

# SOUTHEASTERN BIOLOGY



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Number 2

## ASB 65<sup>TH</sup> ANNUAL MEETING APRIL 14-17, 2004

University of Memphis  
Rhodes College &  
Christian Brothers University  
Memphis, Tennessee

Consult Website  
<http://www.memphis.edu/asb>



The Belltower which marks the main entrance to  
Christian Brothers University

*The Official Publication of*  
*The Association of Southeastern Biologists*  
<http://www.asb.appstate.edu/>

## **SOUTHEASTERN BIOLOGY** (ISSN 1533-8436)

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### **PURPOSE**

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

### **Time and Place of Future Meetings**

2004 April 14-17 Co-hosted by Univ. of Memphis, Rhodes College, and Christian Brothers Univ., Memphis, Tenn.  
2005 April 13-16 Hosted by the University of North Alabama, Florence, Alabama.  
2006 April 5-8 Hosted by the University of Tennessee, Knoxville, Tennessee.  
2007 April 18-21 Hosted by the University of South Carolina, Columbia, South Carolina.

## A MESSAGE FROM THE PRESIDENT

### ANDREW N. ASH

For as long as I have been attending ASB meetings, students have been an important part of our membership. While graduate students can be found at most scientific meetings, the considerable presence of undergraduate students at our meetings makes them somewhat unique. In my opinion, student attendance is a good thing and should be encouraged and enhanced whenever possible.

The Washington meeting was an expensive one, and the Memphis meeting is going to be costly as well. Unfortunately, given the current conference climate, expensive meetings are going to become more common and local arrangements committees will have limited abilities to control costs. Regarding ASB meetings, the recent trend is clearly away from less expensive, campus-based meetings toward meetings held at conference hotels. Since hotels are there to make money, we can be sure the price of hotel-based meetings will continue to rise in the future.



These facts present ASB with a considerable problem. How do we continue to make our meetings affordable to the students who add so much to the character, distinctiveness and quality of our annual meetings? Unfortunately, the answer will not be a simple one. Local Arrangements Committees will have to be increasingly mindful of the registration fees required of students. The Executive Committee of ASB will need to make student registration a major point of emphasis when negotiating with Local Arrangements Committees. Senior members of ASB must become increasingly willing to defray some portion of student costs through unbalanced registration fee schedules. Parent institutions will need to become proactive in helping defray the costs of students who attend ASB meetings. This will be no mean feat given the fact that many states disallow the spending of state monies for student travel. Private donors or local corporations might be approached for subsidies. The student organizations themselves must find new and innovative ways to raise money to subsidize student travel to ASB. There is no question that a solution to this problem will require thought and consideration from all the groups mentioned.

I am pretty sure there are some statements in the preceding paragraph that will irritate more than a few people. The point being that the irritation should recede quickly once we consider how important students are to ASB. I think

students are essential elements of the character of ASB and essential contributors to the longevity of the association. I believe the issue is real, and I believe a successful solution is critical. I don't think we can do without students at our meetings, and I don't think most of us really want to do without them. My home institution, UNC Pembroke, sends a large student contingent to ASB each year, and we have by no means resolved these issues. We are currently struggling to determine exactly how we will get our students to Memphis this year, but we will get them there. I am as mystified as anyone concerning the nature of a final solution to the problem. But a solution should be found quickly, and such a solution should be one of ASB's highest priorities.



Administration Building, University of Memphis.

## ASB CANDIDATES FOR OFFICE—2004

The Nominating Committee composed of Robert Haynes (Chair), Bonnie Kelley, and Kim Marie Tolson has selected the following slate of nominees for the ASB offices to be filled in 2004. Voting will take place at the annual business meeting at 11:15 A.M. on Friday, April 16, 2004. Additional nominations will be accepted from the floor before voting is conducted. Please plan to attend and vote. Elections can sometimes be close. Therefore, your vote could make a difference on who gets elected to office.

<i>President-Elect</i>	<b>Dwayne A. Wise</b>	Mississippi State University Mississippi State, Mississippi
	<b>Gerhard W. Kalmus</b>	East Carolina University Greenville, North Carolina
<i>Vice President</i>	<b>A. Joseph Pollard</b>	Furman University Greenville, South Carolina
	<b>George Cline</b>	Jacksonville State University Jacksonville, Alabama
<i>Executive Committee</i>	<b>Scott Franklin</b>	University of Memphis Memphis, Tennessee
	<b>Elaine J. Davis</b>	Bowie State University Bowie, Maryland
	<b>Edward D. Mills</b>	Wingate University Wingate, North Carolina
	<b>Donald H. Roush</b>	University of North Alabama Florence, Alabama



Dwayne A. Wise



Gerhard W. Kalmus



A. Joseph Pollard



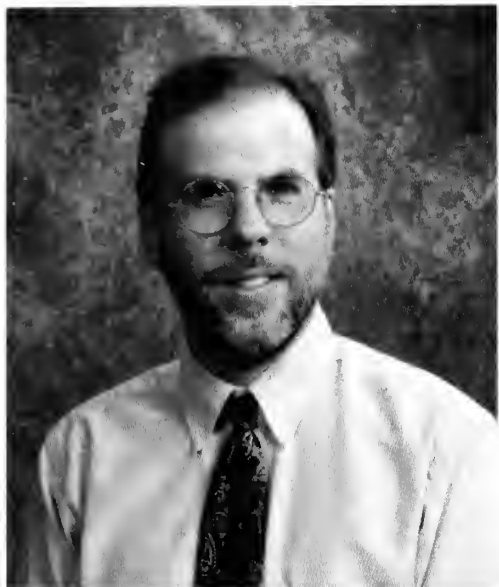
George Cline



Scott Franklin



Elaine J. Davis



Edward D. Mills



Donald H. Roush

### PRESIDENT-ELECT

**DWAYNE A. WISE** - Dr. Wise is a Professor of Biological Sciences and Graduate Coordinator at Mississippi State University. A native of Tennessee, he attended the University of the South and David Lipscomb College before receiving the Master's (1968) and Ph.D. degrees (1972) from Florida State University. He was a postdoctoral fellow at the University of Texas Health Science Center at Dallas and was a Temporary Instructor at Duke University. He has been a faculty member at MSU since 1979, where he teaches genetics. He is a member of the American Society for Cell Biology, AIBS, Sigma Xi, Phi Kappa Phi, is an honorary member of the Beta Beta Beta, and is a member of the American Association of University Professors and the Association of Southeastern Biologists. He has been a member of ASB since 1968. He has served on the ASB Executive Committee, has been Vice-President and has been chair of the faculty award committee twice.

His research interest is to understand chromosome structure and behavior, especially in living cells. This includes the mechanism of chromosome movement, ways in which chromosome structure and behavior may be approached experimentally and the analysis of meiosis in organisms with unusual modes of chromosome distribution. He has been a Visiting Professor in the Department of Cell Biology, Baylor College of Medicine, Houston, Texas and at the University of North Carolina at Chapel Hill. He was named Outstanding Faculty Member by the MSU Student Association in 1987, and the Margaret Y. Menzel Memorial Lecturer at the Boone Chromosome Conference in 1989. He received the ASB Faculty Research Award in 1991 and in 2000. He has served on grant panels for the National Institutes of Health, the National Science

Foundation, the International Human Frontier Science Program, the Italian Ministry of Science, the Charles A. and Anne Morrow Lindeberg Foundation, and the US-Israel Binational Science Foundation. He has reviewed manuscripts for numerous professional journals and his research has been supported by the NIH, NSF, USDA, and NATO.

**GERHARD W. KALMUS** - Dr. Kalmus is a Professor and the Director of Graduate Studies in the Department of Biology at East Carolina University, Greenville, N.C. He received his B.A. degree in German from the University of California at Berkeley (1967), his M.S. degree in Biology from Rutgers University at Camden, N.J. (1974) and his Ph.D. degree in Zoology from Rutgers University at New Brunswick, N.J. (1977). His research interests include mechanisms of neurulation, expression of cell surface molecules during morphogenesis, and the effects of medicinal plant extracts on cultured cells. He has been an active member of the ASB since 1977 and has served on the Graduate Student Support Award Committee, the Patron Members and Exhibitors Committee, as Treasurer, as Business Manager, the Executive Committee Member-at-Large and the Poster Awards Committee. He is a member of Sigma Xi, AAAS, Society for Developmental Biology and other professional societies. He serves as Immediate Past-President of the North Carolina Academy of Science and Faculty advisor to Alpha Epsilon Delta.

## VICE-PRESIDENT

**A. JOSEPH POLLARD** – Dr. Joe Pollard is Professor of Biology at Furman University in Greenville, South Carolina, and has been Chair of the department since 2000. He received a B.S. in Botany at Duke University in 1977 and a Ph.D. in Botany at the University of Cambridge, England, in 1981. Prior to assuming his current position in 1988, he was on the faculty of Oklahoma State University. Dr. Pollard's research concerns plant evolutionary ecology, in particular the interactions of plants with herbivores and with heavy metals in the soil, with a recent emphasis on the ecological genetics of metal hyperaccumulation in European members of the Brassicaceae. This work has implications for the bioremediation of metal-polluted soils and for the conservation of rare endemic species of metalliferous soils, including serpentine outcrops. His undergraduate research students from Furman have published and presented papers on studies of this system, as well as many projects involving the biogeochemistry and botany of the southeastern USA. Joe is curator of the S.A. Ives herbarium at Furman University, teaches courses in Ecology, Field Botany, Genetics, Biostatistics, and Introductory Biology, and has led field courses in New England, Canada, the Pacific Northwest, South Africa, Costa Rica, Ecuador, and the Galápagos Islands. A member of ASB since 1988, he served as a Member-at-Large of the Executive Committee from 1998 to 2001. He has served on the Place of Meeting Committee (chair in 1999/2000), the Finance Committee, the Resolutions Committee, is currently chair of the Publications Committee. He was also a principal organizer and Program Chair of the 1997 ASB meetings hosted by Furman in Greenville.



**GEORGE CLINE** – Dr. Cline is an Associate Professor at Jacksonville State University, Alabama. He received his B.S. in Biology, and Environmental Health from Indiana University of Pennsylvania, and his Ph.D. in Zoology from Oklahoma State University (1990). His undergraduate and graduate student research projects are regularly reported at ASB meetings. He is the University Liaison Officer to the Dauphin Island Sea Lab, and he also serves as an advisor to the JSU Scuba and Snorkel Club. George is broadly interested in amphibian and reptile ecology and conservation. His specialty is frog communication systems and acoustic community structure. He has worked with the diploid-tetraploid complex of gray treefrogs. He has also published several articles on the ecology and conservation biology of the Oklahoma salamander, *Eurycea tynerensis*. He and his students are currently working on acoustic interactions among southeastern frogs, clutch size variation in spotted salamanders (*Ambystoma maculatum*) ecology of the hellbender in Alabama, feeding behavior in mud turtles, and the effects of shape on the ecology of North American Turtles. George has served ASB previously as a member of the Executive Committee, and the Poster Awards Committee, and the Student Travel Awards Committee. He has also served as an officer of one of the ASB affiliates (SE Division of ASIH), and he is on the Board of Editors for the Southeastern Naturalist.

### EXECUTIVE COMMITTEE

**SCOTT FRANKLIN** – Dr. Franklin is a plant community ecologist with an M.S. in forestry and a Ph.D. in plant biology (Southern Illinois University, 1996). Scott has been studying disturbance and vegetation dynamics for over 13 years, with considerable interest in spatial and temporal dynamics. He is an applied ecologist, integrating management questions into his research with exotic species (*Microstegium vimineum*), fire (central hardwoods), forested floodplains (tributaries to the Mississippi River), hydrology of the Mississippi River, and slash and burn agriculture (in both Finland and Belize). Most recently, Scott has developed research examining the potential to restore canebrakes (*Arundinaria gigantea*) in the southeastern United States and the regeneration of bamboo (*Fargesia* and *Bashania*) in the Qinling Mountains of China following die-offs and giant panda herbivory. Scott is an active member of the Southeastern Chapter of the Ecological Society of America, where he has served as Vice-Chair, and of the Association of Southeastern Biologists, where he served three years on the Student Awards Committee and is currently the Local Arrangements co-chair for the 65<sup>th</sup> Annual meeting in Memphis. Scott has co-authored one book, 17 journal articles and six book chapters. He is currently an Associate Professor in the Department of Biology at the University of Memphis.

**ELAINE J. DAVIS** – Dr. Davis is an Associate Professor of Biology at Bowie State University, Bowie, Maryland. She received her undergraduate degree from St. Augustine's College, Raleigh, North Carolina; the Master's degree from Atlanta University, Atlanta, Georgia, and the Ph.D. degree in Microbiology from Meharry Medical College, Nashville, Tennessee. Her research interest is in the area of molecular biology with emphasis on bacterial conjugation and mitochondrial DNA of the Balsam Woolly Adelgid. She is a strong advocate of student participation in research activities. Dr. Davis and her students have presented numerous papers

at various society meetings. She is an active member of the Genes Families and Isozyme Conference, Sigma Xi the Scientific Research Society and was Program Chair for the 2003 ASB Annual Meeting. Currently, she serves as Chair of the Department of Natural Sciences and Director for the Model Institution for Excellence Initiative funded by the National Space Aeronautics Administration (NASA).

**EDWARD D. MILLS** – Dr. Mills is Associate Professor of Biology, and Chair at Wingate University, Wingate, North Carolina. He earned a B.A. in Biology from Wake Forest University, an M.S. in Biology from Appalachian State University, and a Ph.D. from The University of Alabama (1989). His research interests include the habitat ecology of beavers, and avian ecology and migration. He is currently investigating the effects of beavers on aquatic and riparian animal communities. Dr. Mills teaches Zoology, Ornithology, Ecology, Wildlife Management, and Marine Biology. He has been an active member of ASB since 1983, and has served on the Education Committee (Co-Chair) and the Conservation Committee. Dr. Mills is a member of the American Ornithologists' Union, NC Academy of Science, and the Association of Field Ornithologists, and the Wilson Ornithological Society.

**DONALD H. ROUSH** – Dr. Roush is an associate professor of biology in the Department of Biology at the University of North Alabama in Florence, Alabama. His education began and concluded at the University of Mississippi with the awarding of a B.S. (1970), M.S. (1972), and Ph.D. (1981). His experience continued with a short period at St. Jude Research Hospital in Memphis, Tennessee. His areas of interest include general microbiology and immunology. His current research interests are in microbial ecology and antibiotic resistance of organisms from environmental water systems and sewage treatment facilities. He has worked most recently with commercial consulting firms on problems of "sick building" remediation caused by fungal growth and contamination. His teaching includes courses for biology majors and allied health including nursing, physical therapists, pre-medical and pre-dental. He is a member of numerous honor societies, holding regional and national offices. Other professional organizations he is a member of and contributed to include AAUP (campus officer), American Society for Microbiology (ASM), SE Branch ASM, Mississippi Academy of Sciences, and Alabama Academy of Sciences. He has presented papers and posters as well as served as a judge at state meetings and national meetings for all of these organizations and as the delegated ASM judge to several International Science and Engineering Fairs (Westinghouse and Intel competitions). He is a member of ASB and has attended and contributed to every meeting since 1989. He is the representative to ASB for the affiliated organization Beta Beta Beta (TriBeta, the biology honor society), which meets jointly with ASB every year. He is a regional director for the southeastern region for TriBeta and responsible for the organization of their scientific program and field trips held jointly with ASB each year. As a result he has attended and collaborated with all the local arrangement committees and the Executive Committee of ASB since 1991. His goal is to be a representative not only for ASB members and the TriBeta affiliated organization, but the interests and concerns of other affiliated societies to the ASB Executive Committee.

