratory presents unique challenges and opportunities for the instructor because so many diverse subjects are available for exploration. Classical techniques of

planimetric measurement, oxygen determination and lake surveys are supplemented with exercises utilizing new technology, new approaches, and an increasing literature base to acquaint students with practical applications. Symposium presentations are of laboratory exercises used in limnology courses at several universities. These topics, which range from genetic studies of zooplankton to analysis of selective predation by fishes, were selected to represent most major areas of this subject. Copies of each exercise are distributed by the presenter.

110

WYNGAARD, GRACE A. and KEN M. ZEIDNER James Madison University- - Genetic variation in Daphnia as measured by gel electrophoresis.

Zooplankton are increasingly recognized as being important in addressing questions of evolutionary interest, as well as basic ecology. Refinements of certain genetic techniques now enable limnologists to more easily address, or approach in different ways, questions related to the life histories, ecology and genetics of zooplankton. Gel electrophoresis is a technique that separates protein molecules on the basis of their differences in electrical charge, and thereby reflects some of the variation in enzymatic genes. It can be used to either "mark" clones that differ in ecologically important traits or to detect genetic variation in natural populations. For example, we may compare the diversity of clones in different freshwater environments. Or we may describe the spatial or temporal distributions of clones, which relate to problems of patchy distributions or vertical migration behaviors. The technique of cellulose acetate gel electrophoresis enables the proteins of small zooplankters, such as a single *Daphnia*, to be separated in a process that requires only 15 minutes to complete. This represents a significant improvement over standard methods that require several or more hours to complete.

111

TWOMBLY, SARAN. University of Rhode Island--Zooplankton life table response experiments.

Rotifers, cladocerans and copepods are distinguished by markedly different life history patterns. These diverse patterns exert a major influence on population growth rates, patterns of distribution and abundance, species replacement and response to environmental perturbations. In this laboratory, life table response

experiments are used to demonstrate these characteristic demographic patterns, for either rotifers or cladocerans with short generation times. Individuals are raised in defined medium on cultured algae, at constant temperature (25° C) and photoperiod (16L:8D), and observed daily for number of eggs, number of newborn young and number of survivors. Analyses can incorporate experimental treatments such as 1) response to different food levels, 2) comparisons between species (or between a rotifer and a cladoceran), 3) effects of a toxicant. Resultant life table data are used to calculate r , the intrinsic population growth rate, and are further analyzed using age-classified matrix models. Particular emphasis is placed on analyzing the sensitivity of population growth rate to changes (treatments) in individual demographic parameters. The experiments run for 2 weeks; students work in groups to minimize individual work loads.

112

WHITE, DAVID S. Murray State University--"Bioturbation": an exercise in determining lake sediment turnover rates.

Lake bottom sediments are a repository for organic matter, nutrients and ions. While water circulation patterns and chemical reactions at the sediment water interface recycle many substances, sediment turnover (bioturbation) by benthic organisms substantially increases metabolic reactions, the depth of the redox potential and the eventual flux of substances back into the water column. This exercise is designed to demonstrate bioturbation by oligochaete worms in laboratory microcosms. Microcosms are prepared from sieved lake sediments, layered with phosphorescent beads, then a known number of oligochaetes (from the original sediment sample) are added. Sediment reworking rates are calculated by measuring the downward movement of the marker layer over time, usually a three week or longer period. Experimental manipulations include different oligochaete densities, temperature, dissolved oxygen concentration in the overlying water, and light. The depth of the redox potential can be determined visually. Chemistry measurements of the overlying water will give a rough estimate of flux rates. Phosphorescent beads are available commercially, and their position in the microcosms can be monitored with a mineral light or other suitable blacklight.

113

BROOKS, ARTHUR S. University of Wisconsin-Milwaukee--The essentials of water.

Limnologists and aquatic biologists often take for granted the medium in which they work, namely water. So much of basic limnology depends on a sound understanding of the physical properties of water that a lecture and a laboratory exercise on this subject are essential. Using only an aquarium, an air pump, a thermometer, some food coloring and some basic labware, it is possible to demonstrate how seasonal temperature changes influence the density and gas solubility of water. An entire seasonal cycle may be illustrated within a single 3 to 4 hour lab period. Lake stratification can be demonstrated as students actually feel a thermocline, oxygen can be measured in waters of different temperatures, internal waves demonstrated and heat budgets calculated. In the end, students will have a much better "feel" for phenomena they may observe on field trips and/or while conducting research projects.

114

STEVENSON, R. JAN. University of Louisville--Channel morphology and habitat diversity in streams.

In this exercise students construct laboratory streams to demonstrate the role of currents and physical structures in the formation of channel morphology and habitat in stream ecosystems. First in the laboratory, tubing and a pump are used to pump water from an aquarium to the upper end of a vinyl gutter, from which water can flow back to the aquarium. After an introduction to channel morphology, students collect twigs to construct debris dams and a diversity of smaller substrata that can wash downstream, sort naturally, and form the channel bed. During subsequent lectures and field trips on organism groups, students continue collections to build their laboratory streams. With appropriate lighting, productive and diverse streams can be built. Experimental extensions of this exercise can be devised to test hypotheses of abiotic and biotic regulation of stream ecosystem structure and function.

115

GROEGER, ALAN W. Southwest Texas State University--Use of in vivo chlorophyll fluorescence to characterize phytoplankton.

The chlorophyll fluorescence of intact cells can be used to characterize certain properties of an algal population or phytoplankton community, including changes in biomass, photosynthetic capabilities, and general physiological health. Here I present three simple experiments that can be carried out in any lab with access to a fluorometer. In the first

experiment we expose algal cultures or phytoplankton to very bright light, and then measure both their photoinhibitory response and subsequent recovery after varying periods of darkness. In a second experiment we measure the decline in photosynthetic capacity in a nitrogen-limited culture, and its recovery upon addition of ammonia. In both of these experiments DCMU (an herbicide which blocks electron transfer between the two photosystems) is used, and the ratio between poisoned and unpoisoned fluorescence provides a sensitive indication of degree of stress. The third experiment utilizes the fluorometer as a rapid and nondestructive method to track biomass response in a standard nutrient-limitation assay. This exercise can provide a dramatic example of the potential impact of cultural eutrophication on surface water resources.

116

WILLIAMSON, CRAIG E. Lehigh University--Selective predation by fish.

Size selective predation by fish is one of the dominant forces that contributes to the structuring of zooplankton communities in lakes. This laboratory exercise is designed to teach the basic concepts of selective predation, including the use of selectivity indices, and tests of significance using the chi-square statistic. Fish that can be obtained from a supply house or local pond are fed a mixture of zooplankton or other discrete food particles, sacrificed, and the number of each prey species in the gut and remaining in the experimental container are counted and used to assess selective feeding.

117

WILLIAMSON, PAULA S. Southwest Texas State University--Structural adaptations of aquatic macrophytes.

Aquatic macrophyte may be rooted to the substrate or free floating; leaves may be emergent, floating or submerged. Aquatics typically possess extensive aerenchyma and air canals which facilitate movement of gases. This feature is essential in a habitat with a limited supply of oxygen. Generally, the vascular system is qualitatively and quantitatively reduced. Collenchyma and sclerenchyma may also be reduced or absent, a feature likely related to the support provided by water. Some aquatic species produce both types of leaves on the same plant, enabling comparisons within a single taxon. Floating leaves tend to be leathery with entire margins; the submerged leaves thinner and frequently dissected. Floating

leaves typically possess a thick cuticle covering the upper surface, stomata, palisade and spongy parenchyma, and collenchyma or sclerenchyma associated with the veins. Submerged leaves usually lack stomata, and possess a thin cuticle, undifferentiated mesophyll, less lignification of tracheary elements, and reduced supportive tissue. Structural differences relate to different environmental conditions present at and beneath the water surface.

118

PAYNE, JAMES F. Memphis State University--Macroinvertebrate sampling with artificial substrates.

Artificial substrates reduce variation associated with many other modes of sampling and permit collection of data from locations that cannot be sampled effectively by other means. Numerous materials of varying shapes, sizes, and composition can be used, and the final design tests the ingenuity of the investigator. In this exercise coated styrofoam spheres of uniform diameter are placed within weighted wire baskets and employed to study the colonization of macroinvertebrates from different habitats. Students construct the sampling devices, design the experiment, collect, and record data. Two samplers are employed at two locations, one lentic and one lotic. The influence of depth, current, time of exposure and substrate type are analyzed. Species diversity is computed for each sample using the Shannon-Wiener Index, and the theoretical density of individuals per square meter is calculated. Variations on this sampling design are described including ways of enhancing and supplementing the experiments with additional physical and chemical determinations.

119

RODGERS, JR., JOHN H. and NICHOLAS G. AUMEN. The University of Mississippi --Periphyton production in lotic and lentic systems.

Periphyton production may contribute significantly both quantitatively and qualitatively to aquatic production in both lotic and lentic systems. Techniques for measuring primary production or productivity of periphyton in aquatic systems often involve elaborate equipment or use of ¹⁴C-labeled inorganic carbon. A laboratory exercise to estimate periphyton production using an artificial substrate (a "clay pot" technique or nutrient diffusing substrate) is proposed. Sequential monitoring of total and autotrophic biomass

accumulation on an artificial substrate allows students to distinguish the colonization, growth and sloughing phases inherent in this approach. Utilization of a simple protein determination (such as Coomassie blue) in this laboratory exercise also helps to emphasize important qualitative aspects of periphyton production.

120

WILLIAMSON, CRAIG E. Lehigh University--Fluid dynamics and plankton.

Aquatic organisms live in a medium that is much more dense and viscous than we are used to. Small glass beads of various sizes are dropped through cylinders containing solutions that vary in their density and viscosity. Terminal sinking velocities are measured, and also estimated with Stoke's Law. These data are used to examine the role of fluid properties, body size, and Reynolds pressure drag on planktonic organisms. The final exercise is a contest in which students use modelling clay to try to make an organism that falls the slowest.

121

HARRIS, JOHN W.,¹ S. K. BALLAL,¹ and R. N. JOSHI.^{1,2} Tennessee Technological University¹ and Marathwada University (India)²--Genetic variants of indole-acetaldehyde dehydrogenase.

The enzyme indoleacetaldehyde dehydrogenase (IAALDH) catalyzes the conversion of indole-3-acetaldehyde into indole-3-acetic acid (IAA), the final step in the biochemical pathway leading to the production of this key plant hormone. A determination of the genetic control of IAALDH could have various physiological and agricultural applications. Several germplasm lines of soybean (Glycine max (L.) Merr.) and corn (Zea mays L.) were screened for electrophoretic variants of IAALDH. Observed variants will be described and their implications regarding the genetic control of this enzyme will be discussed. Identification of genetic variants should make it possible to characterize the gene(s) which specify this enzyme.

122

S.K.BALLAL and SHARON TERMON. Tennessee Technological University--Effect of an anti-auxin (TIBA) on protein profiles of Jojoba.

Jojoba (Simmondsia chinensis) is an xerophytic shrub that is indigenous to the Sonoran Desert of Southwest America and Mexico. Its' economic significance is considerable because of the high quality of the oil (liquid

wax) contained in the seed. In recent years, increased attention has been focused on the protein content of Jojoba seeds. The seeds contain 30-35% protein, which is usable as animal feed. It has been established in our laboratory that the seed proteins are classifiable based on their molecular weights, and as the seed germinates the profile changes which can be resolved by SDS-PAGE. The enzyme indoleacetaldehyde dehydrogenase (IAALDH) plays an important role in the synthesis of indoleacetic acid (IAA), which controls the differentiation of the plumule in the developmental process of germination. We discovered that the anti-auxin triiodobenzoic acid (TIBA) interferes with the production IAA by inhibiting IAALDH at a concentration of 2mM. The levels of inhibition differ between germinating seeds, mature apical meristems, and leaves. This research is supported by a grant from the National Science Foundation DCB-8611889.

123

MANGURIAN, L.P., R.J. WALSH, and B.I. POSNER, Anatomy Department, The George Washington University Medical Center, Washington, D.C., Royal Victoria Hospital Dept. of Medicine--Prolactin transport increased capacity by the choroid plexus of hyperprolactinemic rats.

The choroid plexus (CP) contains specific prolactin receptors which are involved in the transport of prolactin from blood to (CSF). An in vivo autoradiographic technique and SDS gel electrophoresis were used to assess the ability of the CP to uptake and transport ¹²⁵I-prolactin during hyperprolactinemia. Sprague-Dawley rats were made chronically hyperprolactinemic by treatment with haloperidol (2.5 mg/kg b.w./day for three consecutive days). Control rats received only the haloperidol vehicle. In vivo administration of ¹²⁵I-prolactin (7.3×10^8 dpm/animal) was carried out for hyperprolactinemic and control rats. CSF samples were obtained 10 minutes later, followed by vascular perfusion. Paraffin sections (7 μ thick) were coated with NTB-2 emulsion. Quantitative analysis of ¹²⁵I-prolactin accumulation in the CP and SDS gel autoradiographs of CSF samples was performed with a microcomputer-based video grain counting program. A significant increase in the accumulation of radioactivity was observed in the CP of hyperprolactinemic animals relative to the controls which correlated with a significant increase in the amount of prolactin transported across the CP. The increase in ¹²⁵I-prolactin binding in the CP and its concomitant transport to the CSF indicated an increased transport capacity by the choroid plexus of hyperprolactinemic rats.

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124

KIMBROUGH, T. DANIEL, RICHARD R. MILLS, and PARAG KANITKAR, Virginia Commonwealth University--The Effects of Serotonin Antagonism on Fluid Movement in the Crop of the American Cockroach.

Serotonin stimulates fluid secretion in the salivary glands of insects. In some species, the secretory response is mediated by cyclic AMP and involves an increase in the intracellular potassium concentration. Similar activity has been postulated to occur in other parts of the digestive tract. A dual chamber apparatus with the crop epithelia excised from the American cockroach was used to determine that under physiological conditions, serotonin (5-hydroxytryptamine; 5-HT) induced water secretion into the lumen side at a maximum velocity of 0.273 $\mu\text{l}/\text{mm}/\text{min}$. Three antagonists to serotonin's binding sites (receptors) designated respectively as 5-HT₁, 5-HT₂, and 5-HT₃ antagonists were used in an effort to determine the type of receptor present on the basal side membrane of the crop epithelia. The S₁ antagonist, propanolol eliminated 90% of the serotonin-induced transport of water into the lumen. Ketanserin, a highly selective 5-HT₂ antagonist, similarly blocked nearly 50% of the fluid transport. MDL-72222, a 5-HT₃ antagonist, when solubilized with DMSO, blocked nearly 80% of the serotonin-induced water movement. Since the effects of DMSO on water transport in crop epithelia are unknown, it has been suggested that 5-HT₁ systems operating in association with cAMP (and possibly with the inositol triphosphate system) may be more important in regulating water secretion than the systems in which 5-HT₂ and 5-HT₃ antagonists were tested.

125

LA GRENADE, CECILE,¹ and GEORGE BEAN,² University of Maryland--The involvement of Fusarium moniliforme in equine leucoencephalomalacia in Maryland horses.

Equine leucoencephalomalacia (ELEM) is a fatal disorder of horses reportedly caused by consuming corn contaminated with *Fusarium moniliforme*. Two isolates of *F. moniliforme* were obtained from the feed ration (35% corn) of a horse that died of ELEM. The isolates were inoculated onto corn culture medium and a liquid culture medium (MYRO) and incubated at 27 C +2. After 21 days the cultures were extracted with aqueous and organic solvents and the extracts examined for *Fusarium* mycotoxins using the brine shrimp assay and TLC. The brine shrimp assay was negative but TLC of the liquid culture medium indicated the presence of Fusarin C; zearalenone and T-2 toxin could not be detected. Cytotoxicity tests were performed on the extracts using Hep-2 and BHK cells. Both the organic and aqueous extracts contained fractions which were toxic to Hep-2 and BHK cells. Whereas Fumonisin was detected in the aqueous fraction, the identity of the toxic organic extract is unknown and under investigation.

126

VARNEY, D.R.¹, JONES, D.D.¹, VARNEY, L. A.¹, SIEGEL, M.R.², ZAVOS, P.M.² Eastern Kentucky University¹ and University of Kentucky.² --Reproductive performance of mice fed diets containing endophyte-infected

perennial ryegrass seed via continuous breeding.

This study was done to determine the effect of diets containing endophyte (*Acremonium lolii*)-infected perennial ryegrass (*Lolium perenne*) seed on the reproductive performance of mice (*Mus musculus*) using a continuous breeding protocol for three generations. After 14 d preconditioning at 24°C, a 12/12h light/dark cycle and a diet of ad libitum Purina rodent chow and water, 72 CD-1 mice were paired (male and female) and were random, assigned to a diet containing 50% rodent chow and A) 50% endophyte-infected, perennial ryegrass seed, B) 25% infected seed and 25% non-infected seed, or C) 50% non-infected seed. The mice were allowed to cohabit through three parturition. Litter parameters assessed included: dam weight at parturition, total litter weight, number of pups per litter and mean weight per pup per litter. Adult mice were sacrificed after the third parturition. Female parameters assessed were mean ovary weight and mean uterus weight. Male parameters assessed were mean testis weight and mean epididymus weight. Diets A and B mice had lower dam weights (35.16 \pm 0.69g and 34.78 \pm 0.55g, respectively); lower litter weights (14.40 \pm 0.24g and 15.54 \pm 0.62g, respectively); and fewer pups per litter (10.84 \pm 0.25 and 10.86 \pm 0.45, respectively) than Diet C mice (38.28 \pm 0.40g, 18.92 \pm 0.65g, 12.78 \pm 0.46 pups, respectively). The mean weight per pupper litter for Diet A pairs (1.33 \pm 0.02g) was lower ($P < 0.05$) than for the Diet B (1.44 \pm 0.02g) and Diet C (1.40 \pm 0.02g) pairs. There were no significant differences among the dietary treatments in ovary weight, uterus weight or testis weight. The epididymus weight of Diet A males (0.077 \pm 0.002g) was lower ($P < 0.05$) than Diet B and C males (0.096 \pm 0.004 and 0.098 \pm 0.005g, respectively). These results suggest that animals feeding endophyte-infected perennial ryegrass may have reduced reproductive potential.

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TORCHON, THERESE M.,¹ MORTON, DAVID,¹ and WAYNE W. CARMICHAEL.² Frostburg State University¹ and Wright State University² --Effect of Microcystin-LR on Viability, Morphology, Adherence, and Phagocytosis of Salt-damaged Erythrocytes in Rat Exudate Peritoneal Macrophages.

The potent hepatotoxin microcystin-LR is a cyclic heptapeptide containing L-leucine and L-arginine (molecular weight, 994 daltons) produced by the freshwater cyanobacterium, *Microcystis aeruginosa*. The LD₅₀ for the purified extract is 50-100 $\mu\text{g}/\text{Kg}$ body weight, i.p. mouse. Extensive studies of hepatocytes have revealed profound morphological and physiological alterations at very low toxin concentrations and within minutes of exposure to toxin. In the present study, the effects of a relatively high concentration of toxin (1000 μM , 1-12 hr. incubation) on rat exudate

peritoneal macrophages were investigated. Statistical comparisons were made using paired t-tests at the 0.05 probability level. The toxicity of methanol was tested since the toxin was dissolved in a mixture of 1:9 methanol/HBSS. The concentration of solvent used did not significantly decrease viability or increase blebbing of cells. Although toxin did not significantly decrease the viability of cells, it did increase blebbing. Also, toxin decreased the number of cells adhering to glass and decreased the phagocytic index. Results indicate that both the morphology and basic functions of macrophages are effected by microcystin-LR, at least at relatively high levels of exposure.

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ORVOS, DAVID R. and JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University--Important factors in assessing environmental risk from genetically-engineered microorganisms.

Several factors were examined to determine their potential usefulness in determining environmental risk from the release of genetically-engineered *Erwinia carotovora*. Parameters studied included survival, gene transfer, intraspecific competition, effects upon selected enzymes and nutrients. Survival of the engineered bacterium, gene transfer, and intraspecific competition appear to be important in determining potential environmental risk. Survival assessment of *E. carotovora* demonstrated that the organism always decreased in concentration, even when released into radiation-sterilized soil. The engineered strain was no more competitive than its wildtype parent, and did not appear to exchange genetic material with indigenous bacteria. Other measured factors were not as useful, primarily because of the functional redundancy of bacteria. The environmental risk from this strain of engineered *E. carotovora* appears minimal.

129

MOHAMOOD, ABDIAZIZ S. and BRODERICK E. ERIBO. Howard University--Characterization of Meat-borne Listeria spp.

The bacterial genus *Listeria* contains several spp. with wide range of distribution. Recent outbreaks of listeriosis due to consumption of dairy products contaminated with *Listeria monocytogenes*, has attracted attention to the clinical significance of this organism in various foods. In order to properly understand the ecology of *Listeria* spp in meat, 36 ground beef samples were plated on Trypticase soy agar-yeast extract and two *Listeria* selective media, Lithium chloride-phenylethanol-moxalactan (LFM) and Martin's *Listeria* Agar (MLA) following enrichment. Of 778 bacterial isolates randomly selected from these

media, only 55 were *Listeria* spp. while the others were mainly *Enterococcus* spp. The listeriae were identified to 5 species: *L. monocytogenes*, 22; *L. grayi*, 6; *L. murrayi*, 5; *L. seeligeri*, 15; *L. welshimeri*, 2; and 5 could not be placed. Enzymatic characterization by API-ZYM revealed the presence of the following enzymes in the *Listeria* isolates: Esterase, Esterase Lipase, Acid phosphatase, Phosphohydrolase, Lipase and Alkaline phosphatase. All *L. monocytogenes* isolated were hemolytic by the CAMP test and hybridized with specific *Listeriolysin O* gene probe.

130

MASTERS, BRIAN S. Towson State University--Structure and function of mitochondrial RNA polymerases.

The gene coding for yeast mitochondrial RNA polymerase has been shown by DNA sequence analysis to be related to the DNA-dependent RNA polymerases of T3/T7 bacteriophages. This similarity is somewhat surprising. The nuclear and chloroplast RNA polymerases studied in a number of species, by contrast, show no relationship to the phage polymerases, but are related to the RNA polymerases found in *E. coli*. This peculiarity demonstrated of yeast mitochondrial RNA polymerases has been found by immunological analysis to apply to other species (specifically, *H. sapiens* and *Z. mays*) as well. These observations have implications relating to the evolution of mitochondria and to the structure-function relationship of mitochondrial RNA polymerases.

131

REECE, JERRY F. and MARY U. CONNELL. Appalachian State University--Comparative Plasmid Analysis of Two Varieties of Bacillus thuringiensis.

Two varieties of the endospore producing bacterium *Bacillus thuringiensis* were compared for plasmid content. *Bacillus thuringiensis* v. *krustaki* has been reported to possess from nine to eleven different sized plasmids and served as our reference organism. *Bacillus thuringiensis* v. *kenyae* was analyzed for plasmid content. Both these varieties produce a protein crystal during endospore formation that is toxic to certain insect larvae. The gene encoding this protein crystal, the delta-endotoxin, has been localized on a 75-kb plasmid in *Bacillus thuringiensis* v. *krustaki* HD73 as reported by Whiteley et. al. Plasmid analysis of *Bacillus thuringiensis* v. *kenyae* indicates the presence of eight plasmids ranging in size from 7.2-kb to 110+-kb. Three of the plasmids are of a size large enough to harbor

the protoxin gene. The delta-endo-toxin gene was isolated from the recombinant plasmid pJWK20 (ATCC 31997) constructed by Kronstad and Whiteley and labeled with photobiotin. Results of hybridization of this biotinylated probe to Southern blots of plasmid DNA from *Bacillus thuringiensis* v. *kenyae* will be reported.

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HUBBARD, MARK, SRIYANI RAJAPAKSE, ALBERT ABBOTT, JOHN KELLEY, and ROBERT BALLARD. Clemson University--Differentiation of *Rosa* cultivars by restriction fragment length polymorphisms (RFLPs).

The objective of our research is to isolate and clone restriction fragment length polymorphism (RFLP) probes that can be used as genetic markers in cultivar identification, patent protection, and genetic map construction. Random genomic clones were generated by shotgun cloning *Bam* HI, *Hind* III, and *Eco* RI fragments of DNA isolated from the rose cultivar Confection. Individual clones from the DNA library were screened for polymorphism by Southern hybridization methods. Those displaying polymorphisms are being used to obtain an RFLP profile, i.e., a DNA fingerprint, for each cultivar.

133

ELDREDGE, LINDA M., ROBERT E. BALLARD, WM. VANCE BAIRD, and ALBERT G. ABBOTT. Clemson University--Saturated RFLP linkage map construction in *Prunus persica*.

Random genomic clones isolated from the cultivars Blake and Bicentennial are being utilized to construct a saturated RFLP genetic linkage map of peaches. To generate these clones, genomic peach DNA was digested with the restriction enzyme *Eco* RI and the resulting fragments were shotgun cloned into a pUC8 plasmid of the *E. coli* bacterial strain JM83. Genomic DNA from parents and F1 offspring of peach x peach, peach x almond, and peach x nectarine crosses was isolated, digested with *Hind* III, and run on an agarose gel. Using Southern hybridization methods, the DNA was transferred to a membrane and clones were screened for polymorphism. We have detected polymorphisms for single copy and interspersed repeated sequences among peach cultivars and for single copy sequences in peach x peach, peach x almond, and peach x nectarine hybrids. We believe that the application of RFLP mapping technology will provide a genetic resource for cultivar improvement in peaches, particularly for introgression of advantageous traits from related species.

134

Powers, Sean P., Matthew Meunier, Donald Hauber, David A. White. Loyola University, New Orleans, La. 70118--Correspondence of genetic variation with infrared reflectance patterns in *Phragmites australis* in the Mississippi River Delta

P. australis is the dominant vegetation type in brackish and freshwater marshes in the Mississippi River delta region. Examination

of aerial infrared photographs of colonies of *P. australis* in a subdelta of the Mississippi River delta reveal a distinct circular, patchy pattern with a predominant background color is noticed. Through the method of isozyme electrophoresis, this variation has been determined to correspond to genetic differences between these populations. These results are consistent with earlier studies that demonstrated morphological differences between infrared types.

135

ST. JOHN, R. TODD and FRANK J. BULOW. Tennessee Technological University--Population density and spawning movements of sauger (*Stizostedion canadense*) in the Fort Loudoun tailwaters, Tennessee.

Recent declines in sauger density have occurred in the upper Tennessee River system. The objective of this study was to assess the status of the Fort Loudoun tailwater sauger population. A total of 872 sauger were sampled with gill nets between January 11 and May 1, 1989, in a 20 KM study area immediately downstream of Fort Loudoun Dam. Floy reward tags were attached to 639 sauger, and radio transmitters were attached to 10 individuals. The sauger population was estimated at 2579 fish with 95% confidence limits for this Schnabel estimation ranging from 2213 to 3090 sauger. Net and angler returns, as well as biotelemetry results, were used to determine sauger movements and locate spawning sites. Sauger concentrated in the immediate vicinity of Fort Loudoun Dam from January through mid-March. They then moved 7.6 KM downstream to Browder Shoals, an apparent spawning site. Sauger density at this site remained high from mid-March through mid-April, peaking March 29 through April 6. The sauger dispersed from this spawning site in late April, presumably completing their spawn. Net efforts at other possible spawning sites throughout the study area suggested that Browder Shoals was the only major spawning site.

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MEDLIN, E. SCOTT and FRANK J. BULOW. Tennessee Technological University--Sauger spawning habitat analysis in the Fort Loudoun tailwaters, Tennessee.

Sauger (*Stizostedion canadense*) spawning habitat was evaluated in a 20 KM area downstream from Fort Loudoun Dam (Watts Bar Reservoir) on the upper Tennessee River. Location of the spawning area was accomplished through recapture of tagged individuals and by biotelemetry. Spawning habitat was described in terms of: pool and shoal depths, substrate particle size, and current velocities near the bottom. A towed epibenthic egg-sampling sled was used to collect eggs

from sauger and other fish species. Percent gravid sauger was correlated with water temperature and average daily discharge from Fort Loudoun Dam. Radio-tagged sauger were also monitored in the spawning area to determine disturbance from tow vessel passages. Gonadosomatic indices and estimates of fecundity were obtained from fish captured during the spawning run. Results of this study will be useful in the protection of the limited sauger spawning habitat.

137

BROWN, KEVEN A. and FRANK J. BULOW. Tennessee Technological University--Life history aspects of spawning-run sauger in the Fort Loudoun tailwaters, Tennessee.

The age structure, year-class strengths, and growth rates of the 1989 spawning run population of sauger (*Stizostedion canadense*) in the Fort Loudoun tailwaters (Watts Barr Reservoir, Tennessee) were determined. Scale samples from 431 and otoliths from 144 sauger were analyzed. Sex ratio, length-frequency, coefficients of condition, relative weights, and stomach contents were also determined. Data were analyzed to characterize this spawning population and evaluate factors that may relate to the recent decline in sauger population density in this and other Tennessee River reservoir populations.

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Robert U. Fischer, Christine DeFonzio, John M. Aho, and Justin D. Congdon. Savannah River Ecology Laboratory, University of Georgia. Lipid and Reproductive Cycles in Bluegill, *Lepomis macrochirus*, in Nuclear Reactor Cooling Reservoirs.

Lipid and reproductive cycles have been examined in bluegills, *Lepomis macrochirus*, to determine how resource harvesting patterns are modified by environmental perturbation. Comparative material were collected from two locations during 1986 representing hot and normothermic water temperatures, with the reproductive condition of each adult recorded and lipids extracted from fat bodies, livers, gonads, and carcass using petroleum ether and a Soxhlet apparatus. Seasonally, total lipid concentrations varied regardless of sample site, sex, or age class. Of the four sites of lipid compartmentalization, only the liver did not exhibit temporal variation. Short-term responses for lipid cycling were dramatic in the heated effluent location, where fish are usually confined to small coolwater refuge areas during periods of reactor operation. During one reactor cycle (hot\ambient\hot), total lipid concentrations did not

change appreciably during the first 14 days of the shutdown, and then increased at a rate ca 3% of body weight per week for both adult and juvenile fish. The pattern of lipid deposition parallels the establishment of a forage base within the main lake and a lag in its development.

139

NELSON, DIANE R. East Tennessee State University--Aggression in the giant Maori wrasse on the Great Barrier Reef.

The giant Maori wrasse (*Cheilinus undulatus* Ruppell 1835), in the family Labridae and by far the largest wrasse, inhabits coral reefs off the coast of Queensland, Northern Territory, and Western Australia. Males are distinguished by a pronounced hump on the forehead and reach an adult size of 2.3 m. In May 1989 on an early morning scuba dive on Norman Reef on the Great Barrier Reef, the author (a small adult female) was attacked without provocation by a male giant Maori wrasse approximately 1.5 m in length. The fish was photographed with Nikonos V underwater cameras with strobes by the author and by a male buddy diver before and during the attack. Another male buddy diver videoed portions of the attack with a Nikon 8mm videocamera in an underwater housing with an Ikelite 100W light. The author's camera strobe and hand were bitten before the divers could return to the boat. This aggressive behavior, documented apparently for the first time and investigated by the Great Barrier Reef Marine Park Authority, may be correlated with the tour boats' dumping of food at dive sites to attract fish. The Marine Park Authority is now revising their fish feeding policies on the Great Barrier Reef.

140

HICKS, DERRICK T., and R. D. ESTES. Tennessee Technological University, Cooperative Fisheries Research Unit--Distribution, age, growth, food habits, habitat, reproduction, and survival rate of the cherry darter, *Etheostoma etnieri*.

The distribution and life history of *E. etnieri* were investigated from March 1988 to July 1989 in the Caney Fork River Drainage system of central Tennessee. Distribution is limited to Grundy, Van Buren, White, Warren, and Putnam Counties on the Eastern Highland Rim of the Cumberland Plateau. The species was observed in 8 unrecorded streams and in 9 of the 11 streams from which it was described. The cherry darter inhabits riffles, runs, and margins of streams with cobble and rubble bottom substrates, fairly rapid flows, and average depths of 17 cm. Analysis of scales and length-frequencies of 163 specimens indicated longevity was 4 years. Relatively low survival rates were determined for both sexes at ages III and IV, and higher survival rates for younger age groups. Most rapid growth for both sexes occurs in the first year of life when more than half the total

length is attained. Thereafter, males grow at a slightly faster rate than females. Maximum standard length was 54.4 mm for males and 48.5 mm for females. The overall sex ratio (M:F) was 1:1.7. *E. etnieri* is reproductively promiscuous. Both sexes develop gonads in their first autumn of life, and spawning occurs from late March to July. Fecundity averaged 105 ova/female. Aquatic insect larvae were the major food items, and chironomids predominated numerically (70%) year-round. Prevention of habitat degradation, and implementing population and habitat monitoring programs in behalf of this unique percid will help to insure its continued existence.

141

SMITH, GERALD L.,¹ WALTER S. FLORY,² and JOHN B. NELSON,³ High Point College, Wake Forest University,² and South Carolina Wildlife and Marine Resources³--Cytotaxonomic studies on *Hymenocallis coronaria* (Le Conte) Kunth in South Carolina piedmont river systems.

The synonymization of *Hymenocallis coronaria* in several treatments has led to uncertainty about its taxonomic status. However, studies on *Hymenocallis* populations, identified as *H. coronaria* in South Carolina piedmont river systems during early summer of 1989 have shown this species to be highly distinctive morphologically and ecologically. It is the only southeastern *H.* species which has been observed to inhabit the rocky shoals and margins of piedmont river systems above and near the Fall Line. It may also be distinguished from other *Hymenocallis* species, treated in Traub's Carolinian alliance, on the basis of its cytology. Its chromosome number of $2n=44$ that was first determined by T.F. Schmidhauser at the Blandy Experimental Farm and its distinctive karyology have been confirmed from bulb samples taken from the various sites.

142

STUCKY, JON M. and Milo Pyne. North Carolina State University--A new species of *Liatris* from the Carolina sandhills.

Liatris regimontis (Small) K. Sch. has been regarded as a species widely distributed in the western Piedmont and adjacent provinces of Virginia, North Carolina, South Carolina, and Georgia. Principal components analysis (PCA) show that type specimens of this species are morphologically very similar to the holotype of *L. graminifolia* var. *smallii* (Britt.) Fern. & Griseb. and that the types of *L. regimontis* fall within the range of variability described by a sample of the latter taxon. It is concluded that *L. graminifolia* var. *smallii* and the types of *L. regimontis* represent the same taxon. PCA and cluster analysis show that specimens from the fall-line sandhills of the Carolinas previously determined by others as *L. regimontis* are morphologically discontinuous with material from other portions of the species range, including the type specimens,

and with collections of *L. graminifolia* var. *smallii*. This distinct sandhills plant is described as a new species, *L. cokeri* Pyne & Stucky. In a geographical zone in the Coastal Plain of the Carolinas, where the ranges of *L. cokeri* and *L. graminifolia* are contiguous, specimens intermediate between the two species have been collected.

143

POSTON, MURIEL and JOAN NOWICKE. Howard University and Smithsonian Institution--Pollen Ultrastructure of Loasoideae (Loasaceae).

The Loasaceae are a phylogenetically cohesive family of 280 species/14 genera/3 subfamilies, characterized by an inferior ovary, 3-5 parietal placentae, 4-5 merous flowers, numerous stamens and staminodia. Only two genera, *Kissenia* and *Plakothira* are Old World. The pollen of 25 species representing all genera in the Loasoideae, *Klaprothia*, *Plakothira*, *Kissenia*, *Blumenbachia*, *Caiophora*, *Loasa*, and *Scyphanthus*, were examined in IM and SEM, and a selected group in TEM. All species are 3-colporate with a striate-reticulate tectum. In SEM the distinction of the lirae, as well as the degree to which they are interwoven, does vary; in many taxa the tectum becomes psilate along the colpi. In TEM all species have stratified exines: foot layer, columellae, and tectum, with an endexine prominent beneath the apertures; the endoapertures are well defined. Thus pollen data supports the present concept of Loasoideae. In *Kissenia*, the frequently synocate apertures and less distinct lirae would be expected given the geographic isolation in SW Africa. Furthermore, preliminary data on Mentzeliodeae indicate a close relationship to Loasoideae. However, Gronovioideae is problematic since more than one pollen type is represented, *Petalonyx* has striate tecta similar to Loasoideae, while *Gronovia* and *Cevallia* have psilate and sparsely spinulose tecta.

144

CRISLIP, COLLEEN D., ALBERT G. ABBOTT and ROBERT E. BALLARD. Clemson University--Chloroplast DNA RFLPs in kiwifruit (*Actinidia*).

Chloroplast DNA (cpDNA) from five commonly cultivated species of *Actinidia* is compared. *Actinidia deliciosa*, *A. arguta*, *A. melanandra*, *A. polygama*, and *A. kolimikta* can be distinguished by differences in restriction fragment patterns in cpDNA. CpDNA was isolated from the leaves of these five taxa, then digested with restriction endonucleases. Agarose-gel electrophoresis revealed different fragment patterns for all five species. These RFLPs were then more closely examined by transferring the fragments from the agarose gel to a filter by Southern blotting, then hybridizing the filter with cloned fragments of *A. deliciosa* cpDNA cut with *EcoRI*. The cpDNA restriction fragment patterns of *A. arguta* and *A. melanandra* exhibited the least amount of variation, with very few polymorphisms, while that of *A. polygama* was the most dissimilar from those of the other species. Our results are compared to previous flavonoid studies for these species.

145

JONES, RONALD L. Eastern Kentucky University--The taxonomy and distribution of *Aster pratensis* Raf.

Aster pratensis Raf., for many years known as *A. phyllolepis* T. & G., is a close relative of *A. sericeus* Vent. In recent treatments of *Aster* in the U.S., it has been classified as a variety or subspecies of *A. sericeus*. The taxon differs from typical *A. sericeus* in its larger heads and wider phyllaries that are strongly ciliate rather than sericeous. Field, herbarium, and laboratory studies indicate that the two taxa should be considered as distinct species--they can be consistently distinguished by head features, and these characters are probably correlated with differences in ploidy levels. Both species occur in prairies and similar habitats of eastern U.S., but there is little overlap in ranges. *A. sericeus* occurs from central U.S. to southern Canada; reports from the southeastern states are based on collections of *A. pratensis*. This larger-headed taxon is frequent in eastern Texas and western Louisiana, but rare in other southern states, where it has been documented in only 13 counties. These outlying populations occur in Arkansas, Kentucky, Tennessee, Alabama, Georgia, and Florida, and are usually associated with prairie, glade, or barren types of habitats. *A. pratensis* should be considered as an endangered species in these six states.

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GANDHI, KANCHEEPURAM N. AND FRED E. SMEINS. Texas A&M University--Micromorphology of the *Schizachyrium scoparium* complex.

As part of a biosystematic study on the *Schizachyrium scoparium* complex, anatomy of leaf and rhizome, and leaf epidermal features were investigated. Leaf anatomy: 1) Midrib region was the major source of variation; keel was conspicuous in var. *littorale*; colorless parenchyma cells were less pronounced in var. *divergens*. 2) In lamina region, four orders of vascular bundles were recognized. 3) Sclerenchyma girdles were confined to vascular bundle regions. 4) Vascular bundles tended to be angular in outline and exhibited Kranz anatomy and belonged to XyMS type; chloroplasts in the bundle sheath cells were peripheral. 5) Bulliform cells were mostly found on the abaxial side. Epidermal study: 1) Abaxial surface appeared structurally highly diversified than the adaxial surface. 2) Stomata were abundant on the abaxial surface, and few and confined to margins on the adaxial surface. 3) In the CZ, silica cells were more common than cork cells. 4) The ISC were papillate in var. *neomexicanum*. 5) Long macrohairs with cushion cells were seen in var. *divergens*; prickles were uncommon in var. *littorale*.

Rhizome anatomy: In var. *littorale*, the underground stem showed 6 to 8-layered cortex and 1-layered endodermis outer to sclerenchymatous pericycle.