**PROGRAM of the  
65<sup>TH</sup> ANNUAL MEETING of the  
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS**

Hosted by

**University of Memphis, Christian Brothers University,  
and Rhodes College**

at the

**University of Memphis  
Holiday Inn -- Fogelman Executive Center  
Memphis, Tennessee**

**SOCIETIES MEETING WITH ASB IN MEMPHIS**

American Society of Ichthyologists and Herpetologists,  
Southeastern Division  
Beta Beta Beta, Southeastern Division  
Botanical Society of America, Southeastern Section  
Ecological Society of America, Southeastern Chapter  
Society of Wetland Scientists  
Southeastern Fisheries Council  
Southern Appalachian Botanical Society

## 65<sup>th</sup> Annual Meeting of ASB Exhibitors

**Associated Microscopes**

**Bedford, Freeman and Worth Publishing Group**

**Benjamin Cummings**

**BIOPAC Systems, Inc**

**Brooks/Cole**

**Carolina Biological Supply Company**

**Convion**

**Corps of Engineers, Memphis Division**

**Edvotek – The Biotechnology Education Company**

**Fisher Scientific**

**Forestry Suppliers, Inc**

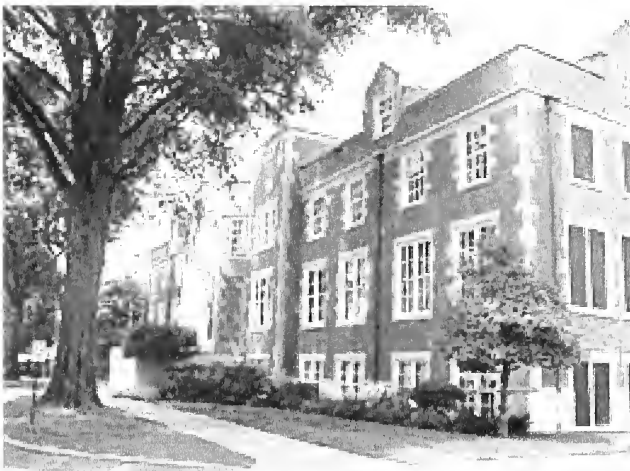
**Florence Conference Center**

**Martin Microscope**

**Mississippi State University**

**Olympus America, Inc**

**What Did You Bring Me**



Barry Hall, Administration Building at  
Christian Brothers University.

## GENERAL INFORMATION

**Registration:** Registration information and early bird registration information were published in the January 2004 issue of *Southeastern Biology*. Pre-registrants may pick up their packet at the registration desk. The registration desk will be located in the foyer of the Holiday Inn with the vendors. Please bring the April 2004 issue of *Southeastern Biology* containing the detailed program and abstracts to the meeting. Additional copies will be sold at the meeting registration desk for \$7.00. The program is also available on the web site ([www.memphis.edu/asb](http://www.memphis.edu/asb)). For further information, please contact Scott Franklin ([sfrankli@memphis.edu](mailto:sfrankli@memphis.edu)) or Mel Beck ([mbeck@memphis.edu](mailto:mbeck@memphis.edu)).

**Ground Travel:** The Holiday Inn and Fogelman Executive Center (meeting headquarters) are located on the University of Memphis campus in the center of the city. Complimentary shuttles between the meeting headquarters and off-site lodging will be provided (see program schedule for shuttle schedule).

**Coming from the east on I-40:** Follow the Sam Cooper Blvd. signs, take the Highland Street exit from Sam Cooper Blvd., follow Highland south to Central, turn east and follow Central to the Holiday Inn (on your left) or Fogelman Executive Center (on your right).

**Coming from the west on I-40:** Take the Riverside Drive exit, follow Riverside Drive south to Union Avenue, turn east and follow Union (Union will change to Walnut Grove) to Highland, turn south and follow Highland to Central, turn east and follow Central to the Holiday Inn (on your left) or Fogelman Executive Center (on your right).

**Coming from the airport (rental car dealerships):** Leaving the car dealerships, turn west onto Democrat Road; from Democrat, take the Plough Boulevard/Airways North exit; from Plough Boulevard/Airways North, take the I-240 exit to Nashville (keep to the right as you take that exit); from I-240, take the Getwell North exit (exit 20-B); follow Getwell north until it makes a "T" intersection with Park Avenue; turn east onto Park Avenue; at the first stop light (just a block away) turn north onto Goodlett Street; follow Goodlett across the railroad tracks to Central Avenue; turn west onto Central and follow Central to the Holiday Inn (on your right) or Fogelman Executive Center (on your left).

**Coming from the north on I-55:** Follow the signs to get onto I-40, go east on I-40 and take the Riverside Drive exit, follow Riverside Drive south to Union Avenue, turn east and follow Union (Union will change to Walnut Grove) to Highland, turn south and follow Highland to Central, turn east and follow Central to the Holiday Inn (on your left) or Fogelman Executive Center (on your right).

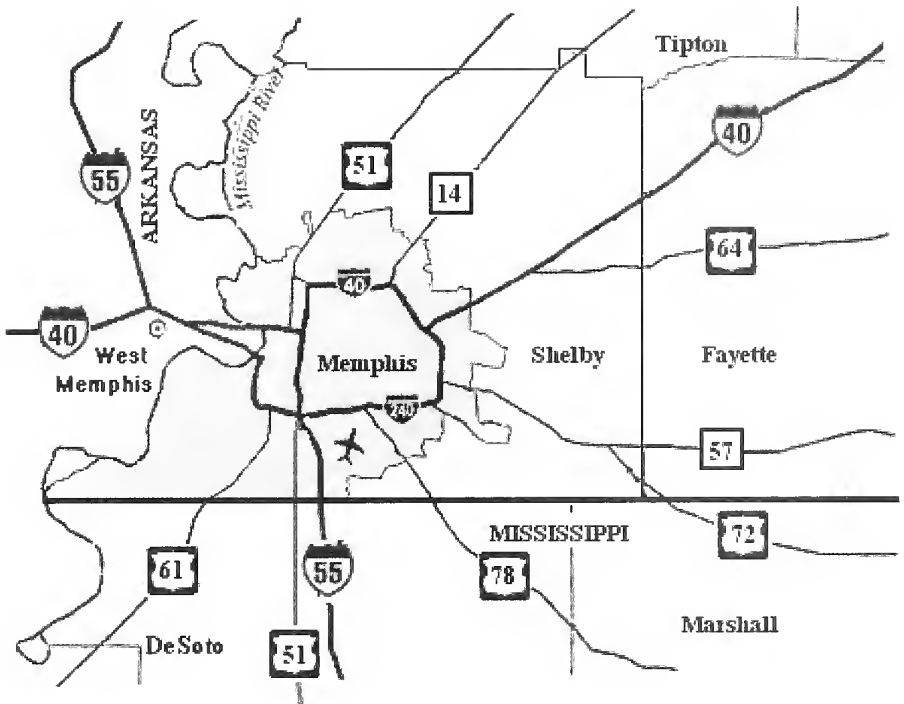
**Coming from the north on U.S. Hwy. 51:** Just south of Millington, turn left onto Paul Barret Parkway; take Paul Barret Parkway to State Rd. 204; turn onto Hwy. 204 and stay on that road until it ends at Summer Avenue (Hwy. 204 will change to Covington Pike, then Stratford Road); turn west and follow Summer Avenue to Highland; turn south and follow Highland to Central; turn east and follow Central to the Holiday Inn (on your left) or Fogelman Executive Center (on your right).

**Coming from the south on I-55:** Take the I-240 exit to Nashville, follow I-240 to the Getwell North exit and take that exit, follow Getwell north to Park Avenue, turn east and follow Park Avenue to Goodlett (only about one block away), turn north and follow Goodlett to Central, turn west and follow Central to the Holiday Inn (on your right) or Fogelman Executive Center (on your left).

**Coming from the south on U.S. Hwy. 78:** Take the Perkins Street exit, follow Perkins to Park Avenue, turn west and follow Park Avenue to Goodlett, turn north and follow Goodlett to Central, turn west and follow Central to the Holiday Inn (on your right) or Fogelman Executive Center (on your left).

**Getting to the Holiday Inn Select and Park Vista:** Both of the off-site hotels are found just east of the Polar exit of I-240. Both hotels provide complimentary shuttles from the airport with advance request.

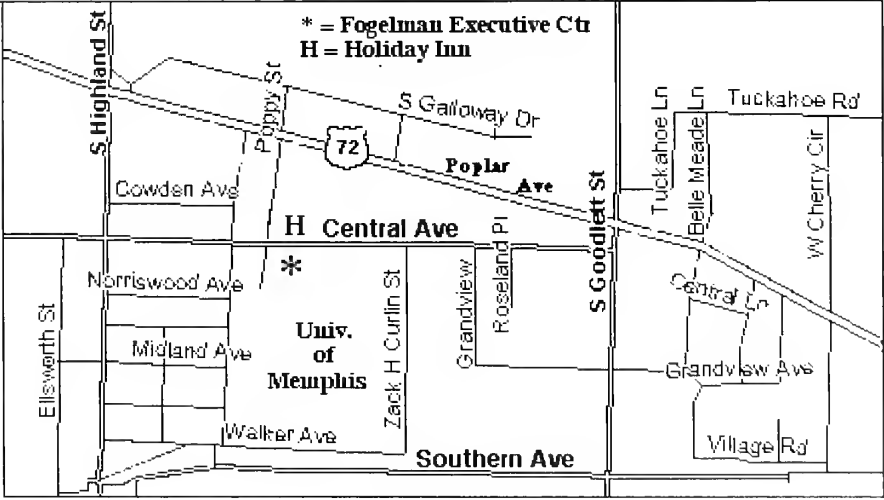
### Travel to Memphis



Regional Map



City Map



Campus Map

**Air Travel:** The Memphis International Airport is served by most major airlines and is the hub for Northwest Airlines. All hotels offer a complimentary shuttle from the airport, but you must request this in advance. Car rental at the airport is also readily available.

**Parking and Local Transportation:** All those participants staying at the Holiday Inn or Fogelman Executive Center may park in their respective lots. If you are staying at the Park Vista or Holiday Inn Select Memphis East hotel, a shuttle will run during morning and afternoon (see program schedule for details), and during evening activities, to take participants to and from events.

**Job Placement and Message Board:** Position notices and messages will be displayed near the meeting registration desk in the Holiday Inn ballroom.

**Local Dining:** Your registration package will contain a list of recommended restaurants. Remember that lunches for Thursday and Friday, as well as the Thursday night social are included in your registration.

**Social Activities and Events:** If you signed up, tickets for the Friday night banquet, various society lunches and breakfasts, and Saturday field trips will be included in your registration packet. Times and places for activities and meals are given in the program schedule in this issue and on the web site ([www.memphis.edu/asb](http://www.memphis.edu/asb)).

**Wednesday Evening Social:** After the plenary, relax with food and drink while visiting with ASB exhibitors. This will be a good way to greet old friends and meet new colleagues.

**Thursday Evening night out at the Gibson Guitar Factory and Rock 'n' Soul Museum:** The Thursday evening social event will be held at the Gibson Guitar Factory, and will include a BBQ dinner, cash bar, and entrance to the Rock "N" Soul Museum, where you can learn about Elvis, BB King, and other famous Memphians. The band Free World will play their original music early in the evening (lots of scratchy guitar, syncopated drum beats, punchy horns, and plenty of jams) and then some dancing music to finish off the festivities at Gibson. You don't have to stop then, however, as Beale Street is only a block away. Feel free to wander this famous street to take in more live music and festivities. Buses will continue running until 12:00 am. This event is included in your conference registration fee, so don't miss out!

**Friday Night Banquet:** The ASB Banquet will be held in the UM Holiday Inn ballroom. Join us for an informal networking social (cash bar) prior to the banquet. Awards will also be presented.

**Field Trips:** Transportation for all field trips will depart from the UM Holiday Inn main entrance. Field trips are detailed in the January 2004 issue of Southeastern Biology and on the meeting web site. The four Saturday field trips include: (1) Low-gradient River Ecology canoe trip, (2) Mississippi Neotropical Migrants, (3) Zoo Conservation, and (4) The Ol' Man – large river ecology on the Mississippi.



In addition, on Thursday April 15, Tri-Beta has developed a field trip for their delegates to the Memphis Zoo.

**Information Sources:** For more detailed information about the meeting and host institutions, please refer to the January 2004 Issue of *Southeastern Biology* or the meeting website ([www.memphis.edu/asb](http://www.memphis.edu/asb)). ☞

### LOCAL ARRANGEMENTS COMMITTEE

#### *Local Arrangements*

<i>Co-Chair:</i>	Mel Beck (UM)	901-678-2970 <a href="mailto:mbeck@memphis.edu">mbeck@memphis.edu</a>
<i>Co-Chair:</i>	Scott Franklin (UM)	901-678-5539 <a href="mailto:sfrankli@memphis.edu">sfrankli@memphis.edu</a>
<i>Program Chair:</i>	Scott Franklin	
<i>Web Master:</i>	Steve Conlee U Memphis IT	901-678-5506 <a href="mailto:sconlee@memphis.edu">sconlee@memphis.edu</a>
<i>Beta Beta Beta:</i>	Mary Ogilvie (CBU)	901-321-3437 <a href="mailto:mogilvie@cbu.edu">mogilvie@cbu.edu</a>
<i>Commercial Exhibits:</i>	Mike Kennedy (UM)  Mel Beck	901-678-2597 <a href="mailto:mlkenndy@memphis.edu">mlkenndy@memphis.edu</a>
<i>Workshops/Symposiums:</i>	Matthew Parris (UM)	901-678-4408 <a href="mailto:mparris@memphis.edu">mparris@memphis.edu</a>
<i>Promotions:</i>	Charlie Biggers (UM)	901-678-4468 <a href="mailto:cbiggers@memphis.edu">cbiggers@memphis.edu</a>
<i>Field Trips:</i>	Jack Grubaugh (UM)	901-678-5487 <a href="mailto:grubaugh@memphis.edu">grubaugh@memphis.edu</a>
<i>Posters and Audiovisual:</i>	Mike Kennedy Mel Beck	
<i>Registration/Meeting Statistics:</i>	Bill Simco (UM)	901-678-2594 <a href="mailto:bsimco@memphis.edu">bsimco@memphis.edu</a>
<i>Social Events:</i>	Alan Jaslow (Rhodes)  Malinda Fitzgerald (CBU)	901-843-3602 <a href="mailto:Ajaslow@rhodes.edu">Ajaslow@rhodes.edu</a> 901-321-3262 <a href="mailto:malinda@cbu.edu">malinda@cbu.edu</a>
<i>Transportation/Parking/Tourism:</i>	Alan Jaslow Malinda Fitzgerald	

## Plenary Speaker – Daniel S. Simberloff

### “Biological Invasions: A War We Can Win!”

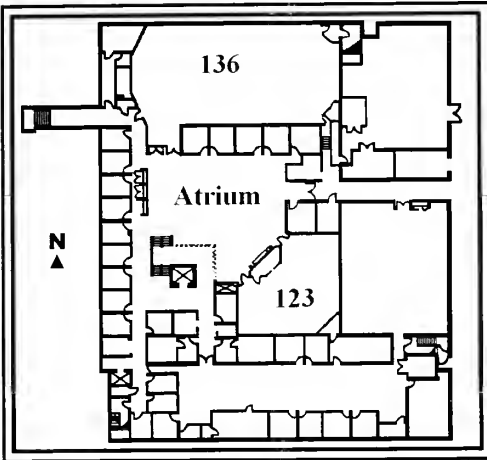


photo by Nick Myers

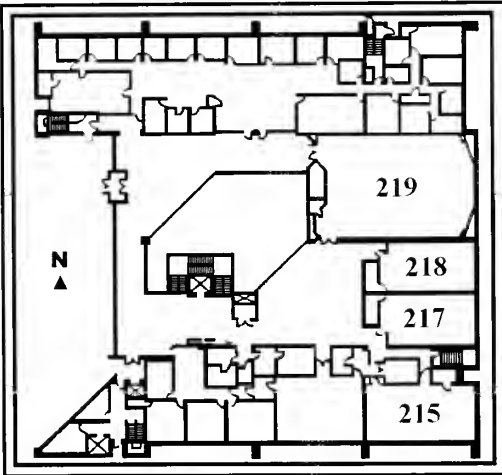
Dr. Dan Simberloff is the Nancy Gore Hunger Professor of Environmental Studies and Distinguished Scientist, Department of Ecology and Evolutionary Biology, and Director of the Institute for Biological Invasions at the University of Tennessee (UT) at Knoxville. Dr. Simberloff received his A.B. and Ph.D. from Harvard University, the latter as a student of E. O. Wilson. After 29 distinguished years teaching at Florida State, Dr. Simberloff moved to UT in 1997. His research interests include ecology, evolution, conservation biology, biogeography, and statistical ecology. Currently, his main focus is invasion biology, particularly ecological and evolutionary changes in species introduced outside their geographic ranges, the impacts such species have on the communities they invade, and the means by which such invasions can be managed. His interests also include community composition and structure, especially patterns that reflect community morphological structure (i.e., the ways in which species vary morphologically depending on which other species are present).

Dr. Simberloff has produced more than 300 publications, including his most recent book, “Strangers in Paradise - Impact and Management of Nonindigenous Species in Florida” (eds. D. Simberloff, D. Schmitz, and T. Brown, Island Press, 1997) and a citation classic, D. Simberloff and E. O. Wilson, 1969, “Experimental zoogeography of islands: The colonization of empty islands,” *Ecology* 50 (2): 278-296. He has served as editor and on editorial boards for many journals, and currently serves in an editorial capacity on *Biodiversity and Conservation*, *BioScience*, *Oecologia*, *Écologie*, and *Biological Invasions*. He is currently president of the American Society of Naturalists and a member of the U.S. National Science Board. Dr. Simberloff has been cited extensively by the popular press, including National Public Radio’s “Living on Earth” and “NOVA.”

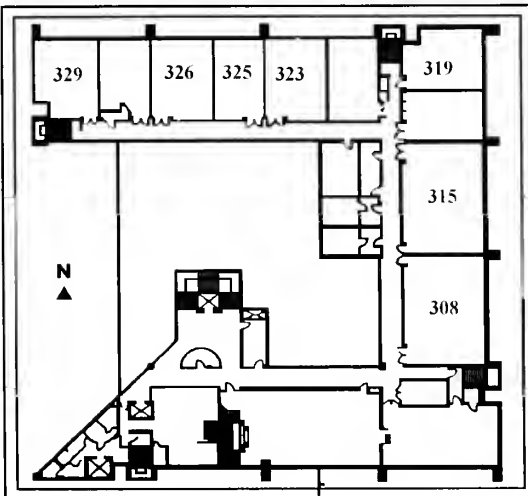
### Fogelman Executive Center



First Floor

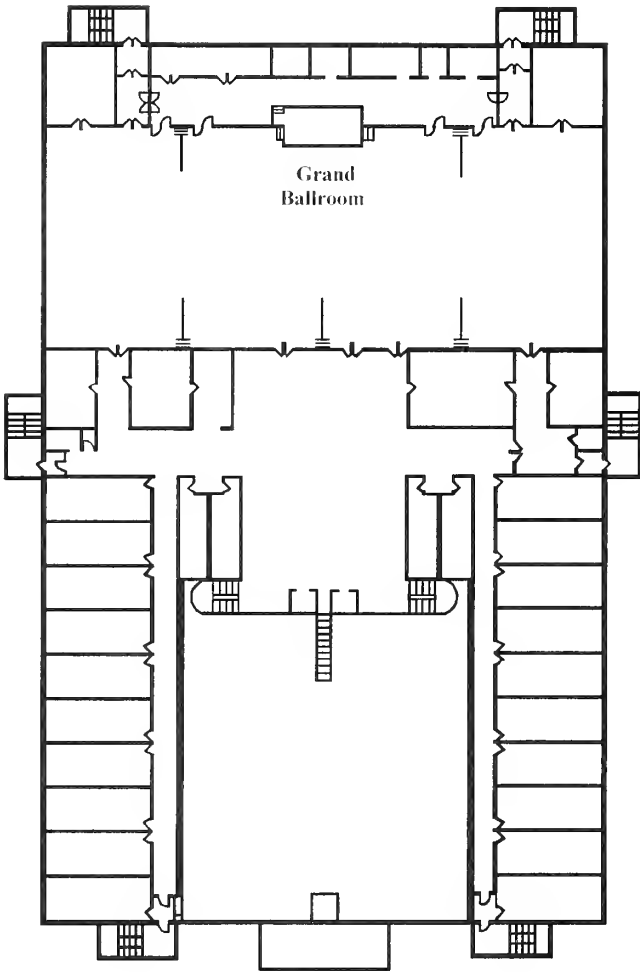


Second Floor



Third Floor

### Holiday Inn – UM



FEC Room	Wednesday		Thursday		Friday		Saturday
	PM	AM	PM	AM	AM	PM	AM
123		Symposium 2: Social Behavior of Animals	Herpetology – Behavior and Classification	Herpetology – Population Ecology & Physiology	Plant Distributions and Floristic Inventories		
136	Plenary Lecture	Symposium 1: Invasive Plant Awareness and Research	Plant Ecology – Populations	Plant Ecology – Communities <b>ASB Business Meeting</b>	Plant Ecology – Disturbance		
215			Symposium 3: Women in Science	Symposium 4: Microbiology Practitioners and Educators	Beta Beta Beta District II		
217	ASB Executive Committee Meeting	ASB Past President's Breakfast	SWS Luncheon	SABS/BSA Breakfast			ASB Executive Committee Meeting
218			Herbarium Curator's Meeting	ESA-SE Luncheon	Beta Beta Beta District I		
219		Genetics	Animal Ecology	Aquatic Management	Landscape Ecology		
308		Plant Biology	Plant Ecology – Toxicity	Animal Behavior	Animal Physiology		
315		Plant Systematics	Teaching Biology	Invertebrate Zoology	<b>Joint <math>\beta\beta\beta</math> Meeting &amp; Awards</b>		
323		PowerPoint Previewing	PowerPoint Previewing	PowerPoint Previewing	Microbiology		
Holiday Inn Ballroom	Registration / Exhibits	Registration / Exhibits	Posters / Registration / Exhibits	Posters / Registration / Exhibits	Registration / Exhibits	Registration	<b>BANQUET</b>

## PROGRAM SUMMARY

All events will be held at the Holiday Inn and Fogelman Executive Center (FEC) on the University of Memphis Campus, with the exception of the Thursday Evening Social at the Gibson Guitar Factory and Rock & Soul Museum. All talks will be given in the FEC (see floor plans in this issue) and all posters will be shown in the Holiday Inn Ballroom with exhibitors.

### WEDNESDAY, APRIL 14

4:00 pm – 10:00pm	<b>Registration</b> , Holiday Inn Ballroom
4:00 pm – 10:00 pm	<b>Shuttle</b> between Campus and Off-site Hotels
10:00 am – 4:00 pm	<b>Exhibitor Set-up</b> , Holiday Inn Ballroom
3:00 pm – 6:00 pm	<b>ASB Executive Committee Meeting</b> , FEC 217
6:30 pm – 8:00 pm	<b>ASB Plenary</b> , FEC Room 136 Dr. Mel Beck, Convener – General Comments Dr. Scott Franklin – Program Dr. Shirley Raines, President, University of Memphis Dr. Claudia Jolls – Introduction of Plenary Speaker Plenary Lecture – Dr. Daniel Simberloff, University of Tennessee
8:00 pm - 10:00 pm	<b>ASB Welcome Reception &amp; Exhibits</b> , Holiday Inn Ballroom

### THURSDAY, APRIL 15

6:30 am – 6:00 pm	<b>Registration</b> , Holiday Inn Ballroom
6:30 am – 8:30 am	<b>Shuttle between Campus and Off-site Hotels</b>
6:30 am – 8:00 am	<b>Poster Set-up</b> , Holiday Inn Ballroom
7:00 am – 8:00 am	<b>ASB Past President's Breakfast</b> , FEC Room 217
7:30 am – 4:00 pm	<b>PowerPoint Previewing</b> , FEC Room 323
8:00 am – 9:45 am	<b>Paper Sessions</b> <b>Genetics</b> , FEC Room 219 <b>Plant Biology</b> , FEC Room 308 <b>Plant Systematics</b> , FEC Room 315
8:15 am – 11:30 am	<b>Symposium 1: Invasive Plant Awareness and Research: a Priority Status</b> , FEC Room 136
8:15 am – 11:30 am	<b>Symposium 2: Social Behavior of Animals</b> , FEC Room 123
9:45 am – 10:15 am	<b>Refreshment Break</b>
10:00 am – 2:00 pm	<b>Exhibit Area Open</b> , Holiday Inn Ballroom
10:15 am – 12:00 pm	<b>Paper Sessions</b> (as above)
12:00 pm – 1:30 pm	<b>Lunch</b> (box lunches provided, Holiday Inn Ballroom)
12:00 pm – 1:30 pm	<b>SWS Luncheon</b> , FEC Room 217
1:00 pm – 4:00 pm	<b>Beta Beta Beta Field Trip to the Memphis Zoo</b> , Leave from Holiday Inn

- 1:30 pm – 3:00 pm **Paper Sessions**  
**Animal Ecology**, FEC Room 219  
**Herpetology–Behavior/Conservation**  
 FEC Room 123  
**Plant Ecology – Populations**, FEC Room 136  
**Teaching Biology**, FEC Room 315
- 1:30 pm – 3:00 pm **Symposium 3: Women in Science**, FEC Room 215
- 3:00 pm – 3:30 pm **Refreshment Break**
- 3:30 pm – 4:30 pm **Herbarium Curator’s Committee Meeting**,  
 FEC Room 218
- 3:30 pm – 5:00 pm **Paper Sessions** (as above plus the following)  
**Plant Ecology – Toxicity**, FEC Room 308
- 3:00 pm – 6:00 pm **Exhibit Area Open**, Holiday Inn Ballroom
- 4:00 pm – 6:00 pm **Afternoon Poster Session**, Holiday Inn Ballroom  
**Animal Behavior and Physiology**  
**Animal Ecology**  
**Developmental Biology**  
**Genetics**  
**Herpetology**  
**Invertebrate Zoology**  
**Microbiology**  
**Teaching Biology**
- \*\* Please remove poster between 6:00 and 6:30 pm \*\***
- 4:30 pm – 6:30 pm **Shuttle between Campus and Off-site Hotels**
- 5:30 pm – 7:00 pm **Shuttle between Holiday Inn and Gibson Guitar**
- 6:00 pm – 10:00 pm **Thursday Night Social at Gibson Guitar (Beale Street)**
- 9:00 pm – 12:00 am **Shuttle from Gibson to Campus & Off-site Hotels**  
*Note: Last shuttle departs Gibson at 12:00 am sharp*

## FRIDAY, APRIL 16

- 6:00 am – 5:00 pm **Registration**, Holiday Inn Ballroom
- 6:00 am – 8:30 am **Shuttle between Campus and Off-site Hotels**
- 6:30 am – 7:00 pm **Poster Set-up** (includes *Beta Beta Beta*),  
 Holiday Inn Ballroom
- 7:00 am – 8:30 am **SABS/BSA Breakfast**, FEC Room 217
- 7:00 am – 9:00 am **Poster Session & Exhibit Area Open**,  
 Holiday Inn Ballroom  
**Aquatic Management**  
**Plant Biology**  
**Plant Systematics**  
**Plant Ecology**  
**Beta Beta Beta**
- \*\* Please remove poster between 1:30 and 2:00 pm \*\***
- 7:00 am – 3:30 pm **PowerPoint Previewing**, FEC Room 323
- 8:00 am – 9:15 pm **Paper Sessions**  
**Animal Behavior**, FEC Room 308

	<b>Aquatic Management, FEC Room 219</b>
	<b>Herpetology – Population Ecology &amp; Physiology,</b> FEC Room 123
	<b>Invertebrate Zoology, FEC Room 315</b>
	<b>Plant Ecology – Communities, FEC Room 136</b>
	<b>Beta Beta Beta Activities</b>
8:30 am – 9:00 am	<b>District I and II Officers Meeting, FEC Room 218</b>
9:00 am – 9:30 am	<b>Judges Meeting, FEC Room 218</b>
10:00 am – 11:00 am	<b>Joint Business Meeting, FEC Room 218</b>
10:45 am – 12:00 pm	<b>Poster Presentations, Holiday Inn Ballroom</b>
	<b>Paper Presentations</b>
1:00 pm – 4:00 pm	<b>District I, FEC Room 218</b>
1:00 pm – 4:00 pm	<b>District II, FEC Room 215</b>
4:00 pm – 4:30 pm	<b>District I Meeting, FEC Room 218</b>
4:00 pm – 4:30 pm	<b>District II Meeting, FEC Room 215</b>
4:45 pm – 5:30 pm	<b>Joint District Meeting &amp; Awards, FEC 308</b>
8:00 am – 11:00 am	<b>Symposium 4: Microbiology Practitioners &amp;</b> <b>Educators (Brooks/Cole), FEC Room 215</b>
9:15 am – 9:45 am	<b>Refreshment Break</b>
9:45 am – 11:15 am	<b>Paper Sessions (as above)</b>
10:00 am – 1:30 pm	<b>Exhibit Area Open, Holiday Inn Ballroom</b>
11:15 am – 12:00 pm	<b>ASB Business Meeting, FEC Room 136</b>
12:00 pm – 1:30 pm	<b>Lunch (box lunch provided), Holiday Inn Ballroom</b>
12:00 pm – 1:30 pm	<b>ESA/SE Business Luncheon, FEC Room 217</b>
1:30 pm – 4:00 pm	<b>Exhibitors Move-out</b>
1:30 pm – 3:00 pm	<b>Paper Sessions</b>
	<b>Animal Physiology, FEC Room 308</b>
	<b>Landscape Ecology, FEC Room 219</b>
	<b>Microbiology, FEC Room 315</b>
	<b>Plant Distributions and Floristic Inventories,</b> FEC Room 123
	<b>Plant Ecology – Disturbance, FEC Room 136</b>
3:00 pm – 3:30 pm	<b>Refreshment Break</b>
3:30 pm – 5:00 pm	<b>Paper Sessions (as above)</b>
4:30 pm – 6:30 pm	<b>Shuttle between Campus and Off-site Hotels</b>
5:00 pm – 7:00 pm	<b>Informal Networking (cash bar), FEC Foyer</b>
7:00 pm – 10:00 pm	<b>ASB Banquet and Awards, Holiday Inn Ballroom</b>
9:00 pm – 11:00 pm	<b>Shuttle between Campus and Off-site Hotels</b>