147

PYNE, MILO and JON M. STUCKY. North Carolina State University--Lectotypification of *Laciniaria carinata* Small (= *Liatris carinata* (Small) Coker (Asteraceae)).

No type specimen was designated with the 1903 publication of *Laciniaria carinata* Small (= *Liatris carinata* (Small) Coker). The lectotypification of this name became necessary in order to evaluate its suitability of application to the sandhills blazing-star, which has passed in recent treatments of the genus as part of *Liatris regimontis* (Small) K. Schumann. Of four specimens obtained from NY which were annotated by Small as *La. carinata*, the one which best fits Small's initial 1903 description is a collection which is actually compatible with *Liatris secunda* Elliott (= *Laciniaria secunda* (Elliott) Small). This choice of a lectotype is made in accordance with the principle that the lectotype chosen should be the specimen which is most compatible with the author's original description. This choice makes *Liatris carinata* (Small) Coker a synonym for *Liatris secunda* Elliott, and necessitates the naming and description of the sandhills blazing-star as a species novum.

148

FAIREY, JOHN E., III. Clemson University--Typification in the genus *Scleria* (Cyperaceae).

Visits to major European herbaria in May 1989 resulted in the clarification of a number of the typification and nomenclatural problems that exist in the genus *Scleria*. Most of Michaux's types were located at P including *S. ciliata* var. *ciliata*, *S. oligantha*, and *S. triglomerata*. Unfortunately his *S. reticularis* was not found. At P is an isotype for *S. wrightiana* Boeck. (Wright 3805). The Lc Dru type for *S. distans* Poir. (= *S. nutans* Willd. ex Kunth, *Humboldt s. n.* B-W! and *S. interrupta* Michx. P!) is also at P. *S. anceps* Liebm. (Liebmann 14534) and *S. mexicana* (Liebm.) Boeck. (Liebmann 14521) are at C. Willdenow's types are in good order at B-W including *S. bracteata* Cav. (n. 17339), *S. pauciflora* Muhl. ex Willd. var. *pauciflora* (n. 17333, duplicate at PH!), and *S. verticillata* Muhl. ex Willd. (n. 17326, ISOTYPE at PH!). At BM is Swartz's type of *S. hirtella*. Also here is the type of *S. secans* (L.) Urban (= *S. reflexa* HBK. P!). No specimen of *S. lithosperma* (L.) Sw. is at LINN. However, Linnaeus did refer to a fairly accurate illustration in Van Rheede's *Hortus Malabaricus* which can stand as the type. Bentham's type for *S. lithosperma* var. *linearis* (E. Muller s. n.) is at K. Due to a nomenclatural problem, a new name may have to be proposed for *S. pauciflora* Muhl. ex Willd. Appreciation is expressed to the curators of the herbaria visited during these investigations.

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TYNDALL, R. WAYNE and PATRICIA M. FARR. Maryland Natural Heritage Program, and Harford County Government.--Vegetation and flora of two serpentine "openings" in Maryland.

Vegetation and flora of two serpentine "openings" were studied in Maryland. The ground layer of the 0.5 ha opening was comprised of 45 vascular plant taxa, including three that are rare in Maryland (*Aster depauperatus* (Porter) Fern., *Sporobolus heterolepis* Gray, and *Talinum teretifolium* Pursh). Community dominants, *Sporobolus heterolepis* and *Andropogon scoparius* Michx., comprised 56% of total vegetative cover. Drought stress was incidentally identified as an important factor inhibiting *Pinus virginiana* Mill. succession. The two-hectare opening was comprised of 69 vascular plant taxa, including three that are rare in the State (*T. teretifolium*, *Cerastium arvense* var. *villosum* Holl. & Britt., and *Panicum flexile* (Gatt.) Scribn.). About 40% of herbaceous cover was produced by *Andropogon scoparius* and *Aristida purpurascens* Poir. Suppression of both fire and domestic live-stock grazing may have contributed to the abundance of *Pinus virginiana* and *Juniperus virginiana* L.

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FARR, PATRICIA M. AND R. WAYNE TYNDALL. Harford County Maryland Department of Planning and Zoning, and Maryland Natural Heritage Program--Recolonization potential of an eastern hemlock forest in Harford County, Maryland.

The expansion potential of an eastern hemlock (*Tsuga canadensis* (L.) Carr.) forest was examined in a north-facing ravine system of the eastern piedmont of Maryland. Based on size-class distributions, growth rate regressions, historical photographs, and distribution of fallen decaying logs, the forest appears to be climax and expanding up the ravine system and into upland areas between ravines. Expansion is expected to continue in the absence of fire, logging, and excessive browsing by deer.

151

CONN, CHRISTINE E. and FRANK P. DAY. Old Dominion University--Belowground biomass allocation on a barrier island.

Root distribution by depth, size class, topographic position and community type was evaluated on Hog Island, a Virginia Coast Reserve NSF LTER site. The communities included a dune dominated by *Ammophila breviligulata*, two *Myrica cerifera* stands (one older and at a higher elevation) and two interdunal communities of different ages dominated by *Spartina patens*. On each site, ten 0.09 m² pits were excavated to 40 cm. The *Spartina* sites were only excavated to 20 cm due to the high

water table. On all sites most biomass was within the top 20 cm of soil. Distributions of root mass among size classes varied among sites. On *Spartina* sites, most total biomass was in the <2 mm size class. The 2-5 mm size class dominated the dune site and the >5 mm size class dominated the *Myrica* sites. Between woody sites, average root mass increased with age and decreased with depth. A similar trend occurred among grassy sites in the <2 mm size class. Although total biomass allocations were greatest on woody sites, *Spartina* sites exhibited more root mass in the <2 mm size class.

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CLEBSCH, EDWARD E. C. The University of Tennessee, Knoxville--Was arbor vitae (Thuja occidentalis L.) native to North Carolina in historic times?

Thuja occidentalis L. has been listed as native in North Carolina since Stephen Elliott's "Botany of South Carolina and Georgia" in 1921-1924. Not reported by the Bartrams', the Michaux's, Fraser's, Nuttall's, or Gray's or Small's expeditions, it was reported by Chapman, Curtis, Gray's 6th et seq. editions, Ayres and Ashe, Coker and Totten, Sargent (ed. 2), et al. There appear to be no specimens from native populations in herbaria. T. G. Harbison knew native populations in North Carolina. If he collected it, the specimen may have been lost in the 1916 flood at the Biltmore Herbarium. W. W. Ashe reported it, and likely collected it. His collection may have been discarded for poor quality, small size, or lack of documentation. The plant is an obligate calciphile in its southern range, and thus there is little good habitat in the North Carolina mountains. The known population was already low in number and small of stature before 1918. Though there are no known viable field populations, continuing search is worthwhile. The question is answered affirmatively on historical evidence.

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McCARTHY, BRIAN C. and JOSE M. FACELLI. Frostburg State University, and Rutgers University--Microdisturbances in seral and mature habitats: implications for woody seedling establishment.

The range and extent to which different microdisturbances could have an impact on woody seedling establishment in seral and mature habitats was investigated. We measured the frequency of small-scale disturbances by following the fate of artificial, plastic structures, designed to hold a point in space the approximate size and shape of a one-year-old tree seedling. We placed 200 models in each of three habitats of contrasting age and structure: two oldfields (5 & 18 yr old) and an old-growth forest (300 yr old). We followed the fates of the models for 275 days, and

assessed the proportion of models damaged at each site and the cause of disturbance. After ten months, the disturbance rate was ca. 25% in both fields and 55% in the forest. Causes of microdisturbances were different in each habitat. Models in the youngest field were damaged primarily by snow and frost-heaving during the winter; gnawing by vertebrates was the predominant disturbance in the older field; trampling accounted for the greatest percentage of damage in the forest. Herb cover and proximity to a shrub, tree, or fallen log differentially affected disturbance rate. This study demonstrates the potential importance of the microdisturbance regime on woody seedling establishment in oldfields and forests, and the relevance of temporal and spatial complexity on the determination of that regime.

driest forests and they have invaded old-growth forests from the margins and in tree gaps. The two most aggressive species are Japanese Honeysuckle (Lonicera japonica) and Poison Ivy (Rhus radicans) but Grapevine (Vitis sp.), Virginia Creeper (Parthenocissus quinquefolia), Greenbriar (Smilax sp.), and Trumpet Vine (Campsis radicans) are also abundant. In some abandoned fields, vines have excluded woody species and other areas are reverting to vine disclimaxes. Vine manipulation experiments have shown that they have a negative influence on the growth of trees growing alone and in closed canopy forests. Long-term monitoring and experimental studies have also indicated that vines may have a negative influence on the recruitment of woody species into secondary forests.

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DRAPALIK, DONALD J. Georgia Southern College--Survival and recovery responses of flooded, vascular plants in the Big Muddy River Valley, Jackson County, southern Illinois.

During a record flood of May 1961, the upper and lower flood plains of the Big Muddy River flooded for 20 and 27 days respectively. After the flood most visible, vascular plants were observed within a 160 acre area of shady to semi-shady, bottomland forest. Plants of 54 terrestrial or semi-terrestrial species (35 woody and 19 non-woody) were able to survive various periods of complete inundation. Most completely inundated plants of most species were able to put forth new, post flood, aerial growth after a recovery (non-flooded) period of 14 or less days, and most completely inundated plants of nine species (Acer saccharinum, Cephalanthus occidentalis, Fraxinus pennsylvanica, Hibiscus militaris, Leersia virginica, Plantago rugelii, Salix nigra, Saururus cernuus, and Smilax tannoides) put forth new, post flood, aerial growth after a recovery period of only two days. On all partially inundated plants, uninundated leaves were not lost or shriveled. In this flood plain, flood water levels and soil moisture are probably two major factors for plant distribution. Despite regular, annual floods many herbaceous perennial populations have persisted for at least a three year period.

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MADDOX, DAVID. Maryland Natural Heritage Program--Demography and habitat requirements of the rare Swamp Pink in Maryland.

Helonias bullata is a federally listed threatened lily which grows in wet seeps, bogs or along stream edges from New Jersey to Georgia. This study addresses two questions for three populations in Maryland: (1) What are the basic demographic patterns and do they suggest trends in population size; (2) Are there features of habitat or micro-site that can be used as predictors of population decline? H. bullata is a

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ATKINSON, ROBERT B. and JOHN CAIRNS, JR. Virginia Polytechnic Institute and State University--Early vegetative colonization of manmade forested wetlands in Virginia.

Forested wetland creation attempts have a very brief history in Virginia. Approximately 50 to 100 acres (20 to 40 hectares) have been created this decade. However, projections for the next three years suggest that over 1,000 acres (405 hectares) of forested wetlands will be created. The early stage of forested wetland creation science and the dramatic increase in acreage have highlighted the need for monitoring and improved creation techniques. While wetland species are planted at most sites, a greater number of species colonize from nearby areas. A 3.7 acre (1.5 hectare) creation site located in Prince George County, Virginia was graded in the spring of 1987. In the summer of 1989, seven transects totalling 116 one m² plots were established, and nine 1.5 in. diameter pvc wells were installed and monitored. Vegetation, hydrology and soils were studied from May through October, 1989. In addition to cover estimates for vegetation, qualitative moisture estimates were made for each one m² plot monthly. Data analysis comparing cover to average estimated moisture content for plots showed a positive relationship for wetland species. Peak cover occurred during August and was quite low (25.33%). While other factors may affect species distributions, soil moisture and water depth seem to be important. Several concerns and potential improvements in creation methodology are suggested.

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WHIGHAM, DENNIS F. Smithsonian Environmental Research Center -- The distribution and importance of vines in Coastal Plain forests. Introduced and

native species of vines are very common throughout Coastal Plain forests. In this paper, I report on studies of the distribution and ecological importance of vines in successional and mature forests on the SERC property. Vines are common in all but the

long-lived perennial which forms rosettes of large evergreen leaves. Only 10% of adult plants flower in any year. Probability of flowering is not correlated with plant size or any apparent features of micro-habitat. Seedlings are very rare and apparently suffer extremely high mortality (>95% of experimental seedlings in the greenhouse and field died within 30 days). Thus, adult survivorship is critical to the maintenance of existing populations. Local dispersion is strongly correlated with mean water availability: plants tend to be found in saturated but not inundated sites. Wetness is also correlated with plant community type. Thus, it may be possible to monitor changes in (1) soil water or (2) plant community or key species that presage potential damage to a Helonias population.

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WENTWORTH, THOMAS R.,¹ ROBERT K. PEET,²
MICHAEL P. SCHAFALE,³ ALAN S. WEAKLEY,³
AND PETER S. WHITE.² North Carolina
State University¹, University of North
Carolina at Chapel Hill², and North
Carolina Natural Heritage Program³--
Barrier island forests of North
Carolina.

Terrestrial and palustrine forests and shrublands were characterized throughout most of their extant range on the barrier islands of North Carolina. Sampling was conducted in 1988 as part of an ongoing statewide survey of natural vegetation in North Carolina. Quantitative data were collected in 82 permanent plots. Each plot consisted of one or more 10 x 10 m contiguous modules; actual plot areas ranged from 100 to 1000 m². Presence of all vascular plant species was determined in nested submodules ranging in area from 0.01 to 10 m². Cover of vascular species, and density and diameter distributions of all tree species, were also determined. Approximately 350 vascular taxa were encountered in quantitative sampling. A preliminary classification based on cluster analysis of compositional data identified 11 community types. Upland types included evergreen oak forest, pine forest, deciduous forest, coastal fringe sandhill forest, and disturbance shrub. Palustrine types included bay forest, dogwood shrub swamp, maple-mixed hardwoods swamp forest, maple-gum swamp forest, ash-maple swamp forest, and cypress swamp forest. We present descriptions of these types with discussion of their environmental and geographic relationships.

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WILCZYNSKI, C. J. AND S. T. A. PICKETT. University of North Carolina and Institute of Ecosystem Studies--The dynamics of fine root growth in response to the creation of canopy gaps in an Allegheny hardwoods forest.

Fine roots (< 1 mm, diameter) represent a significant component of the biomass of temperate forests, yet their dynamics have largely been ignored in investigations of gap processes. To study the dynamics of fine root growth in response to canopy gap formation, we examined fine roots in the upper 15 cm of soil within four experimental gaps and the surrounding intact forest. Sampling continued throughout an entire growing season. Overall, the biomass of fine roots was significantly lower within canopy gaps relative to the intact forest. A seasonal trend towards decreased root growth in both gaps and intact forest was observed in June and July.

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PARKER, GEOFFREY G., SUZANNE HILL AND LAUREL A. KUEHMEL, Smithsonian Environmental Research Center and Virginia Polytechnic Institute and State University.--Decline of understory American chestnut (Castanea dentata) in a southern Appalachian forest.

Previously numerous understory stems of Castanea dentata exhibited a precipitous decline in numbers in a 3 hectare stem-mapped permanent plot near the Mountain Lake Biological Station. More than 64% of understory chestnut stems died between 1982 and 1988; recruitment of new stems was less than 3%. Mortality and recruitment of chestnuts showed no spatial dependence over the plot. Concurrent with the decline of chestnut another common understory species, Acer pensylvanicum, underwent a dramatic increase. Recruitment and mortality of striped maples were 200.9 and 8.0%, respectively. Furthermore, the distribution of striped maples within the plot increased dramatically, from circumscribed patches to virtually all of the study area. The increase in Acer pensylvanicum is probably not directly related to the decline of Castanea dentata.

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ASB Canadidates for Office—1990

The Nominating Committee composed of T. Atkinson, G. Esch, and R. Sharitz, Chairman, has selected the following slate of nominees for the ASB offices to be filled in 1990. Additional nominations will be received from the floor. Voting will take place at the Annual Business Meeting Friday 20 April 1990 at 11:30 A.M. Please plan to attend.

President-Elect: **Sandra T. Bowden**, Agnes Scott College, Decatur, GA
J. Kenneth Shull, Jr., Appalachian St. Univ., Boone, NC

Vice-President: **M. J. Baranski**, Catawba College, Salisbury, NC
Paul Yokley, Jr., Univ. North Alabama, Florence, AL

Treasurer: **Timothy A. Atkinson**, Carolina Biological Supply, Burlington, NC
Patricia D. Parr, Oak Ridge National Lab., Oak Ridge, TN

Executive Committee: **Eloise B. Carter**, Oxford College of Emory Univ., Oxford, GA
(Two Positions)

Stephen T. Ross, Univ. Southern Mississippi, Hattiesburg, MS

James W. Wallace, Jr., Western Carolina Univ., Cullowhee, NC

R. Donald Whetstone, Jacksonville St. Univ., Jacksonville, AL

PRESIDENT-ELECT



Sandra T. Bowden



J. Kenneth Shull, Jr.

Sandra T. Bowden—Dr. Bowden is Professor of Biology at Agnes Scott College, Decatur, GA. She received the B.S. in biology from Georgia Southern College in Statesboro, GA, and M.A. and Ph.D. degrees in botany from the University of North Carolina at Chapel Hill. During four years at Chapel Hill, Dr. Bowden was a National Science Foundation Graduate Fellow. During her tenure at Agnes Scott, she served as chair of the Department of Biology for several years. In addition, Dr. Bowden has chaired many faculty and College committees, including the Faculty Executive Committee, the Committee on Academic Standards, the Professional Development Committee, and the Curriculum Committee. In 1988, Dr. Bowden and colleagues at Agnes Scott received a National Science Foundation grant for \$32,500 for improvements in laboratory instruction in cellular and molecular biology. Dr. Bowden has done research on growth regulation in mosses, tumorigenesis in plants by *Agrobacterium tumefaciens*, and currently is collaborating in research on the ecology of soil microbial consortia of granite outcrop plant communities in Georgia. Dr. Bowden is a member of the American Society of Plant Physiologists, the American Institute of Biological Sciences, the American Association for the Advancement of Science, the Southeastern Branch of the American Society for Microbiology, Sigma Xi, and the Georgia Academy of Science. She is a member of the Executive Committee of State-of-the-Art Biology/Georgia. She is a long-time member of ASB and has served as Chair of the Meritorious Teaching Award Committee, Secretary of ASB (1985–88), and Vice President of ASB (1989–90).

J. Kenneth Shull, Jr. is professor of biology of Appalachian State University in Boone, NC where he joined the faculty in 1984. He was formerly associate professor and chairperson of the Department of Biological Sciences at Loyola University in New Orleans, LA. Ken received his B.S. in chemistry (1963) and M.S. in biology (1967) from the University of Alabama, and his Ph.D. in genetics (1973) from Florida State University. His research interests include chromosome evolution, especially in *Lilium*, meiotic nuclear fine structure, and the effects on meiotic chromosomes of chronic environmental radiation. Besides general biology, genetics and cytogenetics, his teaching interests have included bioethics, a course that he has developed at two institutions. He has tried to make the public aware of developments and issues in biology by speaking to high school classes, church, and civic groups on a variety of topics. In 1986 and again in 1989 Ken organized the Boone Chromosome Conference, an international meeting that has dealt with current research in cytogenetics, especially the events of meiosis. He has been a member of ASB since 1971, serving on several committees, chairing numerous sessions at annual meetings, and organizing a symposium on ecological genetics and, with Margaret Menzel, organizing a second on cytogenetics. He is currently serving on the resolutions committee and is chairperson of the local arrangements committee for the 1991 ASB meeting at Appalachian State University. He served as Vice President of ASB in 1982–83.

VICE-PRESIDENT

Michael J. Baranski—B.S. in biology from West Liberty State College, West Virginia (1968), Ph.D. from North Carolina State University in botany (1974). Currently Professor of Biology at Catawba College, Salisbury, NC. Visiting and adjunct appointments: North Carolina State University—Department of Botany (1973–74), Biological Sciences Program (1982); Rocky Mountain Biological Laboratory (1975); Duke University School of Forestry and Environmental Studies (1978–80); University of North Carolina—Charlotte (1988). Member of Association of Southeastern Biologists since 1969. ASB service: Executive Committee (1986–89); other committees and chairs—Conservation (1979–81), Place of Meeting (1983–86), Publications (1987–89). Other offices: Botanical Society of America—Southeastern Section (Secretary-Treasurer, 1977–80; Nominating Committees); North Carolina Academy of Science (Board of Directors, 1980–89; Director of Collegiate Academy, 1981–85; various committees and chairs); North Carolina Science Olympiad (Director, 1985–87); Southern Appalachian Botanical Club (Secretary-Treasurer, 1981–90). Service on several state-level science and environment advisory committees and panels. Active in natural heritage protection and nongame and endangered species programs in North Carolina. Interests in woody plant taxonomy and ecology, floristics and community ecology, natural areas, conservation/environmental issues and education.

Paul Yokley, Jr.—Dr. Yokley is Professor of Biology and Head of the Department of Biology at the University of North Alabama, Florence, Alabama. He received his B.S. and M.A. from George

Peabody College and Ph.D. (1968) in zoology from the Ohio State University, Columbus, Ohio. Research is mainly concerned with taxonomy, life history, and distribution of freshwater mussels. Present research includes development of techniques for maintaining and artificial culturing of rare and endangered freshwater mussel species. He is a member of the Rare and Endangered Aquatic Mollusk Committee for the state of Tennessee. Dr. Yokley has been an active member of ASB for many years. He received the ASB Research Award in 1969 and served on the Research Award Selection Committee for three years. He served a term on the ASB Executive Committee. Dr. Yokley is Vice-President of Beta Beta Beta in the Southeastern Region. Beta Beta Beta is an affiliate organization of ASB with more than seventy chapters in the southeastern states. These undergraduate students become the future members of the ASB, meeting each year with ASB and having their paper sessions on Friday afternoon. He is exceptionally proud of the success of Beta Beta Beta through many years.

TREASURER

Timothy A. Atkinson—Tim is Assistant Department Head of Botany at Carolina Biological Supply Company, Burlington, NC. He received B.S. (1974) and M.S. (1977) in biology from Jacksonville State University, AL, and studied Ecosystematics under A. E. Radford at UNC—Chapel Hill before accepting his current position (1980). Current research interests include the Flora of North America project and Solanaceae in the flora of Alabama. He has performed contract work for the U.S. Department of Energy, U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, the Nature Conservancy, and many private researchers. He has published through publications, education videos and films. He represents Carolina Biological Supply Company and/or holds individual membership in numerous professional and educational organizations. He serves as a reviewer for journals, newsletters, textbooks, manuals, and films. He first became involved in ASB as a student in 1974 and currently holds an individual membership as well as representing the patron membership of Carolina Biological Supply Company.

Patricia D. Parr—Patricia D. Parr is a Research Associate II in the Environmental Sciences Division of Oak Ridge National Laboratory in Tennessee. A researcher there for 16 yr (10 yr in effects research), she currently manages the Oak Ridge National Environmental Research Park. She received her B.S. in Biology from Tennessee Wesleyan College (1974) and M.S. in ecology from the University of Tennessee (1981). Professional interests include resource management, planning, rare plant population management, and native wildflower gardening. Pat has been a member of ASB since 1978, participating in the annual meetings with paper and poster presentations. She is a member of the Ecological Society of America, Southern Appalachian Botanical Society, Tennessee Native Plants Society, and the Association for Women in Science—East Tennessee Chapter (the last two of which she has served as Treasurer).

EXECUTIVE COMMITTEE

Eloise B. Carter—Dr. Carter is Assistant Professor of Biology at Oxford College of Emory University, Oxford, GA. She received her A.B. from Wesleyan College, Macon, GA, and her M.S. and Ph.D. from Emory University in Biology. Her research interests are in plant ecology and evolution of closely related species. She is particularly interested in the population biology and systematics of plant species endemic to the rock outcrops of the Southeast. A member of ASB since 1978, she received the Faculty Research Award in 1987 and is Chairperson of the Faculty Research Award Committee. As Activities Chairperson for the Southeastern Section of the Botanical Society of America, she has been responsible for planning the Teaching Update Symposia from 1988–90. She was Secretary of the Southeastern Chapter of the Ecological Society from 1984–86, and she serves as a member of the Plant Collections Committee for the Atlanta Botanical Gardens.

Stephen T. Ross—Dr. Ross is Professor of Biological Sciences and Curator of Fishes at the University of Southern Mississippi, Hattiesburg. He received a B.A. degree in zoology from the University of California, Los Angeles, an M.A. in biology from California State University, Fullerton, and a Ph.D. in biology from the University of South Florida in 1974. His research interests include

ecological and evolutionary relationships of fishes, with particular emphasis on the persistence and stability of fish assemblages, and ecological responses of fishes to altered environments. His more than 20 research papers have spanned habitats from the continental shelf of the Gulf of Mexico, to barrier island surfzones, to streams, and have been published in such journals as *Copeia*, *The American Naturalist*, *American Midland Naturalist* and *Estuarine Coastal and Shelf Science*. He is a member of 14 professional societies and is serving his second term on the Board of Governors of the American Society of Ichthyologists and Herpetologists (ASIH) and is on the editorial board of the *Journal of Freshwater Ecology*. He has served on the editorial board of *Copeia* and is a past president of the Gulf Estuarine Research Society, and Southeastern Division of ASIH and the Mississippi Chapter of the American Fisheries Society. He has served ASB as program chairman and member of the local committee for the 1988 meetings.

James W. Wallace, Jr. — Dr. Wallace is a Professor of Biology at Western Carolina University. Jim received his B.S. in Chemistry (Pulp and Paper Technology) and his M.S. in Botany from Miami University, Oxford, Ohio, in 1962 and 1964 respectively. He received his Ph.D. in Botany (Plant Biochemistry) from the University of Texas, Austin, in 1967, did post-doctoral study at the University of British Columbia in 1969, and served as a Senior Research Fellow for the New Zealand Department of Scientific and Industrial Research in 1976–77. In addition he served as an environmental photographer for Labdell and Associates (Anchorage 1983) and participated in a faculty exchange program in the Peoples Republic of China (1984). He is a member of nine professional societies, has served terms as Chairman for both the Southeastern Section and the Phytochemical Section of the Botanical Society of America, as Secretary and Editor-in-Chief of the Phytochemical Society of North America, and as Chairman of the WCU Chapter of Sigma Xi. He is currently the Associate Editor for the *Phytochemical Bulletin*. His research interests include the biogenesis and distribution of secondary compounds, especially a group of phenolics known as flavonoids. Much of his published work has considered the role of these compounds as they relate to the phylogeny of ferns, especially the “primitive” ferns. He has authored/coauthored 38 manuscripts which have appeared primarily in *Phytochemistry*, *Biochemical Systematics and Ecology*, or *The American Journal of Botany*. He has made 60 presentations at scientific meetings including invited symposium papers at the XIV International Botanical Congress (Berlin 1986) and an International Symposium on the Present and Future Perspectives in Pteridology (Jaipur 1989). He has participated in ASB meetings since 1971.

David Whetstone — David Whetstone is Professor of Biology at Jacksonville State University and Curator of the Herbarium (JSU). He graduated from Jacksonville State University with a B.S. in 1970 and returned to complete his M.A. in Biology in 1973. He received his Ph.D. in botany from the University of North Carolina at Chapel Hill in 1981. He returned to JSU in 1978 as Assistant Professor, rose to the rank of Associate Professor in 1983, thence to Professor in 1984. His research interests are systematics of Sapotaceae and Sterculiaceae, floristics of Alabama, and threatened and endangered species of the temperate Southeastern United States. He has served as consultant to numerous government agencies on endangered plant species and is a member of the planning committee of the South Central Native Plant Conference held at the Birmingham Botanical Gardens. He is author or coauthor of a number of scientific papers published in such journals as *SIDA*, *Castanea*, *Rhodora*, and the *Annals of the Missouri Botanical Garden*.

Dr. Whetstone joined ASB in 1974 and is a member of a number of other professional societies including the International Association for Plant Taxonomy, American Society of Plant Taxonomists, Southern Appalachian Botanical Club, and New England Botanical Club. He was inducted into the Sigma Xi in 1976. Also, he is actively involved with the Alabama Wildflower Society and the Birmingham Fern Society.

He serves on the Editorial Board of the Flora of North America Project (funded by the Packard Foundation and the NSF) and is Regional Coordinator of the Southeastern United States. Currently, he is Chairman of the Editorial Committee of *Castanea* (Journal of the Southern Appalachian Botanical Club). He is active in Tri-Beta as Co-sponsor of the Mu Phi Chapter at Jacksonville State University.

ANNOUNCEMENTS

TENNESSEE TECHNOLOGICAL UNIVERSITY UPPER CUMBERLAND BIOLOGICAL STATION (TECH AQUA)

Upper Cumberland Biological Station at Tech Aqua is located on approximately 500 acres of land in Middle Tennessee on a U.S. Army Corps of Engineers Reservoir: Center Hill Lake. Our 25-year lease, which will be renewed mid-summer 1990, makes the entire Center Hill Reservation available to us for research and education: 18,000 acres of reservoir surface area, 415 miles of lake shore, and 20,000 terrestrial acres. It is a beautiful place to spend a summer! Come join us for one or two sessions of strongly field-oriented courses.

Four courses per five-week term—two class meetings per week each—from 8:00 A.M. to 5:00 P.M. for 4 semester hours credit per class. Additionally, field research special problems with 1–2 semester hours may be added, in addition to a one hour field seminar. A student may earn up to 11 semester hours of Biology credit per session during the 1990 summer sessions.

First Term Registration: June 3, 1990—2:00–4:00 P.M. at the Lodge.

First Term: June 4, 1990–July 5. Courses 4 semester hours except as noted.

- M-W 467–567 Freshwater Invertebrates—Dr. Charles R. McGhee—Middle Tennessee State University. Survey, habitats, behavior, morphology, and sampling techniques. Extensive fieldwork.
- M-W 469–569 Ornithology—Dr. Herbert Shadowen—Western Kentucky University. General survey of the class Aves with emphasis on morphology, ecology and identification of local birds.
- T-T 487–587 Ichthyology—Dr. Robert Stiles—Samford University. Identification, anatomy, physiology and adaptation of N. American freshwater species.
- T-T 448–548 Plants and Man—Dr. Thomas Hemmerly—Middle Tennessee State University. Emphasis on identification and practical laboratory experience in use of plants for sugar-making, paper-making, tanning, dyeing and weaving.

Given both terms

- TBA 457-8D–557-8D Field Investigations (1–2 semester hours) Staff. Topic-oriented research problems, directed by a resident professor with special expertise in the area of investigation.
- Tues. 497-8D–597-8D Field Biology Seminar (1 semester hr). 7:00 P.M. Staff and guest presentations with student participation.

Second Term Registration: July 8, 1990—2:00–4:00 P.M. at the Lodge.

Second Term: July 9, 1990–August 9.

- M-W 488–588 Stream Ecology—Dr. Rudolph Prins—Western Kentucky University. Study of fresh water as an ecological environment, studying parameters of the ecosystem including lotic systems, biota, production and energy flow. Extensive fieldwork.
- M-W 418–518 Wildlife Policy and Land Use Planning—Dr. Daniel L. Combs—TTU. 3 semester hrs. To familiarize students with policies, agencies and laws involved in managing wildlife resources, leading to certification from The Wildlife Society.
- 419–519 Lab for 418–518. 1 semester hour. To be taken concurrently with 418–518. A field lab, involving identification of wildlife plants, and relevant field techniques.
- T-T 447–547 Ecosystem Analysis—Dr. Joe Winstead—Western Kentucky University. Structure and function of regional ecosystems including production, food webs, nutrient cycling, diversity and stability.

Interested students may write to:

Dr. Henri Willard, Director
Upper Cumberland Biological Station at Tech Aqua
Box 5063
Tennessee Technological University
Cookeville, TN 38505
Telephone: (615) 372-3129 or 372-3140 or 372-3134 (Biology)

**MOUNTAIN LAKE BIOLOGICAL STATION
SUMMER FIELD COURSES 1990**

First Term: June 10–July 14

Biology of Insects

George W. Byers

University of Kansas

Christine A. Nalepa

North Carolina State University

Natural History of the Southern Appalachians

Philip C. Shelton

Clinch Valley College

Univ. of Va.

Animal Population Biology

Stephen G. Tilley

Smith College

Workshop in Nature Photography (June 24–30)

John Danehy

Workshop for Secondary School Teachers

(July 1–14)

Jerry O. Wolff

Savannah River Ecology Lab

Second Term: July 15–August 18

Evolutionary Genetics

Bruce Grant

College of William and Mary

Experimental Biology of Fungi

Rytas Vilgalys

Duke University

Quantitative Methods in Field Biology

Joseph Travis

Florida State University

Henry M. Wilbur

Duke University

Workshop in Allozyme Techniques (July 15–28)

Charles R. Werth

Texas Tech University

Workshop in Molecular Techniques for Field

Biology (July 29–August 18)

Daniel J. Burke

University of Virginia

Michael P. Timko

University of Virginia

Scholarships Available: Service Awards for students covering room and board costs.
Scholarships which provide financial assistance.
Post-Doctoral Research Awards (10 weeks).

For further information and application, write to:

Director

Mountain Lake Biological Station

Rm. 251, Gilmer Hall

University of Virginia

Charlottesville, VA 22901

DeSELM BOTANY, PLANT ECOLOGY AWARD

At the end of 1989, Dr. Hal R. DeSelm retired as Professor of Botany at The University of Tennessee/Knoxville. Former students, friends, and colleagues are establishing an endowment fund in his honor and in recognition of his substantial contributions to plant ecology in the Southeast. This endowed Award will support field research of graduate students in plant ecology at The University of Tennessee.

ASB members interested in honoring Hal can send contributions, payable to "The University of Tennessee—The DeSelm Botany, Plant Ecology Fund," to the Office of Development; The University of Tennessee; Tyson Alumni House; Knoxville, Tennessee 37996.

REVIEWS

Smith, Richard M. 1989. **Wild Plants of America.** John Wiley & Sons, NY. \$12.95 (paper). 267 p.

The sub-title of this book, "A Select Guide for the Naturalist and Traveler," is helpful by defining content beyond the title. The author's obvious enthusiasm for wild plants and far-flung places is evident in the meat of the book—he would, it seems, like to write about *all* of the plants he encounters. The book is a guide to nice places and the plants that occur there; it is not (nor does it claim to be!) a guide to identification. The geographic limits are the conterminous United States—Alaska and Hawaii are not mentioned—so "America" is used with editorial license. The targeted readers, naturalists and travelers, but not just travelling naturalists, are well served. There is much natural history information in the book beyond that concerning wild plants. The entire effort reflects scholarship, attention to detail, care in preparation, and both talent and craft in the prose.

The book is arranged in 24 chapters that are variously based on geographic regions, physiographic provinces, and predominant plant communities (*e.g.* The Pacific Northwest, Rocky Coasts and Sandy Shores, Cove Forests and Their Wildflowers), among others. It includes as an appendix an incomplete list of the botanic gardens and arboreta in 42 states and D.C. (omitting the Dakotas, Arkansas, Nebraska, Wyoming, Montana, and the two outlier states). The index is complete to a turn, and includes scientific names, common names, state names, and place names. The only out and out error I found in the book was in the index, and even that is arguable. I stumbled on the fact that Montana and Wyoming are indexed on pages that do not include the words, but the pages deal with parks located in the states. It's nice to have to stretch that far to find a factual error!

The 100 illustrations are drawings by the author. They are excellent, and are dispersed interestingly through the text. Their pages are emboldened in the index.

The latest in the Wiley Nature Editions series, the book is well manufactured. The paper stock is heavy enough and the cover tough enough to stand the day hiking that the book is intended for. The binding is strong enough to stand field use, too. The enticing color photograph on the cover is alluring (hopefully not misleading), but is nowhere identified as to species.

Who should buy this book? I refer you to the sub-title again. It is not a reference to the flora of any place; it is not a complete list of the plants on any trail; it is not adequate for spring, summer, and autumn differences in flora; it is not a shelf reference. It is, on the other hand, one small nibble of the appetizer of a five course dinner, the fullness of which is better served by local and regional authoritative and complete guides. Its power is in its prose. The author has been there, and takes you with him. He has not just noted the plants at a given place, he has looked at them and thought about them and the rest of what is there. I'll be glad to have him along the next time I travel.

EDWARD E. C. CLEBSCH, *Department of Botany, The University of Tennessee, Knoxville, TN 37996-1100.*

Lawrence, E. 1989. **Henderson's Dictionary of Biological Terms.** 10th ed. John Wiley and Sons, NY. \$49.95. 637 p.

This 10th edition of Henderson's Dictionary of Biological Terms contains 18,000 terms found in most major fields of biology, biochemistry, botany, cell biology, genetics, immunology, and zoology. New terms in current usage are included. Appendix 1 contains 60 structural formulae of important biochemical compounds. Appendices 2–6 present outliners of the plant kingdom, fungi, animal kingdom, protista, and prokaryote (Monera). A list of abbreviations precedes the listing of terms while a list of common chemical elements comprises appendix 7. The only aspect I found wanting is that no mention is made of whose classifications the author follows in relation to appendices 2–6. Some or many of us would disagree with several of the classifications presented. This volume is the best updated reference one will find on terminology and should be used by professional and student alike and at all levels of training from high school through college.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Brum, Gil D. and Larry K. McKane. 1989. **Biology: Exploring Life.** John Wiley & Sons, NY. \$42.95. 727 p.

Although not a very attractive book, compared to others on the market, this general biology text does offer some differences, for example, the ratio of interrogative to declarative sentences. It is much higher than in any text I have seen recently. The authors' aim, according to the Preface, is to present a book that integrates the "how" into the "what" of biology—in other words, a book that is more than just a compilation of facts. They succeed in this better than other current texts. All the usual topics are included and the three-column format and smaller print enable the authors to pack more words into the numerous pages.

Features, described by the authors as "learning strategies," include: 1) Connections, discussion boxes that include a list of related topics and pages where these topics are discussed; 2) Series, discussions of specific topics that explore topics central to biology, such as the species concept; 3) Biolines, short essays that highlight "real life" lessons on specific topics; 4) Synopsis, a review of main concepts and a key term integrator; 5) Chapter Outline, beginning each chapter; 6) Review and Synthesis, questions and suggested ideas for further consideration; and 7) Additional Readings. In more than one instance, the authors declare that visual connections are made by a series of "articulation icons" and standardized drawings. I did not find this to be true. For example, according to the chart of "icons," phosphate groups should always be yellow balls with a P inside, although in the text they vary from green to colorless, and drawings are by no means standardized. They are not bad drawings, and I would never have noticed the differences unless I had been told to look for the similarities.

In any general text, there is much with which to disagree; however, the presentation of material is generally acceptable here, indeed, more than in most texts that I have reviewed recently. It is up-to-date, with the final section devoted to the Technology Revolution. It fails to address current environmental issues as strongly as I prefer. The ubiquitous use of the little balls for carbons in organic compounds in place of structural formulas, especially in a text for majors' courses, is grossly inadequate. Losing and gaining balls in metabolic pathways just isn't the same thing as seeing some reasonable representation of atoms! And how do H's come from little gray balls with a C in the center? It is the way texts depict pathways these days; therefore, everyone does it. Why?

These authors do a better job than most with bringing in the connections that they seem desperate to convey. I suggest that anyone choosing a text at least look this one over—if only to see how many different ways it is possible to say the same thing in the name of "interconnectedness."

JANICE COFFEY SWAB, *Department of Science, Saint Mary's College, Raleigh, NC 27603.*

Hay, Robert K. M., and Andrew J. Walker. 1989. **An Introduction to the Physiology of Crop Yield.** John Wiley & Sons, New York, NY. \$44.95. 292 p.

This book is a welcome addition to the small group of crop physiology textbooks available to teachers, researchers, and graduate students in this area, and it should be of interest to plant physiologists and ecologists, as well. The organization of the material differs substantially from other crop physiology texts (e.g., Gardner et al. 1985; Tesar 1984) because the authors have chosen to deal almost exclusively with above ground processes, with a focus on fixation, metabolism, and partitioning of carbon as a basis for discussion of the physiological principles underlying crop production practices. For this reason, topics which receive chapter status in other texts, including growth analysis, water relations, and mineral nutrition, are discussed here primarily in relation to photosynthesis and related processes. This may be seen as a negative to workers who are less "photosynthetically-inclined," but it allows for those topics which are stressed to be presented in much more detail than is the norm. Indeed, this book is probably inappropriate for many undergraduates, who may lack the necessary background in anatomy, physiology, and biochemistry of crop plants to understand or appreciate the relatively large amount of data presented here. In contrast, graduate students should benefit from the manner in which experimental evidence is presented to show *how* researchers have arrived at certain ideas.