## SATURDAY, APRIL 17

8:00 am – 12:00 pm	<b>ASB Executive Committee Meeting (includes</b> <b>breakfast), FEC Room 217</b>
	<b>Field Trips – all field trips leave from Holiday Inn</b>
6:30 am – 3:00 pm	<b>The Ol' Man (includes lunch)</b>
6:30 am – 12:00 pm	<b>Mississippi Neotropical Migrants</b>
7:00 am – 3:00 pm	<b>Low-gradient River Ecology (includes lunch)</b>
1:00 pm – 4:00 pm	<b>Zoo Conservation</b>



## ASB PAPER AND POSTER SESSIONS

THURSDAY, APRIL 15, 2004

THURSDAY MORNING SYMPOSIA

Social Behavior in Animals

Fogelman Executive Center, Room 123

**Presiding:** Michael Ferkin, University of Memphis

- 8:15    **Ferkin, Michael.** The University of Memphis – Introductory statement.
- 8:30    1    **Griebel, Ulrike, Jennifer A. Mather<sup>2</sup>, and David K. Oller<sup>1</sup>.**  
<sup>1</sup>University of Memphis and <sup>2</sup>University of Lethbridge–Double signaling in the Caribbean reef squid *Sepioteuthis sepioidea*.
- 8:55    2    **Mathis, Alicia.** Southwest Missouri State University–Social behavior of terrestrial salamanders.
- 9:20    3    **Risch, Tom and Thomas Robinson.** Arkansas State University–Egg size and parental quality, an experiment to evaluate their separate effects upon chick performance in the eastern bluebird (*Sialia sialis*).
- 9:45    **Break**
- 10:15   4    **Bednarz, James<sup>1</sup>, Rebecca Kimball<sup>2</sup>, and Patricia Parker<sup>3</sup>.**  
<sup>1</sup>Arkansas State University, <sup>2</sup>University of Florida, and <sup>3</sup>University of Missouri-St. Louis–The occurrence and evolution of cooperative breeding among the diurnal raptors.
- 10:40   5    **Ferkin, Michael.** The University of Memphis–Sex and reproductive state affects scent marking and over-marking in voles.
- 11:05   6    **Wolff, Jerry.** The University of Memphis–Human social evolution.

### Invasive Plant Awareness and Research: Priority Status

Fogelman Executive Center, Room 136

**Presiding:** Pat Parr, Oak Ridge National Laboratory Area Manager and President of Tennessee Exotic Pest Plant Council

- 8:15    **Parr. Pat.** Oak Ridge National Laboratory Area Manager and President of TN Exotic Pest Plant Council–Celebrating 10 years of progress against invasive plants.

- 8:30 7 **Spaine, Paula.** USFS Southern Research Station, Athens, Georgia—Information management strategies for exotic invasive species.
- 8:50 8 **Weltzin, Jake.** University of Tennessee, Knoxville—Biological invasions in a greenhouse world.
- 9:10 9 **Huebner, Cynthia.** USFS Northeast Research Station and Mid-Atlantic EPPC—Predicting plant invasions in forested systems of West Virginia.
- 9:30 10 **Randall, Johnny.** North Carolina Botanical Garden, Chapel Hill—Competition for reproduction between native and alien plants.
- 9:50 **Break**
- 10:00 **Round Table discussion**
- The role of science in taking an active position on making invasive plant research a priority - led by Jack Ranney, SAMAB invasive species leader and Vice-President Tennessee Exotic Pest Plant Council with the invited speakers and audience participation.
- 10:45 **Closing**
- How awareness affects research and education: the next 10 years - Pat Parr and Jack Ranney.

## THURSDAY MORNING PAPER SESSIONS

### Genetics

Fogelman Executive Center, Room 219

**Presiding: Gary Voelker,** University of Memphis

- 8:00 11 **Seymer, Jennifer and Dwayne Wise.** Mississippi State University—Characterization of bivalent stretching in living spermatocytes of the cockroach, *Periplaneta Americana*.
- 8:15 12 **Hudson, Beth and Kenneth Shull.** Appalachian State University—Meiotic chromosome pairing in an interspecific hybrid.
- 8:30 13 **Shull, Kenneth and Beth Hudson.** Appalachian State University—Banding of meiotic chromosomes in plants.
- 8:45 14 **Billington, Neil<sup>1</sup>, Rachael Koigi<sup>1</sup>, Brian Graeb<sup>2</sup>, and David Willis<sup>2</sup>.** <sup>1</sup>Troy State University and <sup>2</sup>South Dakota State University—Hybridization and introgression between walleye and sauger in

three main-stem Missouri River reservoirs in South Dakota determined by protein electrophoresis.

- 9:00 15 **Lynch, Jennifer<sup>1</sup>, Neil Billington<sup>1</sup>, and John Pitlo<sup>2</sup>.** <sup>1</sup>Troy State University and <sup>2</sup>Iowa Department of Natural Resources—Hybridization and introgression between sauger and walleye from Pool 13 of the Mississippi River.
- 9:15 16 **Smith, Kimberly.** Howard University—Mycelial studies on DNA relatedness between wild type *Neurospora dodgei* and a spontaneous mutant.
- 9:30 17 **Sucaet, Yves and Christi Magrath.** Troy State University—ARS containing intergenic regions have a higher incidence of transcription termination sequences as compared to the rest of the Intergenic space in *Saccharomyces cerevisiae*.
- 9:45 **Break**
- 10:15 18 **Stockdale, Heather, Kenneth Shull, and Michael Windelspecht.** Appalachian State University—A quantitative analysis of mating and courtship behavior of *Drosophila melanogaster*.
- 10:30 19 **Namenye, Kristin and David Crowley.** Mercer University—Complementation of a bacterial repair mutant with a haloarchaeal gene.
- 10:45 20 **Outlaw, Diana and Gary Voelker.** The University of Memphis—Exploring the evolution of migration in the avian family Motacillidae.
- 11:00 21 **Large, Danielle<sup>1</sup>, Suzanne Davis<sup>2</sup>, Jim Fortney<sup>2</sup>, and Laura Gibson<sup>3</sup>.** <sup>1</sup>Alderson-Broadus College and the WV-BRIN, <sup>2</sup>West Virginia University, and <sup>3</sup>West Virginia University School of Medicine—Effects of chemotherapy on matrix metalloproteinase expression in leukemia
- 11:15 22 **Wise, Ashley<sup>1</sup> and Suleiman Bahouth<sup>2</sup>.** <sup>1</sup>Christian Brothers University and <sup>2</sup>University of Tennessee, Memphis—Characterization of MAPK activation by the human  $\alpha_1$ -adrenergic receptor.
- 11:30 23 **Moore, Shawn and Gehard Kalmus.** East Carolina University; Dept. of Biology—The possible anti-inflammatory effects of *Cassia occidentalis* shown by the inhibition of histamine release from MC/9 mast cells.
- 11:45 24 **Freeman, Jennifer<sup>1</sup>, Shaila Kotadia<sup>2</sup>, and A. Lane Rayburn<sup>1</sup>.** <sup>1</sup>University of Illinois at Urbana-Champaign and <sup>2</sup>University of

Texas Southwestern Medical Center—Comparing the cytotoxicity and cell cycle effects of common food additives to agrochemicals contaminating potable water.

**Plant Biology**  
**Fogelman Executive Center, Room 308**

**Presiding: To be arranged**

- 8:00 25 **Gibson, Phil<sup>1</sup>, Amelia Tomlinson<sup>2</sup>, and Cayenne Engel<sup>3</sup>.** <sup>1</sup>Agnes Scott College, <sup>2</sup>Indiana University, and <sup>3</sup>University of Tennessee, Knoxville—Pericarp characteristics and the expression of heterocarpy in *Grindelia ciliata* (Asteraceae).
- 8:15 26 **McMullen, Conley and Alejandro Stella.** James Madison University—Pollen-ovule ratio and pollen size of selected Galápagos Islands endemics.
- 8:30 27 **Lee, Melissa, Karla Gage, and Sam Pierce.** The University of Memphis—Analyses of patterns of resource distribution in plants using projected surface areas of leaf and root.
- 8:45 28 **Crum, M.L., J.J. Zaczek, J.A. Preece, and S.G. Baer.** Southern Illinois University, Carbondale—Genetic and environmental influences on sap sugar concentration of silver maple (*Acer saccharinum*).
- 9:00 29 **Atwood, Aaron, John E. Preece, and James Zaczek.** Southern Illinois University, Carbondale—Positional effects on forced shoot production and rooting of shoots from northern red oak and cherrybark oak boles and branches.
- 9:15 30 **Durham, T. Justun and S.K. Ballal.** Tennessee Technological University—Electrophoretic and western blot investigation of rubisco, alkaline phosphatase, and lactate dehydrogenase isozymes in three genera of Lemnaceae.
- 9:30 31 **Hamissou, Mijitaba.** Jacksonville State University—Roles of three inducer signals of osmolyte synthesis in five taxonomic groups of plants.
- 9:45 **Break**
- 10:15 32 **Foster, Kari<sup>1</sup>, Sedonia Sipes<sup>1</sup>, and Beth Middleton<sup>2</sup>.** <sup>1</sup>Southern Illinois University and <sup>2</sup>National Wetlands Research Center, Carbondale—Effects of heating and scarification on germination of the rare species *Trifolium reflexum*.
- 10:30 33 **Biernacki, Maciej<sup>1</sup> and Jon Lovett-Doust<sup>2</sup>.** <sup>1</sup>University of Memphis and <sup>2</sup>University of Windsor, Ontario, Canada—Effects of

- heat accumulation on phenology of watermelon, *Citrullus lanatus* (Cucurbitaceae).
- 10:45 34 **Pierce, Samuel, Melissa Lee, and Karla Gage.** The University of Memphis—Interactive effect of light and temperature on plant phenology.
- 11:00 35 **Hawkins, Tracy, Carol Baskin, and Jerry Baskin.** University of Kentucky—Dormancy-breaking and germination requirements for seeds of three eastern deciduous forest *Sanicula* species.
- 11:15 36 **Cirtain, Margaret<sup>1</sup>, John Preece<sup>2</sup>, and Scott Franklin<sup>1</sup>.** <sup>1</sup>The University of Memphis and <sup>2</sup>Southern Illinois University, Carbondale—Restoration of *Arundinaria gigantea* (Walt.) Walt Ex Muhl. canebrakes using micropropagation.
- 11:30 37 **Hudson, Sharon and Margaret Cirtain.** University of Memphis—Reintroduction of native bamboo through vegetative culm propagation.
- 11:45 38 **Caldwell, Laura and Scott Franklin.** The University of Memphis — Restoration of *Arundinaria gigantea* canebrake Strawberry Plains Audubon Center, Marshall County, Mississippi Dahomey National Wildlife Refuge, Bolivar County, Mississippi.

**Plant Systematics**  
**Fogelman Executive Center, Room 315**

**Presiding: Zack Murrell, Appalachian State University**

- 8:00 39 **Estes, Dwayne<sup>1</sup> and Chris Fleming<sup>2</sup>.** <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Breedlove, Dennis, Young & Associates, Inc.—*Clematis morefieldii* Kral (Ranunculaceae), a federally endangered species, discovered in Tennessee.
- 8:15 40 **Eakin, David A.** Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475—SEM confirmation of species-specific characteristics in the moss genus *egmatodon* (Regmatodontaceae).
- 8:30 41 **Small, Randall<sup>1</sup>, Edgar Lickey<sup>1</sup>, Joey Shaw<sup>1</sup>, and Warren Hauk<sup>2</sup>.** <sup>1</sup>University of Tennessee and <sup>2</sup>Denison University—Amplification of non-coding chloroplast DNA for phylogenetic studies in Pteridophytes and Lycophytes.
- 8:45 42 **Lickey, Edgar<sup>1</sup>, Randall Small<sup>1</sup>, and Sydney Bacchus<sup>2</sup>.** <sup>1</sup>University of Tennessee and <sup>2</sup>University of Georgia—Genetic variation in non-coding chloroplast and nuclear DNA regions in *Taxodium* (Cupressaceae).

- 9:00 43 **Beck, John and Randall Small.** University of Tennessee, Knoxville—Preliminary investigation of *Sida* and related genera (Malvaceae) based on analysis of chloroplast DNA rpL16 intron sequences.
- 9:15 44 **Siripun, Kunsiri Chaw and Edward Schilling.** University of Tennessee, Knoxville—Comparative analysis of phylogenetic relationships of *Eupatorium* diploid and polyploidy populations using molecular approaches.
- 9:30 45 **Goodwillie, Carol, Kerry Partis, Jennifer Ness, Jonathan Kornegay, and Mary Catherine Knight.** East Carolina University—The distribution and genetic basis of variation in self-incompatibility in *Leptosiphon jepsonii* (Polemoniaceae).
- 9:45 **Break**
- 10:15 46 **Roberts, Roland P.** Department of Biological Sciences, Towson University, Towson, MD—The systematics of *Chrysothamnus* and related genera: A model for the evolution of desert flora?
- 10:30 47 **Haefner, Kerry D.<sup>1</sup> and Rebecca D. Bray<sup>2</sup>.** <sup>1</sup>University of Louisiana at Monroe and <sup>2</sup>Old Dominion University—Morphological evidence for introgressive speciation in *Isoetes*: Support for the Matthews and Murdy hypothesis.
- 10:45 48 **Mellichamp, Larry.** University of North Carolina at Charlotte—How do pitcher plants (*Sarracenia*; Sarraceniaceae) keep from eating their pollinators?
- 11:00 49 **Knapp, Wesley M.** Delaware State University—Taxonomic status of *Juncus longil*, a putative taxon within the *Juncos marginatus* complex (Juncaceae sect. Graminifolii).
- 11:15 50 **Twyman, Walter Dan and T. Wayne Barger.** Tennessee Technological University—History and technology collide: The electronic databasing of the Paul L. Hollister Herbarium at Tennessee Technological University.
- 11:30 51 **Farmer, Susan B.** University of Tennessee, Knoxville, TN 37996-1100 – Phylogeographic survey of Trilliaceae.
- 11:45 52 **Gillespie, Emily L., Zack E. Murrell, and Gary L. Walker.** Appalachian State University – Phylogeography of *Carex eburnea* and the systematics of *Carex* Section *Albae*.
- 12:00 53 **Jones, Ronald L.** Department of Biological Sciences, Eastern Kentucky University, Richmond, KY – A reclassification and reassessment of the vascular flora of Kentucky.

## THURSDAY AFTERNOON SYMPOSIUM

### Women in Science Fogelman Executive Center, Room 215

**Presiding:** Irene Kokkala, North Georgia College & State University

Parr, Pat.

Swab, Janice.

Twitty, Geraldine.

## THURSDAY AFTERNOON PAPER SESSIONS

### Animal Ecology Fogelman Executive Center, Room 219

**Presiding:** Michael Kennedy, University of Memphis

- 1:30 54 **Keaton, Molly<sup>1</sup>, Julio Bonillo<sup>2</sup>, Dennis Haney<sup>1</sup>, and C. Brannon Anderson<sup>1</sup>.** <sup>1</sup>Furman University and <sup>2</sup>Universidad Metropolitano – Impact of drought upon fish assemblages in two South Carolina piedmont streams.
- 1:45 55 **Rotman, Robin<sup>1</sup>, Dennis Haney<sup>2</sup>, and Greg Lewis<sup>2</sup>.** <sup>1</sup>University of the South and <sup>2</sup>Furman University – Relationships between stream and watershed characteristics and fish abundance and diversity in the Little River basin, South Carolina.
- 2:00 56 **Adams, Keenan and Travis Perry.** Furman University – Stream chemistry and growth rates in the bluehead chub (*Nocomis leptocephalus*) in Greenville County, South Carolina.
- 2:15 57 **Greenberg, Cathryn<sup>1</sup> and Stanlee Miller<sup>2</sup>.** <sup>1</sup>US Forest Service, Southern Research Station and <sup>2</sup>Clemson Bob and Betsy Campbell Museum Natural History – Soricid response to canopy gaps created by wind disturbance in the southern Appalachians.
- 2:30 58 **Wells, Carrie N. and Ray S. Williams.** Appalachian State University – The effects of habitat corridors on the genetic structure of an open habitat butterfly, *Precis coenia*.
- 2:45 59 **Millwood, Mary and Roger Sauterer.** Jacksonville State University – Effects of water and sediment extracts near the Anniston, AL Monsanto site on developing frog embryos by the FETAX assay and immunoblotting for CYP 1A.
- 3:00 **Break**

- 3:15 60 **Knight, Mike.** The University of Memphis – Do higher order effects govern the outcomes of biological invasions? An examination of the interactions of larval Cuban treefrogs and native frogs in Florida.
- 3:30 61 **Jennings, Jason B.<sup>1</sup>, Michael L. Kennedy<sup>1</sup>, and Allan E. Houston<sup>2</sup>.** <sup>1</sup>Department of Biology, The University of Memphis, Memphis, TN 38152 and <sup>2</sup>Ames Plantation, Grand Junction, TN 38039 – Predation on artificial nests of northern bobwhites at varying distances from habitat edge.
- 3:45 62 **Lesak, Adrian<sup>1</sup>, Wang Yong<sup>1</sup>, and Callie Jo Schweitzer<sup>2</sup>.** <sup>1</sup>Alabama A&M University and <sup>2</sup>Southern Research Station, USDA Forest Service – Initial response of small ground-nesting birds to five levels of overstory retention.
- 4:00 63 **Edge, Justin and Christopher Mowry.** Berry College – An ecological study of eastern coyotes (*Canis latrans*) in northwest Georgia.
- 4:15 64 **Ayoub, Nadia.** University of Tennessee, Knoxville – Effects of geography versus habitat on genetic structure of a desert spider, *Agelenopsis aperta*.
- 4:30 65 **Myhalyk, Tracy and Ray Williams.** Appalachian State University – The effects of fire on ground beetle assemblages and herbivory of *Kalmia latifolia* in the Linville Gorge Wilderness Area.
- 4:45 66 **Cline, George, Taba Hamissou, Mark Meade, James Rayburn, and Frank A. Romano III.** Jacksonville State University – Preliminary notes on the biology of the freshwater jellyfish (*Craspedacusta sowerbii*) in northeastern Alabama.

**Herpetology – Behavior and Conservation  
Fogelman Executive Center, Room 123**

**Presiding: Mizuki Takahashi, University of Memphis**

- 1:30 67 **Akin, Jonathan.** Northwestern State University – Fighting and assessment in male ground skinks.
- 1:45 68 **Andrews, Kimberly.** SREL/University of Georgia – How does the snake cross the road? - An interspecific comparison of snake behavior.
- 2:00 69 **Cobb, Vincent A., Timothy Worrall, J. Jeffery Green, Jake Pruett, and Brad Glorioso.** Department of Biology, Middle Tennessee State University, Murfreesboro, TN – Initial den location behavior in a litter of timber rattlesnakes.



- 2:15 70 **Moreau, Kenneth and Jonathan Akin.** Northwestern State University – Agonistic behavior and tail loss status in male ground skinks.
- 2:30 71 **Carr, Meghan and Ben Forrest.** Memphis Zoo – Microhabitat use of Pan's box turtles (*Cuora pani*).
- 2:45 72 **Cline, George, Robert Carter, and Jason Adams.** Jacksonville State University – Analysis of calling frog communities in northeastern Alabama.
- 3:00 **Break**
- 3:30 73 **Gibbons, Whit.** SREL – University of Georgia – How productive can an isolated wetland be?
- 3:45 74 **Holmes, Sherry and Ken Marion.** University of Alabama at Birmingham – The status of the populations of the flattened musk turtle (*Sternotherus depressus*) in Bankhead National Forest and Smith Lake, Alabama, and the possible effects of stream conditions on trapping success.
- 4:00 75 **Makowsky, Robert<sup>1</sup>, Thomas Pauley<sup>1</sup>, and Lawrence Wilson<sup>2</sup>.** <sup>1</sup>Marshall University and <sup>2</sup>Fernbank Science Center – Sexual dimorphism in the eastern hellbender, *Cryptobranchus a. alleganiensis*.
- 4:15 76 **Osbourn, Michael S. and Thomas K. Pauley.** Department of Biological Sciences, Marshall University, Huntington, West Virginia -- Phenotypic variation among cave-dwelling spring salamanders, *Gyrinophilus* spp. Cope (Plethodontidae), in West Virginia, Virginia, and Tennessee.
- 4:30 77 **Osbourn, Michael S. and Thomas K. Pauley.** Department of Biological Sciences, Marshall University, Huntington, West Virginia -- The natural history of cave-dwelling spring salamanders, *Gyrinophilus* spp. Cope (Plethodontidae), in West Virginia.
- 4:45 78 **Phu, Linh D.<sup>1</sup>, Michael S. Osbourn<sup>1</sup>, Jeff Bailey<sup>2</sup>, and Thomas K. Pauley<sup>1</sup>.** <sup>1</sup>Department of Biology, Marshall University and <sup>2</sup>West Virginia Division of Environmental Protection – The use of streamside salamanders as indicators of headwater stream health in West Virginia.

**Plant Ecology – Populations  
Fogelman Executive Center, Room 136**

**Presiding: Maciej Biernacki, University of Memphis**

- 1:30 79 **McEwan, Ryan and Brian McCarthy.** Ohio University – Tree-ring analysis of the largest remaining stand of American chestnut (*Castanea dentata* [Marsh.] Borkh.), West Salem, Wisconsin.
- 1:45 80 **White, David<sup>1</sup> and Joan Walker<sup>2</sup>.** <sup>1</sup>USDA FS Southern Research Station and <sup>2</sup>USDA Forest Service – A monitoring plan to detect change in abundance of ramps (*Allium tricoccum* Ait.) in the upper Nantahala River watershed.
- 2:00 81 **Silletti, Andrea, Joan Walker, and David White.** USDA Forest Service, Southern Research Station – Abundance of Ramps (*Allium tricoccum* Ait.) in the Southern Appalachians: variability in time and space.
- 2:15 82 **Hull, James, Elizabeth Slavik, and Kenneth Letendre.** Towson University – Pollination ecology in populations of differing size of *Gentianopsis crinita* at Soldiers Delight, Maryland.
- 2:30 83 **Wang, Wei<sup>1</sup>, Scott Franklin<sup>1</sup>, and John Ouellette<sup>2</sup>.** <sup>1</sup>Department of Biology, University of Memphis and <sup>2</sup>Memphis Zoo – Regeneration of Songhua bamboo (*Fargesia qinlingensis*) following herbivory by giant pandas.
- 2:45 84 **Albrecht, Matthew and Brian McCarthy.** Ohio University – The population biology and life history of black cohosh (*Actaea racemosa* L.; Ranunculaceae), an economically important eastern woodland herb.
- 3:00 **Break**
- 3:30 85 **Farrah, Katherine<sup>1</sup>, Joan Walker<sup>2</sup>, Timothy Spira<sup>1</sup>, and James Rieck<sup>1</sup>.** <sup>1</sup>Clemson University and <sup>2</sup>U.S. Forest Service – Breeding system and timing of inbreeding depression in the rare plant *Shortia galacifolia*.
- 3:45 86 **Johnson, Sarah E., Claudia L. Jolls, and Cass A. Wigent.** East Carolina University – Success of the federally threatened seabeach amaranth (*Amaranthus pumilus*, Raf.) at two elevations.
- 4:00 87 **Matthews, Charlotte, G. Lewis, and T. Perry.** Furman University – Inter and intra specific competition in the bunched arrowhead (*Sagittaria fasciculata*): the role of native and invasive species.
- 4:15 88 **Euliss, Amy, Melany Fisk, Coleman McCleneghan, and Howard Neufeld.** Appalachian State University – Growth, reproduction, and mycorrhizal associations of *Houstonia montana* in varying environments.
- 4:30 89 **Hughes, Nicole M. and Howard S. Neufeld.** Appalachian State University – Biochemical and ecophysiological functions of

anthocyanins in leaves of the evergreen herb *Galax urceolata* (or, why *Galax* turns red in the winter).

**Plant Ecology – Toxicity**  
**Fogelman Executive Center, Room 308**

**Presiding: Dean Cocking, James Madison University**

- 3:30 90 **Neufeld, Howard<sup>1</sup>, Alan Davison<sup>2</sup>, Arthur Chappelka<sup>3</sup>, Kent Burkey<sup>4</sup>, and Peter Finkelstein<sup>5</sup>.** Appalachian State University, <sup>2</sup>Department of Biological Sciences, University of Newcastle, <sup>3</sup>School of Forestry and Wildlife, Auburn University, <sup>4</sup>USDA-ARS Air Quality Research Unit Plant Science, and <sup>5</sup>Atmospheric Modeling Division-NOAA at USEPA, Research Unit – Foliar injury caused by exposure to ozone reduces the absorbance of light in leaves of cutleaf coneflower (*Rudbeckia laciniata* var. *digitata*).
- 3:45 91 **Peoples, Seth<sup>1</sup>, Howard Neufeld<sup>1</sup>, Peter Finkelstein<sup>2</sup>, Alan Davison<sup>3</sup>, Arthur Chappelka<sup>4</sup>, and Kent Burkey<sup>5</sup>.** Appalachian State University, <sup>2</sup>Atmospheric Modeling Division-NOAA at USEPA, Research Unit, <sup>3</sup>School of Biological Sciences, University of Newcastle, <sup>4</sup>School of Forestry and Wildlife, Auburn University, and <sup>5</sup>USDA-ARS Air Quality Research Unit, Raleigh, NC – Seasonal development of stand structure for cutleaf coneflower (*Rudbeckia laciniata*) at two sites in Great Smoky Mountains National Park: Influences on ozone uptake.
- 4:00 92 **Cocking, Dean, Amir Allak, Jennifer Loder, and Wendy Pendleton.** Department of Biology, James Madison University, Harrisonburg, VA 22807 – Vegetation as a collecting surface for atmospheric mercury deposition and a potential entry point for herbivore and detritivore bioaccumulation.
- 4:15 93 **Chilton, Rachael and David Orvos.** Sweet Briar College – Bioaccumulation of mercury in lichen (*Hypogymnia physodes*) near a coal-fired power plant.
- 4:30 94 **Judah, Leann and Sigurdur Greipsson.** Troy State University – Metal contamination of soils and plants at three polluted sites in southeast Alabama.

**Teaching Biology**  
**Fogelman Executive Center, Room 315**

**Presiding: Martha Brown, University of Memphis**

- 1:30 95 **Brooks, Carroll.** Brevard College – Employing DNA sequence analysis software in the undergraduate biotechnology laboratory.

- 1:45 96 **Davidson, Paul and Paul Kittle.** University of North Alabama – A micro-aquarium for the culture and examination of aquatic life.
- 2:00 97 **Sauterer, Roger.** Jacksonville State University–Investigating the role of calcium ions in sea urchin fertilization: A laboratory exercise.
- 2:15 98 **Goodwillie, Carol, Lisa Clough, and David Knowles.** East Carolina University – Investigative ecology: Long-term field experiments for undergraduates.
- 2:30 99 **Ferzli, Miriam, Michael Carter, Eric Wiebe, and Trina Allen.** North Carolina State University – Using the laboratory report to promote scientific thinking and learning in college biology students.
- 2:45 100 **Eakin, Dave<sup>1</sup>, Ruth Beattie<sup>2</sup> and Kelli Harris<sup>1</sup>.** <sup>1</sup>Eastern Kentucky University and <sup>2</sup>University of Kentucky – An assessment of the role of multimedia in enhancing student learning.
- 3:00 **Break**
- 3:30 101 **Aliff, John V.** Georgia Perimeter College – Comparing student satisfaction with group and individual case studies in anatomy and physiology.
- 3:45 102 **Eakin, David A.** Department of Biological Sciences, Eastern Kentucky University – Development of an honors science seminar around a single essential topic – Water: The matrix of life.
- 4:00 103 **Brooks, Janie.** Brevard College – Evolution versus faith? Techniques for teaching evolutionary biology at a church-affiliated liberal arts institution.

**THURSDAY AFTERNOON POSTER SESSION  
HOLIDAY INN GRAND BALLROOM**

**Poster Setup: 6:30-8:30 a.m.  
Posters Displayed: 8:00 am – 6:30 pm  
Presenters with Posters: 4:30 – 6:00 pm  
Dismantle poster by 6:30 pm**

**Animal Behavior and Physiology**

- P1 **Maxwell, Cherie<sup>1</sup>, Frank Romano<sup>1</sup>, and Terry Richardson<sup>2</sup>.** <sup>1</sup>Jacksonville State University and <sup>2</sup>University of North Alabama – A behavioral study of *Viviparous georgianus*.