The book is arranged in three parts. Part I, "Fundamental Principles of Crop Physiology," makes up about one-half of the text, and it includes chapters on light interception by crop canopies, photosynthesis and photorespiration, respiration, and partitioning of dry matter. The chapter on partitioning includes excellent discussions of source vs. sink limitations to yield, the harvest index, sucrose vs. starch partitioning in the leaf, and phloem unloading. The latter is examined in relation to the

economically-important sinks of three crops: the wheat grain (with fused pericarp/testa), the legume seed (with cleaner separation between maternal and seed tissue, which makes it an easier system to manipulate experimentally), and the tomato fruit. In addition, some evidence is presented to illustrate alterations of carbon partitioning patterns by diseased plants.

Part II, "Crop Case Histories," includes chapters on the temperate small grains (especially wheat and barley), potatoes, and forage/grassland crops. The emphasis in this part is on important crops and production practices in the United Kingdom. Because several important crops of the U.S., including maize and soybeans, are omitted, this section is of less practical importance to the American student. Nevertheless, a number of common research and production practices, such as yield component analysis, planting date and density considerations, nitrogen fertilization, and irrigation management, are well-illustrated, and Part II should be of interest if for no other reason than that the three groups of crops selected for discussion are so diverse in growth habit as well as in the plant parts comprising the economic yield. Simulation models are introduced in Part II, primarily as tools for evaluating yield-limiting factors in field situations. Part III, "Crop Simulation," begins with an excellent discussion of various kinds of models, and then uses the AFRC (Agricultural and Food Research Council of the United Kingdom) winter wheat model to illustrate simulation model (and sub-model) development and use. This section should be quite helpful to students and researchers who need a solid introduction to the subject.

The book is well-illustrated, and the references cited are extensive. The book is available in soft-cover only; perhaps this helps to keep costs in line, but, after a semester of frequent use, I find that my copy is becoming a little "dog-eared." I suppose this is a fitting testimony to its usefulness.

Gardner, F. P., R. B. Pearce, and R. L. Mitchell. 1985. *Physiology of Crop Plants*. Iowa State University Press, Ames, IA. 327 p.

Tesar, M. B. (ed.). 1984. *Physiological Basis of Crop Growth and Development*. American Society of Agronomy and Crop Science Society of America, Madison, WI. 341 p.

S. U. WALLACE, *Department of Agronomy and Soils, Clemson University, Clemson, SC 29634.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

ALABAMA

University of Montevallo, Department of Biology and Geology. Dr. Kenneth Relyea has joined the department as chairperson, succeeding Dr. Phil Beasley who has retired after 21 years on the faculty. Dr. Eugene B. Sledge will retire at the end of this academic year, his 27th year at Montevallo. Dr. Fadhil Al-Lami is on Sabbatical leave in Iraq and is studying camel adrenal glands. Dr. Malcolm Braid was promoted to the rank of Professor. Dr. Robert McGuire presented a paper at a seminar at Tennessee Tech on "Numerical Taxonomy of the Cyanophyta," and participated in the meeting of the NABF. Mrs. Barbara Brande, Geology, conducted field work in Utah and Colorado this summer. The faculty has a new member: Dr. Davinderjit Bagga, Microbiologist.

Samford University, Department of Biology. Herbert Alfred McCullough, a former Samford biology department chairman noted for his work as a naturalist, died 21 July 1989. He was 74. He was a native of Pittsburgh, Pa., and was a Professor of Biology at Samford from 1947 until his retirement in 1985. He spent most of those 38 years as Head of the Department.

FLORIDA

Archbold Biological Station, Lake Placid. The Florida Ornithological Society announces its 1990 Helen A. and Allan D. Cruickshank Research Award in the amount of \$500 for research dealing with Florida Birds. Applicants should submit three copies of a proposal outlining goals, significance, feasibility, and budget (including other funding anticipated) and a resume by 15 February 1990 to John W. Fitzpatrick, Archbold Biological Station, P.O. Box 2057, Lake Placid, FL 33852. The recipient will be announced at the FOS Spring meeting in April 1990.

University of South Florida, Department of Biology. Two new faculty joined the Department. They are Dr. David Dunigan and Dr. Sam Edwards. Dr. Dunigan has research interests which deal with mechanisms of resistance to virus infection and biochemical and immunological analysis of the structural and non-structural proteins of tobacco mosaic virus. Dr. Edwards is interested in the biochemical elucidation of the properties of protein intermediates involved in photoreceptor functions. Dr. Daniel Lim was recently appointed Director of the Institute for Biomolecular Science. Dr. Mary Jane Saunders, whose interests are Plant Cell Biology, was promoted to Associate Professor with tenure. A Center for Urban Ecology has been formed by faculty within the Department of Biology, College of Natural Sciences. The Center will be concerned with ecological issues generated by increases in human population density and its disturbances. The Center will serve a variety of functions, all of which will enhance the University's research, teaching, and service missions. Correspondence should be directed to Henry R. Mushinsky.

University of Florida, Department of Botany. David A. Jones has joined the department as Professor and Chairman. Dr. Jones was formerly the Head of the Department of Plant Biology and Genetics at the University of Hull, England, and also served as Professor of Genetics for 15 years before becoming Head. He served for 5 years as Department Head before coming to Florida. Alice C. Harmon has joined the faculty as Assistant Professor from the University of Georgia. She has recently obtained a \$140,000 grant from NSF and a \$10,000 grant from the Division of Sponsored Research, University of Florida.

GEORGIA

Georgia Southern College, Biology Department. Dr. James Oliver, Callaway Professor and Director of the Institute of Arthropodology and Parasitology, was chosen as the recipient for the triennial Phi

Kappa Phi National Scholar Award. *Dr. Oliver* is only the sixth winner of this award. He is currently the president-elect of the Entomological Society of America. He was awarded a renewal \$720,000 NIH grant for his research on ticks and mites. *Dr. Timothy Spira*, Assistant Professor, received a \$101,000 NSF grant for his studies on pollen tube growth rate and male fitness in *Hibiscus*. *Dr. Lisa Wagner*, Assistant Professor and Director of the Georgia Southern Botanical Garden, received a \$25,000 Smithsonian grant for her work on the regulation of fruit and seed production in *Hibiscus*. *Dr. Daniel Hagan*, Associate Professor of Biology, was the recipient of a \$50,000 College Program Sea Grant for his research on the ecology of the biting midges, *Culicoides* spp. *Dr. J. B. Claiborne*, Associate Professor, received the third year funding of his \$90,000 NSF grant on acid-base balance and ion regulation in euryhaline fish. *Dr. Michael Moulton*, Assistant Professor, spent two weeks studying the biology of introduced finches in Hawaii this summer. His trip was funded by a grant from the National Philosophical Society. *Dr. Frank French*, Assistant Professor, has begun work on the nature of Spiroplasm-tabanid association, which is being funded by the Insect Pathology Laboratory at Beltsville. *Dr. John Parrish*, Professor and Head, was inducted into the 19th Edition of American Men and Women in Science. New faculty members in the department are: *William Irby* (Ph.D. North Carolina State University), Assistant Professor, Vector-host-pathogen interactions in arthropods. *John Parrish*, (Ph.D. Bowling Green State University), Professor and Head, Avian vision and bioenergetics. Mammalian reproduction and circadian rhythms. *Ann Pratt* (Ph.D. University of Florida), Assistant Professor, Taphonomy and paleoecology of Cenozoic (Florida) vertebrate faunas. Rodent systematics, auarar morphology and systematics. *Lisa Wagner* (Ph.D. University of California, Berkeley), Assistant Professor and Director GSC Magnolia Botanical Garden, Life history strategies, resource allocation patterns, and population biology of plants, especially in weedy species.

Georgia College, Department of Biology. *Dr. Dennis Parnley* (Ph.D. Michigan State) has joined the Faculty as a vertebrate paleontologist and herpetologist.

Georgia Southern College, Department of Biology. The department invited a number of outstanding biologists this past Fall to speak at the Campus Life Enrichment Seminars. Some of the speakers included *Dr. Robert L. Metcalf*, LeConte Scholar, Professor, Center for Advanced Study, University of Illinois, who spoke on Plant Kairomones and Insect Pest Control. *Dr. Kenneth W. McLeod*, Savannah River Ecology Laboratory, gave a talk on High Temperature Flood Stress of Swamp Forests. Another topic, given by *Dr. William E. Timberlake*, Department of Genetics, University of Georgia, was "Genetic Regulation of Fungal Development." "The Big Badlands and Adventures in Vertebrate Paleontology" was the topic by *Dr. William P. Wall*, Department of Biological and Environmental Sciences, Georgia College. The final seminar was given by *Dr. W. Ross Halliday*, USDA Stored Insect Lab, Savannah, who talked on Comparative Toxicology of Malathion in Stored Product Moths—Teaching Old Dogs New Tricks.

Mercer University, Georgia Academy of Science. The annual meeting of the GAS will be held 4–5 May 1990 at Mercer University.

University of Georgia, Department of Botany. A woman has been named to head the Department of Botany. *Dr. Elizabeth G. Williams* spent 13 years as a pasture plant breeder and cytogeneticist in New Zealand, followed by seven years as a Plant cell biologist at the University of Melbourne, Australia. From 1987–89 she worked as a plant cellular geneticist at the University of Kentucky. Her major fields of research include cell biology of higher plant reproductive systems, plant genetics and genetic engineering and controlled breeding of plants. Her research program is internationally recognized and her commitment to the educational programs in the department continue the strong tradition of academic leadership in the botany department. A native of Australia, she earned a doctorate in genetics and botany at the University of Wisconsin in 1972. She has a firm commitment to fostering the careers of women in science. As a mother of four, she understands the conflicting demands on women scientists during the years regarded by male colleagues as their prime career development phase. *Dr. Williams* believes that more assistance and understanding should be available to mothers who wish to remain in scientific careers or to re-enter them after a break for child rearing.

KENTUCKY

Western Kentucky University, Department of Biology. *Mr. and Mrs. Joe Barrett* of Bowling Green, the family of the late *Brett Barrett* recently donated to the L. Y. Lancaster Natural History Display a collection made by their son of over 1,500 specimens of insects and related reference materials. The collection provides very significant research material for future students and faculty interested in the study of entomology. The great majority of the preserved specimens are from South America, Africa,

and Asia. Included in the donated materials are numerous volumes of reference books concerning insects. In addition to being very valuable research material, the insect collection will allow new specific displays to be developed for use by the public as well as area schools. *Dr. Herbert Shadowen* is serving as coordinator of the Display which is located on the second floor of historic Snell Hall. *Dr. Gary Dillard*, Professor of Biology, has just had published Part Two of his Volume *Freshwater Algae of the Southeastern United States*.

LOUISIANA

University of Southwestern Louisiana, Department of Biology. *Dr. William D. Reese* will take part in a four-week expedition to Hainan Island, China to collect bryophytes. The expedition, sponsored by the Missouri Botanical Garden and the National Geographic Society, will include American and Chinese bryologists. Specimens collected will increase the data base for a proposed moss flora of China. *Dr. Betty Lemmon* will be traveling to Oaxaca, Mexico with *John Mickle* of the New York Botanical Garden to collect Selaginella species and other plant material related to her research. *Dr. Robert Twilley* has recently received funding from the LA Water Resource Research Institute to investigate the efficiency of forested wetlands near Thibodeaux in removal of nitrogen in wastewater, and by the LSU Sea Grant to study nitrogen cycling in a shallow coastal system, Fourleague Bay. *James Lynch* will be leaving the department in December to accept a position with the Louisiana DNR—Coastal Restoration Division. *Dr. Carol Chlan* has joined the faculty. She received her Ph.D. from the Department of Biochemistry, University of GA in 1985. During 1986–89 she held postdoctoral positions at UCLA and LSU. Her area of research is plant gene expression. *Dr. Glen Watson* has also joined the faculty. He received his Ph.D. from Florida State University in 1983, and held a postdoctoral position at Loma Linda University. His field of research is developmental biology. The Department has available two Board of Regent Doctoral Fellowships to begin in August 1990. Each Fellow will receive a renewable stipend of \$15,000 per year (12 months) plus complete waiver of tuition and fees. Both fellowships may be used for studies in animal behavior. For information and application materials, write *Dr. Robert Jaeger*, Dept. of Biology, USL, Lafayette, LA 70504 or phone 318-231-5235.

MARYLAND

Howard University, Department of Botany. *Dr. Lafayette Frederick* was elected a member of the advisory council of affiliate societies of the American Institute of Biological Sciences.

MISSISSIPPI

The University of Mississippi, Department of Biology. *Dr. Joel Trexler* has joined the faculty as an Assistant Professor. He received his Ph.D. from Florida State University. His area of expertise is fish population genetics and evolutionary biology. *Dr. John H. Rodgers, Jr.*, has also joined the faculty as a Professor of Biology and Director of the Biological Field Station. *Dr. Rodger's* research is in aquatic botany and ecotoxicology.

Gulf Coast Research Laboratory, Ocean Springs. The invertebrate zoology section has been awarded a \$108,085 contract from the U.S. Dept. of the Interior for the first year of a biological monitoring study at Perdido Key, Fla. for the National Park Service's Gulf Islands National Seashore. *Julie Miller* and her father, *John K. Miller* have put the finishing touches on "Discovery Island", the newest exhibit at GCRL J. L. Scott Marine Education Center and Aquarium in Biloxi, Mississippi. It is an interactive display which enhances its educational value by providing hands-on experiences. GCRL was host to the 1990 Mississippi Academy of Sciences meeting in Biloxi. *Dr. Stuart G. Poss*, systematic zoology section head, is in Europe conducting research on the systematic biology of scorpionfishes supported by NSF. *Dr. Sharon Walker*, coordinator of educational programs at the J.L. Scott Marine Education Center and Aquarium, has been elected to a one-year term as president of Biloxi's Seafood Industry Museum Board of Directors.

NORTH CAROLINA

Wake Forest University, Department of Biology. *Dr. Ronald V. Dimock, Jr.*, Chairman of the Department, has been elected President-Elect of the American Microscopical Society. In what seems to have been a historical event, *Dr. Dimock* and the other candidate, *Dr. Edward Ruppert*, Clemson

University, finished in a dead tie in the balloting. The Executive Committee of the Society has asked the two candidates to serve consecutively as presidents of the AMS. Dr. Dimock's term as President-Elect will begin in 1992, and he will be president of the society in 1993. *Dr. Michael J. Foote*, a paleobiologist, has joined the department as Assistant Professor. Dr. Foote received his Ph.D. from the University of Chicago.

North Carolina State University, Department of Zoology. Dr. Jaime Collazo has been appointed as Assistant Unit Leader and Assistant Professor of Zoology. He will conduct research in wildlife biology with a focus on wetlands and aquatic birds.

SOUTH CAROLINA

Wofford College, Department of Biology. Dr. Douglas A. Rayner has joined the faculty as an Assistant Professor in field botany and ecology. Formerly in research for the South Carolina Department of Wildlife, *Dr. Rayner* earned his Ph.D. in biology at the University of South Carolina.

TENNESSEE

Memphis State University, Department of Biology. Dr. Steven Klaine has received a \$20,000 Ciba Geigy Fellowship and a \$69,300 grant from the United States Geological Survey for "Mussels and Yellow Colony Former Syndrome." *Dr. Bill Simco* received an \$85,000 contract to study "Intensive Production Techniques for Aquaculture." *Dr. Kent Gartner* was awarded an NIH grant for \$49,945 to study "RDGS and LGGAKOAGDV Binding Sites on GPIIb/IIIa."

VIRGINIA

Virginia Polytechnic Institute and State University, University Center for Environmental Studies. Dr. John Cairns, Jr., received the prestigious American Fisheries Society Award of Excellence for outstanding achievement in fisheries science and management. The award consists of a bronze medal, a certificate mounted in a walnut plaque, and travel and related expenses to attend the annual meeting for presentation of the award. The award was presented at the 119th Annual Meeting in Anchorage, Alaska on 6 September 1989.

WEST VIRGINIA

West Virginia University, Department of Biology. James B. McGraw received \$26,000 from NSF for research on "Excavation and radiocarbon dating of ancient viable seeds and permafrost soils in arctic tundra."

ABOUT MUSEUMS AND BOTANICAL GARDENS

GEORGIA

Savannah Science Museum, Savannah. This past Fall, the Museum exhibited working models of Leonardo da Vinci's drawings and sketches of aeronautic, mechanical and hydraulic devices. Produced by IBM Corporation, the exhibit features of approximately two dozen of Leonardo's ideas that have been transformed into table-top models.

KENTUCKY

Museum of History and Science, Louisville. Dottie Saunders joined the ranks of Museum volunteers in 1982 after her retirement from a 20 year teaching career. She began as a volunteer in the Collection Department devoting her energies to the preservation and storage of the costume collection. In 1986, she added a day of working in the gift shop. Dottie is also active in several other departments at the Museum.

NEWS FROM AFFILIATE SOCIETIES OF ASB

SEASIH

THE UNIVERSITY OF TENNESSEE RESEARCH COLLECTION OF FISHES

The University of Tennessee ichthyology collection (standard abbreviation = UT, Leviton et al., 1985) began in 1965 with the arrival of the senior author, initiation of a course in ichthyology, and incorporation of some specimens collected by that fall's ichthyology class plus a few species previously collected by Drs. J. Gordon Carlson and James T. Tanner. Unfortunately, because of the urgent need for a teaching collection, many specimens collected in the late 1960's by the ichthyology classes were not catalogued, and some valuable records from those years are not substantiated by preserved specimens. It was immediately apparent that neither a knowledge of Midwestern fishes, available guides to fish identification, nor the primary literature on freshwater fishes of southeastern United States was sufficient to allow identification of Tennessee fishes, for between 1965 and 1988, 29 fish species occurring in Tennessee were described as new and an additional 10 species were elevated to species from subspecies status; an additional 10 or so known species await description. Thus, in 1965, some 50 of Tennessee's native fish fauna of about 280 species, could not be identified. As several of these species were rather common, the need for initiating a research collection was apparent.

Starting in 1968 and continuing through 1982, UT graduate students began systematic surveys of fishes of various river systems in Tennessee that resulted in addition of important material to the collection from many areas in and around Tennessee. These surveys resulted in eight Master's theses. Additional funded surveys, mostly related to distribution and status of protected species, began in the early 1970's. These included surveys of the Cherokee National Forest, north Georgia, Great Smoky Mountains National Park (in progress), and 20 relatively pristine streams throughout the state as a baseline stream survey; plus status surveys of the smoky madtom (*Noturus baileyi*) and spotfin chub (*Hybopsis monacha*) in the upper Little Tennessee River system, Barrens topminnow (*Fundulus julisia*) in the Barrens Plateau area of middle Tennessee, whiteline topminnow (*Fundulus albolineatus*) in springs in northern Alabama, and boulder darter (*Etheostoma wapiti*) in the Elk River and Shoal Creek systems of southern middle Tennessee. Many additional collections have resulted from the long-term goal of producing a book on the fishes of Tennessee (Etnier and Wayne C. Starnes, in progress).

In 1974 the Zoology Department began a variety of intensive three-week "minicourses." This initiated the "regional faunas" minicourses which consist of preparation for and conducting of field trips to various parts of the country. Students, in addition to collecting fishes, were involved in collecting aquatic insects, reptiles, and amphibians, and in identifying local plants and birds. Such forays have taken us to the Ozark region, the southern and central Great Plains, Atlantic and Gulf coastal areas, the New River system of Virginia and West Virginia, and the Ohio River drainage, and greatly increased the geographical scope of the collection. Upper Midwest coverage has been provided by UT collections plus donations of large collections from the University of Ohio at Mansfield and the consulting firms WAPORA, Inc. and Ecological Analysts.

The end result of the above work is reflected by the extensive coverage of freshwater fishes of eastern and central North America provided by the collection. As an example, the minnow family (Cyprinidae) is represented by over 100,000 specimens, 4,700 lots (=bottles), and nearly 230 species. Other speciose families have similar coverage, as follows: Percidae (39,000 specimens, 3,500 lots, 153 species), Centrarchidae (7,700, 1,200, 30), Fundulidae (5,000, 425, 38), and Catostomidae (4,700, 800, 36). The collection has been extensively used by UT faculty and students as well as our colleagues, and, with few exceptions, authors publishing within the past 15 years on the systematics of freshwater fishes of eastern and central North America have utilized UT specimens. An example of its value and use is in the families Cyprinidae and Percidae where loans have been made of nearly 500 and 250 lots, respectively, at this writing, plus providing additional information as requested concerning distribution, status, biology, and color patterns.

While the original intent was to provide the sort of regional coverage discussed above, the scope of the collection has recently been enlarged, prompted by the inquisitive minds of students in the ichthyology and coral reef ecology classes where weekend field trips to the Gulf and Atlantic coasts

and week-long trips to the Florida Keys have resulted in the collection having good coverage of inshore marine fishes of those areas. Students working on commercial shrimp trawlers and with the fishery observer program on foreign commercial fishery boats in the Alaska region have supplemented the collection, as have collections from the Amazon River basin of Peru and the Pacific Coast drainages of western North America. Trade of specimens with other institutions has resulted in addition of inshore marine species from California and Great Britain. Aquatic Specialists, a Knoxville aquarium shop has maintained a "morgue" for dead specimens, and has provided over 500 species of exotic marine and freshwater fishes from the aquarium trade. At the family level, the collection continues to be weak in pelagic marine fishes and exotic marine and freshwater fishes that do not enter the aquarium trade.

Earlier, the collection was housed at 2104 Terrace Avenue in a University-owned former private residence which was intentionally demolished in 1985 shortly after the collection had been moved to its present location of 636 Hesler Biology Building on the "Hill" of the UT campus. Specimens are stored in 50% isopropyl alcohol, and shelved in approximate phylogenetic order by family. Within a family, entries are shelved numerically by date of accession, with no regard to species or genus. A catalogue is maintained, again arranged by family and time of accession, and includes only species, catalogue number, abbreviated locality data, and date of capture. A card catalogue, arranged by family with genera alphabetical and species alphabetical within genera, is also maintained. A card is filed for each lot, and contains scientific name and author, catalogue number, number of specimens, range of length of specimens, person responsible for identification, locality information, names of collectors, plus notes on condition and any counts or measurements taken from the specimens by UT personnel. Field notes, color notes, and a large reference library supplement the collection.

The UT collection currently contains about 200 families, 1,600 species, 14,000 lots, and 200,000 specimens. Paratypes in the collection include 1,942 specimens in 137 lots representing 28 species; we have no primary types. This is a small collection when compared with some of the larger North American museums such as the University of Michigan, U.S. National Museum, American Museum of Natural History, Academy of Natural Sciences at Philadelphia, Field Museum of Natural History, Tulane University, Cornell University, the Florida State Museum, Los Angeles county Museum, California Academy of Sciences, and Royal Ontario Museum, but we are proud of our efforts to date, pleased with the extent of use of the collection by our colleagues, grateful for interest shown in adding to the collection by UT students and others, and appreciative of the support of the University of Tennessee and the UT Zoology Department in providing space and supplies. Numerous UT graduate and undergraduate students have enrolled in research participation courses that involve chores associated with curation of the collection, and their cheerful and conscientious help has been appreciated.

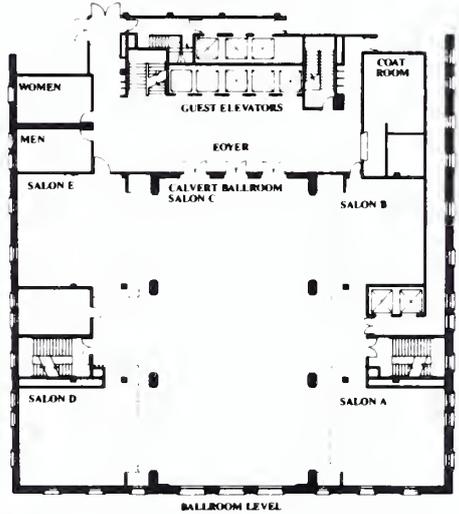
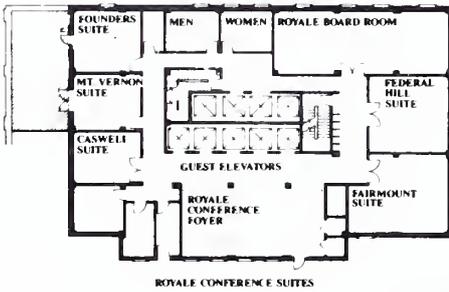
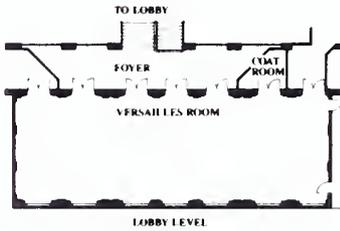
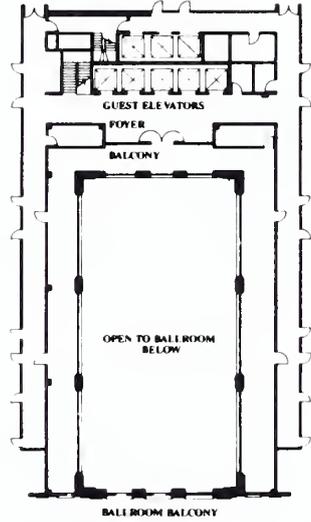
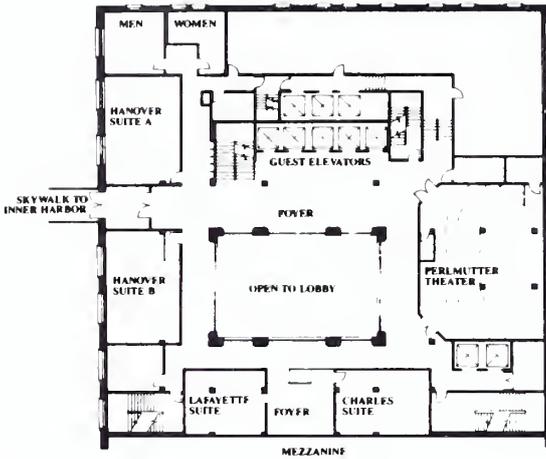
Although maintained as a research collection and not as a public museum (we have no "displays"), the collection is in no way closed to the public, and we invite interested persons to stop by and browse; we enjoy and encourage this sort of use.

Literature Cited

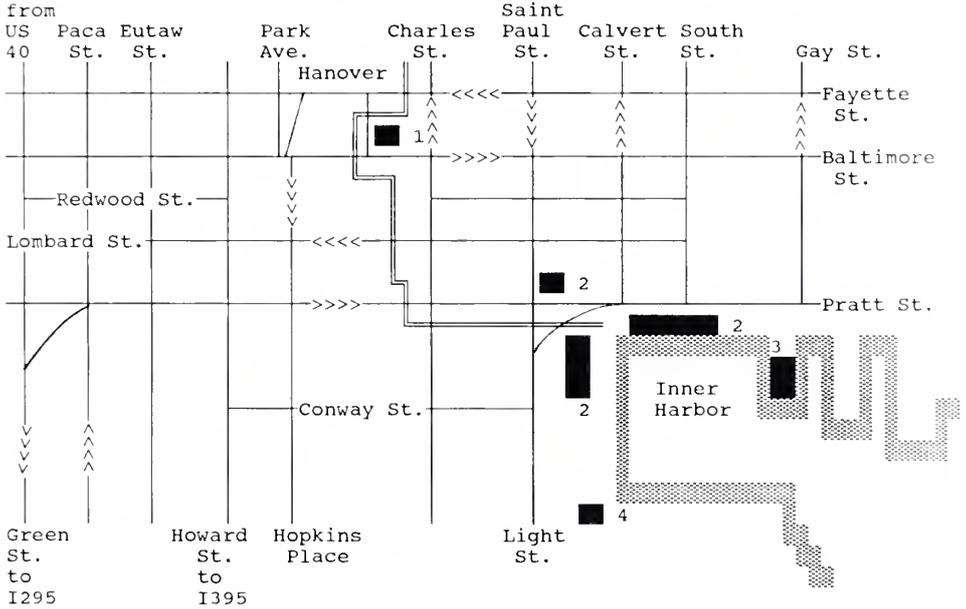
Leviton, A. E., R. H. Gibbs, Jr., E. Heal, and C. E. Dawson. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional collections in herpetology and ichthyology. *Copeia* 1985(3):802-832.

DAVID A. ETNIER and MARY JANE KROTZER, *Department of Zoology, University of Tennessee, Knoxville, Tennessee 37996-0810.*

FLOOR PLANS



Principal Streets of Baltimore Civic Center



== Skywalk to Inner Harbor

>>>> One Way Street

■ 1 Lord Baltimore

■ 3 The National Aquarium

■ 2 The Gallery, Light & Pratt
Food and Shopping Pavilions

■ 4 Maryland Science
Center



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The ASB BULLETIN

Volume 37, Number 3

July 1990



Conservation or Destruction?

***The Official Quarterly Publication of
The Association of Southeastern Biologists***

ASB BULLETIN
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1992: James S. Fralish, Forestry Dept. So. Illinois Univ., Carbondale, IL 62901

Ken R. Marion, Biol. Dept., Univ. Alabama-Birmingham, Birmingham, AL 35294

1993: M. Eloise Carter, Oxford College of Emory, Oxford, GA 30267

James W. Wallace, Jr., Western Carolina University, Cullowhee, NC 28723

The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1991 April 10-13 Appalachian State University, Boone, NC

1992 April 8-11 University Alabama-Tuscaloosa, Tuscaloosa, AL

1993 April 14-17 Old Dominion University, Norfolk or Virginia Beach, VA

PATRON MEMBERS

Breedlove, Dennis and Associates, Inc., Orlando, FL

Carolina Biological Supply Co., Burlington, NC

Martin Microscope Co., Easley, SC

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AUG 22 1990
A. M. N. H



PRESIDENT'S CORNER

A VIEW FROM HERE

Just back from the excellent meeting in Baltimore, I reflect on the directions and needs of ASB in 1990-91.

The coming year heralds continued excellence in ASB activities. The special camaraderie among our members at the annual meeting and elsewhere generates a fertile atmosphere for the conception of new ideas and the initiation of educational and research projects. Graduate students in particular are well served by ASB and the annual meeting. In my view, the ASB meeting provides the best forum around for graduate student presentations. The most consistent advice I give to my students is to attend professional meetings as frequently as possible, and this might be the most important action they take during their graduate careers. We must insure that ASB meetings remain easily accessible and affordable to our graduate students.

My personal agenda for this year includes increased national involvement of ASB, increased membership, and a stable budget. Our affiliation with AAAS, AIBS, and AEE is serving us well and greater involvement in national affairs through these organizations is desirable. ASB's recent contributions to the Biodiversity issue through the Forest Service-ESA Workshop and the symposium at the AAAS meeting are exemplary of what ASB can do on the national level. I am convinced that ASB's membership can be increased substantially. Many of our colleagues in the southeast are still largely unaware of ASB and ASB activities. We need to continue to spread the word on one of the best professional bargains around. The society is presently in sound financial condition, but we cannot become complacent. We need to consider adopting policies which will insure continued financial stability.

Finally, I want to remind ASB members attending the AIBS meeting in Richmond in August to visit our booth and come to the ASB mixer.

ASB depends upon the ideas and contributions of its members. Please communicate your desires and complaints to the Executive Committee so we can better serve the society.

ASSOCIATION AFFAIRS

1990 MERITORIOUS TEACHING AWARD



Dr. J. Charles O'Kelley

The 1990 Meritorious Teaching Award was presented by Dr. Stewart Ware of the College of William and Mary to Dr. J. C. O'Kelley of the University of Alabama. The award is sponsored by the Carolina Biological Supply Company.

The recipient of the 1990 Meritorious Teaching Award is Dr. Joseph Charles O'Kelley, Research Professor of Biology, Emeritus, at the University of Alabama. This award, accompanied by a check for \$1,000 generously provided by the Carolina Biological Supply Company, represents the highest honor the Association of Southeastern Biologists can bestow upon one of its members. Dr. O'Kelley was born in Unadilla, Georgia, but received his undergraduate and master's degrees in botany at the University of North Carolina, and his Ph.D. degree from Iowa State University. He joined the faculty of the University of Alabama in 1951,

and served there until his retirement in 1986. During those years he has been an active participant in ASB, serving as its President in 1984–85. Dr. O’Kelley has had a very productive research career, publishing over four dozen papers on the physiology and photobiology of algae. His master’s and Ph.D. students spoke often in their letters of his enthusiasm for scientific research and the sense of excitement about research he inspired in those who worked in his laboratory. They wrote at even greater length about the demanding but patient way he taught, both in the classroom and in the lab. They spoke often of his clear explanations and his willingness to answer questions from students, so that each student was made to feel a worthy participant in the class. Student after student told of occasions when they or other students were uncertain, discouraged, or had made mistakes in class or lab that left them open to chastisement or even ridicule. They wrote in admiration of the way, in these cases, Dr. O’Kelley patiently and with sensitivity made sure these students understood what they had done wrong, and how they could avoid that error in the future. The students had been corrected but not chastised, so that Dr. O’Kelley left them feeling encouraged and more confident rather than disheartened. Many of his students pointed out that Dr. O’Kelley is their role model in their own teaching, both with undergraduates in the classroom and graduate students in the research lab. To be enthusiastic about the subject matter, clear in one’s explanations, aware of the needs and worth of each student, and inspiring to others—this is indeed meritorious teaching.

1990 RESEARCH AWARDS

THE ASB FACULTY RESEARCH AWARD was presented by Dr. Eloise Carter to Dr. James Fralish of Southern Illinois University (see abstract 50 in ASB Bulletin Vol. 37, No. 2, 1990) who coauthored a paper with Fred Crooks entitled: A comparison of presettlement, second-growth, and old-growth forest communities in the Shawnee Hills of Illinois. The award consisted of a plaque and a check for \$500.



Dr. J. Fralish receiving the Faculty Research Award from Dr. E. Carter

STUDENT RESEARCH AWARD, supported by the Martin Microscope Company of Easley, SC, was presented by Dr. S. K. Ballal to J. E. Lovich of the Savannah

River Ecology Laboratory (abstract 68 in ASB Bulletin Vol. 37, No. 2, 1990) who coauthored a paper with J. Whitfield Gibbons on: Male-biased sex ratios in a South Carolina population of the turtle *Malaclemys terrapin*. The award consisted of a plaque and a check for \$500.



Jeff E. Lovich

The **EUGENE P. ODUM AWARD** committee selected the paper by Anton Tucker of the University of Georgia, Savannah River Ecology Laboratory for the Eugene Odum Award. His paper treated: Natural Selection for randomness nest distribution in the leatherback turtle, *Dermochelys coriacea* (abstract 65 in ASB Bulletin Vol. 37, No. 2, 1990). The award is sponsored by the Southeastern Chapter of the Ecological Society of America who voted to raise the amount of the award to \$250 immediately and a plaque. Nine papers were reviewed by four of 11 judges. The award committee consisted of Drs. D. Cocking, A. Ash, and S. Ware.



Anton Tucker

The **SOUTHEASTERN BOTANICAL ASSOCIATION AWARD** was presented by Dr. L. Mellichamp to L. Zettler of Clemson University for his coauthored paper with John Fairey III and T. M. McInnis Jr. on: The status and seed germination of *Plantanthera integrilabia* (Correll) Luer, an endangered terrestrial orchid (abstract 92 ASB Bulletin Vol. 37, No. 2, 1990). The award was for \$100.



The **SOUTHERN APPALACHIAN BOTANICAL CLUB-ELIZABETH ANN BARTHOLOMEW SERVICE AWARD** was presented to Dr. W. Duncan of the University of Georgia.



Dr. W. Duncan

Shiela Peel of the University of North Carolina-Chapel Hill received the best paper award in parasitology for the paper *Mefloquine* resistance in *Faleioarum*. This award was presented in Boone where the parasitological society met.

GRADUATE STUDENT SUPPORT AWARDS were presented to 29 applicants to help them with costs associated in attending the annual meeting. The number following each name refers to the abstract number as found in ASB Bulletin Vol. 37, No. 2, 1990.

Affronti, L. F., Old Dominion Univ. (23)	McGregor, M. A., Tennessee Tech. Univ. (107)
Atkinson, R. B., Virginia Tech. (154)	Mcldlin, E. S., Tennessee Tech. Univ. (136)
Brown, K. A., Tennessee Tech. Univ. (137)	Pauley, E. F., Univ. Tennessee (40)
Conn, C. E., Old Dominion Univ. (151)	Parkinson, J., UNC Chapel Hill (108)
Dong Q., Vanderbilt Univ. (36)	Reitcheck, B. G., Western Kentucky Univ. (16)
Flinchum, R. Y., Univ. South Carolina	Rudowicz, L. C., Southern Ill. Univ. (45)
Franklin, S., Southern Ill. Univ. (44)	Saad, Z. A., Old Dominion Univ. (87)
Gammill, S. P., UNC Wilmington (26)	Shen, Z., Univ. Tennessee (38)
Hicks, D. T., Tennessee Tech. Univ. (140)	St. John, R. T., Tennessee Tech. Univ. (135)
Hutcherson, J. D., Appalachian State Univ. (6)	Swab, E. C., NC State Univ. (57)
Kettler, S., Southern Ill. Univ. (43)	Veara, T. E., Southern Ill. Univ. (42)
Liu, J., Univ. Georgia (32)	Wu, X., Univ. Tennessee (31a)
Long, A. A., Southern Ill. Univ. (46)	Yin, Y., Univ. Tennessee (35)
McCarron, J. K., Appalachian State Univ. (7)	You, C., Univ. Tennessee (31)
McGlothlin, K. L., East Tenn. State Univ. (15)	

MERITORIOUS TEACHING AWARD NOMINATION DEADLINE: 1 FEBRUARY 1991

Each year the ASB recognizes one of its members for especially meritorious teaching. This award of \$1000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the July ASB BULLETIN.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a southeastern institution for at least ten years and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his or her institution (important assignments, other contributions specifically related to effective teaching, teaching awards) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially those who later received advanced degrees.

Members are urged to nominate outstanding teachers for this award, using the form given below and including supporting documentation (biographical sketch or CV, supporting letters, photograph of candidate, etc.). Send all of this, once compiled, to Dr. Dorothy L. Brock, Division of Natural Sciences, Gainesville College, Gainesville, GA 30503 (404-535-6304).

NOTE: Supporting letters for nominees should be sent to the nominator, not to the selection committee. Past unsuccessful nominees will not be reconsidered unless they are re-nominated. Nomination materials of unsuccessful nominees will be returned to nominators.

NOMINATION—ASB MERITORIOUS TEACHING AWARD, 1991

NAME _____

ADDRESS _____

TEACHING INTERESTS _____

Nominator

Name/Address _____

Supporting documentation:
(enclosed)

_____ curriculum vitae

_____ letter of nomination

_____ supporting letters (no. _____)

_____ additional information (list):

**ADDITIONAL COMMERCIAL EXHIBITORS
NOT LISTED IN ASB NO. 2 APRIL ISSUE**

The following exhibitors and sponsors, not listed in the April issue of the ASB Bulletin Vol. 37, no. 2, 1990 also manned exhibits during the April meetings.

AIBS
Apple Computers
The Benjamin/Cummings Publ. Co.
W. C. Brown Publ. Co.
Conference Book Service Inc.
Environmental Growth Chambers
Leica Co.
Macintosh

Prentice Hall Co.
Southern Appalachian Botanical Club Sponsors
Cole-Palmer Instrument Co.
Deagon Devices Inc.
Li-Cor Inc.
Optical Data Corp.
Ted Pella Inc.
S. Biological Supply Co.

NECROLOGY

Frank Barclay
Janet S. Harrison
R. W. Menzel
Charles Jenner

OTHER BANQUET ACTIVITIES

A total of 434 members attended the ASB meeting in Baltimore, Md. Nine past presidents were in attendance including founding father member W. Duncan. Retiring President W. Martin's banquet address was entitled: "E" words and acorns.