- P2 **Herr, Jared, Arthur Strunk, and Darwin Jorgensen.** Roanoke College – The relationship between respiratory pump function and the gill circulation in the American lobster, *Homarus americanus*.
- P3 **Parsons, Joy<sup>1,3</sup>, Aaron Erdely<sup>2</sup>, Cheryl Smith<sup>2</sup>, Lennie Samsell<sup>2</sup>, Kevin Engels<sup>2</sup>, You-Lin Tain<sup>2</sup>, Jonathon Christy<sup>2</sup>, Alex Canfield<sup>2</sup>, and Chris Baylis<sup>2,3</sup>.** <sup>1</sup>Alderson-Broadus College, <sup>2</sup>West Virginia University, Department of Physiology and Pharmacology, Robert C. Byrd HSC, and <sup>3</sup>The West Virginia Biomedical Research Infrastructure Network – Do high levels of aldosterone trigger kidney fibrosis.
- P4 **Winne, Christopher, Luke Fedewa, and William Hopkins.** Savannah River Ecology Lab – Quantitative genetics of thermal sensitivity in swimming performance of neonate black swamp snakes, *Seminatrix pygaea*.

### Animal Ecology

- P5 **LaMountain, Heidi L. and Michael L. Kennedy.** The University of Memphis, Memphis, TN 38152 – Measures of biodiversity of small mammals in three habitat types in western Tennessee.
- P6 **Johnson, Philip L.<sup>1</sup>, Michael L. Kennedy<sup>1</sup>, and Steve W. Stephenson<sup>2</sup>.** <sup>1</sup>The University of Memphis, Memphis, TN 38158 and <sup>2</sup>Milan Army Ammunition Plant, Milan, TN 38358 – An assessment of population density of white-tailed deer (*Odocoileus virginianus*) in western Tennessee.
- P7 **Akins, James D.<sup>1</sup>, Brian D. Carver<sup>2</sup>, and Michael L. Kennedy<sup>1</sup>.** <sup>1</sup>Department of Biology, The University of Memphis, Memphis, TN 38152 and <sup>2</sup>Department of Biology, Freed-Hardeman University, Henderson, TN 38340 – An examination of species richness in mammals using scent-station methodology in three habitats.
- P8 **Bainbridge, Ben and Travis Perry.** Furman University – Effects of mowing and vegetation type in a small mammal community in an old-field habitat in the piedmont of South Carolina.
- P9 **Silvano, Amy L.<sup>1</sup>, Kevin K. Kleiner<sup>1</sup>, Benton Taylor<sup>1</sup>, Elise R Irwin<sup>2</sup>, Mark D. MacKenzie<sup>3</sup>, Michael S. Mitchell<sup>2</sup>, and James B. Grand<sup>2</sup>.** <sup>1</sup>Auburn University, Alabama Cooperative Fish & Wildlife Research Unit; <sup>2</sup>USGS, Alabama Cooperative Fish & Wildlife Research Unit; <sup>3</sup>Auburn University, School of Forestry & Wildlife Sciences – ALABAMA GAP ANALYSIS PROJECT: Managing Biological Diversity with Geographic Information Systems.
- P10 **Fitzpatrick, Matt.** University of Montana – Use of a modified habitat suitability index model to quantify Columbian sharp-tailed grouse habitats in the Upper Blackfoot Valley, Montana.

- P11 **Ferguson, Heather<sup>1</sup>, Diane Neudorf<sup>2</sup>, and William Lutterschmidt<sup>2</sup>.** <sup>1</sup>Shorter College and <sup>2</sup>Sam Houston State University – Influence of habitat on nest-box microclimate and nest success of Carolina wrens (*Thryothorus ludovicianus*).
- P12 **Mills, Edward and Janet Mulligan.** Wingate University – Habitat factors influencing beaver (*Castor canadensis*) lodge-site selection in the southern Piedmont of North Carolina.

### Developmental Biology

- P13 **McLaren, Daniel, Mark Meade, and Benjie Blair.** Jacksonville State University – SEM examination of the larval stages of *Macrobrachium rosenbergii*.
- P14 **Moser, Bernice and James Rayburn.** Jacksonville State University – Evaluation of developmental toxicity of interaction between caffeine and pseudoephedrine using frog embryo teratogenesis assay-Xenopus (Fetax).
- P15 **Cook, Leslie, Christopher Paradise, and Barbara Lom.** Davidson College – Malathion causes earlier hatching and stunted growth in developing zebrafish, *Brachydanio rerio*.

### Genetics

- P16 **Koigi, Rachael<sup>1</sup>, Neil Billington<sup>1</sup>, and William Gardner<sup>2</sup>.** <sup>1</sup>Troy State University and <sup>2</sup>Montana Department of Fish, Wildlife, and Parks – Genetic variation, hybridization and introgression in Montana sauger populations.
- P17 **Segalas, Chenein, Mark Meade, and Frank Romano.** Jacksonville State University – Isozyme variation among Gulf of Mexico goatfish.
- P18 **Bellyeu, Heath, Blake Amos, Robin Gorman, Robert Carter, and Mark Meade.** Department of Biology, Jacksonville State University, Jacksonville AL – Genetic variation between coastal and montane longleaf pine, *Pinus palustris*, populations.
- P19 **Tatum, Tatiana C., R. B. McClosky, Patrick J. Tranel, and A. Lane Rayburn.** University of Illinois at Urbana-Champaign – In vitro root propagation for chromosome analysis in *Amaranthus*.
- P20 **McNally, Lacey R., William G. Henk, and Richard K. Cooper.** Louisiana State University – Laser pressure catapult microdissection and DNA amplification from single Japanese quail, *Coturnix coturnix*, chromosomes.

- P21 **Musa, Hussein B., Jennifer L. Freeman, and A. Lane Rayburn.** University of Illinois at Urbana-Champaign – Comparison of nuclei isolated from various organisms for use as internal standards for observing DNA content variation in plants.
- P22 **Trinachartyant, Wachareeporn, Betta Francis, and A. Lane Rayburn.** University of Illinois at Urbana-Champaign – Alteration of chemotherapeutic-induced DNA damage by a common health food supplement.
- P23 **Thompson, Krystal<sup>1</sup>, Sydha Salihas<sup>2</sup>, Stacey Sylvester<sup>2</sup>, and Nilay Mukherjee<sup>2</sup>.** <sup>1</sup>Alderson Broaddus College and <sup>2</sup> Department of Orthopedics, West Virginia University – TGF- $\beta$  expression in ATDC5 cell line.
- P24 **Houston, Jessica, Mary Connell, and Joanne Holden.** Appalachian State University – The *psaB* gene from the marine brown algal *Scytosiphon lomentaria*.
- P25 **Romer, Carrie<sup>1</sup>, Daniel Dorset<sup>1</sup>, Christopher Meyer<sup>1</sup>, Michael Thompson<sup>2</sup>, and Rebecca Seipelt.** <sup>1</sup>Middle Tennessee State University and <sup>2</sup>Vanderbilt University – Cloning and characterization of yeast leukotriene A4 hydrolase.
- P26 **McClanahan, Ana M. and John Stiller.** Biology Department, East Carolina University – Environmental PCR targets algal components using new phytoplankton-specific primers.
- P27 **Fay, Lauren, Darlene Loprete, and Terry Hill.** Rhodes College – Generation and characterization of a calcofluor hypersensitive mutant of *Aspergillus nidulans* showing a hyperbranched growth morphology.
- P28 **Chen, Yi.** Alderson-Broaddus College – Inhibition of hypoxia-inducible factor 1a and vascular endothelial growth factor by anti-cancer drugs in human ovary carcinoma cells.
- P29 **Caceres, Cynthia<sup>1</sup>, Kim Ries<sup>1</sup>, Claudio Toledo<sup>2</sup>, Raquel Pires<sup>2</sup>, Malinda Fitzgerald<sup>1</sup>, and Anton Reiner<sup>3</sup>.** <sup>1</sup>Christian Brothers University, <sup>2</sup>Lab Neuroscience University of Sao Paulo, Brazil, and <sup>3</sup>University of Tennessee, Memphis – Distribution of AMPA-type glutamate receptor subunits in oculomotor and facial motor nuclei in rat and chicken brain.
- P30 **Musa, Shamsideen O. and A. Lane Rayburn.** University of Illinois at Urbana-Champaign – Health supplements and chemotherapy agents: A helpful or harmful combination.

### Herpetology

- P31 **Hill, Pierson, Bill Johnson, and Michael Dorcas.** Davidson College – Utilization of edge habitat by black rat snakes (*Elaphe obsoleta*).
- P32 **Dozeman, Vanessa and Thomas K. Pauley.** Department of Biological Sciences, Marshall University, Huntington, West Virginia – Use of an artificial pond by amphibians and reptiles in West Virginia.
- P33 **Sutton, William B. and Thomas K. Pauley.** Department of Biological Sciences, Marshall University, Huntington, WV – Analysis of anuran community level interactions at Greenbottom Swamp in Cabell County, WV.
- P34 **Barclay, Matt and Jonathan Akin.** Northwestern State University – Comparing population density estimation techniques for the ground skink lizard.
- P35 **Thawley, Chris, Bill Johnson, and Michael E. Dorcas.** Davidson College – Effects of seasonal, meteorological, and directional variables on amphibian capture in terrestrial drift fences.
- P36 **Kaylor, Doug and Ricky Fiorillo.** Shorter College – Diet of *Eurycea cirrigera* larvae in a woodland stream.
- P37 **Dietrich, Dan, Michael Windelspecht, and Wayne Van Devender.** Appalachian State University – Effect of sedimentation on larval salamanders in small streams in the southern Appalachian Mountains.
- P38 **Campbell, Selena and Ricky Fiorillo.** Shorter College – Effects of predation risk on activity and substrate choice of *Eurycea cirrigera* larvae.
- P39 **Phu, Linh D. and Thomas K. Pauley.** Department of Biology, Marshall University – Effectiveness of turtle trapping techniques in West Virginia.
- P40 **Delecki, David, Anissa Delecki, and George Cline.** Jacksonville State University – Patterns in carapace shape among multiple turtle species.
- P41 **Delecki, Anissa, George Cline, James Rayburn and David Delecki.** Jacksonville State University – Distribution of hellbenders (*Cryptobranchus alleganiensis*) in Alabama.
- P42 **Makowsky, Robert, Zachary Loughman, and Thomas Pauley.** Marshall University – Amphibian and reptile surveys in the Gauley River National Recreation area in West Virginia.
- P43 **Pauley, Thomas<sup>1</sup>, Robert Makowsky<sup>1</sup>, Seth Myers<sup>2</sup>, Ariana Breisch<sup>1</sup>, and Cynthia Lucas<sup>1</sup>.** <sup>1</sup>Marshall University and <sup>2</sup>State University of New



York, Syracuse – Status of the West Virginia state collection of amphibians and reptiles.

- P44 **Belk, Melanie K.<sup>1</sup>, Scott A. Sapoznick<sup>2</sup>, Jennifer L. Davis<sup>2</sup>, Lesley E. Hanson<sup>1</sup>, Erik D. Lindquist<sup>2,3</sup>, and David Bruce Conn<sup>1</sup>.** <sup>1</sup>Berry College, <sup>2</sup>Lee University, and <sup>3</sup>Messiah College – Collaborative herpetological surveying as an experiential pedagogical tool.

### Invertebrate Zoology

- P45 **Cozzie, Linsey R., Christina L. Saracina, and C. Brian Odom.** Wingate University – Geographic distribution of RAPD-genetic markers among colonies of the red imported fire ant, *Solenopsis invicta* (Buren) in Union County, North Carolina.
- P46 **Scocco, Erika A., Adrienne L. Bogusz, and C. Brian Odom.** Wingate University – Diversity of RAPD-genetic markers within a colony of the red imported fire ant, *Solenopsis invicta* (Buren) in Union County, North Carolina.
- P47 **Graham, Matthew<sup>1</sup>, Rolando Teruel<sup>2</sup>, and Victor Fet<sup>1</sup>.** <sup>1</sup>Marshall University and <sup>2</sup>Museo de Historia Natural "Tomas Romay" - Mitochondrial DNA data on phylogeny of Centruroides (Scorpiones: Buthidae) from the Caribbean and North America.
- P48 **Osborn, Rae.** Northwestern State University – Distribution and ecology of potential mosquito vectors of West Nile Virus.
- P49 **Parent, Katie, Victor Townsend, Jr. and Daniel Margolies.** Virginia Wesleyan College – Ecology of harvestmen associated with beehives.
- P50 **Sudbrink, Donald<sup>1</sup>, Aubrey Harris<sup>2</sup>, and Patrick English<sup>2</sup>.** <sup>1</sup>Delta State University and <sup>2</sup>Mississippi State University – Remote sensing of host plants of tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvoir), (Hemiptera: Miridae).
- P51 **Lowery, Adam, Ben Colvin, and Michael Land.** Northwestern State University – Black soldier fly (*Hermetia illucens*) bioconversion of poultry viscera and poultry carcasses.

### Microbiology

- P52 **Michelin, Ruel<sup>1</sup>, Lafayette Frederick<sup>2</sup>, Lunique Estimate<sup>1</sup>, Ellis Benjamin<sup>1\*</sup>, Jacob Adeyeye<sup>3</sup>, and Arthur Williams<sup>1</sup>.** <sup>1</sup>Department of Biology, Morgan State University, Baltimore, MD 21251, <sup>1\*</sup>Department of Chemistry, Morgan State University, Baltimore, MD 21251 <sup>2</sup>Department of Biology, Howard University, Washington, DC 20056, and <sup>3</sup>Department of Natural Sciences, Coppin State College, Baltimore, MD 21256 –

Purification and partial characterization of an antifungal metabolite from an unidentified *Bacillus* sp.

- P53 **Oller, Anna.** Central Missouri State University – Fungal molecular techniques: A useful tool in forensic science and human disease.
- P54 **Stevens, Stanley E. and Augustus Mealor.** Department of Microbiology and Molecular Cell Sciences, The University of Memphis, Memphis, TN – Gliding motility in the thermophilic cyanobacterium *Mastigocladus laminosus*.
- P55 **Bray, Amanda, Joey Guillory, and Michael Land.** Northwestern State University – Detection of green and blue fluorescent protein denaturation during macrophage destruction of transfected bacteria.
- P56 **Cook, Elisa<sup>1</sup>, Robert Campbell<sup>1</sup>, Michael Krasilobsky<sup>2</sup>, and Min-Ken Liao<sup>1</sup>.** <sup>1</sup>Furman University and <sup>2</sup>Oberlin University – Characterizing antibiotic resistant *Serratia marcescens* in watersheds of upstate South Carolina.
- P57 **Meade, Mark and Benjie Blair.** Jacksonville State University – Anaerobic bacteria as probiotic for the culture of Nile tilapia *Oreochromis niloticus*.
- P58 **Baghai-Riding, Nina and Charles Swann.** Delta State University – Maastrichtian palynomorphs from the McNairy Sand Member in northwestern Mississippi.

### Teaching Biology

- P59 **Ferzli, Miriam, Michael Carter, Eric Wiebe, and Trina Allen.** North Carolina State University – LabWrite: Teaching students how to write effective lab reports.
- P60 **Kokkala, Irene and Donna Gessell.** North Georgia College & State University – Group dynamics in teaching science writing.