Dr. W. Martin delivering
Past-President address



Dr. Frank P. Day
1990-1991 ASB President

EDITOR'S REPORT FOR 1989

A total of 183 pages were published in the ASB Bulletin in 1989. This included 136 pages devoted to society material and abstracts, 27 pages contained 29 book reviews, 15 pages noted News of Biology in the southeast, and one paper of five pages. This was a decrease from 1988, when 240 were published. A membership directory of 47 pages was also published in 1989. Members are reminded and encouraged again that papers, notes, and other information are welcome and will contribute to a stronger ASB Bulletin.

PROGRAM CHANGES

- A1. Jolls, C. L., L. G. Poole, T. C. Chenier, and R. J. Downs. (East Carolina University and North Carolina State University) The reproductive ecology and oil content of *Senna obtusifolia*.
- A2. Dickson, C. C. and C. F. Nixon. (Jacksonville State University) Taxa of special concern, Sunset Rock area, Chickamauga and Chattanooga National Military Park, with attached flora.

Additional Posters

- A3. Bonner, L. A., R. G. Altig, and W. Diehl. (Mississippi State University) Limnology of temporary forest pools in north-central Mississippi.
- A4. Flinchum, R. Y. and W. D. Dawson. (University of South Carolina) Subspecific differences in genetic variants of oldfield mice (*Peromyscus polionotus*).
- A5. Wu, X. and E. S. Groton. (University of Tennessee and Tennessee Valley Authority) Change in growth rate of white pine at an east Tennessee site and its relationship with environmental factors.
- A6. Turek, J. G., C. L. Bernstein, W. L. Buettner, and D. R. Smith. (John Harms and Associates, Inc.) Identification of potential wetland creation sites within three Maryland estuaries.

An additional Wetlands Session was held on Thursday afternoon in Salon B.

- 1:30 A7. McLendon, C. S. and F. D. Heliotis. (George Mason University) Growth dynamics and patterns of nutrient allocation in seedlings of *Peltandra virginica* (L.) Kunth in a constructed and natural tidal freshwater marsh.
- 1:45 A8. Kent, D. M. and C. E. Tammi. (Metcalf & Eddy, Inc.) Ruderals in the Parker River/Essex Bay, Massachusetts coastal area of critical environmental concern.
- 2:00 A9. Belling, A. J. (Metcalf & Eddy of New York, Inc.) Vegetation history of a northern New Jersey tidal marsh.
- 2:15 A10. Bigley, T. W., J. A. Labriola, and J. L. Woodard. (Edwards and Kelcey, Inc.) The creation and enhancement of a formerly tidally flowed freshwater wetland within the Hackensack Meadowlands, New Jersey.

LATE ABSTRACTS OF PAPERS PRESENTED AT APRIL MEETING

A1

JOLLS, C. L.,¹ L. G. Poole,¹ T. C. Chenier¹ and R. J. Downs,² ¹ East Carolina University and ²North Carolina State University—*The reproductive ecology and oil content of Senna obtusifolia (Leguminosae).*

Senna obtusifolia, a pernicious weed of the southeast, has been confused with an Asiatic relative cultivated for its oils, *Senna tora*. Our objective is to screen oil content and heritability in sicklepod to determine its potential as a crop. Seed, the source of oils, were highly variable in number and size, particularly among maternal parents ($F = 137.26$, $df = 13$) and among branches ($F = 54.9$ $df = 24$). Seed location within a legume explained 4–97% of the variation in seed mass. Lack of pattern among plants, among branches and within fruit suggests environmental and genetic influences on seed mass and perhaps oil content. In the field, these influences include resources, parental genetics, floral morphology and insect activity. To control these last two variables, we compared greenhouse-reared progeny from artificially-pollinated field plants. Sicklepod is very tractable and plastic in cultivation. Seed to flowering can occur in six weeks with 20 9-h days for floral induction. Flower and fruit abortion appear to be light and temperature sensitive. Plant growth can double as a function of pot size. Oil contents of seed were low, from 2–10% dependent upon solvent used for the extraction. Fatty acids were typical of other legumes, with high percentages of oleic (18:1) relative to linoleic (18:2). This seed mass variation, suggested variation in oils, and reports of medicinal uses and livestock poisoning construct an interesting story for the feasibility of sicklepod as a potential cash crop. This research is supported in part by the North Carolina Biotechnology Center, 8913-ARIC-0306.

A2

DICKSON, CATHERINE C. and CHRISTOPHER F. NIXON, Jacksonville State University—*Taxa of special concern, Sunset Rock Area, Chickamauga and Chattanooga National Military Park, with attached flora.*

An assessment of the impact of rock climbing and rappelling on the vascular flora of the Sunset Rock area of the Chickamauga and Chattanooga National Military Park on Lookout Mountain, Tennessee was conducted. A negative impact

upon the vascular flora of rock faces and bluff bases was noted as well as upon the lichen flora. Also documented were erosion and soil compaction from recreationists gaining access to climbs as well as invasion of non-native species. A vascular flora was produced including the following species of special concern: *Asplenium montanum*, *Silene rotundifolia*, *Diervilla rivularis*, *Lonicera flava*, *Trillium decumbens*, *T. cuneatum* var. *luteum*.

A3

BONNER, LISA A., RONN G. ALTIG, and WALTER DIEHL. Mississippi State University—*Limnology of temporary forest pools in north-central Mississippi.*

Five temporary forest pools at Noxubee National Wildlife Refuge in Mississippi were surveyed monthly from October 1984 through May 1987. One objective was to obtain descriptive data on the physicochemical and biological fluctuations and their interactions. These ecosystems were heterotrophic with a detrital-based food web derived from allochthonous leaf litter. Multifactor analysis of variance revealed significant differences ($P \leq 0.05$) in several physicochemical parameters and subsets of fauna among pools, months, seasons and years. Overall, chlorophyll *a* values were correlated with phosphate concentrations seasonally; numbers of zooplankton differed significantly among months, possibly as a consequence of temperature; pelagic macroinvertebrate numbers were influenced by temperature; and resident amphibian larval densities were affected significantly by dissolved oxygen concentrations and numbers of macroinvertebrates present. The second part of this study involved perturbations (addition or subtraction of allochthonous energy sources, controlled burning, or chlorination) of four of the five pools to ascertain the effects on community structure or the physicochemical environment. It appears that these heavily shaded, ephemeral pools are each unique ecosystems and are highly resilient to perturbation.

A4

FLINCHUM, RENÉE Y. and WALLACE D. DAWSON. University of South Carolina—*Subspecific differences in genetic variants of Oldfield mice (Peromyscus polionotus).*

Laboratory-reared and/or wild-caught specimens of three subspecies of *Peromyscus polio-*

notus (*subgriseus*, *lucubrans* and *leucocephalus*) were screened for polymorphic genetic variants. Screening consisted of visual observation of a coat color marker (white cheek), starch gel electrophoresis of blood proteins (albumin, transferrin and erythrocytic esterase) and Southern analysis of a restriction fragment length polymorphism (alcohol dehydrogenase). Initial screening demonstrated subspecific differences in the incidence of the variants. Only *P. p. leucocephalus* exhibited the white cheek allele and only *P. p. subgriseus* expressed one of the esterase variants. Individuals from each of the subspecies were intermated and the resulting intersubspecific F_1 hybrids were scored for color and blood protein types. Additionally, backcross and F_2 progeny were typed and will be released at an experimental field site. The released animals will be used in a study designed to explore genetic drift in an artificially constructed population.

A5

WU, XINYUAN AND ELIZABETH S. GROTON. Tennessee Valley Authority—*Change in growth rate of white pine at an East Tennessee site and its relationship with environmental factors.*

White pine trees from a system of permanent inventory plots at a private land holding in East Tennessee were sampled in 1964, 74, 84 and 87. There was little mortality of white pine in the sampling period; only 4 trees died during the 74–84 period. There was a significant amount of ingrowth in the 64–74 and 74–84 periods. The size distribution shows a change towards more large trees. The relative growth rate in the 74–84 and 84–87 periods were significantly lower than that in 64–74 period. When the relative growth rate was adjusted by initial basal area using covariance analysis, similar results were obtained. According to the nature of the re-measurement data, multivariate analysis methods were used in analyzing the relationship of growth rate and three environmental factors: topography, slope and aspect. The relative growth rate of white pine was sensitive to environmental conditions in the 64–74 period, but became insensitive in the 74–84 and 84–87 periods. Profile analysis shows that the pattern of the relative growth rate in different environmental conditions changed significantly through time.

A6

TUREK, JAMES G., CAROL L. BERNSTEIN, WILLIAM L. BUETTNER, and DAVID R. SMITH. John Harms and Associates,

Inc.—*Identification of potential wetland creation sites within three Maryland estuaries.*

Creation, restoration, and enhancement of wetlands is requisite for achieving the no net loss policy supported by the Bush Administration. Regulatory agencies frequently authorize wetland impacts with requirements of compensatory mitigation. The lack of feasible mitigation sites, particularly in urban regions, and the deficiencies of agency compliance/enforcement programs are factors that inhibit successful implementation of the no net loss policy. Advanced identification of mitigation sites would help to improve regulatory compliance. A quantitative method was applied in field identifying feasible wetland mitigation sites within three small (less than 1 square mile) urbanized estuaries in Maryland. Methodology included an evaluation of environmental variables for shoreline segments assessed by boat and ranking of shoreline segments according to the feasibility of the segment for wetlands construction. Shoreline variable included: fetch, shoreline shape and orientation, beach width and slope, substrate type, extent of overstory shading, and proximity of the site to boat traffic. Empirical values were assigned to the 10 rating variables for each shoreline segment. Values were then summed to obtain a cumulative vegetative treatment potential (VTP), and the VTP was then ranked for each site. Results indicate that feasible sites are available for the construction of emergent fringe wetlands. Excessive sedimentation from upland development is an existing problem that must be addressed if wetland construction is to occur. Many of the sites border privately-owned lands, and permission for construction would have to be granted by the landowner. Tax incentives and public education of the ecologic values (water quality improvement, shoreline stabilization) generated by constructed wetlands could serve as measures for gaining landowner approval.

A7

MCLENDON, C. SCOTT and FRANCIS D. HELIOTIS. George Mason University—*Growth Dynamics and Patterns of nutrient Allocation in Seedlings of *Peltandra virginica* (L.) Kunth in a Constructed and a Natural Tidal Freshwater Marsh.*

In April of 1989, a study was initiated to compare mortality, above and belowground productivity, and allocation of nitrogen and phosphorous in newly planted seedlings of *Peltandra virginica* (L.) Kunth at two elevations in adjacent constructed and natural tidal freshwater marshes. Mortality was greatest at the high el-

evaluations of the natural marsh and the low elevations of the constructed marsh. This was attributed to a combination of factors including competition with existing plant species (eg. *Eleocharus obtusa*) and creek bank erosion. Significant differences were not apparent until September when root, shoot, and rhizome biomass at the low elevations of both sites was approximately 4.0, 7.5, and 3.8 times greater, respectively, than at the high elevations. Of the 500 seedlings planted, less than 1 percent flowered during the first growing season. Time of planting appears to significantly affect the success of seedling survival during the first growing season.

A8

KENT, DONALD M. and CARL E. TAMM. Metcalf & Eddy, Inc.—*Ruderals in the Parker River/Essex Bay, Massachusetts Coastal Area of Critical Environmental Concern*.

The Massachusetts Area of Critical Environmental Concern (ACEC) program was established in 1974 as recognition of the fact that certain land and water resources are of limited distribution, are of central importance to the welfare, safety, and pleasure of all citizens of the Commonwealth, and that the protection and management of these resources transcends purely local concerns. One of the factors leading to designation of the Parker River/Essex Bay ACEC was the quality of natural characteristics, including 10,070 acres of pristine salt marsh. *Phragmites australis*, an introduced, ruderal species indicative of disturbed conditions, has become established in the ACEC. A survey was conducted to determine the location and areal extent of *Phragmites australis* in the Parker River/Essex Bay ACEC. The results are used to establish a baseline for future assessments of the health of the salt marsh and to document changes in the succession of the marsh flora. Also, the occurrence of *Phragmites australis* is compared to land use patterns for the purpose of guiding future development activities adjacent to the ACEC.

A9

BELLING, Alice J. Metcalf & Eddy of New York, Inc.—*Vegetation history of a northern New Jersey tidal marsh*.

The vegetation history of a northern New Jersey tidal marsh was documented from data contained in cores extracted from marsh sediments on the northern shore of the Raritan River estuary, Edison, New Jersey. Fossil data were used

to determine the structure and composition of past communities on the marsh and the adjacent uplands. Radio-carbon dating analyses of marsh sediments at two locations on the marsh indicate that marsh communities became established approximately 3,300 years ago at a sampling site located midway between the river edge and the present upland, and approximately 1,700 years ago at a sampling site located close to the marsh-upland border. Pollen data were used to reconstruct the past history of marsh and adjacent upland communities. Cramineae and other herbaceous taxa have dominated the marsh communities, while pitch pine, oak and other deciduous forest species reflect the composition of associated upland forests during the past two millennia. Evidence for conversion of the tidal marsh to a freshwater marsh at the beginning of the present century will also be presented.

A10

BIGLEY, Thomas W., Joseph A. LABRIOLA and John L. Woodard. Edwards and Kelcey Inc.—*The Creation and Enhancement of a Formerly Tidally Flowed Freshwater Wetland Within the Hackensack Meadowlands, New Jersey*.

A 28 acre site located primarily in Secaucus Township, Hudson County, New Jersey, was evaluated to establish pre and post-development wetland functional values and a compensatory wetland mitigation plan was prepared. The existing on-site degraded palustrine emergent wetland dominated by *Phragmites australis* and adjacent upland areas were evaluated and selected for mitigation design. The resultant palustrine-open water wetland mitigation area/habitat complex presented is predicted by WET 2.0 analysis to possess overall higher wetland functional values. Additional off-site compensatory mitigation areas were also evaluated.

A11

PARR, PATRICIA D. and MAUREEN CUNNINGHAM. Environmental Sciences Division, Oak Ridge National Laboratory, and University of Tennessee—*Habitat manipulation: effects on a declining rare plant population*.

A population of *Delphinium exaltatum* (listed as an endangered species in Tennessee) on the Oak Ridge National Environmental Research Park, Oak Ridge, TN, has been monitored for 5 years following a partial bulldozing of the site in 1984. The majority of the *Delphinium* population occurs in a powerline right-of-way where

the area was mowed periodically prior to 1984. After the bulldozing, mowing was halted until winter of 1989. In 1985, 100 permanent plots were established on the site. Numbers of flowering adults and immature plants have been recorded annually since 1985. Total numbers of plants declined 80% from 1985–1988. Following the mowing, total numbers of plants in the plots increased 60% from 1988 (39 plants) to 1989 (100 plants). While the total number of plants in 1989 was 50% less than those recorded in 1985 (197 plants), the number of immature plants increased 290% (from 32 to 93 seedlings and juveniles) indicating that some kind of periodic disturbance may be necessary for the pop-

ulation. Above average rainfall in 1989 following four years of severe drought confounds population response to mowing. The population will continue to be monitored to determine appropriate management strategies for this species. This program is sponsored by the Oak Ridge National Environmental Research Park, Ecological Research Division, Office of Health and Environmental Research, U.S. Department of Energy, under contract No. DE-AC05-84OR21400 with Martin Marietta Energy Systems.

* A corrected abstract of abstract 90 in ASB Bull. 37(2): 85, 1990.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS PRESIDENT'S REPORT 20 APRIL 1990

Joe E. Winstead

Continuity, Financial Concerns, Recruitment of New and Old Members, Environmental Issues, Symposium Publication, Symposia Sponsorship, Visibility of ASB at the National Level and untold hours of Volunteer Work by ASB Committee Chairs and Members represent the main functions of your organization since we met formally in Charlotte, North Carolina in April of last year.

As I indicated in the October ASB Bulletin (Vol. 36(4): 163) your resolution on Biological Diversity (Vol. 36(3): 143) was conveyed to each representative of the national legislative branch from the southeast that have committee influence on biological legislation. That thrust was enforced by supplemental letters from other ASB officers and, I hope, by your individual letter writing efforts that were called for by Becky Sharitz last year. The Conservation Committee continued to track legislative action on this topic and has sent detailed comments about H.R. 1268 to Congressman Jerry Studds and Senator Patrick Moynihan who have or will be introducing legislation concerning Biodiversity on Capitol Hill. This week I also visited with various members of Congress and their staffs to urge the development of proper biodiversity legislation. ASB views were also expressed by the Conservation Committee; your president, and others, concerning serious threats to the integrity of the Big South Fork National River and Recreation Area.

Finances have and will continue to be of serious concern to your elected and appointed officials. Monumental work by the Enrichment Fund Committee, the Host Committee here at Towson State, past presidents and executive committee members along with many of you who have given both financial and vocal support have allowed ASB to not draw back from our goals and commitments. Prompt payment of dues, past dues or renewals and great solicitation of new members by ASB affiliates as the Southern Appalachian Botanical Club and others allowed us to start the 1990's on a more positive note than anticipated. I hope all members

recognize that the current dues structure is one of the best bargains for members found in any scientific society. The only operation cushion of this all-volunteer organization will be dependent upon any surplus generated by the annual meeting and gratuitous support by the host institutions or organizations of the membership until the Enrichment Fund is developed as planned. It is probable that your support will be needed for a modest dues increase in the near future. The support that those of you in attendance at the 51st Annual Meeting have shown is however a most reassuring note that we approach the future with confidence of purpose.

The development and sponsorship of five symposia at this meeting by ASB members and affiliates indicates the continued success of one of our roles. As I indicated in the January Bulletin (Vol. 37(1): 1) these activities often prove to be significant in the history of biology and we can anticipate long term benefits from the efforts of this week. If all goes well one of the 1990 ASB Bulletins will feature a significant publication developed from the 1989 Biodiversity Workshop we and affiliates co-sponsored with the U.S. Forest Service. Such efforts developed from tremendous time consuming reviews and editing and minimal financial cost to ASB further enhance the credibility of the organization and the Bulletin.

Your representatives to AIBS, AAAS, and the Alliance for Environmental Education provided strong recognition for ASB in 1989 and 1990. Supported by many ASB members our delegated representatives managed a booth at the AIBS meetings in Toronto, Canada; showed strong presence along with the ASB sponsored symposium at the January AAAS meetings in New Orleans and the environmental education concerns of ASB were represented at meetings of AEA and AAAS in Washington. Those of you planning to attend the AIBS meeting in Richmond, Virginia, 5-9 August of this year will have the opportunity to further ASB membership recruiting by working at our anticipated booth and by participating in field trips and other activities of ASB and affiliates. I urge each of you attending this particular meeting to indicate your ASB membership on the appropriate checkoff space of the registration form.

In closing I would like to comment upon two significant points that should be of interest to those of us charged as being professionals in the biological sciences. The first is for us to demand renewed efforts in targeting and helping young people from preschool to university age to be involved in science and science education. By all accounts the turn of the century will be dominated by professions involved in the life sciences yet our nation faces severe shortages in personnel trained at every level and subdiscipline of biology not to mention other sciences. Our enthusiasm and expertise as well as adaptability is needed through personal involvement at the community, state and regional level in every aspect of science education. Secondly, you should feel considerable pride that in this week, which on a nationwide basis culminates in the 20th Anniversary of Earth Day, you are participating in the "hard science activity" that has allowed the development of a data base giving credibility to the need for an Earth Day. It has been your efforts in teaching, research and application of biology from the molecular and cellular to the populational and ecosystem level that provide the information that can be synthesized on a popular theme to move a nation to herald the many facets of the Earth Day event.

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
TREASURER'S REPORT

1 January 1989–31 December 1989

I. SAVINGS ACCOUNT

A. Merrill-Lynch Ready Assets Trust

Balance 1 January 1989	\$12,556.44
Net Transfers to/from Checking	1,500.00
Interest Earned 1989	<u>893.48</u>
	14,949.92

II. CHECKING ACCOUNT

Balance on Hand, 1 January 1989 686.10

A. Receipts

Patron Dues	800.00
Regular Dues/Subscriptions	19,320.00
Annual Meeting (Charlotte)	944.12
Reimbursement Local Arrgts (Baltimore)	1,000.00
Bulletin Page Charges	2,550.00
Honorarium Reimbursement (Bot. Soc. America)	250.00
N.C. Botanical Garden	100.00
Bulletin Copies	226.50
Interest	<u>94.15</u>
TOTAL RECEIPTS	\$25,284.77

TOTAL RECEIPTS & BEGINNING BALANCE \$25,970.87

B. Disbursements

1. Membership Cultivation

Printing & Mailing	<u>201.60</u>
	\$ 201.60

2. Publication

ASB Bulletin (Vol. 36), Printing	16,347.02
Roll Maintenance for Bulletin Mailing	<u>145.31</u>
	\$16,492.33

3. Office Expenses

Editor	33.66
Other Officers (Includes Travel to Interim Meeting, Decatur)	959.60
Bank Charges	<u>37.90</u>
	\$ 1,031.16

4. Travel and Related Expenses

Student Travel Awards	1,998.00
Speaker Honorarium/Travel	797.00
N.C. Botanical Garden Award	100.00
Plaques	<u>99.15</u>
	\$ 2,994.15

5. Research Awards

	<u>1,000.00</u>
	\$ 1,000.00

6. Miscellaneous

AIBS Affiliation	240.00
Local Arrgt (Charlotte)	52.50
Art Prints	90.00
Transfer to Enrichment Fund	55.00
Advance to Local Arrgt (Baltimore)	\$ 1,000.00
Alliance for Environmental Ed	<u>100.00</u>
	\$ 1,537.50

TOTAL	\$23,256.74
NET TRANSFERS TO/FROM SAVINGS	<u>1,500.00</u>
	24,756.74
BALANCE IN CHECKING 31 December 1989	1,214.13
SUMMARY	
CASH IN CHECKING	1,214.13
CASH IN SAVINGS	<u>14,949.92</u>
TOTAL ASSETS	\$16,164.05
ENRICHMENT FUND	\$ 7,250.17

CONTRIBUTORS TO ASB ENRICHMENT FUND

23 September 1989–4 May 1990

Anonymous—(two)	J. Whitfield Gibbons
Ronald E. Barry, Jr.	Joan R. Gibson
Frank D. Bowers	James G. Gosselink
John R. Bozeman	Bernard Lowy
Alice L. Bull	William H. Martin, III
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News Editor—Jon Fortman, Division of Science and Math., Mississippi University for Women, Columbus, MS 39701 (816/373-3668).

Archivist—Madeline P. Burbank, Box 15134, Atlanta, GA 30333 (404/373-1413).

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- Resolutions Committee**—Chair: Joe E. Winstead, Dept. Biol., Western Kentucky University, Bowling Green, KY 42101 (502/745-6004); Ken R. Marion, Biol., University of Alabama-Birmingham, Birmingham, AL 35294 (205.934-3582); Kenneth Shull, Biol., Appalachian State University, Boone, NC 28608 (704-262-3025).

RESOLUTION

RESOLUTION OF APPRECIATION TO TOWSON STATE UNIVERSITY AND LOCAL ARRANGEMENTS COMMITTEE

WHEREAS, Dr. Hoke L. Smith, and Dr. Robert L. Caret, in their roles as President and Provost of Towson State University on behalf of the University invited the Association of Southeastern biologists to hold its 1990 annual meeting in Baltimore, and;

WHEREAS, Towson State University in its role as host institution for the 51st annual meeting of the Association of Southeastern biologists has extended to the Association the utmost hospitality, courtesy and cooperation, and;

WHEREAS, the Local Arrangements Committee Chair, Dr. James C. Hull and the Program Committee chair, Dr. Katherine Denniston as well as other members of the local committee, have generously given time, thought and effort to organizing the meeting;

BE IT THEREFORE RESOLVED THAT sincere appreciation and gratitude be extended to Towson State University and the Local Arrangements Committee for arranging the successful 51st meeting of the Association of Southeastern Biologists.

RESOLUTION OF APPRECIATION TO DOROTHY J. HUBBARD

WHEREAS, the Association of Southeastern Biologists is indebted to Dorothy J. Hubbard of her years of support; and

WHEREAS, Dorothy J. Hubbard has served to circulate the ASB Bulletin since 1968; and, since 1972 has served as the Circulation Manager of the ASB Bulletin;

NOW, THEREFORE, be it resolved that The Association of Southeastern Biologists commends Dorothy J. Hubbard for her long tenure of service and for the excellent execution of her duties.

Adopted this 20th day of January, 1990



Dorothy J. Hubbard

RESOLUTION IN SUPPORT OF EFFORTS TO INCREASE EDUCATION IN SYSTEMATICS AND CONSERVATION BIOLOGY

WHEREAS, the increasingly rapid reduction of Earth's biological diversity is a significant concern of humanity;

WHEREAS, the biological community will be increasingly called upon to provide advice and leadership in the conservation and preservation of biota and habitats;

WHEREAS, projections indicate a decline in the necessary numbers of scientists;

WHEREAS, the workforce in the year 2000 will consist primarily of women and minorities, groups traditionally underrepresented in the biological sciences;

THEREFORE BE IT RESOLVED that The Association of Southeastern Biologists further promote the conservation and preservation of Earth's biota and habitats by:

1. supporting legislative and other efforts that foster increased participation, education, and training related to systematics and conservation biology;
2. establishing programs that encourage consideration and choice of careers in the biological sciences by women and minorities.

Presented by Priorities in Public Affairs Committee

RESOLUTION IN SUPPORT OF POLICY TO REDUCE THE LOSS OF THE NATION'S WETLAND RESOURCES

WHEREAS, the United States has been losing wetlands at a phenomenal rate of thousands of acres of wetlands per year, and

WHEREAS, wetlands contribute to the natural heritage of the nation through the support of biological diversity, maintenance of endangered and threatened species of plants and animals, and the habitat of many game and nongame species of fish and wildlife, and

WHEREAS, the success of the North American Waterfowl Management Plan of the Department of the Interior's Fish and Wildlife Service in reaching the goal of increased numbers of waterfowl ultimately depends on an expanding wetland resource within and outside the Nation, and

WHEREAS, our Nation's waters benefit from the protection afforded by ecological functions such as the filtering action and chemical processes that wetlands contribute, and

WHEREAS, society benefits from the hydrologic functions of wetlands such as desynchronization of peak flows, groundwater recharge and discharge, and protection from extreme flood events, and

WHEREAS, wetlands provide intangible benefits in otherwise highly urbanized and agricultural landscapes,

THEREFORE BE IT RESOLVED THAT the Association of Southeastern Biologists asks the President of the United States to establish and implement policies that will reduce the losses of wetlands to urban and commercial development, to agriculture and forestry, and to other types of wetland filling, clearing, and draining activities; to support enforcement of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act that serve as mechanisms for maintaining wetlands for water quality protection and other beneficial uses; to renew discussions of the recommendations of the National Wetlands Policy Forum on "no net loss"; and to provide the leadership that will allow wetland problems to be addressed in the Southeast (i.e., reduce further degradation of the Everglades, continue restoration of the Kissimmee River, protect coastal wetlands and associated barrier islands from further encroachment, protect remaining stands of old growth bottomland hardwood forest from being cleared and drained, and reduce activities that worsen the wetland loss in the Mississippi Alluvial delta).

RESOLUTION IN SUPPORT OF H.R. 1268 AND OTHER ACTIVITIES DESIGNED TO PROMOTE MAINTENANCE OF BIOLOGICAL DIVERSITY

WHEREAS, in 1989 the Association of Southeastern Biologists passed a resolution in support of legislation and other activities designed to promote maintenance of biological diversity; and

WHEREAS, hearings have been held on H.R. 1268 to create a National Center for Biological Diversity and Conservation Research,

THEREFORE BE IT RESOLVED THAT The Association of Southeastern Biologists reaffirms its support for legislation and other activities designed to promote biological diversity and asks the Congress of the United States to pass H.R. 1268, the National Biological Diversity Conservation and Research Act.

RESOLUTION ON EARTH DAY 1990

WHEREAS, the celebration of Earth Day on 22 April 1970 marked a period of heightened environmental awareness and;

WHEREAS, this awareness and the increased national concern for the environment influenced the passage of important environmental legislation during the 1970's and;

WHEREAS, continued concern for environmental protection and preservation by the majority of our citizens is essential to maintaining environmental quality for all life;

BE IT THEREFORE RESOLVED THAT the Association of Southeastern Biologists expresses support for EARTH DAY 1990 and the educational and awareness programs associated with this international event and,

BE IT FURTHER RESOLVED THAT the Association will strive to sustain and improve this awareness in the future through its own educational, conservation, and public affairs programs that serve its members and the public.

NOTICE OF RESEARCH AWARDS FOR 1991

ASB FACULTY AND STUDENT RESEARCH AWARDS (\$500 each). Rules are as follows: (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting; in order to qualify for presenting the paper, the author(s) must submit an abstract by the 1 December deadline. Papers submitted for the competition must be received in triplicate and in their entirety by 1 January and must be journal-ready manuscripts worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission. (b) Only ASB members are eligible (this applies to all authors). (c) Papers may be in press but not published prior to the previous annual meeting. (d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Faculty and Student Research Award Committees, the award may be withheld or it may be split in case of a tie. (f) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. Members who anticipate submitting a paper for the ASB Faculty Research Award should submit a copy of the abstract by 1 December. In any event the completed manuscript should be sent to Dr. Courtney Hackney, Univ. North Carolina-Wilmington, Wilmington, NC 28403. (Student): Dr. G. T. Weaver, Dept. Forestry, Wildlife, and Fisheries, Univ. Tennessee, Knoxville, TN 37901.

EUGENE P. ODUM AWARD—\$250 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points: (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;

- (f) The title and abstract of the paper must be submitted to the Award Coordinator by 1 February. This can be a copy of the abstract submitted to ASB 1 December. Submit to Dr. W. D. Cocking, Dept. Biology, James Madison University, Harrisonburg, VA 22807 (703/568-6225).

THE NORTH CAROLINA BOTANICAL GARDEN AWARD—\$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is given for an especially meritorious paper presented in the areas of plant systematics, evolution or conservation. The paper will be evaluated by a panel of judges at the time of presentation, on the following points: (a) significance of ideas, (b) creativity, (c) quality of methodology, (d) validity of results, and (e) clarity of presentation. The actual prize will be presented at the ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award;
- (b) The paper must deal with the systematics, evolution, species biology (including population biology), or conservation of vascular plants that are native or naturalized to the southeastern United States;
- (c) The paper must be presented in a regular Plant Systematics contributed-paper session; papers presented in poster sessions or in symposia are not eligible;
- (d) The title and abstract of the paper must be submitted to the Award Coordinator by 1 February 1990. This may be a copy of the abstract submitted to ASB 1 December. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. L. Mellichamp, Biology, Univ. North Carolina, Charlotte, NC 28223 (704/547-4055).

SOUTHERN APPALACHIAN BOTANICAL CLUB, ELIZABETH ANN BARTHOLOMEW SERVICE AWARD—Worthy candidates should be brought to the attention of Dr. Nancy Coile, North Georgia College, Dahlonega, GA 30597 (404/864-1400) by February 1991.

REVIEWS

Drake, J. A., H. A. Mooney, F. di Castri, R. H. Groves, F. J. Kruger, M. Rejmanek and M. Williamson (Eds.). 1989. **Biological Invasions, A Global Perspective.** *Scope* 37. John Wiley & Sons Ltd., NY. \$146.00 525 p.

Initiated in 1982, the work encompasses the questions involved in why certain species have been successful invaders and expands into an overview of cross-continental questions centered around: (1) What factors determine whether a species will be an invader or not?, (2) What site properties determine whether an ecosystem will be prone or resistant to invasion by new species?, and (3) What management systems should and could be developed when adequate answers to the two previous questions are in hand? The Scientific Committee on the Problems of the Environment (SCOPE) is one of a number of committees established by the International Council of Scientific Unions (ICSU). The mandate of SCOPE, established in 1969, is to assemble, review, and assess the information available on man-made environmental changes and in making assessment of these changes on man. The work attempts to evaluate methodologies of measurement of environmental parameters while at the same time serving as an up-to-date source of current research providing needed advice and suggestions for fundamental research in studies of the environment. Since 1971 the 38 SCOPE publications have addressed the most contemporary environmental problems.

This reference of 22 chapters involves the work of the seven editors and the writing of 23 others synthesized from a plethora of symposia, international conferences, and special workshops. Rich in the cited literature of the general topic covered there are over 1618 citations totaled by the chapters although many, of course, appear repeated in the book. The book has a very good Topical and Correlative Index in addition to the fine Species Index that lists of 807 species that are involved in the invasion process.

Repeated so often in the various chapters to be redundant is the point that the most significant breakdown of natural biogeographical barriers has been human activity since 1500 AD, with an emphasis on old world species moving to the new world. In Chapter One the reader is struck with examples of how immense the impact has been with some grass species becoming the most common species in new habitats in less than 100 yr, and that the dangers of invasions by woody species has not been fully recognized. Another general message that comes across is that the current disturbances and habitat destruction will make questions of what have been invaders before modern day records a moot point.

In several instances (Chapter 2 for example) some interesting food for thought is outlined about the relationship of evolutionary advancement and invasion success. On a positive note it is clear that the mechanisms of successful invasions provide for a wide array of studies for the evolutionary biologist to consider.

The chapters span all lines of biology with discussions on vertebrate invaders, terrestrial plant invasions, aquatic plant invasion success, to topics of the impact of invasions on wildlife conservation, stability of nature reserves and ecological effects of controlling invasive terrestrial vertebrates. On the theoretical side there are chapters on mathematical models of invasion and theories of predicting success and failure of introduced species. Limited coverage of such items as plant pathogens, insect introduction failures and success, and the subject of genetically designed organisms reflect on the limited knowledge of actual studies that have been carried out in regard to these topics. There are various points of view outlined such as the suggestion that a reassessment of scientific attitudes toward exotic species may be needed as some natural systems have been so disturbed that non-endemic species may be needed to provide system stability. Such a suggestion would be reminiscent of ecological equivalent discussions of the 1930's or earlier. It is probable that in the near future there will be discussions of the use of genetically engineered organisms to replace lost niche functions in disturbed ecosystems.

From the various chapters one can see that studies on the failures of invasions are equally needed to fully understand the full scope of the topic and, as so often, the message is clear that what we do not know and understand is greater than what is known. It is clear, however, that strenuous efforts are needed to safeguard the remaining part of our natural ecosystems from invading species, a natural heritage that is under ever increasing threat.

Although it would appear that the price of this book places it out-of-reach for most practicing biologists it is a text that will be valuable as a template or outline of where to start in developing studies of invaders on local or regional levels. It can serve as an excellent reference in developing specific lectures in ecology, environmental biology, and wildlife management courses. Perhaps this book's greatest value would be as a beginning reference to develop expanded literature search type assignments on various topics of invading species since the literature covered in the book is so extensive. It would be a good investment for the moderate sized college or university reference library.

JOE E. WINSTEAD, *Department of Biology, Western Kentucky University, Bowling Green, KY 42101.*

Caddy, J. F. 1989. **Marine Invertebrate Fisheries.** J. Wiley & Sons, NY. \$79.95. 752 p.

Of the fisheries of the world, those for marine invertebrates—shrimps, prawns, and krill; lobster and crabs; gastropods; bivalves; and cephalopods are among the most valuable and interesting. John Caddy of the Food and Agricultural Organization of the United Nations has compiled 31 papers which not only describe the fisheries in varying detail but the dynamics and management of stocks as well.

Different readers will find different papers to be of particular interest. For example, Sahrhage discusses the fisheries for Antarctic krill. The krill, a euphausiid, living in the Antarctic Ocean was once a major food of the great whales, but now that the whale stocks have been depleted, other animals, including man, have become extensive predators on krill. On a smaller scale the Brown shrimp is an important fishery in Northern Europe. Details of the population dynamics and management are described by Boddeke. The pandalid shrimps are of particular interest because when compared with the tropical penaeid shrimps, they have a much longer life span and undergo sex reversal. The fishery for pandalid shrimp in the North Atlantic is described by Parsons and Fréchet. Three species of penaeid shrimp are the primary basis for the shrimp fisheries in the Gulf of Mexico. Klima shows how the populations vary over a 20 yr period and describes management measures in the Gulf and the life history of the penaeid shrimp. As an interesting contrast, papers by Penn, Hall, and Caputi describe the dynamics and management of penaeid shrimp fisheries in western Australia. Lobsters are generally the subject of intense fishing. There are several taxonomic groupings of lobsters. The American lobster fishing industry in Canada is described by Campbell. The west Australian rock lobster, a different animal than the American lobster, has its dynamics and management described by Phillips and Brown and a third distant relative of both the American and rock lobster, the Norway lobster is considered by Brander and Bennett.

Moving from the gustatorial delights of shrimp and lobsters we move into case studies for four crab fisheries which are also noted in the cuisine of the world: the dungeness (Methot), the stone crab (Ehrhardt and Restrepo), crabs of the British Isles (Edwards) and the snow crab. Two of these papers on crabs are of particular technical interest as the abundance of dungeness crabs is considered to be cyclic and the stone crab can be harvested simply by removing its claw. The section on crustaceans is concluded by four review papers on coastal penaeid shrimp fisheries (Garcia), trap fisheries (Krouse), decapod biology (Cobb and Caddy) and effort limitation (Bowen and Hancock). It appears that the gastropod and bivalve fisheries are not nearly as well known as the crustacean fisheries. Here we can find papers on the California albalone (Tegner), the queen conch (Berg and Olson), and precious shells (Wells). The fishery for Chesapeake Bay oysters is described by Kennedy. It is noteworthy because several decades of management (or non-management depending on one's viewpoint) have not been able to still the continual decline of the stocks. The clam fisheries in the U.S. (Murawski and Serchuk) and in the Adriatic are harvested by mechanical means. The U.S. clam fisheries is the subject of detailed management. The trials of management for the Adriatic clam is also described. The Japanese are moving into aquaculture for the Bay scallop and the status of this resource is described by Aoyama. The giant clam represents perhaps the largest organism considered in *Marine Invertebrate Fisheries*. Of the seven species the largest can have a shell length of 137 cm. Various fisheries and aquaculture of the giant clam are described. A stock assessment of scallops off the Eastern coast of Canada is given by Caddy.

Moving on to cephalopods, the octopus, cuttle fish, and squid can represent fisheries of considerable value. Of these fisheries one of the most famous is the Saharan trawl fishery. Bravo de Laguna describes the complexities of managing the complex of these resources in a multi-national setting. Catching squid by jigging rather than by trawl is an important fishery in Japanese waters. The stock assessment and management of the Japanese squid is described by Murata. Precious coral, sea cucumbers, and sea urchins are not commonly thought of as fishery stocks. Fisheries for these species are described by Grigg and by Conand and Sloan.

In the last two chapters we find a description of more traditional analysis of bivalves and gastropods (Caddy) and a more non-traditional analysis using primarily heuristic models based on Box/Jenkins theory by Fogarty.

All in all Caddy has put together an exciting and necessarily eclectic compendium of information on those marine invertebrates that suffer the slings and arrows of being subjected to commercial exploitation.

BRIAN J. ROTHSCHILD, *Chesapeake Biological Laboratory, University of Maryland, Solomon, MD 20688.*

Kensley, Brian, and Marilyn Schotte. 1989. **Guide to the Marine Isopod Crustaceans of the Caribbean.** Smithsonian Press, Washington, DC. \$35.00 (hard cover). 308 p.

This comprehensive and well illustrated guide to the Caribbean marine isopods is divided into several sections: Introduction (pp. 1–6), Glossary of Technical Terms (pp. 7–12), Marine Isopods of the Caribbean (pp. 13–260), Zoogeography (pp. 261–273), Appendix (pp. 275–276), Literature Cited (pp. 277–292), and Index (pp. 293–308).

The Introduction includes a brief historical background of previous works on the marine isopods of the Caribbean region, a definition of the geographic area covered by the guide, information on the arrangement of the guide and how to use it, and the acknowledgments. The Glossary presents the definition of over 145 morphological terms and a generalized illustration depicting basic isopod morphology.