## FRIDAY, APRIL 16, 2004

### FRIDAY MORNING POSTER SESSION HOLIDAY INN GRAND BALLROOM

#### Aquatic Management

- P61 **Bragg, Jennifer, Christy Michaels, Leah Reedy, and Carrie Thomas.** Sweet Briar College – Chemical and biological evaluation of the Buffalo River watershed, Amherst County, Virginia.

- P62 **Owens, Janna<sup>1</sup>, Ken Marion<sup>1</sup>, Robert Angus<sup>1</sup>, Melinda Lalor<sup>1</sup>, Eric Meyer<sup>2</sup>, and Steve McKinney.** <sup>1</sup>University of Alabama at Birmingham and <sup>2</sup>Storm Water Management Authority – Aquatic biota as indicators of urbanization impact.
- P63 **Finley IV, Gene, David D. Moody, and A. Lane Rayburn.** University of Illinois at Champaign-Urbana – Concentration and stability of atrazine in an Illinois watershed.
- P64 **Moody, David D., Jennifer L. Freeman, and A. Lane Rayburn.** University of Illinois at Champaign-Urbana – Comparing the cytotoxicity of field applied atrazine to technical grade atrazine.
- P65 **Smith, Shannon, Mendora Hackler, Rachel Chilton, Rebecca Ambers, and David Orvos.** Sweet Briar College – Determination of heavy metals concentrations in biosolids applied to agricultural fields in Appomattox County, Virginia.
- P66 **Faulkner, S.P. and H.W. Cobb, Jr.** Delta State University – Water-staining of submerged wetland foliage due to iron-polyphenol reactions?
- P67 **McCary, Laura<sup>1</sup> and Dennis Haney<sup>2</sup>.** <sup>1</sup>University of Dallas and <sup>2</sup>Furman University – Detection of estrogen associated with wastewater treatment plants in the Broad River basin of South Carolina.
- P68 **O'Connell, Ann<sup>1</sup> and Joseph King<sup>2</sup>.** <sup>1</sup>University of New Orleans, PIES and <sup>2</sup>University of New Orleans, College of Sciences – Evaluation of algal bloom potential near the Davis Pond Freshwater Diversion Project.
- P69 **Ritchie, Jerry C<sup>1</sup>, Vernon L. Finney<sup>2</sup>, Kenneth J. Oster<sup>3</sup>, and Carole A. Ritchie<sup>4</sup>.** <sup>1</sup>USDA ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD 20705, <sup>2</sup>USDA NRCS California State Office, Davis, CA 95616, <sup>3</sup>USDA NRCS Templeton Service Center, Templeton, CA 93465, and <sup>4</sup>Botanical Consultant, Laurel, MD 20708 – Sediment deposition in the floodplain of Stemple Creek Watershed.
- P70 **Williams, Jason<sup>1</sup> and Charles Pederson<sup>2</sup>.** <sup>1</sup>Augustana College, Rock Island, Illinois and <sup>2</sup>Eastern Illinois University, Charleston, IL – Diel vertical migration in *Daphnia lumholtzi* (Sars).
- P71 **Morton, Steve L.<sup>1</sup>, Stacie Dover<sup>1</sup>, Wes Jackson<sup>1</sup>, Lucie Maranda<sup>2</sup>, Susannah Corwin<sup>2</sup>, Laurie L Bean<sup>3</sup>, and Steven Eaker<sup>1</sup>.** <sup>1</sup>NOAA/National Ocean Services, Marine Biotoxins Program, 331 Fort Johnson Rd., Charleston, SC, <sup>2</sup>Graduate School of Oceanography, University of Rhode Island, Narragansett, RI, and <sup>3</sup>Department of Marine Resources, West Boothbay Harbor, ME – Toxicity and ecology of *Prorocentrum lima* and the potential for diarrhetic shellfish poisoning along the New England coast on the United States.

### Plant Biology

- P72 **Smith, Laurinda L. and Steve L. Morton.** NOAA/NOS/Marine Biotoxins Program – Morphology of *Prorocentrum reniformis* sp. nov., (Dinophyceae) a benthic dinoflagellate from the Gulf of Mexico.
- P73 **Hamissou, Mijitaba, Mark Patton, and Contessa Patton.** Jacksonville State University – Induction of callose biosynthesis in Arabidopsis and tobacco plants; an activation of plant defense mechanisms.

### Plant Systematics

- P74 **Farmer, Susan B. and Edward E. Schilling.** University of Tennessee, Knoxville, TN 37996-1100 – Additional insights into Trilliaceae phylogeny: the Delostylis group. Preliminary results.
- P75 **Gaither, Thomas W.<sup>1</sup> and Howard W. Keller<sup>2</sup>.** <sup>1</sup>Slippery Rock University and <sup>2</sup>Central Missouri State University – The genus *Schenella*, myxomycete or gastroid fungus, a 100 year-old mystery.

### Plant Ecology

- P76 **Delong, Michael<sup>1</sup>, Suneeti Jog<sup>1</sup>, Jeff Johansen<sup>2</sup>, and George Wilder<sup>3</sup>.** <sup>1</sup>Southern Illinois University, Carbondale, <sup>2</sup>John Carroll University and <sup>3</sup>Florida Gulf Coast University – Floristic survey of a highly disturbed wetland within Shaker Median Park, Beachwood (Cuyahoga Co.), Ohio.
- P77 **Conner, William H., George R. Askew, and Jeffery T. Vernon.** Baruch Institute of Coastal Ecology and Forest Science – Community structure and aboveground productivity in a coastal pine-swamp blackgum forest, South Carolina, USA.
- P78 **Wachholder, Brent, Matt Burmeister, Charles Pederson, and Andrew Methven.** Eastern Illinois University – Baseline description of corticolous lichen communities for evaluation of restoration of coastal floodplain forests.
- P79 **Keller, Harold W.** Central Missouri State University – Tree canopy biota in the Great Smoky Mountains National Park.
- P80 **Yeagle, Jessica and John Groniger.** Southern Illinois University, Carbondale – Thirty-year post harvest survey of a relict chestnut oak stand in southern Illinois.
- P81 **Rosenfeld, Kristen and Thomas Wentworth.** North Carolina State University – Ecological characterization of a North Carolina barrier island

- P82 **Howard, Clint, Emily Cohen, Sharla Setzer, and Robert Carter.** Jacksonville State University – Dendrochronological analysis of montane longleaf pine stands on Weisner Mountain, AL.
- P83 **Jenne, Kevin and Robert Carter.** Jacksonville State University – A dendrochronological study of an old-growth stand of longleaf pine, *Pinus palustris*, in Talledega National Forest of northeastern Alabama.
- P84 **Womack, Brent and Robert Carter.** Jacksonville State University – An historical perspective on the montane longleaf pine forest of Alabama and Georgia.
- P85 **Ervin, Gary.** Mississippi State University – Pattern and process during succession of a former beaver pond.
- P86 **Greipsson, Sigurdu.** Troy State University – Role of arbuscular mycorrhizal fungi in mediating invasion of native ecosystems in Alabama by non-native plants (privet and kudzu).
- P87 **Biggerstaff, Matthew and Christopher Beck.** Emory University – Effects of English ivy (*Hedera helix* L.) on regeneration of vegetation in a southeastern Piedmont forest.
- P88 **Allen, Philip B.<sup>1</sup>, Jake F. Weltzin<sup>1</sup>, Richard J. Norby<sup>2</sup>, and James E. Buckner<sup>1</sup>.** <sup>1</sup>University of Tennessee and <sup>2</sup>Oak Ridge National Laboratory – Simulating multifactor climate change in an old-field grass community: Design, setup, and first year monitoring of the Old-Field Community Climate and Atmosphere Manipulation Project (OCCAM).
- P89 **Saunders, N. Elizabeth and Sedonia D. Sipes.** Southern Illinois University, Carbondale – Pollination ecology of the rare Wyoming endemic, *Abronia ammophila* (Nyctaginaceae).
- P90 **Gustafson, Danny<sup>1</sup> and Roger E. Latham<sup>2</sup>.** <sup>1</sup>The Citadel and <sup>2</sup>Continental Conservation – Is the serpentine aster, *Symphyotrichum depauperatum* (Fern.) Nesom, a valid species and actually endemic to eastern serpentine barrens?
- P91 **Slapcinsky, Jodi<sup>1</sup>, Doria Gordon<sup>1</sup> and Bob Nelson<sup>2</sup>.** <sup>1</sup>The Nature Conservancy, P.O. Box 118526, Gainesville, Florida 32611 and <sup>2</sup>The Nature Conservancy, P.O. Box 630, Babson Park, Florida 33827 – Central Florida climbing fern control.
- P92 **Davis, Christopher.** Bowling Green State University – The relationship between mycorrhizal fungi and carnivorous plants of the eastern United States.
- P93 **Faulkner, A.A., S.P. Faulkner, and D.L. Sudbrink.** Department of Biological Sciences, Delta State University, Cleveland, Mississippi 38733

– Isolation of a gramicolous leaf spot fungus from the invasive grass, *Microstegium vimineum* (Trin.) A. Camus.

- P94 **Parker, Erica E. and Harold W. Keller.** Central Missouri State University – Correlation of pH with assemblages of corticolous myxomycetes in Big Oak Tree State Park, Missouri.
- P95 **Jones, Jennifer<sup>1</sup>, Jason Hunt<sup>1</sup>, Matt Wilson<sup>2</sup>, and T. Wayne Barger<sup>1</sup>.** <sup>1</sup>Tennessee Technological University and <sup>2</sup>University of West Georgia – Various *Pteris* species as possible bioremediators of arsenic contamination.
- P96 **Hovsepyan, A. and S. Greipsson.** Department of Biological and Environmental Sciences, Troy State University, Troy, AL 36082 – Effects of the fungicide benomyl on phytoextraction by corn of lead contaminated soil.
- P97 **Hovsepyan, A. and S. Greipsson.** Department of Biological and Environmental Sciences, Troy State University, Troy, AL 36082 – Effects of EDTA on phytoextraction by corn of lead contaminated soil.

## FRIDAY MORNING SYMPOSIUM

### Microbiology Practitioners and Educators Sponsored by Brooks/Cole

Fogelman Executive Center, Room 215

**Presiding: Ann Caven, Brooks/Cole**

Practitioners and educators present the latest real world information on: Bioterrorism and newly emerging/re-emerging diseases such as Anthrax, Small Pox, Tuberculosis, AIDS, Ebola virus infections, and Lyme disease.

- 8:15 **Montgomery, Joel.** National Center for Infectious Diseases (NCID)
- 9:00 **Ingraham, John.** Project Leader, EcoCyc.
- 9:45 **Break**

## FRIDAY MORNING PAPER SESSIONS

**Animal Behavior**  
Fogelman Executive Center, Room 308

**Presiding: Jerry Wolff, University of Memphis**

- 8:00 104 **Pitts, David.** University of Tennessee at Martin – Factors influencing nest cavity choice by Carolina chickadees.
- 8:15 105 **Grassi, N.<sup>1</sup> and J. Parga<sup>2</sup>.** <sup>1</sup>Armstrong Atlantic State University Biology/Anthropology and <sup>2</sup>University of Texas at Austin – The Effects of temporary contraception on group dynamics in the ring-tailed lemur (*Lemur catta*).
- 8:30 106 **Vaughn, Ashlee<sup>1</sup> and Meghan Carr<sup>2</sup>.** <sup>1</sup>Christian Brothers University and <sup>2</sup>Memphis Zoo – A comparison study of Sulawesi macaques (*Macaca nigra*) at the Memphis Zoo.
- 8:45 107 **Pierce, Andrew and Michael Ferkin.** The University of Memphis – Food deprivation induced changes in reproduction in meadow voles (*Microtus pennsylvanicus*).
- 9:00 108 **Delbarco, Javier and Michael Ferkin.** The University of Memphis – Increases in sperm investment in relation to the risk of sperm competition in a mammal species.
- 9:15 **Break**
- 9:30 109 **Hargett, Allison, Katherine Long, and Megan Gibbons.** Birmingham-Southern College – The response of spotted salamander larvae (*Ambystoma maculatum*) to chemical and visual cues of bass (*Micropterus salmoides*) and crayfish (*Orconectes rusticus*).
- 9:45 110 **Humber, Meredith, Megan Biggins, and Allison Hargett.** Birmingham-Southern College – Training red-backed salamanders in egg discrimination.
- 10:00 111 **Shull, Kenneth<sup>1</sup> and Amanda Aldridge<sup>2</sup>.** <sup>1</sup>Appalachian State University and <sup>2</sup>Davidson College – Factors affecting mate choice in *Drosophila melanogaster*.
- 10:15 112 **Ghafary, Julie, Jonathan Allen, and Lindsay Boyett.** Birmingham-Southern College – The effects of crayfish and bass predators on activity level of green treefrogs (*Hyla cinerea*).
- 10:30 113 **Winne, Christopher<sup>1</sup> and Michael Keck<sup>2</sup>.** <sup>1</sup>Savannah River Ecology Laboratory and <sup>2</sup>Grayson County College – Daily activity patterns of whiptail lizards (Squamata: Teiidae: *Aspidozelis*): a proximate response to environmental conditions or an endogenous rhythm?
- 10:45 114 **Sikkel, Paul C.** Department of Biology, Murray State University – The effects of intruder pressure and ectoparasites on reproductive tactics in territorial damselfish.

- 11:00 115 **Gibson, Angela and Alicia Mathis.** Southwest Missouri State University – Experience with predators and conspecifics influences habitat choice by rainbow darters.

**Herpetology – Population Ecology & Physiology  
Fogelman Executive Center, Room 123**

**Presiding: Matthew Parris,** University of Memphis

- 8:00 116 **Greene, Yancey and Travis Perry.** Furman University – Survey techniques and habitat suitability for *Rana chiricahuensis*.
- 8:15 117 **Patrick, Reid and Travis Perry.** Furman University – Population ecology of *Ambystoma maculatum* at an ephemeral pond in Greenville County, South Carolina.
- 8:30 118 **Felix, Zachary<sup>1</sup>, Yong Wang<sup>1</sup>, and Callie Schweitzer<sup>2</sup>.** <sup>1</sup>Alabama A&M University and <sup>2</sup>USDA Forest Service, Southern Research Station – Demographics of *Bufo americanus* populations in relation to several silvicultural techniques in northern Alabama.
- 8:45 119 **Jones, Telenna and Alvin Diamond.** Troy State University – Preliminary results of the comparison of herpetofaunal abundance and diversity in different forest cover types and their response to timber harvesting.
- 9:00 120 **Takahashi, Mizuki and Matthew Parris.** University of Memphis – Effect of hydroperiod on developmental polymorphisms of the eastern newt.
- 9:15 **Break**
- 9:45 121 **Cordova, Cory and Jonathan Akin.** Northwestern State University – Prevalence and persistence of *Salmonella* in wild-caught Iguanid and Scincid lizards.
- 10:00 122 **Williams, K. L. and M.G. Frick.** Caretta Research Project, Savannah Science Museum – Tag returns of loggerhead sea turtles (*Caretta caretta*) from Wassaw National Wildlife Refuge, GA.
- 10:15 123 **Green, Jeffery and Vincent Cobb.** Middle Tennessee State University – The daily thermal profile of black racers (*Coluber constrictor*) in middle Tennessee.
- 10:30 124 **Loughman, Zachary and Thomas K. Pauley.** Marshall University – Reproductive biology of *Regina septemvittata* (Queen Snake) in West Virginia.