The taxonomic section and heart of the guide, "Marine Isopods of the Caribbean," treats nine suborders, over 27 families, 140 genera, and the approximately 280 isopod species known from the intertidal zone to water depths of 200 m in the Caribbean area. Diagnoses and dichotomous keys to the families, subfamilies, and genera of the suborders Anthuridea, Asellota, Flabellifera, Gnathiidea, Microcerberidea, Oniscidea, and Valvifera are given. There are keys, well executed diagnostic illustrations, distribution data, and, in some instances, ecological notes for the approximately 240 Caribbean species treated within these suborders. The suborder Epicaridea is diagnosed, but due to the variable morphology of its members, which are highly modified parasites of other crustaceans, keys and diagnoses to the lower taxonomic categories (families, subfamilies, genera, and species) are not included in the text. However, the four commonly recognized epicaridean families are discussed and the 42 species known from the Caribbean are listed alphabetically with their known crustacean host or hosts.

The section on Zoogeography presents a brief, but interesting, treatment of the faunal provinces, an analysis of the isopod fauna of the Caribbean area, and a comparison of the isopod fauna of the adjacent marine areas of the Americas, Bahamas, and Bermuda. This section is augmented with lists of the known marine isopods from the Gulf of Mexico, Bermuda, and species occurring on both sides of the isthmus of Panama. There is also a brief discussion of the cave dwelling isopod fauna of the Caribbean area.

The small Appendix deals with new isopod taxa from the Caribbean or adjacent areas that were published after the Guide was in press. The extensive Literature Cited includes over 275 references and the Guide concludes with an Index to all the isopod taxa discussed or mentioned in the text.

Aside from a few typographical errors which can be easily corrected in a future printing or updated edition, this Guide is well organized and written. The dichotomous keys for the various taxa treated are clear and richly augmented with excellent illustrations. This publication represents an important updating of our knowledge for the marine isopods from the warm waters of the northwestern Atlantic and presents new distribution records for many of the species covered. Although the Guide is designed primarily to treat the Caribbean area, many of the species included occur in the adjacent tropical and warm temperate waters of the Americas (North Carolina to northern Brazil) and it will be an important aid for identifying much of the marine isopod fauna in these regions. Without reservations I highly recommend this Guide for use by professional biologists, teachers, students, and naturalists interested in marine zoology. The current hard cover price (\$35.00) for this book may be prohibitive for students. I hope that a less expensive, soft covered, edition will be made available in the future to better accommodate this important user group.

RICHARD W. HEARD, *Invertebrate Zoology section, Gulf Coast Research Laboratory, Ocean Springs, MS 39564.*

Hobbs, H. H. Jr. 1989. **An Illustrated Checklist of the American Crayfishes (Decapoda: Astacidae, Cambaridae, and Parastacidae).** Smiths. Contr. Zool. No. 480. Limited number copies available from Smithsonian Institution Press. 236 p.

Horton Hobbs, Jr., zoologist emeritus, Department Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, has produced another sterling publication on crayfishes with the Illustrated Checklist of the American Crayfishes (includes both North and South America). Key anatomical features for each of the 379 recognized extant and two fossil species and subspecies of American crayfishes known prior to 1 January 1988 are illustrated by being arranged in related species groups and subspecies assignments, erroneous spellings, and synonyms. The composition and locations of type series are given as are the type locality, range, and habitat of each organism. Appendix 1 provides an alphabetical list of American crayfishes and the country, state, and/or province in which they live. Appendix 2 is a list of the state and countries and their crayfish faunas and pertinent references. Appendix 3 provides information on 1988 and 1989 descriptions.

This publication is a must for all professional students of crayfishes for it treats all the known species and subspecies in one publication. It also brings together the taxonomic status of all species, their descriptions, locations, and so *much* more. Would that other groups were so well treated.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Cao, T. 1989. **Advances in Sciences of China—Biology.** Vol. 2. J. Wiley & Sons, NY. \$19.95. 103 p.

Advances in Science and China has been published by Science Press of Beijing and John Wiley and Sons of New York since 1986. This review is based upon Volume 2, 1987, dedicated to Biology. The journal is true to its title. Volume 2 describes recent advances throughout the biological sciences ranging from ecology to molecular biology and cancer prevention. Advances are described in terms of reviews and highlights. Articles are supported by unusually extensive literature citations. Reports are restricted to scientific advances by Chinese in China, but literature citations supporting these reports are international. Literature citations are restricted almost entirely to the past decade, reflecting the amazing acceleration of scientific research in China since 1979. Whether by intention or not, practical applications of scientific advances are obvious or are the focus of the articles. This journal is unlike any U.S. counterpart in that it attempts to be representative of the broadest possible spectrum of science, yet is devoid of editorials on the politics of science, letters of controversy or projections of funding for science. Articles are written by Chinese who wish for western scientists to read about scientific advances since the late 1970's. I recommend the journal to those interested in how, how fast, and how far science can advance following a decade of political suppression and scientific dormancy.

J. FRANK MCCORMICK, *Graduate Program in Ecology, University of Tennessee, Knoxville, TN 37996.*

Baker, D. A. and J. A. Milburn (Eds.). 1989. **Transport of Photoassimilates.** Longman Scientific and Technical, Essex, England, co-published in the U.S.A. by John Wiley and Sons, NY. \$108.00 383 p.

The book is a reference work that has taken a complex subject and attempted (successfully I feel) in just eight chapters to focus on the most critical issues and findings in photoassimilate transport. The discussion of investigations from a wide variety of disciplines including agronomy, horticulture, anatomy, developmental morphology, biophysics and biochemistry illustrate the integration of approaches that are necessary to come to a practical understanding of a very complex process. The scope of the book is not all encompassing, therefore, the reader is challenged to search further into the subject by the extensive reference listing at the end of each chapter. Each chapter is written by a well known individual or group of individuals active in that research area. In all, there are 15 total contributors to the book.

The book can be divided into three parts. Part one is covered in the first two chapters and deals with the transport of photoassimilates within and between leaf cells. Chapter one, my favorite due to

bias, does an exceptionally fine job of utilizing figures to outline the transport from the chloroplast of various intermediates from photosynthesis. Both C_3 and C_4 plants are discussed. In chapter two, discussion centers around the symplast and apoplast involvement in mesophyll intercellular transport. The chapter includes the importance of cell compartmentation and transport through plasmodesmata with a comparison to animal cell gap junctions.

Part two which includes chapters three through six, deals with the structure of phloem and the loading and unloading of phloem. Chapter three gives a detailed analysis of phloem structure, utilizing photographs, some in color, which greatly enhance the presentation of the topic. A large part of the chapter is devoted to sieve cells including details of cytoplasmic organelles and proteins. Companion cells are discussed and comparison is made to their gymnosperm counterparts, Strasburger cells. Chapter four is unique because it describes five case studies involving white lupin and cowpea. These case studies attempt to define the origin, destination, and fate of phloem solutes in relation to whole plant functioning. Chapter five discusses the loading of photoassimilates into the phloem. Discussion centers around the role of the apoplast and symplast on the loading of carbohydrates and amino acids. Considerable attention is given to the type of active transport mechanism involved. Chapter six discusses the unloading of photoassimilates from the phloem. The chapter is long and indicates the complexity of the problem. Discussions include the role of the apoplast and symplast in unloading. The role of sucrose as a carbon source and an osmoticum affecting water potential, complicate the picture. Much of the chapter is devoted to the development and description of sinks which are the ultimate driving force leading to the unloading of the phloem.

Part three covered in the last two chapters deals with the physiological aspects of phloem transport and the control mechanisms involved in the regulation of phloem transport. The main emphasis of chapter seven is the environmental factors, both internal and external, which affect the flow rate of phloem. Porosity of sieve plates poses a major objection to accepting a pressure driven mass-flow mechanism for long distance transport and is addressed in the chapter. Chapter eight considers the current concept of Source and Sink and possible mechanisms regulating interactions of source and sink. Considerable effort is made to discuss how to determine source and sink strengths and what are their potentials or limitations to improving crop productivity.

A definite plus for the book is the appendix. Sixteen tables are included with information ranging from general sap analyses to sugar, sugar alcohol, and amino acid content. Other information includes content of polyamines, protein and hormones along with Specific Mass Transfer measurements.

The book is extremely well written with very few typographical errors. It is in hard back and printed on very high quality paper. Active researchers in phloem transport should find it a welcome reference source. The book should be of interest to anyone teaching upper-division or graduate level plant physiology courses and should be made available to upper-class undergraduate and graduate students in botany and biology.

FRANK R. TOMAN, *Department of Biology, Western Kentucky University, Bowling Green, KY 42101.*

Meffe, Gary K., and Franklin F. Snelson, Jr. (eds.). 1989. Ecology and Evolution of Livebearing Fishes (Poeciliidae). Prentice Hall, Englewood Cliffs, NJ. \$50.00. 453 p.

Poeciliids represent one of our best known groups of fishes, but, information on this unique family is widely scattered. We now have a new book providing thorough summaries of major published research plus a perspective for new research directions on ecology and evolution of livebearing fishes. Without doubt, this text provides an indispensable tool in planning future research.

The book aims to: 1) collect and organize widely scattered literature on poeciliids; 2) critically review research into an overall perspective of the family's evolution and ecology; and 3) pinpoint gaps in knowledge with the goal of suggesting directions for future research. The editors chose to omit use of poeciliids in mosquito control, biomedical uses, rearing techniques, and methods related to the aquarium trade and aquaculture. Some readers may be disappointed to find favorite topics such as chromosomal karyotyping or biogeography given low priority.

Many eminent poeciliid investigators contributed to five major subject areas: 1) an *Overview of the Family* (systematics; ecology; reproductive biology; genetics and unisexual poeciliids); 2) *Reproduction and Evolution of Life History Traits* (sexual selection and differentiation; review of life history patterns; social and environmental control of life history traits; genetic control of size at maturity; ecological genetics of life history traits; and phenotypic plasticity in life history); 3) *Evolutionary Genetics* (al-

lozymic studies of variation; demographic, spatial and temporal genetic variation; origin and ecological success of unisexuals and evolutionary ecology of unisexuals); 4) *Conservation and Impacts of Poeciliids*; and 5) *Conclusions for Future Directions*.

In view of the small size of poeciliids, ease of rearing them in aquaria, a wealth of previous genetic research, their unique livebearing habit, genetically identical offspring of those with unisexual parents, and adaptations to varying habitats, the editors suggest "... poeciliids ... can be one of the most important groups of animals ... to explore myriad details of evolution and ecology." They believe there is an urgency to fill gaps in knowledge of life history, especially in view of destruction of habitats such as tropical rain forests. They indicate a need to define the role of poeciliids in community ecology as vectors of energy flow across trophic levels. In respect to small size, the editors suggest significant opportunities to study niche partitioning of small sub-populations in microhabitats. The editors question evolutionary reasons for small size in Poeciliids. The physiology of reproduction needs investigation. Particularly in the areas of physiology, the editors point to unanswered questions in hormonal control of the timing of poeciliid reproduction; allocation of energy affecting number and size within a brood or successive broods; how are nutrients transferred between female and ova or embryos (?), and what are the details of histological biochemical development (?). Most important, the editors hope future studies will scrutinize earlier sloppy research and pursue interests of investigators with a view to testing cross-disciplinary concordance of evolutionary or ecological hypothesis.

I am pleased to see strong emphasis to integrate genetic and ecological principles with conservation of threatened poeciliid populations. The discussion of endangered populations in the United States is commendable. Throughout the text, the standard classification of Rosen and Bailey (1963) is used, however, Parenti's (1981) recent classification is also described which combines Amazonian *Fluvi-phylax* and African aplocheilichthyines within the Poeciliidae and subordinates the conventionally understood Poeciliidae into the subfamily Poeciliinae. Recent studies suggesting the well known mosquito fish *Gambusia affinis* actually comprises three species (*G. affinis*, *G. holbrooki*, and *G. speciosa*) may surprise some readers. Unfortunately, each of the excellent chapters deserves its own review for which there is insufficient space here. The text is well written and tantalizes a reader with visions yet to be explored; here dynamic populations continually strive toward genetic equilibria with ever changing environments, and habitats continually changing temporally and spatially, both naturally and through human interference. Having been away from poeciliid research for more than 20 yr, my fascination with these unique fishes has been rekindled by an excellent presentation and I recommend this book to adorn the shelves of anyone planning to pursue studies on livebearers.

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 ALEX E. PEDEN, *Royal British Columbia Museum, Victoria, B.C., Canada, V8V 1X4.*

Falconer, D. S. 1989. *Introduction to Quantitative Genetics*, 3rd Ed. Longman Group UK Limited, Essex, England; copublished in the United States with John Wiley & Sons, Inc., NY. \$31.95. 438 p.

My first exposure to *Introduction to Quantitative Genetics* was 20 years ago as a graduate student. The book was then in its first edition. I found it easy to read; complex topics were explained carefully and clearly with useful examples. Today, in its third edition, I think the book is even better. It has been expanded from earlier editions with the inclusion of developments in the intervening years, and by more attention being given to plants. The new edition also contains many useful problems of varying difficulty which are based on real data; and detailed solutions are provided.

Falconer begins the Introduction with the sentence: "Quantitative genetics is concerned with the inheritance of those differences between individuals that are of degree rather than of kind, quantitative rather than qualitative." His presentation of quantitative genetics includes a thorough explanation of quantitative traits—what they are and how they are measured in populations—as well as a lucid treatment of the inheritance of quantitative traits at the population level.

The subject is presented in two parts. The first part describes the genetic properties of populations

with reference to genes causing easily identifiable, and therefore qualitative, differences. (The presentation includes three chapters devoted to the significance of population size in influencing gene frequencies. This complex topic is especially well presented.) The information presented in this first part of the book usually is referred to as population genetics. It is a logical and useful prelude to the second part which is concerned with quantitative genetics per se, and comprises about 75% of the book.

Falconer's emphasis is on the theoretical rather than the experimental side of quantitative genetics, but it is not a highly mathematical treatment. The theory addresses the consequences of Mendelian inheritance when extended to the population level and to the simultaneous segregation of genes at many loci. The basic premise is that the inheritance of quantitative differences is by means of genes, which are subject to the Mendelian laws of transmission and may have any of the properties known from Mendelian genetics. The theory permits us to deduce the genetic properties of a population if the genes have the properties postulated. It allows us also to predict the consequences of any specified breeding plan, including those of natural selection. It forms the basis for understanding evolutionary change. There is now a large body of experimental data which substantiates the theory in considerable detail, showing that genes concerned with quantitative variation do have the properties known from Mendelian genetics, and that the outcome of most breeding procedures can be predicted with some confidence. Although conclusions are often drawn directly from experimental data, the experimental side of the subject is presented chiefly in the form of examples, chosen with the purpose of illustrating the theoretical conclusions.

The mathematics of Falconer's treatment does not extend beyond algebra; neither calculus nor matrix method are used. Some knowledge of statistics is assumed, particularly of the analysis of variance, regression, and correlation.

This book will continue for many more years to be an important part of libraries concerned with evolution and the genetics of populations.

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Green, M. B. and D. J. de B. Lyon (eds.). 1989. Pest Management in Cotton. Ellis Norwood Limited, Chichester, West Sussex, England. \$112.50. 259 p.

For those who are seeking a comprehensive treatment of cotton pest management, this book will be a disappointment. The book is symptomatic of a chronic problem which has plagued pest management since its conception; the lack of a consensus definition. A better title would have been, "Insect Pest Management in Cotton," as pests other than insects are rarely mentioned, much less given consideration appropriate to their pest status.

Even from the limited perspective of insect pest management, this book presents only a fragmented account of the subject. Major topics such as ecology and cultural control are not included, whereas 60% of the chapters are devoted to insecticide application or efficacy. The chapters on insecticides are little more than promotional vehicles for specific compounds manufactured by the chemical companies currently employing the authors. In-depth treatment of a few insecticides is included and in some cases efficacy data are presented for experimental compounds, while many more notable chemical tools of insect pest management are not mentioned.

There are specific chapters in the book that present well written and documented overviews of specific areas important to insect pest management in cotton. Among the best are those dealing with insecticide resistance, host plant resistance, biological control, and pheromones. Most of the other chapters contain a much too restrictive treatment of the topics to be considered valuable references.

The style, sharpness and size of print, as well as clarity of the figures, are appropriate for ease of reading, however, there are several pages in the earlier chapters where print was badly faded.

Finally, a price of \$112.50 makes the decision to purchase this book very easy . . . don't.

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Mettee, M. F., P. E. O'Neil, J. M. Pierson, and R. D. Suttkus. Fishes of the Western Mobile River Basin in Alabama and Mississippi. Atlas 24, Ala. Geol. Surv. Ala. Tuscaloosa. \$10.50. 170 p.

The atlas of the fishes of the Western Mobile River Basin in Alabama and Mississippi treats 153 species inhabiting this the largest Gulf Coast drainage east of the Mississippi River. In terms of drainage

area it drains 43,662 m² with the western portion accounting for 20,032 m². It contains the third richest fish fauna in North America. Discussions include the climate, physiography, hydrology, and species distribution of the 125 species found in the Lower Tombigbee, 188 in the upper Tombigbee, and the 127 species found in the Black Warrior portions of the Mobile River basin. Only one species is considered endangered, the darter *Etheostoma nuchale*, 16 species are endemics. Five species are stocked in various portions of the system, of which one is the hybrid *Morone saxatilis* x *Morone chrysops*. Comments on faunal exchange between and within portions of the system and Tennessee River (via the Tenn-Tom waterway) are also covered. Five marine species frequent the system, of which the most remarkable is the freshwater reproducing population of the bay anchovy, *Anchoa mitchilli* 271 miles upriver and above two locks and dams.

An excellent color picture of the upper Tombigbee River near its confluence with Luxapallila Creek, Mississippi, graces the cover. A color physiographic map reveals that all important geological areas of the system were well sampled and why some species are influenced by the fall line or the Selma Chalk, in the Black Belt district. Major portions of each stream within the system are also color-coded as to water use.

The basin was sampled at 847 localities between 1937 and 1988, resulting in 2427 fish sampling stations being taken. *Cyprinella venusta* (= *Notropis venustus*) was the most abundant collected, with *Lepomis megalotis* the most frequently encountered species. All distributions and stations are plotted on maps that haven't been reduced to the point where you need to squint to discern river or locality.

The authors of the atlas, in order to maintain stability, have retained generic names as in the 1980 American Fisheries list rather than change those in the families, Cyprinidae, Ictaluridae and Centrarchidae, as suggested by Lundberg (1982) and Mayden (1989). That is *Ameriurus* would now be used for *I. melas*, *I. nebulosus*, and *I. natalis*. The same is true for various minnows within the family Cyprinidae: genera *Extrarius*, *Lythurus*, *Cyprinella*, *Luxila*, *Opsopoeodus*, *Pteronotropis*, *Semotilus*, and *Hybopsis* instead of *Notropis*. Likewise, there are some species range distribution differences between the atlas and the earlier published Boschung's (1989) Atlas of the Upper Tombigbee. For example, *Ichthyomyzon castaneus* and *Polyodon spathula* are known in the upper Tombigbee (Boschung) but are not shown in the atlas. The same is true for the number of localities for a given species, as one or the other of the above depict different numbers of localities as the known distribution of a species. *Lepisosteus spatula* of Mettie's et al. Table 4 (as *Atractosteus*) is not mapped. Does *Alosa alabamae* really exist in Alabama? Annotations of whether site records were reconfirmed would have helped with this and other species treated. Their *Percina* sp. cf. *caprodes* should have been treated a species B and C, Thompson (1985), and denoted by two different map symbols.

Differences aside, with the production of the Atlas and other subregion treatises on fishes we will shortly have an up-to-date record of the fishes in the southeast as these will soon be augmented by volumes on the fishes of Florida, Mississippi, Alabama, Tennessee, North Carolina, and Virginia. From those efforts we will be better able to follow the changes, extinctions, or repopulations of fishes that frequent the southeast. It is hoped man can maintain or prevent present habitats from further destruction and that we will witness a repopulation by the varied and interesting fishes that occur in the southeast.

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- FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Smith, C. Michael. 1989. **Plant Resistance to Insects: A Fundamental Approach.** John Wiley and Sons, NY. \$34.95. 286 p.

This book is a timely publication in view of the expanding interest in biological control of insects of which one component is plant resistance. According to the author, *Plant Resistance to Insects: A Fundamental Approach* "was prepared as a textbook for students and researchers in entomology and related plant protection disciplines." The book should serve as an excellent textbook for an advanced undergraduate course in plant-insect interactions or as a supplemental text in a first-level graduate course in plant breeding, but would be of little value to experienced researchers in plant-insect interactions. Also, it should be of benefit to individuals in plant science or entomology that are not part of a multidisciplinary team who are changing the orientation of their research program.

The book is presented in three sections. Each section is titled with a basic question and the chapters of each section provide the primary answers to each question. The question for Section 1 is "What is plant resistance to insects?" In the first four chapters Dr. Smith provides many definitions, examples, and explanations for antixenosis, antibiosis, and tolerance. The chapter on antixenosis includes discussion of the insect sensory systems used for host selection as well as plant morphological and chemical defense mechanisms that effect insect behavior. A discussion of allelochemicals is the substantive part of the chapter on antibiosis.

Section 2 on "How is plant resistance to insects obtained?" is the most interesting portion of the book, but the chapter on Location of Sources of Plant Resistance to Insects should have been omitted. This chapter is a discussion of availability and sources for procurement of plant material. Much of the chapter is a partial listing or directory of scientists involved in research on plant resistance to insects. Such a list soon becomes obsolete and is available from other yearly updated sources and is superfluous in a textbook. The discussion on manipulation of plants and insects in measurement of plant resistance to insects is excellent and provides sufficient detail for the novice to initiate well-designed experiments. Based on the presentations in this section even the beginning researcher could obtain some information to distinguish among antixenosis, antibiosis, and plant tolerance types of plant resistance. Simple extraction and isolation procedures for volatile and nonvolatile allelochemicals are clearly presented. The segment on resistance to insects in genetically transformed plants unfortunately does not provide as much detail on techniques as other segments. Descriptions of many observations of effects of plant, insect, and environmental variables that alter plant resistance are presented without comment as to the mode or mechanism involved. Details for selected plant breeding strategies are provided and should prove useful to the undergraduate student or to the entomologist with little experience in plant science. It would have been useful if the author would have suggested to the reader appropriate plant breeding text to provide fundamental information to supplement the specifics for individual crops given in this book. Development of insect biotypes and identification on differential hosts is basically case history presentations without an appreciation of genetic alteration and its significance.

The book ends with a discussion of integrated pest management and the role of plant resistance to insects in a total insect control program. The basic question is how does one optimize biological control and insecticide application with some amount of plant resistance to insects. What combinations of these factors for acceptable insect control will be sustainable and environmentally acceptable for food and fiber production into the future? This is a well conceived section and should stimulate much discussion in the classroom.

For the most part illustrations in the book are excellent. Many of the line drawings illustrate procedures for experimental design or techniques to be used in the laboratory or field. These drawings should be very useful as one is able to follow the protocols easily. One distracting feature is that the bar graphs appear to be computer-generated and in some graphs the different stippling of the bars among treatments cannot be distinguished.

I have indicated several areas in which the book could be improved but, overall, the presentation is clear, concise, and the book should be very useful as an undergraduate textbook or beginning reference. Dr. Smith included an extremely large number of references at the end of each chapter and they should be helpful in getting one into the original literature quickly. The book is well laid-out with good use of different type and illustrations, consequently it is easy to read and yet is very informative. I recommend the book to any biologist with interest in plant-insect interactions.

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Faegri, Knut and Johs. Iversen. 1989. **Textbook of Pollen Analysis**, IV Edition by *Faegri, Knut, Peter Emil Kaland and Knut Krzywinski* (eds.). John Wiley & Sons, NY. \$10.00. 296 p.

The *Textbook of Pollen Analysis* by Faegri and Iversen is a classic, first published in 1950, under a slightly different title, to provide students a basic text. Needless to say the first edition was a landmark and it has grown steadily through two subsequent editions. The 1974 edition is still the most widely used text.

The authors reasons for the new edition are two fold, to present the newer laboratory techniques because older obsolete methods are still in wide use and to provide a theoretical basis for the methodology. Most of the current textbooks are good at explaining how to but rather short on why. These are obviously important in any active scientific field and absolutely essential if one is to remain current.

In some ways the 1989 version is an extension of the 1974 edition in that it completes portions that were planned but terminated by the untimely death of Iversen. However, it is a completely new edition combining Faegri's long experience in the field with that of the new collaborators. Much of the material is new, the sections have been completely rewritten including the important identification keys and student tested.

The book covers pollen analysis in a traditional manner. Following the Introduction with its important historical overview there are chapters on pollen production and dispersal, the origin and deposition of organic deposits, field and laboratory techniques, presentation of basic results, analysis of data, applications of pollen analysis, and one of their most important contributions a revised key to the Northwest European pollen flora. An interesting touch is an separate index at the beginning of each chapter. The overall presentation of the book is biological as are pollen grains; geological aspects are covered as necessary to understand sedimentary deposition and pollen preservation.

Each chapter provides the necessary theoretical background. For example the chapter on pollen production and dispersal included the latest on how pollen is dispersed in the atmosphere and then deposited into a sedimentary environment. These concepts are critical if one is to make meaningful interpretations of the data. The chapter on analysis of data is excellent discussing how inferences on vegetation and climate are derived from counts of fossil pollen grains. This area of the field has grown extremely fast since the 1974 edition and to be truly proficient one must be familiar with numerical techniques. The current edition does not, however, assume we are all mathematically oriented but rather discusses the basic methods so that one can do research and yet refers those who wish further information to appropriate references.

There is an important separate chapter on the applications of pollen analysis to archaeology. Pollen analysis is ideally suited to provided vegetation information to the study of prehistoric peoples and cultures, but this application has often been treated lightly in the past. The new edition considers the effects of prehistoric human activities on pollen data and how to derive useful information from such "altered" sediments.

Faegri has a long distinguished career in pollen analysis, in many respects he and Iversen wrote the book on it. It is great to have an updated edition from a master in the field.

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Wake, D. B. and G. Roth (Eds.). 1989. **Complex Organismal Functions: Integration and Evolution in Vertebrates**. Life Sciences Research Report 45. Dahlem Workshop held in Berlin, 28 August–2 September 1988. John Wiley & Sons, NY. \$122.00 (cloth). 451 p.

It is the expressed purpose of Dahlem Conferences to promote international, interdisciplinary communication, and cooperation in scientific research. This volume summarizes a conference with the stated purpose of examining interrelationships between evolutionary processes that give rise to biological complexity on one hand and that generate species events on the other; that is, how do complex, stable, integrated systems evolve and at the same time permit increase in organismic diversity. The 48 discussants and authors are major contemporary contributors to evolutionary theory from a dozen nationalities and 30 leading research institutions with West Germany and the United States most prominently represented.

This is a small condensed volume of broad scope and clear purpose. The organization of the volume mirrors that of the conference in which the central problem was addressed through examination of

four separate aspects of vertebrate evolution, each of which serves as a model for study of special evolutionary problems and mechanisms. The four major sections of the book deal in sequence with origin of phylogenetic diversity and fixation of order in the following aspects of vertebrate evolution. Each entails varying degrees of increasing complexity in structure and function, an understanding of which depends upon recognition of intrinsic genetic causes, mechanisms for ontogenic canalization, components of structural diversity, and physiological utility within ecological systems.

Part 1. The vertebrate jaw is presented as an aspect of adaptation for utilization of changing foods, as a mechanism for mastication, as an example of coupling for feeding and hearing, as an exercise in ontogenic dissection of evolutionary history, and as a bridge between population and phylogenetic analysis of evolutionary forces involved in the generation of a complex character.

Part 2. Vertebrate paired appendages are presented from the viewpoints of embryonic determination, neuromuscular coordination, evolutionary change in functions of appendages at the transition from reptiles to mammals and from reptiles to flight in birds. It concludes with analysis of constraints on evolutionary change in the tetrapod limb imposed by the archtypic pentadactyl appendage.

Part 3. Vertebrate viviparity is used as a means of studying the interplay of ontogenic (inductive) and endocrine (hormonal) regulators of life cycles in convergent evolution by distantly related vertebrates including sharks, bony fishes, amphibians, reptiles, and mammals for common reproductive strategies. Although egg retention, placentation, and direct development have appeared independently in different vertebrate classes, their regulation is preadaptively based on similar endocrine controls.

Part 4. Vertebrate integration is viewed in the concluding section as a product of interactions of genetic, developmental, morphological, and environmental factors. Guidelines and criteria for research design are given to assist in assessing causal factors involved in evolution of complex systems, and wherever possible to make them subject to quantitation. This goal is to be obtained by utilization and refinement of many familiar observational and phylogenetic methods, coupled with innovative application of new techniques including modeling, statistics, genetics, and biochemistry.

Each section consists of from four to six short research reports that summarize a segment of the common problem addressed by each. These papers in addition give examples from the spectrum of methods available in separate disciplines, and provide good introductory bibliographies for problems under consideration. A Group Report summarizes the conclusions for each major section, and a final summing up draws together the thinking from all four groups. Closing statements set forth general conclusions, agreements and disagreements, as well as, provide a list of subject areas particularly in need of attention.

The book is of value at several levels of scientific interest. Its individual chapters are short and deal with specific issues germane to the expressed purposes of the volume as a whole. As such, most chapters are easily understandable to individuals with very different levels of experience in manipulating evolutionary concepts. For specialists, the collection provides insight into ways in which colleagues are thinking about the future of research in morphology. For beginners, a table is set laden with problems, methods, and theories to entice any evolutionary palate. For biologists in entirely foreign fields, an intimate and exciting view is given into current problems and mental processes that attract one to analytical studies of evolutionary mechanisms. Although the subjects treated in the book are all vertebrate-oriented, the general ideas presented should have broad application for the design of future evolutionary research in invertebrate and plant biology as well. The volume is a welcome and timely addition to the literature on evolutionary mechanisms and is a resource to give impetus for accelerated progress in phylogenetic morphology.

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Ultsch, G. R. 1989. Ecology and Physiology of Hibernation and Overwintering among Freshwater Fishes, Turtles, and Snakes. *Biol. Rev.* 64: 435–516.

NEWS OF BIOLOGY IN THE SOUTHEAST

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ABOUT PEOPLE AND PLACES

ALABAMA

Geological Survey of Alabama, Tuscaloosa. Several years ago, a group of southern ichthyologists decided to pool their resources in order to study the fish fauna of the Mobile basin. The first publication resulting from this effort is entitled, "Fishes of the Western Mobile River Basin in Alabama and Mississippi." Distributional records in this volume are based upon data obtained from 2,427 fish samples collected from 1937 through 1988 at 847 localities in the lower Tombigbee, upper Tombigbee, and Black Warrior River systems. Only pre-Tennessee-Tombigbee Waterway data are included for the upper Tombigbee River system in order to provide a useful database for future assessment studies in the drainage.

Tuskegee University, Department of Biology. A patent has been awarded for "Moveable Root Contact/Pressure Plate Assembly for Hydroponic System." Inventors *Carlton E. Morris, Philip A. Loretan, Conrad K. Bongi* and *Walter A. Hill* designed and developed the device in order to further the research they are conducting as part of a team growing sweet potatoes in soilless culture. With the aid of the device, the team has been able to achieve good sweet potato yields (up to 1800 g of storage roots per plant) using the nutrient film technique. The research is in support of NASA's Controlled Ecological Life Support System (CELSS) program for growing food crops for future long-term manned space missions.

MISSISSIPPI

Gulf Coast Research Laboratory, Ocean Springs. The Laboratory has been awarded a \$166,088 contract from the U.S. Fish and Wildlife Service for a three-year examination of red drum in Mississippi's coastal waters. GCRL Director *Dr. Thomas McIlwain* was chosen president-elect of the Southern Association of Marine Laboratories. *Gerald Corcoran*, curator of the J.L. Scott Marine Education Center and Aquarium, has been elected to a two-year term as vice-chairman of the Mississippi Environmental Education Advisory Council. GCRL was host to the 54th annual Mississippi Academy of Sciences.

KENTUCKY

Thomas More College, Department of Biology. *Dr. William Bryant* spent the 1989 Fall semester on sabbatical studying vegetation of the Jackson Purchase Region. This is one of the final aspects of his long-term studies of the vegetation of Kentucky in association with *Dr. William H. Martin*, Eastern Kentucky University. *Dr. John Ferner* was recently appointed Adjunct Curator of Herpetology at the Cincinnati Museum of Natural History. The CMNH collection of Kentucky amphibians and reptiles is a significant one and available for researchers. In addition, the museum is encouraging donations of regional herpetological material as its collections facility is expanding. *Dr. Ferner* also accompanied museum and Philippine investigators on an expedition to Panay Island in October, 1989.

LOUISIANA

Southern University, Department of Biological Sciences. *Drs. Syed* and *Nusrat Naqvi* have received a \$200,000 research grant from the NIH to extend over a five year period. A graduate research assistantship is available which will pay \$450 per month (12 month basis), tuition, and the cost of

attending a national meeting. The student should be a U.S. citizen or a permanent resident. Please send inquiries to *Dr. Syed Naqvi* (504) 771-5210 or 4240.

Northeast Louisiana University, Department of Biology. Dr. Kancheepuram N. Gandhi, post-doctoral student at the University of North Carolina, and *Dr. R. Dale Thomas*, Professor of Biology and Director and Curator of the Northeast Louisiana University Herbarium, have recently co-authored the book *Asteraceae of Louisiana* (SIDA, Botanical Miscellany, No. 4, published by Southern Methodist University Herbarium in Dallas). The 202-page book contains original descriptions of each of the over 340 species (101 genera) of plants in the Asteraceae (sunflower family) in Louisiana. Since each description is based on original measurements made by *Dr. Gandhi*, this is a "one of a kind" publication, and has been well received by the botanical community since its publication in December, 1989. It represents two years of work by *Dr. Gandhi* while a research assistant under the direction of *Dr. Thomas*, and an additional year finishing the work at Texas A&M. The descriptions of plants in this book are based on *Dr. Thomas's* collections housed in the NLU Herbarium. Of the 315,450 specimens comprising the NLU Herbarium, *Dr. Thomas* has personally collected some 115,500 of these. The collection of Asteraceae alone numbers over 30,000.

NORTH CAROLINA

North Carolina State University, Department of Horticultural Science. Dr. Doug Bailey, Floriculture Extension Specialist, is a new faculty member. *Dr. Tom Monaco* was inducted as a Fellow of the Weed Science Society of America. *Dr. Gus DeHertogh* received the 1989 Futura Award from the Professional Plant Growers Association. *Dr. David Wolff* received the 1990 Krezdorn Award from the Southern Region of the American Society of Horticultural Science.

SOUTH CAROLINA

The University of South Carolina, Department of Biological Sciences Herbarium. Dr. John Nelson joined the department as Herbarium curator on 16 January 1990. *Dr. Nelson* replaces *Ms. Cynthia Aulback-Smith* who for 11 years served as curator. *Ms. Aulback-Smith* will remain affiliated with the Department as a research associate. *Dr. Nelson* was associated with the South Carolina Non-Game and Heritage Trust Program of the South Carolina Wildlife and Marine Resources Department as a botanist/ecologist.

TENNESSEE

Memphis State University, Department of Biology. The department has implemented a new sequence at the freshman level for non-science majors, called "Biology: A Human Perspective." During 1988-89, the faculty published 75 papers in refereed journals and presented 63 papers at scientific meetings. Graduate students authored 24 manuscripts. The department presently administers over 20 grants and contracts in support of research and has external research collaborations with 33 institutions and facilities. The department also supports four postdoctoral students. *Mike Kennedy*, Professor and director of the Meeman Biological Station was presented the 1989 Tennessee Wildlife Professional award for Outstanding Contribution to the Wildlife Profession by the Wildlife Society. A study of anaerobic and facultatively anaerobic bacteria in the deep sub-surface waters was funded by the Department of Energy. The project, proposed by *Dr. S. Edward Stevens* and *Dr. King-Thom Chung*, will include identification of bacteria where possible along with their biological activity and community structure. The grant is for \$425,000 and extends over a three year period. A three year grant, "Hormonal and Genetic Methods for Increasing Channel Catfish Production" funded by the U.S. Dept. of Agriculture for \$79,000 was awarded to *Dr. Bill Simco* and *Dr. Ken Davis*.

VIRGINIA

University of Richmond, Department of Biology. Dr. Willie M. Reams, Jr. has resigned from the department to devote full time to the directorship of Lora Robins Gallery on the campus of the University. *Dr. Barbara A. Mittman* has resigned to join her husband, a physician on assignment with the Navy. *Dr. William G. Shanabruch* (Ph.D. Molecular Genetics, M.I.T.) has been hired as a replacement for *Dr. Mittman*. *Dr. Eugene G. Maurakis* (Ph.D. Systematics and Biogeography, The

George Washington University) has been appointed Assistant Professor beginning in the Fall of 1990. *Dr. Herschell S. Emery* (Ph.D. Molecular Biophysics and Biochemistry, Yale University) joined the department this year as Assistant Professor of Cellular and Molecular Biology. *Mary Farrell* has been hired as Director of Biological Laboratories with the responsibilities of coordinating freshman laboratories and maintaining an inventory of supplies for all classes. *Dr. Roni J. Kingsley* received an N.S.F. grant for a scanning electron microscope and support equipment.

WEST VIRGINIA

West Virginia University, Department of Biology. *James B. McGraw* received \$15,720 from Earthwatch for the "Ice Age Seeds" project.

ABOUT MUSEUMS AND BOTANICAL GARDENS

ALABAMA

Alabama State Museum of Natural History, Tuscaloosa. The Museum has resumed publication of the *Bulletin* according to *Dr. John C. Hall*, Assistant Director and Head of the Natural History Division. *Dr. Richard L. Mayden* will serve as editor. *Dr. Hall* stated that the museum is the only one in Alabama that issues a regular academic publication. The *Bulletin* is dedicated to scholarly research of particular interest to Alabama and the mid-South region which includes the Gulf states and several of those adjoining them. Two new members of the museum staff are *Bernard R. Kuhajda* and *Richard L. Mayden*. *Mr. Kuhajda* has an M.A. degree in Zoology from Southern Illinois University and his research interests include basic and applied research of aquatic systems with interest in ecology and distribution of freshwater fish. He was the Collections Manager of the Department of Biology before joining the museum staff. *Dr. Mayden* received his Ph.D. in Systematics and Ecology from the University of Kansas. His research interests include systematics, ecology, and biogeography of fishes. He served as assistant professor of Biology and Curator of Fishes in the Biology Department at Alabama before joining the museum. He did post doctoral research at UCLA, and was a research associate at the Los Angeles County Museum of Natural History.

On 10 June 1990, the Museum opened Expedition #12, the annual summer camps which takes science out of the classroom and into the field. *Dr. Paul Welch*, archaeologist from Oberlin College, served as the camp Scientific Director. To mark the 50th anniversary of the opening of the Indian Museum at Mound State Monument and the 300-acre park, the Alabama State museum will once again sponsor a Fall Festival from 8 October through 14 October 1990. Mound State Monument is located about 15 mi south of Tuscaloosa on Highway 69. For further information call 205-371-2266 or 371-2572.

Dr. David Watts, a protege of *Dian Fossey's* who spent five years in Rwanda studying the endangered mountain gorillas, was the guest speaker at the annual Tuomey Lecture sponsored by the Alabama Museum. *Dian Fossey* was the American primatologist who lived among the gorillas for 18 years and was murdered in 1985. *Dr. Watts'* research includes the study of diet, habitat, and social behavior of gorillas among both individuals and groups. According to *Dr. Watts*, the government in Rwanda is doing a pretty good job of protecting the park. Not only are they running a successful tourism program, but they are also putting the revenues earned into a conservation education program within the public schools for children. Poaching continues to be a problem for the mountain gorillas, according to *Dr. Watts*. There are estimated to be only 278 mountain gorillas left. *Dr. Watts* is currently a Visiting Professor of Biological Anthropology and Anatomy at Duke University Medical Center.

FLORIDA

Archbold Biological Station, Lake Placid. *Dr. John W. Fitzpatrick* is the new Executive Director of the station. He is no newcomer, since his first visit was as an NSF Undergraduate Research Participant during the summer of 1972. His graduate work was done at Princeton, and did field research from 1974-76 in the Manu National Park of Peru. In 1977, he was offered the job as Head of the Division of Birds at the Field Museum of Natural History in Chicago, and he became Chairman of the Department of Zoology in 1985. His principal research was split between Florida scrub jays at Archbold, and South American avian systematics, mainly in Peru and Brazil. He and his wife, Molly, have a

daughter Sarah and a son, Dylan. All four are delighted to be living in the pristine splendor and intellectual fervor of the Biological Station. Other new post doctoral associates are *David B. McDonald*, who joined the staff in Population Genetics to study the genetic structure and biogeography of animals endemic to Florida scrub. He was a Harry Frank Guggenheim Fellow at the University of Florida, and received his Ph.D. from the University of Arizona. At Archbold, David will be using allozyme and DNA techniques to look at patterns of differentiation in Florida scrub jays, red widow spiders and a grasshopper species. *Mark Alan McPeck* will be working in Aquatic Ecology. Mark has been a Visiting Assistant Professor at the Kellogg Biological Station since receiving his Ph.D. from Michigan State University. His primary research interests deal with the community structure and evolution of aquatic organisms. *Dr. Tom Eisner* has received the Harvard Centennial Medal at Cambridge and was awarded an Honorary Doctorate from the University of Gothenburg, Sweden. *Ron Myers* was elected Secretary of the Vegetation Section, Ecological Society of America. Research Associate *Tom Eisner* has discovered a species of mint, the scrub balm, in the area of the Lake Wales Ridge which has a potent insect repellent activity. This mint is considered Endangered by State and Federal governments. Glandular capsules densely line its leaves and produce chemicals that repel ants and irritate roaches. They are released only when an insect bites the leaf. Back at Cornell, Eisner's chemical ecology research team, *Dr. Jerrold Meinwald* and graduate student, *Kevin D. McCormick* analyzed the contents of the capsules. A new chemical in the oil was identified as trans-pulegol.

GEORGIA

Savannah Science Museum, Savannah. The Museum announces the opening of registration for the 18th season of its Caretta Research Project. This threatened species program researches and protects the loggerhead sea turtle as it conducts its nesting ritual on a Georgia barrier island. This 20-week schedule, from 19 May–6 October covers the nesting and hatching season of this turtle. Participants are needed for week-long stints on the Project where, from mid-May to mid-August, they will work with the females as they come ashore to nest. Participants working mid-August through early October will be on "hatchery duty," monitoring the nests that are stretched along the seven miles of Wassaw Island's beach and protecting the young as they hatch. Participants will assume a nocturnal schedule, therefore only the hardy should apply. Afternoons are reserved for on-your-own activities. A tax-deductible fee of \$375 for a week's participation (May-August) and \$300 during September and October will cover food, housing, and Project expenses in general. For information, call Savannah Science Museum at 912-355-6705. *Christopher J. Shubert*, Museum Director, was recently appointed adjunct Associate Professor of Geology at Georgia Southern University in Statesboro. With this appointment, programs in teacher training, such as the East Africa Geological and Wildlife Safari and the Field Geology of the Grand Canyon, will be accredited through the GSU's School of Education.

NORTH CAROLINA

North Carolina State Museum of Natural Sciences, Education Section. The A. J. Fletcher Foundation will sponsor, for the fourth consecutive year, the museum's Tropical Ecology Workshop, which each summer takes 12 classroom teachers to Belize, Central America, for a week of field experiences under the leadership of *Mary Ann Brittain*. On 23 February 1991, workshop participants will help the staff and other volunteers with "An Afternoon in the Tropics," a festive event designed to educate the public regarding the need for protecting tropical plants and animals. *Robert G. Wolk* and *Jesse P. Perry* led a group of naturalists on the first museum-sponsored trip to the Galapagos Islands in March 1990. *David S. Lee* and *Mary C. Succi* have published a 64 page paperbound book entitled: "Potential Effects of Oil Spills on Seabirds and Selected Other Oceanic Vertebrates off the North Carolina Coast." This book summarizes data collected over a 15 yr period and documents the abundance of wildlife in the area proposed for offshore drilling. The North Carolina Wildlife Resources Commission awarded grants to *Mary K. Clark* for the study of Rafinesque's big-eared bat, *Plecotus rafinesquii*, and to *Alvin L. Braswell* for research on the Carolina crawfish frog, *Rana areolata capito*.

NEWS FROM AFFILIATE SOCIETIES OF ASB

THE SOUTHEASTERN CHAPTER OF THE ECOLOGICAL SOCIETY OF AMERICA

Election of Officers

The Chapter is pleased to announce the election of a new chairperson and secretary for the 1990-92 time period. The term of these offices begins following the annual ESA meeting being held at Snowbird, Utah. The new chair is Dr. Courtney T. Hackney, Department of Biology, University of North Carolina, Wilmington, North Carolina 28403, (919) 395-3759. The newly elected secretary is Dr. Elizabeth R. Blood, Department of Environmental Health Sciences, University of South Carolina, Columbia, South Carolina 29208, (803) 777-6994. Continuing in his role as vice-chair is Dr. Kenneth W. McLeod whose term of office expires in 1991.

Fall Field Trip

The annual fall field trip for the Southeastern Chapter is scheduled to be held 5, 6 and 7 October 1990 at the Hobcaw Barony near Georgetown, South Carolina. This is the site of the NSF's North Inlet LTER and the site of the Belle Baruch Institute for Marine Biology and Coastal Research and the Belle Baruch Forest Research Institute. Our chapter has active members in both of these Institutes who have agreed to host the visit of the Chapter. In addition to seeing the North Inlet site and coastal forest communities, we will also be able to examine some of the impacts Hurricane Hugo caused along the South Carolina coast. The site has several large cabins with multiple bedrooms capable of sleeping several dozen people. The plans are still being put together regarding the trip. Please look for further information in ASB Bulletins and/or the SE-ESA Newsletter. If you would like to ensure that you are on the mailing list to receive information regarding the fall field trip, please notify Dr. Ken McLeod at the Savannah River Ecology Laboratory, P.O. Drawer E, Aiken, South Carolina 29801.

Call for Papers

LIFE AND THE SCIENTIFIC WAY OF THINKING: Biological Science in Liberal Studies

The *ad hoc* Education Committee is organizing a symposium for the 1991 annual meeting which will focus on concrete ways that the excitement of science and significance of biology can be conveyed to the non-major. It has become evident that watered down "majors" courses are generally ineffective in reaching those goals. We are soliciting 2-3 page concept statements for 20 min presentations of specific examples of lecture, laboratory, discussion group or field activities which have been successfully implemented in courses dealing with large numbers of students. We are particularly interested in course modules or tools that promote critical thinking, problem solving, communication and writing across the curriculum, or quantification of ideas. Other suitable concerns include developing global perspectives and preparation for life-long incorporation of an understanding of the nature of science in decision making and day-to-day living.

The examples should be based on one or more focused biological concepts and preferably not require resources unique to a particular institution. They should utilize tools which can be readily acquired for use at other locations. While it is appropriate to briefly address the philosophy behind the module or activity, the focus should be on the concrete usable example. It is desirable to include information about the assessment of the success of the use of this idea, but these presentations are not intended to be reports of research on educational methodology. Furthermore, while it is appropriate to briefly discuss the position of this activity in the context of the overall course curriculum, papers which focus on course outlines of non-majors courses are not appropriate for this symposium.

In summary, we seek presentations of specific field tested examples of ways to overcome the "science anxieties" of non-majors and provide a lasting biological literacy. Participants will be strongly encouraged to bring documents for distribution to those in attendance which will facilitate the implementation of the module at other institutions.

**The deadline for submission of proposals for committee review is
August 15, 1990**

They should be sent to:

Dr. Dean Cocking, Chair, *ad hoc* ASB Education Committee
Biology Dept., James Madison University, Harrisonburg, VA 22807.
703-568-6225

APPLICATION FOR ASB MEMBERSHIP

Give copies of this to your students, colleagues, and your school librarian.

Fill out blanks and enclose check or money order for one year's dues and mail to Dr. R. L. Beckmann, Dept. of Botany, N.C. State Univ., Raleigh, N.C. 27695-7612. **Please include phone number on application** _____.

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1993: M. Eloise Carter, Oxford College of Emory, Oxford, GA 30267

James W. Wallace, Jr., Western Carolina University, Cullowhee, NC 28723

The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1991 April 10–13 Appalachian State University, Boone, NC

1992 April 8–11 University Alabama—Tuscaloosa, Tuscaloosa, AL

1993 April 14–17 Old Dominion University, Norfolk or Virginia Beach, VA

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PRESIDENT'S CORNER

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OCT 24 1990

A. M. N. H.

A very clear message came from the AIBS sponsored Conclave of Presidents in Washington, D.C. in May. Biologists need to be much more active in providing information to legislators and administrators in Washington. We need to speak to environmental and conservation issues with a strong, unified voice, as many other professional groups do. The Washington perception of biologists influences funding in our various research areas and legislative and regulatory activities that affect environmental integrity of the region and the world. Biologists as a group have generally avoided any activity that may be interpreted as political and have focused on their research in a socially isolated atmosphere. We have entered a time when this can no longer be possible. I represented ASB at the Conclave and was deeply impressed by the forceful plea echoed by three U.S. Senators in an informal meeting with the Society presidents. Senator Timothy Wirth, Senator John Heinz, and Senator Al Gore individually called for help from biologists. They desperately need our input and support. This message has also been heard in the previous two ASB past-president's addresses at the annual meeting.

Several specific suggestions from the working segment of the Conclave should be considered by ASB as means to increase our social responsibilities. All societies were urged to develop active Public Affairs committees. I believe ASB's Public Affairs committee has been active, but our involvement can be improved through better communication of environmental and conservation issues to our members and more efficient flow of information from our members to Washington. AIBS can serve as a collector of concerns and information from biological societies, a disseminator of information, and as an effective spokesperson for biology. We can support AIBS by improving our communication ties (in both directions) and by becoming individual members of AIBS.

Congressional Fellows represent an excellent mechanism by which biological societies can increase information flow to Washington. ASB may want to consider possible co-sponsorship of a Congressional Fellow.

A specific societal issue that was extensively discussed at the Conclave was the need to increase the involvement of minorities, women, and the disabled in our profession. Actions that ASB might consider are creation of a committee to address involvement of underrepresented groups and targeting local school kids with special programs in association with our annual meetings. A symposium addressing minority involvement ("Minorities in Biology: opportunities for growth") will be convened on August 8th at the AIBS meeting in Richmond, Virginia. Several ASB members are involved in organizing the session and making presentations.

The ASB Executive Committee will discuss these issues and report to the members at the annual meeting in Boone. Any suggestions before then are welcome.

ASSOCIATION AFFAIRS

“E” WORDS AND ACORNS

1990 ASB Past-President's Address
Baltimore, Maryland

William H. Martin

Eastern Kentucky University
Richmond, KY 40475

As you have probably guessed, one of my “E” words is “ecology.” The others are “environment,” “environmentalists,” and, for this particular time, “Earth Day.” Thomas Lovejoy opened this 51st meeting of the ASB on an environmental note and I want to close it on the same theme with more emphasis on the ASB's region.

April 22 (day after tomorrow) will be the 20th anniversary of Earth Day. In 1970, an estimated 20 million people celebrated the first Earth Day, mostly in this country. Do you remember where you were? (I do; I was in my first year at Eastern and we had an all-day outdoor forum that concentrated on strip mining because that was the consuming issue in Kentucky then.) This year, it is estimated that over 100 million people will be involved in some kind of Earth Day celebration and that the event will be international. It is already a big media event and thanks to the perseverance and ingenuity of many people from all walks of life, the first Earth Day and this one will be the largest grass roots demonstrations in history. You may recall that many “radicals” organized and participated in the first Earth Day. This time, if you do not participate you will not be human, let alone American.

I hope that something is planned where you are and that you will be involved. At Eastern, we will have an entire “Earth Week,” and symptomatic of many environmental issues, strip mining will be discussed again, although it is now called “surface mining.”

Since the first Earth Day, there has been some progress toward making household words of the “E” words. Today, most adults have some notion of what ecology is although most of them still cannot distinguish between ecologists and environmentalists. In the 1970's, a number of important environmental laws and policy acts were passed, *e.g.* the Clean Water Act, the Endangered Species Act, and the Surface Mining and Reclamation Act. The legislation that protected critical lands in Alaska was a hallmark of the Carter administration. The Federal Land Policy and Management Act and Forest Management Act are among the most important pieces of environmental legislation. They have greatly modified management of our public lands. Among the hundreds of accomplishments from this decade are the 90% reduction of lead, the establishment of over 100 National Wildlife Refuges, the protection of law extended to 447 species of plants and animals, and the designation of over 8,000 miles of scenic rivers.

A unique feature of environmental legislation has been the inclusion of science

into law and the participation of scientists in writing these laws. We have been actively involved in drafting the enabling legislation, the regulatory framework, and as regulators. This scientific involvement must and will continue.

NEPA (The National Environmental Policy Act) and its famous EIS (Environmental Impact Statement) came into being on 1 January 1970, a few months before the first Earth Day. Let's look at this Act for a moment as an example of the degree of success of our national effort. NEPA is indicative of most environmental legislation *i.e.* the results are ambiguous. NEPA **has** provided environmental protection, and it **has** prevented some environmentally unsound projects from occurring. Most importantly, it **has permitted citizen participation and redress** and it has provided cracks in doors that were formerly shut. Prior to the 1970's, federal decisions about use of natural resources and policies regarding energy use, transportation, timber harvest, were made behind closed doors, presumably in the hands of professionals. With the opening of the doors, we have seen just how these so-called "professionals" work and how some of their decisions are made.

On the other hand, NEPA is not a total success story. Politicians, agencies, and attorneys have seen NEPA from the procedural standpoint of the EIS, not a commitment to elevate environmental protection to a policy level. That struggle continues. Unfortunately, NEPA has led to millions of extra dollars being spent to **justify** an activity, and some environmentally-unsound projects have continued in spite of the fact that the NEPA process shows them to be environmentally **and** economically unjustifiable. In all fairness to NEPA, this is not a fault of the Act but of the politicians, professionals, and agencies involved. However, we can see some change in the way the federal government conducts its business, and a strong case is being made to amend the Constitution to include environmental protection as part of the national body of law and direction for this country.

The 1970's saw the creation of these laws, but in the 1980's we saw the systematic attempt by the Reagan administration to dismantle all of those efforts. Beginning with James Watt and Anne Gorsuch and ending with Robert Gentile (the Head of the Office of Surface Mining), the entire period was spent fighting the fires set to cripple practically every environmental law at the federal level and wreck the environmental establishment. The decade finally ended on a note that summed it up: the filth and pollution associated with the Exxon Valdez oil spill in Prince William Sound.

Over the last 20 years, we have also seen fundamental changes in the environmental movement. In 1970, the environmental organizations and its members could be considered as one. They were and are still accused of being elitists. Today, three basic groups have evolved, partly in response to the Reagan years: The regular, established groups that depend on government policy and regulation: NWF, The Wilderness Society, Audubon Society (remember when they were considered radicals?). The second group concentrates on the market forces: World Wildlife Fund and The Nature Conservancy; the third group of present-day "radicals" who are confrontational: Earth First!, Greenpeace, The Tropical Rainforest Action Network (RAN), and The Sea Shepherd Society (SSS).

What will be the major ecological issues in this decade, particularly in the South? From the standpoint of natural resources, I think they will focus on:

- (1) the issue of biodiversity on all of our public lands. We will also begin to

discuss “corridors” and “connections” for wildlife and we will continue to fight the disappearance of wetlands, coastal ecosystems, and endangered species and habitats;

(2) the need for regulating land use and dealing with population growth particularly on the coastal plain and around our cities;

(3) protecting the quality and the quantity of surface and ground waters, and;

(4) controlling human and toxic wastes.

This last health issue will be a major one. The Institute of Southern Studies in Durham, North Carolina reports that **human health is less protected in the South than any other region**. We have a disproportionate share of hazardous jobs, contaminated water, homes without plumbing, and polluting industry. The Institute also notes that the South has (a) six of the 10 states with the largest per capita toxic chemical discharge, (b) five of the 10 states with the most radioactive waste, and (c) over 60% of the industries that pose the greatest risk of cancer. The U.S. Environmental Protection Agency indicates that $\frac{2}{3}$ of the nation’s hazardous waste is treated or disposed of in the South.

To correct any of these issues in the South will be a long struggle. In addition to fighting vested industrial interests and bureaucracies that focus on deadlines, the environmental community has to deal with generally apathetic legislators and the public. With few exceptions, our states do not have a long history of environmental concern and activism. Most of the southern states devote smaller parts of their budgets to natural and environmental resources than average state appropriations. In Kentucky, every environmental issue seems to be a struggle, requiring years of resolve. For example, a small group of people in Middlesboro, Kentucky have been fighting a tannery **and** the state over the water quality of Yellow Creek for years. We have also been trying for four years (two legislative sessions) to get some wetlands protection in a state that has important wetland areas that are rapidly disappearing. Undoubtedly, we have years to go.

To add to the struggle, every environmental issue is complex and the public is confused. All of them require some application of scientific principles and the scientific community is not united on one subject by any means. In fact, scientists are busy collecting and analyzing data that reveal more problems than solutions, especially workable ones. Look at the acid deposition issue as one example; others are the use of Alar, asbestos clean-up, and radon monitoring. Closer to the hearts of ASB members, National Biodiversity Act has a difficult path to follow because of the fear that inventories will reveal further uncertainty about our biota and stop some development plans of industry and government. Uncertainty is attractive to us as natural scientists because it presents a challenge and an opportunity to investigate and explain the unknown. However, uncertainty is not liked by the public and it absolutely is not tolerated by those people called “decision-makers.”

What can we do? What should we do? There is a desperate need for people who can bridge the gap between science and the public. Constructing the bridge is where ASB, its members, and the acorns come into the picture.

What can ASB do? For that matter, what can any organization do? The lack of a good answer is often used as an excuse to do nothing. I firmly believe that the ASB has an opportunity to fill an empty niche. As I have said before, we are large enough as an organization and we serve a region, not the nation, so we **can**

be an effective group if we just turn hopes and wishes into action. So, here is what can do:

(1) The membership must continue to elect officers and Executive Committee members who believe that ASB should be an activist organization of biologists. These elected people will be responsible for setting the agenda, appointing the members to committees, creating the necessary *ad hoc* committees, and determining short- and long-term goals and directions. In the 1980's, I think the membership has given more attention to the annual elections. As President, I was certainly surrounded by active, reliable, and conscientious people on the Executive Committee. They provided excellent guidance and advice and always turned to the task at hand. Any success we realized in 1988–89 is due to their hard work.

(2) For ourselves, we should continue to adopt and publicize resolutions prepared by our Conservation, Education, and Public Affairs committees. Resolutions won't mean much unless something is done to publicize them and bring them to the attention of the people the resolution is designed to reach. They do provide a means of group expression and make us feel like we've done **something** and **that** is important. When we stop making this minimum of efforts, ASB is dead in the water.

(3) For ourselves, we can publish issue-oriented articles on southeastern environmental matters. For a different approach, we should encourage members in state and federal resource agencies to submit articles. You may say that this activity is preaching to the choir; I prefer to think of it as an attempt to get the attention of the backsliders and the people in the back pews.

(4) For the members **and** our colleagues **and** the interested public, we can sponsor symposia and workshops on environmental issues such as the ones that we had at the Charlotte meeting and the ones that we have had here at Baltimore. Congratulations and thanks to the organizers of these superb sessions!

(5) We can become involved with more public outreach. We can serve the public by sponsoring excursions that get people into the southern outdoors where you and I know life is best. Well, let's tell people about it and give them a little ecology and natural history at the same time. They may not be able to pass a test on it, but I predict that they will be more receptive to environmental issues and more importantly, legislation and funding. If ecologists had paid more attention to the public in the past, we would not now be fighting over crumbs from the funding table. It really is a sad state of national affairs when a single university's (Princeton) molecular biology department gets **more money** for health-related research **than** the **total** amount allocated to **ecology** by NSF!

(6) Through our Education and Conservation committees and our affiliations with American Association for the Advancement of Science (AAAS), The American Institute of Biological Sciences (AIBS), The Alliance for Environmental Education (AEE), other science organizations, and our own affiliates, we can do more about environmental education, especially with teacher training. We need to investigate that in more detail. We should also follow up on some of our recent symposia. For example, based on the Biodiversity Workshop in Charlotte, what is the next step for a partnership role with the U.S. Forest Service? How about jointly sponsoring workshops to address specific problems at particular national forests?

(7) Finally, we can provide a registry or directory of members who can serve

as consultants in their area of expertise. This registry can also list all of the environmental consulting firms, state natural resource agencies, and the state and regional offices of public and private agencies in the South. Of course, to make this registry useful we have to get it into the hands of the users: The agencies themselves, activist groups, teachers, and established organizations such as League of Women Voters, garden clubs, and civic organizations. This way, ASB provides information and, through the expertise of its membership, it provides direction for making ecologically-sound decisions.

Now, what can you do? To those cynics who point to failures in environmental laws and regulations and those fatalists who say nothing can be done, I say _____ (you fill in the blank)! In the first place, pointing to failures marks the true sign of the pessimist who also ignores the accomplishments. Maybe our air and waters are not as clean as they should be, but where would we be without the Clean Air and Clean Water acts?

I remind both of them that **there are at least two ways to get to the top of an oak tree: You can climb it, or you can sit on an acorn and wait for it to grow** (of course, the fatalist won't even try). The environmental movement, Earth Day, and the discipline of ecology are all testimonials to people who decided to climb the tree rather than suffocate the attempt **and** the oak.

So, what will you do? Look around you at your home and see who is going to be making decisions about the local and regional environmental issues. Are you one of them? Who are the people called "leaders" in your community? Politicians? Physicians? Attorneys? Business people? Jane Q. Citizen? What do they know compared to what you know and can do?

Now, to become more active means getting up off the acorn. **You** step forward and volunteer:

- (1) Make yourself available to talk to people.
 - a. Let elementary teachers know that you are willing to lead field trips. To really solve the future environmental problems, we have to get to the children. **Share with them your joy of nature.**
 - b. Also, be available to talk to college student organizations, civic groups, garden clubs, and state agencies.
 - c. Let regulatory agencies know that you are available to help them if they haven't contacted you already. They may not always accept your pearls of wisdom and position (which are undoubtedly correct) but they should know what they are.
- (2) Join a conservation group and be active in their activities; serve on committees, be an officer, attend meetings and speak up. Any organization (including ASB) will be glad to take your money, but they really need people who will be leaders and participants.
- (3) Contact the media when an environmental issue arises and you see a chance to provide better information. Let the press know that you are available and willing to help them. Media people are not uninformed by any means, but they usually do not have the science background to provide depth. They do want to inform and they do want to help in the educational process, so help them carry out their assignments.

In dealing with all of these individuals and groups, remember KISS—"Keep It Simple, Stupid." In formal and informal presentations, try to get just one or two

points across. For example, when I have been asked to talk to elementary school children “about trees,” I’ve chosen to make the understandable points about their size and that some of them are the largest living things on earth instead of providing a forgettable lecture on different kinds of trees and their habitats. For such a complex subject as acid deposition, a short talk can emphasize the water cycle and mobility of things in the atmosphere. You may not be an expert on acid deposition but you probably know more than anyone else at your talk. Remember—you will have to change the language you use—most people do not really care if *Quercus alba* is either a white or red oak.

If you are reluctant to talk about a subject because you are not the expert, make a point of knowing who is one. In cases of a proposed action that may affect the biota or environment, based on your understanding of the way something works, do the proposed actions make sense? People and organizations with vested interests will always put their best foot forward and try to minimize impacts of their activities and maximize improvement on nature. In Kentucky, a corporation dumping tons of salt into one of our lakes claims that there are few risks and little environmental damage. How does that sound? You don’t have to be an aquatic ecologist to challenge those assertions.

Being an advocate and activist is counter to scientific activities and our preparation for a career. We have to get beyond that. We have to leave the privacy of our office, lab, or field project. Second, we cannot wait until there is certainty to act. Scientists are reluctant to step out in front on issues of uncertainty, but ambiguity and uncertainty doesn’t stop the captains of industry and development when they get the **bit** in **their** teeth. In most cases, there will not be a definite answer. Point out the degree of uncertainty and risks of the issue. What evidence can advocates of the opposing side provide as “no” or “little” risk? You will not compromise your profession by staying with the facts and being truthful and outspoken.

Activism may mean dealing with some strange bedfellows who march to a different drummer. Just remember that you are not having to live with them. I would recommend that you also attend non-science meetings and hear what others say about us “academic-types” and “scientists.” You may be surprised and initially dismayed, but that’s part of leaving your comfortable little world.

So, let’s get up off our acorns and get involved. This last decade of this century is one when some of the neglected environmental problems of the 80’s will come home to roost. Protection of biodiversity and human health is not an elitist position. There will always be opposition, so be prepared for a long struggle. People producing pollution and extracting natural resources can forestall regulatory actions for years and there is always the argument that regulations and preservation of species habitat will drive someone out of business. In some cases it will. The 1977 Surface Mining and Reclamation Act did drive some coal companies out of business, but enabling the legislation was still the right thing to do. I believe it was Will Rogers who observed that some people should not be in business; that’s the reason government is in business.

Finally, we do not have to be absolutely sure of all outcomes before taking a position. Progressive environmental protection will go forward when led by those who look at the facts, see what is right, and commit themselves to advancing protection and preservation. And don’t worry about uncertainty. As Yogi Berra said, “When you come to a fork in the road, take it!” In other words, do it!

ENVIRONMENTAL EDUCATION INFORMATION

Two recent meetings attended by ASB members will be of interest to many of our membership: 1) the second meeting of Committee T-4 on Environmental Education of the American Society for Testing and Materials (ASTM), 9–10 May 1990; and 2) the Alliance for Environmental Education (AEE), 9–11 May 1990. The meetings were held at the same location so that participants could attend both.

The ASTM, organized in 1898, is one of the largest voluntary standards development systems in the world. A **standard is a document that has been developed and established within the consensus principle of the Society that meets the approval requirements of ASTM procedures and regulations.** Of the six types of standards that can be developed, a **standard guide** is projected for environmental education, *i.e.* **a series of options or instructions that do not recommend a specific course of action.** Four subcommittees of Committee T-4 are now working on standard development: .01 Environmental Literacy, .02 Formal Education/Schooling, .03 Nonformal Education/Training, and .04 Technical Training.

Anyone wishing input into this Committee, or information about ASTM, should contact Ms. Wendy Dyer, ASTM, 1916 Race Street, Philadelphia, PA 19103 (215/299-5526).

The AEE, established in 1972 as a private, nonprofit organization, **serves as an advocate for a quality environment through education and advances communication, cooperation, and exchange among organizations concerned with environmental education.** The aim to establish a **National Network of centers that assesses needs and provides services in teacher and leadership training, program development, regional outreach, and research and evaluation** is finally a reality. The Network is patterned after the one established by the Tennessee Valley Authority (TVA) in cooperation with colleges and universities in the Tennessee River Basin. The AEE, TVA, and the Environmental Protection Agency are major partners in the establishment and support of the current Network. More than 100 centers are now members of the Network. In addition to the centers, over 100 organizations, agencies, and corporations are members of the Alliance. ASB has been an AEE member for two years, one of a handful of professional organization members representing the sciences. Our continued involvement will be decided on a year-to-year basis. Anyone wishing information about the Alliance can request this from the Chairman of the *ad hoc* Education Committee, Dr. Dean Cocking, Biology Department, James Madison University, Harrisonburg, VA 22807.

There are many unanswered questions about environmental education, not least of which might be stated as: What is it? Judging from these meetings, there are a multitude of widely-divergent ideas. The concern of some ASB members who have attended these meetings is that the natural science component is not strong, or in some cases possibly lacking altogether. At this time, when the environment is arguably the hottest topic in education, ASB and its members should give careful attention to this emerging field of education to assure that it is emphasizing science as an essential foundation block. ASB members can make important contributions in this field by becoming more active in the workings of the AEE and the Network centers. Surely there are many possibilities for positive involvement, if we look for them.—Janice Coffey Swab, Department of Science, Saint Mary's College, Raleigh, NC 27603.

REVIEWS

Pough, F. Harvey, John B. Heiser, and William N. McFarland. 1989. **Vertebrate Life** (3rd ed.). Macmillan Publ. Co., NY and Collier Macmillan Publ., London. \$65.00. 900 p.

This represents the third edition of "Vertebrate Life," earlier versions of which had appeared in 1979 and 1985.

Later editions of books often amount to mere reprintings, with very few changes or additions being evident. In such cases, reviews are essentially superfluous, with about the only things left for a reviewer to do being to comment on changes from the earlier edition, to indicate whether or not the authors have chosen to incorporate suggestions and criticisms of earlier reviews, and to advise the readers whether or not such changes and updatings as have occurred are sufficient to justify the expense of acquiring the most recent version of the book. Although the above would have been true, to some degree, for a review of the second edition of "Vertebrate Life," it definitely is not the case here. The third edition of this book is so different in organization and content that one is well advised to add it to one's library.

One need go no further than the front cover to see one of these differences. There has been an upward progression in visual appeal, beginning with the plain blue cover of the first edition (containing outline drawings of two chimaerids), to the white cover of the second edition (with well-executed drawings of two lizards each on both front and back), to the clear and attractive color photographs of various vertebrate animals in natural settings (three each on both the front and back covers) of the third edition. The next thing one notices is that both the names and sequence of authors have been changed from the first two editions. The earlier authors were indicated as McFarland, Pough, Cade, and Heiser; however, the third edition has only three authors (Pough, Heiser, and McFarland, in that order) with Cade being dropped. No explanation for this authorship change appears in either the "Preface" or "Acknowledgments" sections of the book.

In the "Preface" to the third edition, the authors discuss the reasons for certain of these changes. They particularly emphasize the emergence and widespread adoption of phylogenetic systematics (cladistics), and point out that the organization of their book has been changed in various places in order to reflect the resultant modified evolutionary groupings. To quote, "... cladistics provides an evolutionary framework in which ideas from other biological specialities can be accommodated. As a result, studies of behavior, physiology, and ecology are increasingly being placed in an explicitly evolutionary context, and this common ground has fostered increased interaction among these specialities." This philosophy is evidenced at various places throughout the book. One example may be seen in the organization of the new chapters 12 through 15. In the previous editions, all reptiles were treated in two chapters (13 and 14), which were entitled simply "Mesozoic Reptiles" and "Modern Reptiles," with extinct groups being treated in the first chapter and extant groups in the second. In the third edition, the turtles, which are really an ancient group little changed since their origin in the Mesozoic, are treated separately (Chapter 12), the evolutionary histories of the crocodilians and dinosaurs are considered together with those of the birds (all are collectively called "Mesozoic Diapsids") in Chapter 13, and the remaining reptiles (the Lepidosauria) are discussed together in Chapter 15. The intervening Chapter 14 deals with geology and ecology of Pangaea during the late Paleozoic and Mesozoic, whereas this particular topic preceded (Chapter 11) the evolutionary discussion of the reptilian groups in the previous editions. In connection with this, an expanded treatment of phylogenetic systematics appears in the latter part of Chapter 1 (this previously had been included in Chapter 3), and includes a useful discussion of cladistic philosophy and methods, as well as of the accompanying and sometimes-confusing jargon.

In the first two editions, Chapter 7 ("Life in Water") was concerned exclusively with the fishes, and dealt with such subjects as osmoregulation, temperature responses, and sensory adaptations. Part of this information forms a portion of the new Chapter 4 (which deals with homeostasis and energetics throughout all the vertebrates), and part has been incorporated into a new Chapter 8, where it has been integrated into a discussion of evolution of the bony fishes.

It is appropriate here to review the basic organization of the third edition. As is to be expected, the book is organized along classical evolutionary lines, with the fish-like vertebrates appearing first, working up through the amphibians, reptiles, birds, and mammals, and culminating with man. The

book ends, appropriately enough, with a discussion of the pervasive effect man has had on all other forms of life and what the future holds. The new volume has now been divided into four "Parts," within which are included 24 consecutively-numbered chapters. (By contrast, the second edition contained no such major divisions, but simply had 23 chapters.) Part one is entitled "Vertebrate Diversity, Function, and Evolution," and contains five chapters (1. Diversity, evolution and classification; 2. Origin of vertebrates; 3. Vertebrate organ systems and their evolution; 4. Homeostasis and energetics [water balance, temperature regulation, and energy use]; 5. Geology and ecology during the origin of vertebrates). Part Two covers the aquatic vertebrates (6. Earliest vertebrates; 7. First jawed vertebrates and the radiation of chondrichthyans; 8. Radiation and the major radiations of the bony fishes; 9. Geology and ecology of the origin of tetrapods). Part Three is primarily concerned with the terrestrial ectotherms, but in keeping with the cladistic approach also brings birds into the discussion (10. Origin and radiation of tetrapods in the late Paleozoic; 11. Amphibians; 12. Turtles; 13. Mesozoic diapsids [dinosaurs, birds, crocodilians, and others]; 14. Geology and evolution of Pangaea during the late Paleozoic and Mesozoic; 15. Lepidosaurs [tuatara, lizards, amphisbaenids, and snakes]; 16. Ectothermy [a low-cost approach to life]). Part Four includes eight chapters dealing mostly with the endotherms (17. Specialization for flight in birds; 18. Ecology and behavior of birds; 19. The synapsids and the evolution of mammals; 20. Geology and ecology of the Cenozoic; 21. Characteristics of mammals; 22. Body size, ecology, and sociality of mammals; 23. Endothermy [a high-energy approach to life]; 24. Human evolution, including man's relationship to the other vertebrates). Since both the composition and sequence of chapters have been changed in a number of cases, it would have been useful, for purposes of comparison, to include here a list of chapter titles from the earlier editions. In the interest of space, however, this is left for the reader to do.

As was true of the first two editions, the various chapters have been extensively subindexed (a very useful technique that permits the reader to easily locate topics of specific interest); key words are highlighted in black throughout the text, and are supplemented by a glossary of terms near the end of the book; a useful list of references (many briefly annotated) appears at the end of each chapter; and a condensed Latin and Greek lexicon is found inside the back cover.

An innovation of the third edition, which has become increasingly popular in recent years and which Pough et al. have used with great effectiveness, is the introduction of information "boxes" throughout the book. These boxes contain discussions dealing with subject matter of special interest, and which may not readily fit into the flow of the text. They are easily located, since they are highlighted in gray and are also listed separately in the indices to the respective chapters. A quick perusal of the indices of the first two editions suggests that the information contained in the boxes of the third edition is largely or entirely new. A total of 33 such boxes have been introduced into the most recent "Vertebrate Life," with one or more being found in all but five of the 24 chapters. To give some idea of their content, four boxes appear in the first chapter ("Vertebrate Diversity, Function, and Evolution"): The first ("Names and Endings") provides us with a quick, two-page lesson on zoological nomenclature; the second ("Evolving Views of Evolution") deals with changing ideas of how evolutionary processes work, with discussions on the pros and cons of gradualism versus punctuated equilibrium; the third concerns species flocks (with special attention to the cichlid fish flocks of east African lakes); and the last contains a discussion of the molecular clock hypothesis.

Another new and useful aspect of the third edition are the introductions and summaries at the beginning and end, respectively, of each chapter. The brief introduction (which appears in red print) introduces the readers to the questions being asked in that particular chapter, and the closing summary reviews what has been learned. Thus, it is possible to go through the book quickly, without reading the main text, and still obtain a good idea of the book's content.

The authors have done an extremely skillful job of integrating the vertebrate story from all aspects, with evolution being the connecting thread throughout. There is a strong emphasis on functional morphology, but this has been so well integrated with such disciplines as physiological, classical, and historical ecology; paleontology; systematics; and zoogeography that one never has the feeling that one discipline is being emphasized at the expense of the others.

To give the reader an idea of a few of the many fascinating topics discussed and the interesting conclusions reached, one can point to the authors' treatment of the subject of biological extinctions in Chapters 13 and 14 and of human evolution in Chapter 24. In Chapter 13, they point out that the demise of the dinosaurs, which has been widely publicized as *the* great biological extinction, was really no greater in scope of magnitude than various other mass extinctions through time, and in fact has been exceeded several times in terms of overall percentage of species lost. In Chapter 14, they review extensively the subject of mass extinctions, including their demonstrated periodicity and the evidence for and against extraterrestrial (*i.e.* asteroid) impacts. They carefully point out the pros and cons of the

various theories, but leave it to the reader to reach his or her own conclusions. They also discuss Pleistocene extinctions in Chapter 24, partly in connection with the impact of early Man. With regard to human phylogenetic relationships, they point out (on page 872 of Chapter 24) that recent work has shown that hybridization of non-repeated DNA sequences of humans and chimpanzees indicates 98 percent identity, which is at a higher level than for many other unquestioned congeneric species of vertebrates, and well within the range at which hybridization would be possible. Let us hope that this is not put to a practical test!

As a complete authoritative story of the vertebrate animals, contained between two covers, this book is without equal. Probably one of the strongest recommendations I can make is that it simply is extremely interesting reading! It is clearly and succinctly written, but at the same time the writing is never so succinct that one feels short changed in terms of the information being conveyed. Also, because of its organization, one can search out topics of specific interest, and it can serve also as an invaluable reference source.

The book has very few typographical or factual errors, or areas of ambiguity, and those that do appear are essentially inconsequential and in no way detract from the overall excellence of the book. In fact, the remarkable thing is that there are as few errors as there are, particularly when one considers the increased possibilities for this to occur in an edition that has been so extensively reorganized. Certainly the authors can be excused for a few errors in a 900+ page book. Those noted are listed below (I am sure there are some I haven't caught), in order that they can be eliminated or modified in subsequent editions of the book:

Page 39—Strictly speaking, fish don't fly, although the point the authors are trying to make is clear, and this statement was not intended to be taken literally.

Pages 250–251—The species name for a member of the shark genus *Etmopterus* has been misspelled *vierens* on p. 250, but is correctly spelled (*virens*) on the following page.

Page 309—Recent fishes of the infraclass Osteoglossomorpha are not restricted to tropical fresh waters, as indicated by Pough et al., but include the mooneyes (Hiodontidae), which are found in warm to cold temperate fresh waters of North America.

Page 324—It has long been my understanding that the Central American uplift occurred about two million years ago, rather than the four million years indicated.

Pages 511–513—References are made to Figures 5-3 and 5-4 in the book, but there is no Figure 5-4 in the third edition and Figure 5-3 appears not to be applicable. Furthermore, these figure numbers in the first two editions refer to figures that also are obviously not applicable.

Page 528 (Fig. 15-1)—The figure legend 15-1(h) appears twice.

Pages 577–578—It could have been added that the various mesopelagic fish (particularly lanternfishes of the family Myctophidae) that ascend to the surface at night to feed are important mechanisms for the transport of nutrients from the surface down to predators living at deeper depths.

Page 581 (Fig. 16-4)—Spelling of the generic names *Chiasmodon* and *Liophryne* should be corrected to *Chiasmodon* and *Linophryne*, respectively.

Page 641 (Summary)—The authors obviously meant to say “bones of birds,” rather than “birds of bones.”

Pages 725 and 728—The number of monotreme species is indicated as six on page 725, but only three on page 728.

Page 894 (Table 24-2)—The way it has been written, it would appear that the turkey vulture is an insectivore.

In summary, it should be obvious that I have nothing but praise of this edition of “Vertebrate Life.” Not only is it an authoritative and, at the same time, highly readable book, but it is an invaluable reference source that can be used time and again. It serves as a model of how a book should be written!

CARTER R. GILBERT, *Florida Museum of Natural History, University of Florida, Gainesville, FL 32611.*

Treshow, Michael, and Franklin K. Anderson. 1989. Plant Stress from Air Pollution. John Wiley & Sons, New York, NY. \$59.95. 283 p.

The authors clearly state in their preface that their book should serve as text and reference for anyone concerned with plant response to air pollutants. They assume, in the writing, that readers will not have a wealth of background in air pollution biology, or even plant stress. This reviewer found that, in the main, the book meets these goals. It should serve as an excellent text for an upper class or beginning graduate level course in air pollution, plant biology. It is written in an easy-to-read fashion

yet with sufficient depth as to appeal to the science major. This reviewer found no scientific errors in a rapid review of the book while disagreeing with the depth of coverage in several areas and the emphasis given to other areas, these are in the nature of personal differences not scientific errors. Although this book should grace the bookshelves of all serious investigators, it will be less used by them personally as offered to others who want a fairly rapid overall exposure to the field.

Although the authors use the term air pollution biology in several places, this text covers only plant not animal responses to air pollutants. The book is indexed to provide ready access to specific areas of interest. The list of suggested readings at the end of each chapter is well chosen and should be useful to both the student and control or policy level people. The text is up-to-date even though the reference list is weak on many publications that have appeared since 1985. This is not necessarily a criticism because the literature has increased almost geometrically in the past few years. The authors have chosen a good selection of available literature for inclusion in this text. A primary criticism is the use of black and white pictures (chapters 5, 6, 7, 8, 13) for the 18 figures showing injury. These are almost useless; the authors should have insisted on use of color plates.

The book is divided into 17 easily read chapters. They occur in a logical sequence and, to some extent, build upon each other. The first chapter develops some basis for the science of air pollution and presents an interesting, in brief, history. The second chapter focuses on air pollution and the plant itself. While the third chapter addresses lichens as a primary indicator of air pollution stress and develops much on the biology of the lichen species, to this reviewer the chapter puts a greater emphasis on lichens than is needed. The fourth chapter is an interesting discussion of early problems principally concerned with sulfur dioxide releases. Chapters 5 through 9 highlight selective history and the effects of several major pollutants (sulfur dioxide, fluoride, PAN, ozone) on plant response. Chapters 10 and 11 cover possible biotic and abiotic interactions with the pollutants of interest. Chapters 12 and 13 highlight the current interest in forest decline and possible ecosystem level concerns. Chapter 14 discussed some general and emerging concerns, chapter 15 economic problems, and 16 air quality standards and control strategies. Chapter 17 is a general chapter developed to suggest positive directions for future research. The list of scientific names and the information for conversion of gas concentrations from ppm to $\mu\text{g}/\text{m}^3$ and back, found in Appendices A and B, are most helpful.

The book should be accepted as filling a need in the plant sciences field of air pollution.

WALTER W. HECK, *USDA/ARS and Department of Botany, N. C. State University, Raleigh, NC 27605.*

White, Christopher P., with drawings by Karen Teramura. 1989. Chesapeake Bay, Nature of the Estuary, A Field Guide. Tidewater Publ., Centreville, MD. \$12.95 (paper). 212 p.

This book attempts to be a field guide to the common fauna and flora of the Chesapeake Bay and surrounding wetlands. It also includes a geological and natural history of the area. In the 212 pages between the glossy covers, the author has done a good job on each of those counts.

The author acknowledges the help of 46 experts and an additional 24 who helped locate specimens. I am not familiar with all of the people named, but those I am familiar with are truly leaders in their respective fields.

The first four chapters—The Nature of the Estuary; Geological History and Sediments; Salinity, Tides, and Circulation; and Ecology of the Bay—are useful and well illustrated. I am sure both students and professionals will use many of the concise statements from these chapters. Some nice sound bites are provided in these chapters. For example: The meaning of its Indian name, Chesepiooc, is great shellfish bay. The author succinctly presents facts about estuaries in general (salinity zones, species distribution, food webs) and the Chesapeake Bay in particular (dimensions, length, number of tributaries, miles of shoreline, water volume). The geological history is also explained. The author selected and adapted some excellent graphics to illustrate concepts such as the two-layer circulation pattern and tides. The author presents his information in an interesting, easily understood style.

From this point on the book is divided into two main sections: I. The Rivers and Tributaries and II. The Bay and Its Marshes and Shores. This is unique from the standpoint of a field guide. This treatment may eliminate some confusion in identification, but since many of the 2,700 species found in the bay are migratory and transitory, this treatment could add to the confusion. There are necessarily some redundancies in this arrangement, even though only the more common species are included. Section I is further divided into Freshwater Swamps, Freshwater Tributaries and Adjoining Freshwater Marshes, Estuarine Rivers and Associated Brackish Marshes. Section II is divided into Fresh Bay

Marshes, Brackish Bay Marshes, Salt Marshes, Beaches and Tidal Flats, Shallow Water Habitats, and Deep Open Water.

There are no photos (except the cover) in this volume, but it contains some really excellent line drawings. This works well for plant identification, but not so well for animals. It is unfortunate that some of the drawings are not in color (though that would make the book substantially more expensive), because it would certainly make identification for many species easier. The single paragraph descriptive note identifies the species in this guide, provided they are not too similar.

There are some species that I am surprised are not included. For instance, at least the Atlantic loggerhead sea turtles, which are often seen in the bay, and at least mention of the cetaceans common to the lower bay, such as the bottlenose dolphin *Tursiops truncatus* should have been mentioned. The book ends with a useful Glossary, brief sections on Migratory Patterns and Life Cycles, Selected References, and an Index to the Illustrated Species.

This is the type of book you will often find for sale at information desks of State or Federal parks. For the price printed on the back cover, \$12.95, I am sure it will be a high volume seller. Do I think it's worth the price? Yes indeed. Would I recommend its use for a class field trip? Yes, for non-majors. However, I would feel more comfortable leading such a group if I were carrying the usual three or four field guides that I am used to which cover the common and not so common transient species.

MICHAEL COSTAGNA, *Virginia Institute of Marine Sciences, School of Marine Science, College of William and Mary, Wachapreague, VA 23480.*

**PRE-DOCTORAL FELLOWSHIP
IN ECOLOGY AND ENVIRONMENTAL SCIENCES
SAVANNAH RIVER ECOLOGY LABORATORY
UNIVERSITY OF GEORGIA**

Basic and applied research in ecology and environmental science has been conducted on the Southeastern Coastal Plain for over 30 years by the faculty at the UGA's Savannah River Ecology Laboratory. Applications are invited for a competitive fellowship program that will support Ph.D. students at their home institutions during completion of course work and prior to full-time residence at SREL to conduct their dissertation research. It is expected that an SREL faculty member will serve on the student's doctoral committee, preferably as major or co-major professor. Particular areas of SREL expertise include, but are not limited to, population biology and genetics, physiological ecology, environmental chemistry, toxicology, life history evolution, aquatic ecology, radioecology, plant ecology and soil science. Support includes stipend and tuition and is contingent on acceptance into a Ph.D. program. All applicants must be U.S. citizens. For further information and application forms contact: Ms. Teresa Carroll, Savannah River Ecology Laboratory, Drawer E, Aiken, SC 29802, (803) 725-2472. Deadline for applications is February 1, 1991. Equal Opportunity/Affirmative Action Employer.

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
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ABOUT PEOPLE AND PLACES

ALABAMA

Tuskegee University, Department of Biology. Dr. James Henderson, Professor of Biology, visited the Soviet Union as a delegate to that country on the Citizen Ambassador Program of People to People International. The tour, which covered several Soviet states, was a Botany delegates tour headed by Dr. Frank Salisbury, plant physiologist at Utah State University. The Howard Hughes Medical Institute sponsors a program at Tuskegee University called ENHANCES (Educational Nurturing of Highly Academic National Candidates for Excellence in Science). It involved about 20 high ability high school students who intend to major in modern molecular and cellular biology as freshmen, especially at Tuskegee University. The students are from geographical areas throughout the United States. They engage in courses in Mathematics, English, Computer Science, and Molecular and Cellular Biology. The program was initiated last year and is a 5-year grant from HHMI.

FLORIDA

University of Florida, Department of Botany. Kimberly Williams (Ph.D. Stanford) joined the department as Assistant Professor in Plant Physiological Ecology. She had previously been a Post Doctoral Fellow in the Ecology Center at Utah State University. David Dilcher, currently president of the Botanical Society of America, joined the staff of the Florida State Museum, June 1990. He has an affiliate appointment in this department and will be teaching a course in Paleobotany, Spring 1991. Scott Zona became a Post Doctoral Assistant to Department Chairman David A. Jones. Scott obtained his Ph.D. through Claremont Graduate School while a Research Assistant at the Rancho Santa Ana Botanic Garden, California. Large NSF grants have been obtained by Jack Ewel and Bill Stern. Dr. Ewel is attempting to establish an "outdoor laboratory" in Costa Rica to design ecologically sustainable, low input, agricultural systems for the humid tropics. Dr. Stern will be developing a comprehensive treatment of the comparative vegetative anatomy and systematics of Orchidaceae.

GEORGIA

University of Georgia, Department of Zoology. Dr. Judith Willis of the University of Illinois at Urbana has accepted the headship of the department. Dr. Willis will be directing a faculty of 41 zoologists representing a broad spectrum of cellular biologists, ecologists, and organismal scientists. Dr. Willis is a 1956 honor graduate of Cornell University and a 1961 graduate of Harvard University, where she earned her Ph.D. in Biology.

KENTUCKY

Western Kentucky University, Department of Biology. Dr. Nancy S. Dawson, recent graduate from the Department of Botany, University of Tennessee, Knoxville, is currently an adjunct professor. She teaches general biology and the advanced cell biology course. Dr. Valgene Dunham, spent 7 May—1 June at the East China University of Chemical Technology at Shanghai, PRC, teaching a special course in DNA replication. Dr. Gary E. Dillard, Professor, has just published Part 3 of his book *Freshwater Algae of the Southeastern United States*, which encompasses the Chlorophyceae. Part 3 consists of 275 pages with 51 plates and 445 figures. It is published by J. Cramer, Stuttgart, Germany. Dr. Charles Kupchella was the author of chapters "The Cellular Biology of Cancer," and "The Spread of Cancer:

Invasion and Metastasis" in the recently published book *Cancer Nursing: Principles and Practice* by Groenwald, S. L. et al. released in April by Jones and Bartlett Publishers.

Georgetown College, Department of Biology. Dr. Charles N. Boehms has received a grant from Johnson and Johnson and Georgetown College for \$53,000 to conduct precollege student science training programs in biology, chemistry, and math/eomputer sciences during the summers of 1991 and 1992. Under the sponsorship of the Kentucky Academy of Science, eight workshops on "The Use of Animals in the Classroom" have been conducted across the state for secondary school life science teachers. The primary points covered are (1) acquainting participants in the principles of humane care and use of vertebrate animals in the classroom. (2) Illustrating alternatives to invasive studies on vertebrate animals. (3) Familiarizing participants with federal and state regulations and laws that offset use of vertebrates in teaching and research, and (4) sensitizing participants to societal attitudes and issues dealing with animal use. Dr. J. G. Rodriguez was the program director (Univ. of Ky), and program coordinators were Dr. Charles N. Boehms (Georgetown College) and Dr. Terry Canerdy (Murray State Univ.). Instructors were Dr. Tom Bennett, Dr. Maurice Esham, Dr. Ron Gardella, Dr. James Koper, Mr. Shaw Blankenship, Ms. Betty Tripure, and Ms. Margaret Wiseman.

MISSISSIPPI

Belhaven College, Biology Department. The department has received a \$50,000 grant from a private Mississippi corporation for the funding of a new Microbiology-Immunology Laboratory. The laboratory should be operational by the 1990 summer session.

Gulf Coast Research Laboratory, Ocean Springs. GCRL has received \$180,702 from the National Marine Fisheries Service to continue its fisheries monitoring and assessment program, now in its 17th year. Two foreign scientists are currently conducting research at the Laboratory. Dr. Jan M. Everaarts of the Netherlands is working with Dr. William Hawkins, head of the microscopy section, and Dr. William Walker, head of the toxicology section. Dr. Iva Dykova of Czechoslovakia arrived at Ocean Springs in April 1990 and is working with Dr. Robin Overstreet, parasitology section head. Dr. Everaarts is a senior scientist and deputy head of the Dept. of Chemical Oceanography and Marine Pollution at the Netherlands Institute for Sea Research. Dr. Dykova, a veterinarian and parasitologist at the Charles University in Prague, is a specialist in the protozoan parasites of fishes. She has authored over 100 papers and has studied in Cuba, Hungary, Bulgaria, and West Germany.

NORTH CAROLINA

North Carolina State University, Department of Zoology. Dr. Grover C. Miller, Professor of Zoology, received the 1989 Meritorious Service Award from the Southeastern Society of Parasitologists.

Western Carolina University, Department of Biology. Dr. Roger H. Lumb is now the Head of the Department of Biology replacing Dr. Frederick Harrison. Dr. Harrison returned to full-time teaching. Dr. Lumb has been at Western Carolina since 1967 where he has an active grant-funded research program in lipid biochemistry.

Appalachian State University, Department of Biology. Dr. Robert Murray joins the faculty as an ecosystem ecologist. Dr. Murray received his Ph.D. from the University of Georgia in 1985. Dr. Mary U. Connell will spend the 1990-91 academic year on sabbatical in the laboratory of Dr. Robert Schmidt, Department of Microbiology and Cell Science at the University of Florida. Drs. Wayne Van Devender and Matthew Rowe have received a North Carolina Non-game Wildlife Grant to study the ecology of the endangered pigmy rattlesnake. Dr. Van Devender received a National Museum of Natural History Meritorious Service Award for contribution to research and collections in the Division of Amphibians and Reptiles. Dr. Marie Hicks has been awarded the Hester Visiting Professor Award for research at the University of Tennessee for the Fall semester of 1990. Dr. Howard Neufeld has received a three year EPA grant to study long term ozone exposure response studies for tree seedlings from the Southern Appalachian mountains. Mr. Ted Wesemann received the 1989 Outstanding Thesis Award from the Conference of Southern Graduate Schools. The title of the thesis was "Factors Influencing the Distribution and Abundance of Burrowing Owls (*Athene cunicularia*) in Cape Coral Florida." His thesis advisor was Dr. Matthew Rowe.

Saint Mary's College, Department of Science. Janice Coffey Swab will be in Khartoum, Sudan, teaching at the University of Juba, during the academic year 1990-91, as Fulbright grantee. She and her husband, Edward, will be traveling in East and South Africa, and will attempt to collect plant

materials for anyone who has specific research needs requiring plants from these areas. Bulk collections will probably be impossible. Their address is available by phoning (919) 839-4050 or 828-2521.

Atlantic Christian College, Department of Biological and Physical Sciences. Dr. J. P. Tyndall retired after having served as Professor of Biology and Chair of the Department since 1941. Dr. Philip Witherington, Professor of Biology has been named the new Chair. Joining the faculty in August 1990 were Paul H. Demchick, Indiana University (Assistant Professor of Biology), and Jane M. Kolonie, Rutgers University (Assistant Professor of Biology).

University of North Carolina at Greensboro, Department of Biology. Dr. Vincent Henrich, most recently from UNC-Chapel Hill, will join the department as a geneticist in the Fall of 1990. Dr. Jim Wilson is retiring from teaching duties this year after 26 years on the faculty. He will continue his laboratory research on the genetics of *Neurospora*.

SOUTH CAROLINA

Furman University, Department of Biology. Dr. William Blaker, a neurophysiologist, has recently joined the department.

ABOUT MUSEUMS AND BOTANICAL GARDENS

ALABAMA

State Museum of Natural History, Tuscaloosa. On 10 June 1990, the Museum launched its twelfth expedition. Dr. Paul Welch, archaeologist from Oberlin College, served as the camp Scientific Director. The excavation plan was to excavate the northernmost mound of the chiefdom, located in Tuscaloosa County some miles upstream from the main Moundville site. The team was interested in activities between 1050–1250 A.D. The expeditions which began in 1979, are targeted toward high school students, teachers and parents. The Expedition features a large tent camp, supervised by Museum naturalist Rosa Newman. Students and adults live on the site with scientists and Museum professionals. The Alabama Indian Resource Center at Mound State Monument, a unit of the Museum, is pleased to announce the *Alabama Indian Messenger*, an information clearinghouse about Native Americans for educators. The first issue of the *Messenger* premiered August 1990.

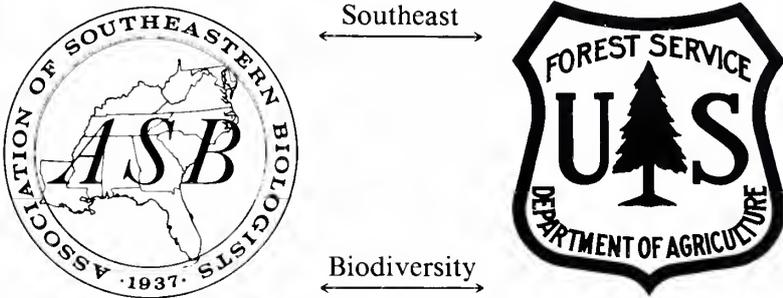
Anniston Museum of Natural History, Anniston. A collection of nineteenth and twentieth century American and European animal sculpture will be featured during early Fall 1990. The event will be titled: "Animals in Art: The Schmidgall Sculpture Collection." The display contains over 75 individual animal sculptures, cast in bronze and sculpted from wood, welded steel, stone and aluminum.

FLORIDA

Archbold Biological Station, Lake Placid. The station recently purchased 464 acres of natural habitat near the old town of Hicoria, immediately adjacent to the existing 4,300 acre Archbold preserve in southern Highlands County. The new acreage contains at least 8 families of Florida Scrub Jays, oak scrub, flatwoods, cutthroat-grass ponds and grassy swales. There are also at least 10 species listed by State or Federal agencies as Endangered or Threatened. The rarest of these is the Lake Placid Scrub Balm, known only from southern Highlands County and currently protected only on Archbold Biological Station property. The newly protected acreage will be known locally as the "MacArthur Tract" in honor of the late John D. MacArthur. The MacArthur Foundation recently supported Archbold Biological Station with a major grant of land and cattle, to establish an agro-ecology research center nearby. The Station is a private, non-profit scientific institute devoted to long-term ecological research and conservation. It was founded in 1941 by the aviator and explorer Richard Archbold, who resided at the Station until his death in 1976. The Station's program is supported by an endowment, grants and donations, and fees from visiting scientists.

BIODIVERSITY WORKSHOP
PERSPECTIVES ON BIOLOGICAL DIVERSITY
IN THE SOUTHEAST
4-5 April 1989

Sponsored by
United States Forest Service
Southern Forest Experiment Station
Southeastern Forest Experiment Station
Region 8
Southeastern Chapter of the
Ecological Society of America
Association of Southeastern Biologists



The Hilton at University Place,
Charlotte, NC

Published by
Association of Southeastern Biologists

PERSPECTIVES ON BIOLOGICAL DIVERSITY IN THE SOUTHEAST

Held 4–5 April 1989

Sponsors: U.S. Forest Service, Southeastern Chapter of the Ecological Society of America, Association of Southeastern Biologists.

Objectives: To gain a better understanding of biodiversity, improve communication between academics and land managers, and identify opportunities to conserve biological diversity through management.

Focus: Identifying, measuring, and managing genetic, species, community, and landscape diversity.

Format: Small working groups will discuss these issues. A keynote address will be given by Dr. Larry Harris, author of *The Fragmented Forest*.¹

For information contact: Margaret Devall, USDA Forest Service, 701 Loyola Ave., Room T-10210, New Orleans, LA 70113. Telephone (504) 589-4552.

PROGRAM

April 4

- 8:00 What is Biological Diversity and why is it important?—Art Cooper, NC State University
- 8:45 Legal and institutional frameworks for managing biodiversity—Hal Slawasser, US Forest Service
- 9:15 Measuring biodiversity—Michael Palmer, UNC, and Lynn Maguire, Duke University
- 10:15 Processes influencing biodiversity—Peter White, UNC Chapel Hill
- 10:45 Landscape diversity—Reed Noss, EPA
- 11:15 Community diversity—Alan Weakley, NC Natural Heritage
- 1:15 Species diversity—Joan Walker, US Forest Service
- 1:45 Genetic diversity—Gene Namkoong, US Forest Service
- 2:15 Charge to working groups
- 3:00 Working group meetings—Landscape, community, species and genetic diversity

April 5

- 8:00 Case study—Landscape diversity—Reed Noss, EPA
- 8:30 Case study—Community diversity—Dorothy Allard, The Nature Conservancy
- 9:00 Case study—Species diversity—Rob Sutter, NC Plant Conservation Program
- 9:30 Case study—Genetic diversity—Peter Stangel, Savannah River Ecology Lab
- 10:30 Working group meetings—Landscape, community, species and genetic diversity
- 2:00 Summaries from working group meetings
- 4:00 Major address—Managing biodiversity—Larry Harris, University of Florida

¹ Available only as videotape loan from the US Forest Service. Contact Dr. Margaret Devall, Southern Forest Experimental Station, 701 Loyola Ave. Room T, 10210, New Orleans, LA 70113.

Foreword. Margaret S. Devall, Southern Forest Experiment Station, USDA Forest Service, New Orleans, LA 70113.

Biological diversity has recently become an important issue in the Southeastern United States and throughout the country as well as throughout the world. The scientific community and the public are concerned with the number of species extinctions, the simplification of ecological systems, and the loss of entire communities. Another concern is the lessening of genetic variation within species. The threats of global climate change and atmospheric pollution make the preservation of biological diversity even more urgent.

In order to prepare for increased efforts to maintain biodiversity in the Southeast, a workshop entitled, "Perspectives in Biological Diversity in the Southeast" was held on April 4th and 5th, 1989 in Charlotte, North Carolina. The workshop was sponsored by the U. S. Forest Service: Region 8, the Southern Forest Experiment Station, the Southeastern Forest Experiment Station; the Southeastern Chapter of the Ecological Society of America; and the Association of Southeastern Biologists. The workshop was held in conjunction with the annual meeting of the Association of Southeastern Biologists, and was attended by approximately 130 participants representing several universities, the Forest Service and other agencies, and private organizations.

The objectives of the workshop were to (1) gain a better understanding of biodiversity, (2) improve communication between academics and land managers, and (3) identify opportunities to conserve biological diversity through land management practices. The focus was on identifying, measuring and managing diversity at four levels; genetic, species, community, and landscape.

The two-day workshop included a general session, two meetings of working groups, case studies, and the keynote address. The legislative and regulatory biodiversity requirement of the Forest Service, conserving biodiversity in the National Forest system, measuring biodiversity, ecological processes influencing biodiversity, and maintaining biodiversity at the landscape, community, species and genetic levels were topics of the general session. Then participants joined one of four working groups to discuss the key elements of diversity at the landscape, community, species or genetic level. On the second day, a series of case studies was presented, then the working groups met again to identify potential opportunities for improving biological diversity through land management activities. The working group meetings were followed by the

keynote address, "Conservation of Southern Biological Diversity" by Larry Harris of the University of Florida.

The presentation on the legislative and regulatory background of the Forest Service's diversity requirement by Art Cooper of North Carolina State University is included in these proceedings, as are abstracts of the other presentations and summaries of the working group sessions. For information on obtaining the proceedings, contact: Margaret Devall, Southern Forest Experiment Station, 701 Loyola Avenue, Room T-10210, New Orleans, LA 70113; Joseph Barnard, Forestry Sciences lab, Box 12254, Research Triangle Park, NC 27607; or James Fenwood, U. S. Forest Service, Fisheries, Wildlife and Range, 1720 Peachtree Road, NW, Atlanta, GA 30367.

The workshop provided an opportunity for people with differing views and different levels of knowledge of biodiversity to talk with one another. It is hoped that this workshop is just the beginning of increased efforts and cooperation in maintaining biodiversity in the Southeast.

Acknowledgments

The planning and preparation of the symposium and the publication of the materials herein included the contributions of Dorothy Al-lard, James Baker, Joseph Barnard, Stephen G. Boyce, Edward E. Clebsch, Frank Day, Margaret Devall, Lynn Maguire, William H. Martin, Tim Mead, Levester Pendergrass, John Rich, Frank J. Schwartz, Robert Sutter, Peter White, and Joe E. Winstead.

THE LEGISLATIVE AND REGULATORY BACKGROUND OF THE
FOREST SERVICE DIVERSITY REQUIREMENT

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ABSTRACT

The biodiversity requirement contained in the National Forest Management Act of 1976 (NFMA) has four roots. The first is in ecological theory, reflected in the now disproven assumption that more diverse communities are more stable than less diverse communities. The second lies in our concern for rare and endangered species and the third derives from the utilitarian view that there is great value in preserving the diversity of life because of the potential value of unstudied species to man. Finally, there is the moralistic view that every species on the earth has a right to survive equal to that of other species.

The legislative history of the diversity section of NFMA is contained in a section that instructs the Secretary of Agriculture to develop regulations to guide planning for the National Forest System. Congress apparently used the term diversity in its simplest meaning, as a surrogate for the term variety, and did not intend a special ecological meaning. Part of the requirement came from the Senate and reflected the desire of Senators, particularly Hubert H. Humphrey, to insure that the Forest Service's multiple use mandate was realized. Likewise, it arose from the wishes of several Senators that forest type conversions, particularly to pure pine stands, be severely limited. Language from the House was more straight-forward and represented a desire to maintain the mix of species on a forest that was natural to that region and not to manage toward uniform stands of a single species. These differences were resolved in conference committee by melding the two different sections

¹ Keynote paper delivered at Biodiversity Workshop sponsored by the Association of Southeastern Biologists, Charlotte, NC, April 4, 1989.

into one. The intent of the section was to bring timber production into balance with wildlife and ecological values, to limit type conversions, and essentially prohibit monocultures. Congress did not, however, define diversity nor did it suggest how diversity provisions of the law should be met.

The regulations implementing NFMA require that 1) diversity be provided for consistent with multiple use objectives, 2) inventories be adequate to evaluate the effects of management on diversity, 3) the effects of each alternative on diversity be considered, 4) management practices preserve the diversity of plant and animal communities, and 5) the impacts on diversity of wilderness designation be considered. No measures for estimating diversity are prescribed.

Consideration of diversity in management is important because, even if the relationship between diversity and stability is not true, promotion of the protection of diversity is desirable. There are severe limitations on our ability to plan for diversity because of limitations on inventory information and limited knowledge of dynamics of ecosystems in areas being managed. Diversity has become a "surrogate" issue, as reflected by recent court cases, for attacking other Forest Service management practices, particularly clearcutting and management of old growth. Concern for diversity reflects an increasingly-important change in public desires for management of the National Forests away from a concern with commodity outputs to a concern for values.

INTRODUCTION

This paper traces the origin of the diversity requirement of the National Forest Management Act of 1976--NFMA (Public Law 94-588, 90 Stat. 2949-2963, 1976)--from its ecological, social, and ethical roots to its inclusion in the NFMA. I also discuss the legislative history of the diversity requirement, showing how various factors influenced its inclusion in NFMA and the way it was treated in the regulations implementing NFMA. Finally, I provide some general comments about the significance of our current concern with biological diversity.

This is of particular interest because it is an opportunity to see some of the ideas the Committee of

Scientists (NFMA, Sec 6(h)) dealt with in its attempts to develop regulations that would translate a broadly-stated Congressional mandate on a complex biological issue (diversity) into actual on-the-ground management practices.

ROOTS OF OUR CONCERN FOR BIODIVERSITY

The biodiversity concept has four roots. The first is in ecological theory. For many years ecologists have been aware of, and interested in, the fact that there are a variety of ecosystems of the earth and that numbers of species within these systems varies greatly. Some areas are characterized by considerable richness of species and others by more limited numbers. Ecologists and other biologists recognized early that there were at least three levels of biological diversity: genetic diversity, species diversity, and ecosystem diversity. It was only within the last 20 or 30 yr that ecologists began to wonder what diversity meant, from an ecological viewpoint. Perhaps the first ecological processes recognized in North America, and around which a body of theory developed, were natural succession and the climax community. It was recognized and generally accepted that as succession proceeded, the number of species in a community increased. It was further assumed that climax communities were relatively stable. At least that was ecological dogma and what observation seemed to support. The conclusion was reached that, since successional communities were typically characterized by small numbers of species and climax communities by large numbers, a large number of species (relatively high biological diversity) meant a relatively stable community. In fact, that proposition was stated as accepted fact in ecological texts as recently as 10 or 15 yr ago. It is not entirely true. There are many examples of situations where communities low in species' number are stable. Nonetheless, at the time the NFMA was passed it was thought that stability and high diversity were positively correlated. Therefore, since community stability seemed desirable, it followed that diversity (which seemed to contribute to stability) was also desirable.

Ecologists have also concerned themselves for many years with the relative number of species present in natural communities in different parts of the world. It was recognized very early that tropical communities, particularly tropical rainforests, were unquestionably the most diverse communities in the world. They were also

assumed to be the most stable, again by equating diversity with stability. It turns out that this also is not the case, because tropical rainforests are much less stable and much more easily disrupted than we used to think possible.

In addition to the concepts of stability and diversity being related in terms of species' numbers, it was also accepted that a large number of species leads to functional stability in a community; in other words the more species in a community the more feedback loops there are and the less opportunity there is to upset the functioning of the community by removal of a single species. This principle, functional redundancy, is probably basically correct. It also became a part of the ecological literature about the time the NFMA was being considered.

The second root of the diversity concept lies in our concern for rare and endangered species. We hotly debated the development of a piece of legislation in the late 1960's and early 1970's which would provide protection for rare and endangered species. Motivation for this legislation can be traced, in large part, to the increasing awareness of the public for the precarious condition of many important wild animal species (the American eagle, California condor, and American alligator). The Rare and Endangered Species Act, first passed in 1972, highlighted the issue of protection for species that were rare or threatened and thus served to focus further attention on the biodiversity issue.

The third thread is a utilitarian view which stems from the realization by biologists that there is great value in preserving naturally-occurring species because of their potential value to man. There are many examples of fortuitous discoveries, from little-known species, of substances which have proven to be of great importance to man. Frequently, these come from relatively obscure or uncommon species, thus lending further credence to the view that diversity is a desirable feature of natural systems.

Finally, there is a moralistic root which may take a variety of forms. A view mentioned frequently, particularly by foresters, is Aldo Leopold's land management ethic. According to this view, the natural resource manager has an ethical responsibility to protect the landscape and the species that make up that landscape. All land managers are familiar with this view and probably subscribe to it, at least to some degree. Another expression of this view is

manifested in the animal rights movement or, to an even greater extreme, in the plant rights movement. Here the argument is that each species has a right equal to that of humans to survive and it is immoral for humans to take the steps which would eliminate any species from the earth.

All of these roots permeated the fabric of ecology and natural resource management at the time the NFMA was being considered by Congress.

LEGISLATIVE HISTORY OF THE DIVERSITY REQUIREMENT OF NFMA

The legislative history of the diversity section of the NFMA is fascinating. The section is not, to put it mildly, a jewel of legislative drafting. Neither the section nor its legislative history make clear the legislative intent of Congress with respect to this difficult subject. The section (6(g)(3)(b)) requires that forest plans:

"provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan."

This language is part of a larger section of NFMA which requires the Secretary of Agriculture to prepare a set of regulations to be used in developing land management plans for individual units of the National Forest System. That larger section spells out in a number of different ways the content of those regulations. The diversity wording appears in the section instructing the Secretary to insure that the regulations developed specify guidelines for land management plans developed to achieve the goals of the program required by the Renewable Resources Planning Act of 1974.

Several ideas appear in the diversity section and it is instructive to trace the origin of each. There is no evidence in any of the legislative history of NFMA that the Congress, in using the word diversity, attached any special meaning to it. In other words, neither committee debate nor any other source indicates that any member of Congress or

any member of the staffs working for the committees of Congress intended diversity in the sense of any ecological theory extant at that time. The evidence suggests that the word was simply used as a surrogate for "variety." Obviously Congress had to have obtained the word "diversity" from somewhere and it is quite clear that it probably came from ecologists or natural resource managers who had testified before them about diversity as an important concept. However, there is nothing to reflect that the use of the word implies any of the ecological theories that were in vogue at that particular time.

The first part of the section (through the words "...to meet overall multiple use objectives...") came from the Senate; the remainder came from the House. The evolution of the Senate's section is instructive. There were two versions of NFMA introduced in the Senate, one by Jennings Randolph and one by Hubert Humphrey. The Randolph bill was prescriptive in the sense that it offered statutory definitions of land management practices and would have written into law guidelines for conducting certain controversial land management practices which were being debated at that time. For example, if the Randolph bill had been passed, there would have been a virtual prohibition against clearcutting east of the 100th meridian, except for the aspen and birch types in the Lake States. The Humphrey bill, structured as an amendment to the Renewable Resources Planning Act of 1974, was much more general. It sought to establish a planning process within the context of which the Forest Service would deal with complex issues such as clearcutting and timber type conversions.

Humphrey came to see early in the debate that his original bill was not going to satisfy the critics of the Forest Service. He realized that it would be necessary to include some additional direction to the agency as to the nature and content of the planning process. One of the things with which Senator Humphrey was much concerned was what he perceived as an over-emphasis by the Forest Service on timber management. It was, in fact, his view that the criticism of the Forest Service that timber drove the agency's activities was legitimate and that its multiple use mandate was therefore not being realized. He introduced additional language which would "provide for plant and animal communities based on the suitability and capability of a specific land area." His goal in introducing this language was to elevate wildlife and ecological values to a

point where they were at parity with timber. Thus, one element of the diversity requirement can be traced to Humphrey's desire to make it clear, once and for all, that multiple use meant multiple use--not management for other values merely in the context of timber management.

A second concern was reflected in the introduction by Senators Dale Bumpers and Lee Metcalf of a proposed amendment, essentially lifted from the Randolph bill, which would require the Forest Service to "ensure the use of such systems of silviculture which maintain the diversity of forest types and species found naturally in each national forest." The aim of this provision was to preserve natural forest ecosystems to the extent possible. Discussion of this proposed amendment revealed that Bumpers' particular goal was to maintain hardwood forest and not convert it to pine. This intent was illustrated when Bumpers and John McGuire, then Chief of the Forest Service, became involved in a colloquy about dogwood trees. Bumpers pointed out the beauty of dogwood trees in the spring and that they were disappearing from the Arkansas landscape because the Forest Service was converting to pines. McGuire rejoined that the Forest Service certainly enjoyed the beauty of dogwood trees, pointing out that there was a particularly attractive one in front of an headquarters building in Arkansas.

This anecdote clearly reflects Bumpers' concern that the Forest Service was in the process of eliminating hardwood forest in much of the south and converting it to pine. Thus, the question of monocultures and their relationship to the maintenance of diversity was brought up. There was no clear resolution of this matter, but the Senate committee instructed its staff to combine these two concerns, in other words to mesh Humphrey's and Bumpers' proposals. The committee did this simply by adding to Humphrey's amendment the word "diversity" and the phrase "to meet overall use of objectives," so that Humphrey's original statement came to read "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet multiple use objectives." That wording was accepted by the committee. Bumpers again made it clear in the committee discussion that he wanted to limit the extent to which type conversions could be carried out. The proposed language was included in the Senate version of the bill.

The language from the House was more straight-forward. It is embodied in what is now the last section of the diversity provision of NFMA, that is "...for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan." In discussing that section with the House committee, Chief McGuire approved of the language and indicated in the discussion that Forest Service management would certainly try to keep all of the species that were present in a forest at the time of harvest and not manage toward a completely uniform forest of a single species. The provision passed the House committee and was included in the House bill.

The House and Senate versions of NFMA were different and were thus resolved in a conference committee. To rationalize the differences between the diversity sections of the bills, the conference committee, rather than developing a single statement of what was intended, simply melded the two differing sections by using the connective language "...and within the multiple use objectives of a land management plan adopted pursuant to this section, provide where appropriate, to the degree practicable..." between the House and Senate language. What resulted, then, is a hybrid section combining the intent of both the Senate and the House.

When the diversity section is read in its entirety, one can infer three basic instructions to the Forest Service. First, there is a mandate to bring timber production into balance with wildlife and ecological values. It is important to note that this does not include wildlife values alone; it includes wildlife and ecological values. There has been some confusion that wildlife was Congress' primary concern in mentioning diversity. However, a reading of the legislative history of NFMA shows that is clearly not true. The second mandate limits type conversions to cases which can be justified by their benefit to non-timber resources. In other words, one does not type convert simply to do a more efficient or more productive job of timber management. One does it where it can be justified by benefits to other non-timber resources. The third mandate is that monocultures are very nearly prohibited.

It is important to note some of the things that Congress did and did not do in dealing with the diversity question. It did not define diversity; that task was left to the drafters of the implementing regulations. If Congress

had defined diversity, for example in terms of one of the ecological concepts that was accepted at that time, then one could infer Congress had some specific, perhaps limiting (or broadening), concept in mind. However, in the absence of a definition one must revert to the dictionary definition of the term which suggests that Congress meant variety.

Congress also placed no temporal limitations on the concept. At one time during committee discussion the phrase "at the time of harvest" was in the House language dealing with preservation of the "diversity of tree species similar to that existing in the region controlled by the plan." This would have put a temporal freeze on the diversity toward which management was directed. Congress removed that wording and one can infer from the action that 1) it did not wish to circumscribe the issue temporally and 2) it was interested in a much broader interpretation of diversity than would be implied by the phrase "at the time of harvest."

Congress also provided no prescription as to how to meet the diversity mandate; no language suggested how the Forest Service should deal with the diversity issue. There is no direction that it should look in particular to the ecological literature for solutions or that ecological measures of diversity should be used in its planning.

WHAT DO THE NFMA REGULATIONS REQUIRE?

Given that background, what do the regulations require? More importantly, why are they structured the way they are? The following is a brief discussion of why the Committee of Scientists and the Forest Service drafters included the provisions that are now in the regulations.

The Committee of Scientists' report takes a hard line on the diversity question. By this I mean we believed that the regulations should provide strong direction to the Forest Service as to what should be done in responding to the diversity requirement. There were two reasons for this. The first was that the Committee did not feel a simple restatement of the law in the regulations would fulfill the intent of Congress. It felt that there was enough background in the legislative history of the act to lead to the conclusion that Congress wanted a rigorous treatment of the subject. The second reason for believing that there should be strong direction in the regulations was that the

legislation lacked direction. Therefore, there needed to be some kind of "nudge" to head the Forest Service off in a specific direction to deal with this problem. The Committee stated very clearly that the regulations should go beyond narrow restatement of the wording of NFMA, that they should make the consideration of diversity a major concern, and that they should make certain that any reductions in diversity were justified in a very detailed and careful way.

Direction concerning diversity occurs in five places in the current regulations (36 CFR 219)(Forest Service--USDA 1982). First, it is defined in 219.3 as "The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan". Although the original regulations had a somewhat different structure, the current version has a separate section (219.26) dealing with diversity which states that planners are to provide for diversity of plant and animal communities and tree species consistent with the overall multiple use objectives of the planning area. The section goes on to indicate what is probably the most important requirement: that diversity must be considered throughout the entire planning process. It has to be woven into the planning process in the same way as are other analyses such as environmental, economic, and social. The section also requires the plan to be based on inventories that are adequate to evaluate the effects of management practices on diversity. Finally, the plan has to ensure that the effects of each alternative on diversity are clearly explained. This section represents the belief of the Committee of Scientists and the drafters that diversity was important enough to ensure that consideration of it was institutionalized throughout the entire planning process.

A third section on diversity (219.27(g)), located in the part of the regulations dealing with management requirements (219.27), indicates that management practices should preserve and enhance the diversity of plant and animal communities so that 1) it is at least as great as that which would be expected in a natural forest under the same environmental conditions, 2) reductions are permitted only to meet overall multiple-use objectives and 3) such reductions must be justified through complex analysis. These directions clearly reflect Congressional intent, at least insofar as it can be inferred from legislative history.

The fourth provision appears in the wilderness section (219.18). The Committee of Scientists felt strongly that when an area was being evaluated for consideration and designation as wilderness, the implications of such designation on diversity of the forest in question should be considered. There was a recognition that if, on the one hand, trees are harvested or herbicides used there may be impacts on diversity and that equally significant effects on diversity may stem from simply locking an area up and preserving it.

Finally, the regulations contain no provisions indicating what measures the Forest Service should use to describe diversity and how those measures should be applied. There was much debate on this point, with some suggesting that certain measures of diversity should be required and that these should be contained in all of the plans. The Committee of Scientists concluded that the ecological meaning of such measures was sufficiently unclear so as to preclude their use. Furthermore, the use of such terms would in no way elucidate, to planners or the public, what is really happening to diversity. Planners were left to devise their own ways to express the impacts of management on diversity.

HOW IMPORTANT IS THE CONCERN FOR BIOLOGICAL DIVERSITY?

One can legitimately ask "why is all of this important?" Of what general good to society is it that we concern ourselves so intensely with diversity? There are, I think, a number of reasons, each of a rather different sort.

The first has to do with the relation between diversity and stability. If one of the basic ecological premises, that diversity leads to stability, is wrong, then why should we be so concerned about diversity? Now that we know that a diverse community is not necessarily in and of itself stable, of what significance is diversity? An answer lies in a proposition outlined in an excellent paper by Goodman (1975) on the diversity concept. He points out that even if the hypothesis that diversity leads to stability is wrong, it is still true that disruption in species interactions by the elimination of species from natural systems usually has unfortunate and, occasionally, catastrophic results. In other words, although a diverse community is not necessarily stable there are many examples of situations where, by some action or other, we have removed a species from a system or

seriously reduced the population of a species in that system with consequent catastrophic results on the system. Thus, Goodman points out that even if the hypothesis is faulty, the policy that it promotes protection of diversity, is sound.

Another point has to do with what we need to know in order to deal with the diversity requirements. One of the things that sobered me most while helping develop the regulations on forest planning was the degree to which the Forest Service lacked fundamental information about the 190 million acres of National Forests that it manages. I was shocked to discover the extent to which basic inventory and basic ecological data were lacking for many National Forests.

Obviously, if one is going to deal with the diversity requirements competently, one has to have a variety of kinds of information. The first is an inventory of species present, including a good understanding of the flora and fauna and of the ecosystems within the area and their distribution. Without these pieces of information one really does not have the foundation on which to build any understanding of diversity.

Second, one must understand the dynamics of the natural and managed systems that occur in the area being planned. One has to understand the successional sequences that are taking place--both the sequences that would take place if the system remains undisturbed, and those that would take place given different kinds and intensities of management practices.

Third, one needs to understand the habitat requirements of the species being managed, where each occurs, and under what conditions. This involves both the common, important wildlife species and the many less well-known but nonetheless important plant and animal species. Early on in the discussion of diversity, the Committee of Scientists sensed that there was a view that if one dealt adequately with wildlife, that is, if what the Forest Service called wildlife indicator species were dealt with adequately, then the diversity question was resolved. Not so. Diversity goes far beyond dealing with wildlife. It deals with all forms of life and that is, of course, what makes it the extraordinarily complex concept that it is.

Many of our problems in dealing with diversity hark back to the fact that in many cases we simply do not have the basic inventory information that we need. It is a curious fact that the United States has evolved as perhaps the only major country in the world where natural resource management is practiced in the absence of competent inventory systems. That may be because of the vastness of the United States, or it may be because of a number of other reasons. Nonetheless, we have concentrated a great deal of sophisticated effort on the development of management systems without concentrating a comparable amount of effort on sophisticated inventory systems. To the extent that dealing with the diversity concept forces us to learn more about the species and systems we manage and their dynamics, the requirement will have provided a vital service to resource management.

Another point stems from the one just made. It has to do with the importance of understanding the dynamics of the basic ecological systems being managed, species distributions, successional patterns, and ecosystem dynamics. It is absolutely essential that the planner and manager understand these. Sadly, we often find ourselves without this information for large areas of our public, and private, lands.

Fourth, diversity has, in many ways, become a surrogate tool to attack other issues. This is best reflected in the organizations that are particularly interested in perpetuating old growth and in promoting wilderness. They have seized upon the diversity requirements as a tool to further their own objectives. This has led, perhaps rightly, to a degree of skepticism on the part of managers that all the interest in diversity is really just a smoke screen to cover efforts to prohibit cutting of old growth and to promote wilderness. This may or may not be true. My response to that skepticism is that the values being debated in the diversity discussion highlight essential and important dimensions of the natural systems being managed and that those values must be considered and treated during management. If they are not, then the management system is not really competent. I do not believe that the fact that an interest group may be using a requirement to promote its own objectives is any reason why one should view dealing with that requirement skeptically and emphasize it less.

Another point has to do with the position of the Forest Service vis-a-vis other natural resources agencies which

will, ultimately, also be managing for diversity. Despite all the difficulties the Forest Service is having in dealing with this problem, it is still far ahead of any other United States land management agency and probably any other land management agency in the world in dealing with these concepts. I say this not to make the agency feel good, but because it is a fact. The Forest Service has proceeded farther in dealing with biological diversity than any other land management agency. An advantage of this leadership role will be clear if we do get a piece of national legislation on diversity. It is hard to predict whether such legislation will pass, but if it does the Forest Service will be in a position to respond to its requirements with less difficulty than might be encountered by other federal agencies. Furthermore, the Forest Service might actually play a role of national leadership role in developing responses to the legislation.

What does all this discussion of diversity mean to State resource management programs which have no legal mandate to consider diversity? First, by being concerned with diversity, State natural resource agencies can have an opportunity to participate in state programs designed to enhance diversity. Dealing with State heritage programs or State programs designed to protect natural area which are not represented on federal lands offers State agencies an intellectual opportunity to participate in that activity. Such activity also positions a State agency to deal much better with the requirements of environmental impact review and preparation and to participate much more intelligently in regulatory decision-making at the state level. Thus, if the agency is concerned with diversity in the jurisdiction it manages, it is able to carry out its statutory mandates more effectively. A concern with diversity offers an avenue of communication between State agencies and citizens who do not necessarily support active management. Many people are value-oriented, rather than commodity oriented, and a concern with diversity offers an agency the opportunity to talk to such people about issues which they find important.

What we see in the diversity requirement is a reflection of a none-too-subtle change that has taken place in natural resource management over the past decade. We are making a transition from natural resource management which emphasizes commodities to management which emphasizes values. For example the Multiple Use and Sustained Yield Act deals with commodities-- wood, wildlife, water,

recreation, and range. These are outputs which can be valued, either absolutely or approximately. We are seeing a transition from an emphasis on commodities alone to an emphasis which incorporates management for values. Aesthetics, gene conservation, diversity, the opportunity to contribute to the protection of the world environment--all of these are more subtle, more difficult to quantify, and far more difficult to factor into our planning than commodities. However, there is a significant portion of our population for whom such management for values is the important aspect of public land management. What these people are concerned with is not the production of wood. They do not understand or care about the extent of their dependence on public land for their wood supply. They do, however, have some dim perception that a lot of animals are becoming extinct and that their climate may be changing as a result of man's activity. They like the knowledge that wild lands exist somewhere.

This concern with intangible values confronts the resource manager with a difficult job. On the one hand, the manager has to acknowledge that the desire for management for values is a valid societal objective which has to be met. On the other hand, the manager has to realize that much of society is poorly informed about the extent to which it depends upon natural resource management to produce the commodities it needs. The resource manager has, at the same time, to help private citizens understand that management for commodities in order to produce wood, wildlife, and other benefits is just as essential to their lives as is management for the values in which they have greater interest. He or she also has to avoid forcing views and cultural biases on the public. Perhaps the public is right--values are more important than commodities on the National Forests, and we managers must change rather than expect the public to do so.

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ABSTRACTS OF OTHER WORKSHOP PAPERS

Conserving biological diversity--A perspective on scope and approaches. Hal Salwasser, USDA Forest Service, P. O. Box 96090, Washington, DC 20090.

Biological diversity is the variety of life and its processes in an area. It encompasses a spectrum of biological organization from genes to biomes, and a spectrum of geographic locations from microsites to the biosphere. Significant losses of biological diversity could affect the future well-being of human life. Extinction of species and simplification of ecosystems diminish future resource options and the ability of natural areas to provide life-supporting ecological services.

Major factors that affect biological diversity include conversion of wild areas to agriculture, industry, and other human uses; toxics, pollution, and global climate change; overuse of species by humans; fragmentation of habitats and populations; restoration of species and ecosystems; and management of wild areas for sustainable uses of natural resources. The latter two factors are useful in countering the potential negative effects of the others.

Reasons for conserving as much of the variety of life as possible include: its intrinsic values, its roles in providing current and future resources, and its roles in overall environmental quality. Biological diversity, however, is so complex and intangible that its conservation cannot be approached without focus on specific elements and processes. Principal among these are genetic variation, populations of species, communities, ecosystems, and biomes. Goals for biological diversity must address specific, achievable objectives for the principal elements of concern in an area. Further, they must be integrated in three major ways. First, goals and actions for biological diversity must be integrated into overall conservation plans of public resource management agencies and private sector organizations which collectively determine ecological conditions and trends in the area. Obviously, those plans must also be coordinated among the agencies, and the needs of people must be taken into consideration. Second, goals and actions must be integrated up and down geographic scales so that actions taken at individual sites or stands contribute to goals for watershed conditions, which are in turn part of a regional landscape that sustains both the variety of life and that meets human resource needs. And third, goals and actions must integrate across the biological spectrum of genetic resources, species, communities, ecosystems, and biomes. This increased need

for integration across geographical, biological and temporal scales and coordination among multiple federal and state agencies and private institutions is a daunting challenge that is fraught with scientific, technological, and political barriers and uncertainties. Nevertheless, it must be done and done soon.

The Forest Service is working to refine its roles in an evolving national strategy for conserving biological diversity. This is occurring through individual forest plans, major resource programs, research priorities, public dialogue on policies and priorities, and domestic and international cooperative assistance.

Measuring biodiversity for resource management. Michael W. Palmer, North Carolina Botanical Garden, Chapel Hill, NC, and Lynn A. Maguire, School of Forestry and Natural Sciences, Duke University, Durham, NC.

If the preservation, promotion, or maximization of biodiversity is a consideration in the design or management of natural areas, reliable means to assess biodiversity must be found. Biodiversity can be measured either as number of types (or elements), or as a continuous index of variability. Whether types or variability are more useful depends on the kind of diversity being considered. Expected heterozygosity, a measure of variability, is one useful index of genetic diversity.

Species richness is the number of types (species) in a defined region, and is the most straightforward measure of species diversity. However, it is difficult to obtain complete species lists for large regions, so we must find appropriate ways to extrapolate.

Since communities are arbitrarily defined, community diversity should not be measured in terms of numbers of community types. Community diversity is better evaluated by ordination followed by analysis of the semivariogram, (a graphic product derived from geostatistical procedures) which summarizes variability as a function of scale. All types of diversity are strongly scale-dependent. When a policy is made to maintain or increase biodiversity, a spatial scale must be specified. This scale-dependence suggests that the measurement and management of biodiversity be considered in a regional context.

Ecological processes influencing natural diversity. Peter S. White, Department of Biology, University of North Carolina, Chapel Hill, NC 27599.

Biological diversity can be described as the variety of life at a series of levels--genetic diversity, species

diversity, community and ecosystem diversity, and the diversity of landscapes and seascapes. Conservationists and managers are very rightly interested in the survival of this diversity or natural heritage into the future. We must remember, however, that the diversity itself is, in a sense, a pattern in the distribution of living things. That pattern, in turn, is the result of natural and dynamic processes operating on evolutionary and ecological time scales. Conserving and managing biological diversity consists of conserving and managing natural processes, as well as the patterns we see today. We often lack critical knowledge about what those processes are and discovering the processes, whether for gene pools, species, or ecosystems is an important objective of research. At the same time, man has influenced the patterns of biological diversity and the natural processes that support biological diversity in five important ways: (1) through habitat fragmentation; (2) through direct and exploitive effects on particular species; (3) through the purposeful and accidental introduction of exotic species; (4) through human effects on the chemical and physical environment; and (5) through changes to dynamic natural processes. Examples of the latter are the alteration of natural water regime as in the creation of impoundments on some lands and the draining of others, fire suppression, and attempt to control erosional and depositional processes on coast lines. Natural disturbances provide sites for colonization and set succession back to earlier stages (these earlier stages may be more diverse than later stages or the mosaic created by disturbance may hold more species than any one age-defined patch). The solution is not as simple as merely reintroducing a natural disturbance like fire. We may not know what the original natural fire regime was like or the behavior of fire may no longer be similar to original behaviors because of historic changes in the ecosystems. Too much fire may be as bad for biological diversity as too little, too regular and uniform a fire may be as bad as no fire at all.

These dilemmas underscore the need for proactive management, explicit management goals, long-term research and data collection, and periodic evaluation.

Maintaining biodiversity at the landscape scale: why we need to think big. Reed F. Noss, Environmental Research Laboratory, U.S. Environmental Protection Agency, Corvallis, OR.

A comprehensive strategy to maintain biodiversity must consider multiple levels of biological organization. The spatial scale of the landscape is useful for integrating

concerns from multiple levels, and for considering effects of regional and global processes (in addition to local processes) on biodiversity. The landscape is what is actually managed in forest management, even though the explicit focus often has been lower (i. e., the stand) and less integrated. Environmental factors such as climate, soil, and topography are largely responsible for the pattern of vegetation types that constitute landscape diversity. Superimposed on this environmentally determined gradient-mosaic is another mosaic created by disturbances, both natural and anthropogenic. Only rather large, intact landscapes are able to incorporate local disturbances and maintain some stability of habitat diversity over time. Management of multiple-use landscapes ideally would mimic the natural disturbance regime and space-time mosaic. Unfortunately, many prevailing forestry and wildlife management practices contribute directly to habitat fragmentation, which when combined with rapid climate change, may be the greatest threat to biodiversity. To address this problem, a three-part land management strategy is suggested: (1) Maintain large roadless areas to represent each ecosystem type and to serve as benchmarks for comparison with intensively managed lands, (2) Surround sensitive areas with a gradation of multiple-use buffer zones; and (3) Connect protected areas by corridors into networks, at scales ranging from single watersheds to biogeographic regions.

The maintenance of community-level biodiversity in the southeast--theory and practice. Alan S. Weakley, N. C. Natural Heritage Program, Raleigh, N.C.

The goal of maintaining the biodiversity of the Southeast can be approached from a variety of hierarchical levels. Between the level of landscape diversity and that of species diversity is the community level. A community is an assemblage of organisms, in association and interacting with environmental factors. The North Carolina Natural Heritage Program has developed a classification of the natural communities of North Carolina and has begun the task of locating and protecting representative examples of the 117 community types recognized. Communities occur in the landscape in a predictable and mappable pattern, correlated with such abiotic factors as soil type, rock type, hydrology, elevation, climate, and natural disturbance (especially fire). The concept of the community has extensive and useful connections to a variety of disciplines, being useful to wildlife biologists for habitat typing and to foresters for site typing. Some communities

are common, such as Dry-mesic Oak--Hickory Forest, while others are rare, such as Southern Appalachian Bog. Some communities are naturally diverse (i.e., rich in species), while others may have low species diversity. All natural communities, however, are significant components of our natural heritage. Management for biodiversity has sometimes been interpreted to mean diversity of age classes or total number of species on a given site (including weedy and/or exotic species). Management based on such interpretations is likely to lead to homogenization and loss of biodiversity at landscape, community, and species levels. "Protecton" of communities involves management with techniques which approximate natural processes. Mimicking natural processes through such "ecological management" provides the best assurance of retaining all the species and interactive processes of the natural system. The protection of biodiversity through ecological management can be compatible with other goals of multiple-use resource management.

Species diversity--a management challenge. Joan Walker, U.S. Forest Service, Region 8, Tallahassee, FL

Species diversity provides some measure of the number of different species and their relative abundances within a community. It is one of many characters used to describe ecological communities. Just as community may be broadly applied to all species living within a specified area or to a subset of those species (such as plant community), species diversity may also refer to all co-occurring species or to a subset of them (e. g., vertebrate species diversity).

As the definition states, species diversity accounts for both number of species, or species richness, and their abundances. Various indices have been devised to combine the contributions of both components. (Refer to the presentation of Palmer and Maguire, or general ecology texts for more information about diversity indices.) However, for many purposes species richness expressed as number of species per some specified area provides the simplest and most easily interpretable diversity index.

How rich is rich? Typical southeastern U. S. forest communities range in (vascular plant) species richness from about 6 spp./0.1 ha. in Tsuga-Rhododendron communities to over 100 spp./0.1 ha. in some mid-successional Pinus taeda communities. On a smaller scale some of the richest plant communities in the world are found in the southeast. Mesic longleaf pine-wiregrass savannas with 30-35 spp./0.25 m², along with a few other herbaceous communities, rank at the top of species rich communities worldwide.

Several factors have been implicated in controlling

levels of species diversity. They include site productivity, types and abundances of resources (or habitats) available, frequency and intensity of disturbance, evolutionary history, land use history, balance between immigration and extinction, and others. The relationships between species diversity and these factors are complex, and not easily predicted. Examples discussed showed (1) bird species diversity increases with habitat diversity, (2) plant species diversity increases with site fertility, (3) plant species richness can also decline with experimental increases in fertility, (4) successional patterns in species richness vary with initial site conditions (e.g., on rich sites plant diversity may peak early in succession and eventually decline, while on a xeric site diversity may increase monotonically).

Currently, many management practices are directed explicitly toward changing local site conditions. Examples include clearcutting, which decreases local habitat diversity, and fertilization, which changes site fertility. Such actions may directly change patterns of species diversity at scales of individual stands, or cumulatively at larger scales. It is vital that land managers consider these impacts, and mitigate them, both locally by choosing methods that facilitate maintaining natural site diversity, and more broadly by making strategic landscape level decisions.

Three time-honored beliefs about species diversity were discussed: (1) creating edges enhances diversity, (2) forest age-class diversity constitutes a good approach for managing diversity, (3) site preparation increases diversity. While these may be true to some extent, there are also negative aspects that need to be considered. All refer to activities that increase available habitat for ruderal, or weedy, species. These species readily invade disturbed habitats and reproduce reliably in such habitats. To the extent that ruderal species are added to the existing undisturbed flora and fauna, species richness increases. However, the costs of such increases are in habitat losses to species requiring undisturbed conditions. Providing habitat for ruderal species may be an appropriate choice in some situations; however, it must not be the guiding principle for diversity management.

Genetic diversity. Gene Namkoong, USDA Forest Service, Southeastern Forest Experiment Station, North Carolina State University, Raleigh, NC

In a hierarchy of biological diversity, genetic variation is normally placed below the level of the

individual organism. Variations in ecosystems, species, and populations are placed above it, and allelic and genotypic variations are placed below. While this view may be intellectually convenient, it leads to biologically naive conclusions about genetic diversity. The hierarchy permits simple handling of questions about genetic variation and the derivations of simple rules of thumb. In the thinking of managers, species, ecosystem, and landscape diversity are separated from genetic diversity. Since there are major flaws in this view, however, alternative management systems are necessary to conserve genetic diversity.

To ensure that even rare alleles are contained in a random collections of seeds, clones, or individual plants, a few thousand independent genotypes are needed. While no collection short of sampling all extant individuals can give 100% assurance of saving all alleles, almost all of them can be saved with high probability in small management areas. The need to regenerate populations and the existence of many exceptions to the randomness and independence of allelic distributions can expand the recommended minimum population sizes. With reasonable care, however, a collection of less than 10,000 individuals can be sufficient to save alleles. A somewhat simpler objective is to ensure the continued existence not of specific alleles but of genetic variation, which can be generated by a subset of the loci affecting heritable traits. For these purposes, a few hundred randomly selected individuals can be sufficient if heritability is moderate. For an even simpler objective of avoiding inbreeding depression, only a few tens of individuals are necessary. Therefore, for simple objectives in a hierarchical world, gene conservation is quite easy.

At least two problems exist with this view: (1) genetic variation is not distributed in meaningless, random patterns, and (2) the interaction between variation and ecosystem dynamics cannot be contained in a hierarchy. Genetic variation exists in gradients or pockets, and populations exist in patches created by migrational divergences and selective forces. This results in vital differences for natural evolution and for the exploitation of resources for the future. Since genetic variation patterns do not always coincide with environmental boundaries or gradients, interactions exist between migration and selection forces, giving rise to a complex evolutionary dynamic. Genetic variation responds to the ecological variables of its physical environment and the biotic environment of its cohorts and competitors, but it also affects the capacity of interacting populations to coexist with or to exclude other members of their

communities. Therefore, ecosystem dynamics and the distribution and diversity of species are functions of the patterns of genetic variation, and the patterns of genetic variation are dependent on the ecosystem. Therefore, we cannot first deal with large scale ecosystem management and then fine tune the management at the genetic level. In principle, the hierarchical view of biological organization is inadequate for understanding or managing diversity at any level. The problem of biodiversity for the forest manager not only involves planting, harvesting, and other techniques that affect species numbers and distribution, but requires a deeper understanding of complexity of the biological systems that exist in forests.

Landscape diversity: A Florida case study. Reed F. Noss, Environmental Research Laboratory, U.S. Environmental Protection Agency, Corvallis, OR.

To maintain the native biodiversity of Florida, genetic, species, and community biodiversity must be considered in the context of the regional landscapes in which they function. Five elements of a coordinated biodiversity strategy are to (1) identify hot spots of concentrated biodiversity, i. e., centers of species richness and endemism; (2) analyze threats to biodiversity, and vulnerability of specific elements; (3) protect sensitive areas, restore degraded lands, and manage landscapes to mimic natural processes; (4) regulate land-use and other threats; and (5) be expedient, i. e., use what tools are available, even if not ideal for the job. Most threats to biodiversity in Florida are related to excessive human population growth and associated habitat destruction. Intensive forestry practices are also problematic. Furthermore, elimination of large, native predators also has allowed opportunistic herbivores and "mesopredators" to flourish and impact herbaceous plants and ground-dwelling or ground-nesting fauna. Two important centers of species richness and endemism in Florida--the scrub-sandhill mosaic of peninsular Florida ridges, and the flatwoods, savannas, and slope forests of the Appalachian region--are extremely vulnerable to development and intensive forestry. Efforts to protect, buffer, and manage these critical areas, and provide broad landscape linkages, are discussed.

Community classification for region 8 lands: A first step for maintaining community diversity in a multi-use setting. Dorothy J. Allard, The Nature Conservancy, Chapel Hill, NC.

The southeast region of The Nature Conservancy and Region 8 of the Forest Service are jointly developing a

regional community classification. Protecting biodiversity by protecting communities is a wise use of limited conservation dollars and may be the best way to save species. Since communities are components of landscapes, we can best protect them and larger ecosystems after identifying their components. By protecting examples of all natural communities, we will be protecting across a range of site types and environmental combinations, providing a basis for long-term protection under change in global climatic conditions. Communities should be protected to maintain the processes and interactions of organisms and environment within them, as well as for their human value.

The classification and community descriptions are being developed with the help of state Heritage Program ecologists since they relate to the ongoing work with classification in the states. Multiple characteristics of the vegetation as well as environmental factors that influence the vegetation are being used to develop a five-level hierarchical system which will facilitate data management, standardize incorporation of data into the system, and provide a common language for communication about natural communities and their relationships.

The fifth (finest) level (natural community) in the hierarchy at which elements of community diversity are described, mapped and entered into computerized databases, are developed from heritage classifications and selected others. Cultural communities are included. To aid development of the lower levels in the classification, state Heritage ecologists cross reference their classifications with others. Coarser levels of the hierarchy allow us to link our classification with the national and regional classifications, and define groups of natural communities that are easier and ecologically meaningful to work with.

A pilot study to develop methods to inventory community types and to refine the first draft of the classification will begin this year on parts of the Croatan and Uwharrie National Forests. All existing natural and cultural communities will be identified, delineated, and sampled. Aerial photos will be used to tentatively outline the community types that occur on the forests. These delineations will be ground truthed and quantitative and descriptive data will be collected on the natural communities. Once community boundaries are decided upon, the Forest Service's GIS will be used to produce maps of the natural community types. Another study will involve collection of data from a select group of community types across their range. The data will be used to help refine the first draft of the classification for these types.

To be usable in the field, the classification must be compatible with existing information and management systems within the USFS. All of the work that must be done to classify forest lands cannot be accomplished under the Cooperative Agreement, as currently written, but must be turned over to USFS staff. Inventory of community types in the classification may be integrated with existing USFS inventories, or Heritage program personnel and others may serve as contractees to inventory communities. Some of this work can be coordinated with rare and endangered species inventories on the forests. For standardization, proper training in the classification must be built into the process. The successful administration of this project will be a critical part of the eventual completion of the classification of national forest lands.

To transfer information to the Forest Service about the classification, manuals describing community types and providing community keys for field personnel will be developed. It is expected that the Region 8 GIS will be very useful in mapping community types and in providing comparisons between community types and other mapped units.

USFS databases, such as CISC (Continuing Inventory of Stand Conditions), can provide a way to store information on community types, but will require a method by which community information can be incorporated into CISC.

The classification of communities in the southeast requires a long time commitment. Its uses will include identifying pristine natural communities for designation as RNA's or SIA's; identifying areas with several adjacent natural communities for large scale, landscape-level protection, and adjusting stand boundaries to better reflect the natural community boundaries. Any and all of these are worth the effort.

Rare species and biological diversity. Robert D. Sutter, North Carolina Plant Conservation Program, Raleigh, NC.

Rare species are an important component of biological diversity. Rare species are indicators of unique natural communities and rare microhabitats. They are, many times, the first to reflect the decline of biological diversity, and they have come to represent our national commitment to protect biological diversity. Three projects concerning rare plant species provide insights into the process of protecting biological diversity. These insights are: (1) the distribution of diversity must be known, (2) natural areas need to be established and protected, (3) the biology of the species or natural community must be known, (4) monitoring is essential to determine whether goals and

objectives are being met, (5) natural processes must be re-established or protected, and (6) the surroundings of the protected site must be considered. The conservation profession works in the real world with limited resources and is often forced to make decisions with incomplete information. Despite this, it is imperative that conservation agencies be guided by the biology of the species or systems they seek to preserve.

The red-cockaded woodpecker: genetic diversity in national forests. Peter W. Stangel, Savannah River Ecology Laboratory, Aiken, SC 29802.

The red-cockaded woodpecker is an ideal organism for a case study of genetic diversity in a vertebrate. The red-cockaded is a habitat specialist, requiring old-age, living pine trees for cavity excavation. Historical records suggest that the red-cockaded woodpecker's distribution was formerly continuous throughout the southeastern United States. In recent times, however, the required habitat has been seriously impacted, resulting in fragmentation of the red-cockaded's current distribution. Fragmentation and reduced population size can increase a species' susceptibility to extinction from a variety of factors, one of which includes the loss of genetic diversity. Small, isolated populations lose genetic variability through random genetic drift, and in extreme cases, inbreeding. Genetic diversity is critical to maintain the long-term evolutionary flexibility and short-term fitness of species. In 1985 we therefore began a survey to assess levels of genetic diversity in the red-cockaded woodpecker. The objectives of this study were to (1) estimate levels of genetic diversity within and among red-cockaded populations, (2) determine the relationship between population size and genetic variability, (3) investigate the relationship between genetic diversity and fitness correlates, and (4) assess genetic relationships among red-cockaded populations.

Genetic diversity was estimated using protein electrophoresis. Protein electrophoresis is fast, easy, relatively inexpensive, and permits analysis of large numbers of individuals. Tissue samples were nondestructively taken from 440 red-cockaded woodpeckers from 33 sites across the South.

Preliminary results suggest that red-cockaded woodpeckers' levels of diversity are typical of other birds. Estimates varied among sites, however, suggesting the need for large scale surveys to accurately assess genetic diversity. There was no clear relationship between diversity and population size, but small, isolated

populations with reduced diversity did exhibit increased levels of fluctuating asymmetry in morphological measurements. This suggests that loss of genetic variability in small populations may result in the loss of fitness. Red-cockaded woodpeckers also exhibit considerably more genetic differences among populations than do most birds. We were not able to detect any clear pattern to the genetic differences among populations, i. e., there was no indication that populations within physiographic regions or close proximity were most closely related.

Our genetic survey suggests that small, isolated populations with reduced genetic diversity may require immediate management. Genetic differences among populations call for the maintenance of several populations to ensure natural genetic structure for the species. The lack of clear genetic patterns among populations suggests that ecological considerations may be more important for translocations and other management programs.

Summary of working group discussion on landscape diversity.

Margaret S. Devall, Lynn A. Maguire.

The objectives of the first working group session were to increase understanding of landscape diversity and to list its key elements. The group discussed major controlling factors and associated processes of landscape diversity. The group decided that major controlling factors include climate, geology, and land use. Processes associated with climate are weather patterns, soil formation, erosion, weathering, hydrology, and species distributions. Soil chemistry, topography, species substrate, continental position and hydrology are related to geology. Land use influences vegetation patterns, fauna and flora, soils, and climate. Man is responsible for factors that affect biodiversity such as fragmentation, pollution, sudden radical changes such as man-made lakes, clearcutting, and bombs. Man makes important connections between species, such as by introducing a new species into an area. It is obvious that the controlling factors of landscape diversity are interrelated.

Scale is important in managing for biodiversity in the landscape. The observation scale has to be suited for the problem at hand. Scale does not recognize political boundaries. Adjacent management activities must also be considered in understanding changes in biodiversity.

The objective of the second session was to identify future opportunities for maintaining and restoring native and desired biological diversity. The group concluded that a vocabulary for landscape patterns should include

boundaries, edge, grain size, patch size, connectivity, corridors, and context (within a setting). A list of management needs related to biodiversity includes:

- a. a system for describing and measuring pattern in landscapes--track performance;
- b. reconsider the size of clearcuts--mimic natural processes; target different species;
- c. maintain important ecological processes--e.g., migration, predation;
- d. education of public to values of landscape scale diversity;
- e. transfer of knowledge to forest/wildlife managers--e.g., value of "edge" vs. large blocks;
- f. formation of regional, interagency organizations to coordinate activities over several ownerships--e.g., black bear management, hog management in the Southern Appalachians;
- g. define appropriate scale--may be beyond forest boundaries;
- h. need compatible inventories of biological resources to share among agencies--plant community classification, population inventories, locations of threatened and endangered species;
- i. interaction of landscape pattern (especially fragmentation) and global climate change--the need for corridors and perhaps artificial movement of species;
- j. clarification of goals for National Forest management--harvest, targets may conflict with maintaining diversity at the landscape scale;
- k. road closures--consider public reaction.

Summary of working group discussion on community diversity.
Rick Ullrich.

SESSION 1: OBJECTIVES: Increase understanding and identify key elements of community diversity.

ELEMENTS:

1. Species composition--relative abundance of species in a community.
2. Soil characteristics, climate, topography and other physical features.
3. Species relationships/interactions.
4. Internal variability (within a community).
5. Quality (naturalness).
6. Disturbance regimes.
7. Site productivity.
8. Age class distribution.
9. Self-sustainable.

10. Size structure of organisms that make up community.
11. Physical size (area).
12. Successional stage.
13. Juxtaposition of communities (spatial arrangements).

SESSION 2: OBJECTIVE: Identify potential opportunities for improving biological diversity through land management activities and other means.

OPPORTUNITIES:

1. More and better inventories.
2. Basic research into natural conditions.
3. Comprehensive plans for preserving communities.
4. Identify communities with critical concerns and protect them.
5. Consistent classification systems (correlation between systems).
6. Identify forces (processes and agents) that structure communities.
7. Legislation to support natural land management through tax advantages and other means.
8. Determine critical elements of systems and match with landowners objectives and values.
9. Identify key organisms that are representative of biological diversity.
10. Monitor identified organisms (9) and whole communities.
11. Preserve representative examples of all communities. Complete network of research natural areas. Manage them for natural processes and use for research.
12. Establish regional networks of land managers, scientists and technicians. Increase communication between knowledgeable and interested parties (e.g., Man and the Biosphere Program).
13. Communicate to mainstream America.
14. Take global approach and utilize patch system to improve diversity.
15. Pay attention to aquatic communities.
16. More public involvement in decision-making concerning community diversity.
17. Increase awareness of specialists inventorying public lands.
18. Need more opportunities to exchange information and coordinate processes (e.g., workshops, meetings, etc.).
19. Choose management techniques that imitate natural processes to the extent possible.
20. Purchase critical communities to protect them.

21. More research on impacts of management techniques (e.g., harvesting, site-preparation, etc.).

Summary of working group discussion on species diversity.

Robert D. Sutter.

The objective of this working group was to identify opportunities to conserve species diversity on Forest Service lands. The trigger questions were: What are the potential opportunities for conserving species diversity? What can and should be done? How does one manage for species diversity?

The group generated numerous ideas. These were grouped in the four categories listed below.

BASIC CONCEPTS AND ACTIONS.

The group generated a number of basic actions that would enhance the goal to conserve species diversity on the Forests. Most of these actions are administrative with significant influence on the management of Forest lands. The group suggested that the U.S. Forest Service:

1. Hire an ecologist and research botanist for each Forest.
2. Establish cooperative agreements with governmental agencies and private conservation groups whose interests include the protection of biological diversity. (For example: The Nature Conservancy, state endangered species or Natural Heritage programs).
3. Invite the assistance of local experts on species diversity. (For examples: university and agency staff).
4. Have district level trainings on the protection of species diversity.
5. Develop appropriate short courses on the protection of species diversity.
6. Establish demonstration areas addressing species protection with interpretation on the Forests. (For example: the use of fire to improve Red-cockaded Woodpecker and rare plant species habitat).
7. Involve public affairs in the protection of species diversity.
8. Develop written guidelines for the protection of species diversity.
9. Prepare long and short range workplans encompassing the protection of species diversity, the demand for products, recreational needs, and legislative demands.
10. Amend Forest Plans to better address species diversity.
11. Pass Biodiversity legislation to re-enforce these efforts.

12. Emphasize diversity on public lands and shift commodity production to private lands.
13. Shift funding to biodiversity.
14. Enforce existing laws.

SETTING GOALS AND OBJECTIVES.

Having clearly stated and concise goals and objectives is essential for any project. These goals address the resources, the species and the habitats in which they occur. The working group developed the following goals.

1. Manage to protect species diversity.
2. Manage for natural processes.
3. Operate at custodial level (make no irreversible action) until good biological data and guidance are obtained.
4. Restore extirpated species.
5. Remove exotics and introduced species.

INVENTORY.

Baseline information on species diversity on Forest lands is needed. Inventories need to be completed to obtain this information and to determine which species we should emphasize in protection. This information will also be essential for determining levels of species diversity to manage for, both in specific management units and on a Forest as a whole. The working group suggested the following:

1. Work with local experts, governmental agencies, and private conservation groups to assist with inventories;
2. Plan inventories for species diversity;
3. Propose a National Biological Survey for species diversity;
4. Establish the funds to support the inventory projects; and
5. Establish monitoring projects to ascertain changes in species diversity over time.

SPECIES BIOLOGY.

Inventories would establish a baseline concerning species diversity in National Forests, but much of the important information to manage and protect this diversity needs to come from studies into the biology of keystone or rare species. The working group suggested that the U.S. Forest Service:

1. Fund basic research on the management and protection of species diversity, including species interactions, measures of diversity, and major causes of diversity;

2. Consult with local experts, governmental agencies, and private conservation groups to assist in the research; and
3. Set aside critical habitats.

Summary of working group discussion on genetic diversity.

Lynn A. Maguire.

Genetic diversity was the topic for one of four working groups sessions held during the biodiversity workshop. The objectives for the working group were to increase understanding of genetic diversity, to identify key elements of genetic diversity, and to identify opportunities for maintaining or improving genetic diversity through land management activities.

The first concern of the group was to address the question: What social values are important to decision about genetic management? Possible values include financial return, biodiversity, species conservation and legal requirements (such as the Endangered Species Act), with both short and long term perspectives on each. The group did not attempt to decide which social values are most important, but rather acknowledged that values guide decisions about genetic diversity. One concern expressed was: What if social values change? The group felt that preserving the potential to change the direction of management of genetic diversity, e.g., by "saving the parts," was essential.

Specific objectives for genetic management depend on social values and particular circumstances. Some candidate objectives include: (1) maintaining genetic elements (e.g., alleles); (2) conserving phenotypic characters; (3) selecting for desired traits; (4) increasing genetic variation through selection of extremes; and (5) conserving endangered species.

What measures of genetic diversity are useful for evaluating how well management is meeting objectives? The group identified two parts to this question: what elements of genetic diversity to measure and how to express the results quantitatively. Genetic measures that may prove useful include: (1) the frequency distribution of alleles; (2) the frequency distribution of genotypes (often, the relationship of these measures to fitness is unclear); (3) the quantitative variation in heritable traits (a disadvantage of this measure is that it requires knowledge of pedigrees); (4) interpopulation variation in heritable traits; (5) the proportion of polymorphic loci; and (6) genetic distances among populations and species.

The group recognized important interactions between genetic and demographic management. For example, in

managing extremely small populations, should hybridization be used to augment population sizes to ensure survival of at least some unique genetic material, even if in hybrid form? Measures of genetic differences among populations can help make such decisions. In other cases, genetic information can be used to shed light on demography, such as when analyses of genetic similarity are used to determine population substructure and migration rates. Genetic data can offer guidance when small populations are to be managed demographically by moving individuals among populations. The group noted that there are ethical, as well as biological, considerations in mixing gene pools, as may happen in reciprocal transplant experiments. Of course, many such transfers have already been made, with little concern for genetic integrity, in fisheries management and forest provenance studies, so that current conditions reflect past human actions. In the future, the choice of genotypes for re-introduction or population augmentation can be enhanced by genetic information. Two possible strategies are (1) to mix genotypes and then let natural selection operate to produce adaptation to current environments and (2) to select locally adapted genotypes where possible. The role of peripheral populations and of "rare" phenotypes in longterm adaptation of species to changing environments (e.g., global warming) was identified as a little-recognized problem and opportunity.

When the group discussed opportunities for genetic management, they included research and education, along with land and population management. An appropriate goal for genetic management is to maintain (or, in some cases, improve) genetic diversity, including maintaining the potential for genetic change. Collecting baseline genetic data and setting up programs for monitoring genetic diversity were identified as immediate priorities. Needs include: inventorying species, surveying genetic variation, and improving taxonomic knowledge.

The group suggested several types of genetic studies to aid management. When dealing with rare and endangered species, techniques for management may be developed using related, but less imperiled, species as surrogates. Heritability studies are often needed to distinguish between genetic effects and phenotypic plasticity; confusing the two can lead to pursuit of inappropriate and unreachable genetic goals. Both natural and artificial selection (e.g., timber management) influence genetic composition; these effects should be studied more carefully. Genetic studies must be integrated with both species level and community level

studies, to understand how genetic management fits into larger scale concerns for biodiversity. The group suggested monitoring the results of genetic management and testing the "rules of thumb" (e.g., effective population sizes of 50, 500, and 5000 for short to long term adaptation) that have been proposed to guide genetic conservation.

Some situations require intensive research and management soon. These are: (1) species with very small population sizes, where guidelines for intensive management are uncertain; (2) "special" species, including those that are rare or endangered, those that are "keystone" species in their ecological communities, and those that are used as indicator species; and (3) species that are being impacted heavily by human activities. The group expressed special concern for the management of species with disjunct populations. They proposed efforts to locate relict, peripheral populations that may serve as reservoirs of unique genetic variation. They also highlighted the management tradeoff between maintaining separation of disjunct populations versus providing corridors to restore gene flow. Again, clearly articulated objectives and genetic studies may help clarify which type of management is more appropriate.

The group stressed education and information transfer as important components of the management of genetic diversity. They cited the need to more effectively transfer information from academic researchers to the management community (a goal of this conference); to improve formal and informal communication between researchers and managers at the forest level within the USFS; to develop a consensus on management activities for species that range across forest management units; and to communicate that consensus to managers, the public, and politicians. Lastly, the group called for changes in the budgetary and organizational structure of the USFS to facilitate these genetic management actions.

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