- 10:45 125 **Sutton, William B. and Thomas K. Pauley.** Department of Biological Sciences, Marshall University, Huntington, WV. – Discovery of *Aeromonas hydrophila* and *Pseudomonas spp.* skin infections and other malformations of *Rana pipiens* in West Virginia.

**Invertebrate Zoology**  
**Fogelman Executive Center, Room 315**

**Presiding: Frank Romano,** Jacksonville State University

- 8:00 126 **Munden, Andrea<sup>1</sup>, Stephen Landers<sup>1</sup>, and Scott Phipps<sup>2</sup>.** <sup>1</sup>Troy State University and <sup>2</sup>Weeks Bay National Estuarine Research Reserve – Settlement of the suctorian *Lernaeophrya capitata* in Weeks Bay, Alabama.
- 8:15 127 **Nelson, Charles H.** The University of Tennessee-Chattanooga – Ultrastructure of the *Pteronarcys* hammer (Insecta: Plecoptera: Pteronarcyidae) and testing hypotheses concerning the number of origins of this structure in Systellognatha.
- 8:30 128 **Warriner, Michael<sup>1</sup>, Evan Nebeker<sup>2</sup>, Steven Tucker<sup>2</sup>, and Terence Schiefer<sup>2</sup>.** <sup>1</sup>Arkansas Natural Heritage Commission and <sup>2</sup>Mississippi State University – The influence of forest type on saproxylic beetle assemblages in east-central Mississippi.
- 8:45 129 **Tannahill, Christina L. and Linda S. Fink.** Sweet Briar College – The effects of Japanese stilt grass, *Microstegium vimineum*, on earthworm abundance and diversity in central Virginia.
- 9:00 130 **Pisani, Kristy A. and Stephen C. Landers.** Department of Biological and Environmental Sciences, Troy State University – The effect of salinity changes on *Hyalophysa chattoni*, an apistome ciliate symbiotic on grass shrimp.
- 9:15 **Break**
- 9:45 131 **Pollard, Joseph.** Furman University – Responses of herbivores to cadmium hyperaccumulation in *Thlaspi caerulescens*.
- 10:00 132 **Alley, Valerie E., Mark D. Farr, Jimmy L. Alley, Jr. and Andrew C. Miller.** Environmental Laboratory, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi 39180-6199 – A Stream Monitoring Program at Ft. Benning Military Reservation, Georgia.
- 10:15 133 **Daniel, Hal and Claudia Jolls.** East Carolina University – Man eating insects: The ABC's of entomophagy.

- 10:30 134 **Landers, Stephen.** Troy State University – Apostome ciliated protozoa from decapod crustacea in St. Andrew Bay, Florida.
- 10:45 135 **Henson, Richard.** Appalachian State University – Scorpion diversity and distribution within Big Bend and Guadalupe Mountains National Park Texas.
- 11:00 136 **Meyer, Harry A.** McNeese State University, Lake Charles, Louisiana – Tardigrada of the Florida Keys.
- 11:15 137 **Dafoe, Robert and Frank Romano.** Department of Biology, Jacksonville State University, Jacksonville, AL 36265 – Marine meiofauna of the subtidal regions of Sand Island, AL, NE Gulf of Mexico, USA.

**Plant Ecology – Communities**  
**Fogelman Executive Center, Room 136**

**Presiding: Jake Weltzin**, University of Tennessee-Knoxville

- 8:00 138 **Collins, Beverly<sup>1</sup> and Loretta Battaglia<sup>2</sup>.** <sup>1</sup>Savannah River Ecology Lab and <sup>2</sup>Southern Illinois University, Carbondale – Regeneration strategies in bottomland hardwood forests.
- 8:15 139 **Battaglia, Loretta<sup>1</sup>, Davis Pritchett<sup>2</sup>, and Peter Minchin<sup>1</sup>.** <sup>1</sup>Southern Illinois University, Carbondale and <sup>2</sup>University of Louisiana, Monroe – Dispersal of bottomland hardwood forest species during old-field succession.
- 8:30 140 **Engel, E.C. and J. Weltzin.** University of Tennessee, Knoxville – What factors drive the response of an old-field plant community to the interactive effects of CO<sub>2</sub>, temperature, and soil water availability?
- 8:45 141 **Chandy, Shibi and David Gibson.** Southern Illinois University, Carbondale – Partitioning of diversity at different scales in the Shawnee National Forest, Illinois.
- 9:00 142 **West, Natalie and David Gibson.** Southern Illinois University, Carbondale – Microhabitat analysis of exotic species in Illinois shale barrens.
- 9:15 **Break**
- 9:45 143 **Madden, Kathryn<sup>1</sup>, Rebecca Sharitz<sup>1</sup> and Donald Imm<sup>2</sup>.** <sup>1</sup>Savannah River Ecology Laboratory and <sup>2</sup>USFS-Savanna River – Comparisons of vegetation, canopy, and soil composition of selected Fall-line sandhill TES plant populations.

- 10:00 144 **Vandermast, David<sup>1</sup>, Michael Jenkins<sup>2</sup>, and Peter White<sup>1</sup>.** <sup>1</sup>University of North Carolina-Chapel Hill and <sup>2</sup>Great Smoky Mountains National Park – Environmental correlates of long-term change in the high-elevation hardwood forests of Great Smoky Mountains National Park.
- 10:15 145 **Iversen, Colleen<sup>1</sup> and Scott D. Bridgham<sup>2</sup>.** <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>University of Oregon – Effects of nutrient availability on nutrient-use efficiency at multiple levels of ecological organization in peatlands.
- 10:30 146 **Dilustro, John, Beverly Collins, Lisa Duncan, and Chris Crawford.** Savannah River Ecology Laboratory – Soil respiration and fine root production in southeastern mixed pine forests of varying soil texture.

**Aquatic Management  
Fogelman Executive Center, Room 219**

**Presiding: LaFayette Frederick,** Howard University

- 8:00 147 **Collins, Christa, Michael Mullen, and Michael Stewart.** Troy State University – Assessing the ecological health of urban impacted streams in the Choctawhatchee and Pea Rivers watershed.
- 8:15 148 **Pilarczyk, Megan, Christa Collins, Kristy Pisani, Bonnie Hamiter, and Jonathan Miller.** Troy State University – The impact of urbanization on fish assemblage diversity and biological integrity in the Southeastern Plains ecoregion, Alabama.
- 8:30 149 **Benton, Paul and William Ensign.** Department of Biology, Kennesaw State University – The effect of road crossings on stream fish movement in small Etowah Basin streams.
- 8:45 150 **Hupp, Cliff R.<sup>1</sup>, Richard H. Day<sup>2</sup>, Daniel E Kroes<sup>1</sup>, and Charles R. Demas<sup>3</sup>.** <sup>1</sup>USGS, Reston, VA, <sup>2</sup>USGS, Lafayette, LA, <sup>3</sup>USGS, Baton Rouge, LA – Sediment trapping and carbon sequestration in the Atchafalaya River Basin, Louisiana
- 9:00 151 **Kroes, Daniel R. and Cliff R. Hupp.** U.S. Geological Survey, 430 National Center Reston, VA 20192 – Patterns of riparian sedimentation and subsidence along channelized and unchannelized reaches of the Pocomoke River, Maryland
- 9:15 **Break**
- 9:30 152 **Hackler, Medora, Shannon Smith, Rachel Chilton, Rebecca Ambers, and David Orvos.** Sweet Briar College – A

comparison of aquatic macroinvertebrates and fishes in dam-regulated and unregulated streams.

- 9:45 153 **Tychus, Adewale, Peter Fotang, LaFayette Frederick, and Raymond Petersen.** Howard University – The occurrence of water molds in *Sarracenia purpurea* pitchers.
- 10:00 154 **Daulton, Nathan M.<sup>1</sup>, Eliana Cristina Ventura<sup>2</sup>, Afonso C.D. Bairy<sup>2</sup>, and Maria R.F. Marques<sup>2</sup>.** <sup>1</sup>Christian Brothers University and <sup>2</sup>Universidade Federal de Santa Catarina – Antioxidant responses of the brown mussel *Perna perna* exposed to lead and paraquat.
- 10:15 155 **McNally, Kelsey.** Louisiana State University – Developing a risk assessment model for *Schistosoma haematobium* in Kenya based on climate and remotely sensed data.
- 10:30 156 **Li, Shuwen<sup>1</sup>, L. Martin<sup>1</sup>, S. Reza Pezeshki<sup>1</sup>, and F. Shields<sup>2</sup>.** <sup>1</sup>The University of Memphis and <sup>2</sup>USDA-ARS National Sedimentation Laboratory – Effect of simulated herbivory and flooding on photosynthesis and growth in black willow (*Salix nigra*).
- 10:45 157 **Martinez, Angelique M.** Middle Tennessee State University – The use of species diversity as an ecological indicator in southeastern U. S. estuaries: Dynamic and hierarchical linear models.
- 11:00 158 **George, Robert Y.** George Institute for Biodiversity and Sustainability, GIBS, 305 Yorkshire Lane, Wilmington, North Carolina – How to protect tropical and deep-sea coral reefs off Southeastern United States: New conservation and management strategies.

## FRIDAY AFTERNOON PAPER SESSIONS

### Animal Physiology

Fogelman Executive Center, Room 308

**Presiding: Malinda Fitzgerald,** Christian Brothers University

- 1:30 159 **Blaudow, R.A.<sup>1,2</sup>, J.A. Cole<sup>2</sup>, and L.B. Coons<sup>1,2</sup>.** <sup>1</sup>Integrated Microscopy Center and <sup>2</sup>Department of Microbiology and Molecular Cell Sciences, The University of Memphis, Memphis, Tennessee – Evidence that multiple second messengers regulate calcium dependent fluid movement in isolated salivary glands of partially fed *Dermacentor variabilis*.

- 1:45 160 **Coons, L.B.<sup>1,2</sup>, J.L. Tzefakes<sup>1</sup>, R.A. Blaudow<sup>1,2</sup>, S. Frase<sup>1</sup>, L. Boykins<sup>1</sup>, Corta Thompson<sup>3</sup>, and C.M. Williams<sup>1</sup>.** <sup>1</sup>Integrated Microscopy Center, University of Memphis, <sup>2</sup>Department of Microbiology and Molecular Cell Sciences, and <sup>3</sup>Department of Biology, Christian Brothers University – Programmed cell death is involved in tick salivary gland degeneration.
- 2:00 161 **Dixon, A.B, D.J. Marsh, M.E. Wilson, J.L. Pate, R.A. Dailey, and E.K. Inskeep.** Wingate University – Effect of breed type on late embryonic and fetal mortality and concentrations of progesterone, estradiol 17 $\beta$  and vascular endothelial growth factor (VEGF) in the ewe.
- 2:15 162 **Rayburn, James, Jimmy Childers, and Jason Wisener.** Jacksonville State University – Developmental toxicity of phloxine B to *Palaemonetes pugio* (grass shrimp embryos).
- 2:30 163 **Haygood, Mark, Ashley Ward, Benjie Blair, Mark Meade, and Charles Olander.** Jacksonville State University – Phloxine B, a xanthene photoactive dye, is a successful treatment against *Ichthyophthirius multifiliis* in channel catfish, *Ictalurus punctatus*.
- 2:45 164 **Chaplin, Ashley.** Columbus State University – The effects of a one-tesla magnet on human fibroblast cell growth.
- 3:00 165 **Patel, Minish<sup>1</sup>, Leandro Bertoglio<sup>2</sup>, and Antonio Carobrez<sup>2</sup>.** <sup>1</sup>Christian Brothers University and <sup>2</sup>Universidade Federal de Santa Catarina - Anxiolytic effects of 8 OH DPAT are abolished in test-experienced rats submitted to the elevated plus maze.

### Microbiology

#### Fogelman Executive Center, Room 315

**Presiding: Edward Stevens,** University of Memphis

- 1:30 166 **Belcher, Richard and Sigurdu Greipsson.** Troy State University – Role of cytochrome P-450 in the oxidative desulfuration of bensulide.
- 1:45 167 **Boopathy, Ramaraj and Earl Melancon.** Department of Biological Sciences, Nicholls State University, Thibodaux, LA – Metabolism of nitrophenol by a *Klebsiella* sp.
- 2:00 168 **Colvin, Ben, Adam Lowery, and Michael Land.** Northwestern State University – Commercial demand and processing methods for microbial reduction and acceptance of softshell turtle meat (*Trionyx* spp.).
- 2:15 169 **Lyles, Chris, Derick Wenning, and Michael Land** Northwestern State University – Evaluation of copper salts on

*Salmonella enteritidis* growth under varying conditions in broiler production.

- 2:30 170 **Land, Michael and Ryan Terry.** Northwestern State University – Survey of coliform and pathogen leakage of peritoneal cavity of game taken with shot gun and microbial reduction strategies.
- 2:45 171 **Greene, Chris, Steve Barger, Wanda Story, Stephan Moss, Dawn Castle, and Henry Spratt.** University of Tennessee at Chattanooga – The effect of nitrogen or phosphorous addition on microbial mineralization of biphenyl in floodplain soils from the Chattanooga Creek superfund site.
- 3:00 **Break**
- 3:30 172 **Miller, Suzanne, Chris Green, Wanda Story, Stephan Moss, Steve Barger, Dawn Castle, and Henry Spratt.** University of Tennessee at Chattanooga – Biphenyl mineralization by bacterial cultures isolated from floodplain soils from the Chattanooga Creek Superfund Site.
- 3:45 173 **Van Deusen, Katherine, Dawn Castle, and Henry Spratt.** University of Tennessee at Chattanooga – Stimulation of nahAC gene production in naphthalene-spiked polycyclic aromatic hydrocarbon contaminated soils.

**Plant Ecology – Disturbance  
Fogelman Executive Center, Room 136**

**Presiding: Beverly Collins, SREL**

- 1:30 174 **Welch, Nicole Turrill.** Middle Tennessee State University, Murfreesboro, Tennessee – What is inhibiting table mountain pine (*Pinus pungens* Lamb.) regeneration following prescribed fire?
- 1:45 175 **Kuppinger, Dane<sup>1</sup>, Peter White<sup>1</sup>, and Michael Jenkins<sup>2</sup>.** University of North Carolina at Chapel Hill and <sup>2</sup>National Park Service, Great Smokey Mountains – Biotic and abiotic factors that affect the invasion success of *Paulownia tomentosa* following wildfires in pine and oak-pine forests of the Southern Appalachian mountains.
- 2:00 176 **Shelingoski, Susan<sup>1</sup>, Thomas Wentworth<sup>1</sup>, Jon Stucky<sup>1</sup>, and Richard Leblond<sup>2</sup>.** <sup>1</sup>North Carolina State University and <sup>2</sup>North Carolina Natural Heritage Program – Wells Savannah, an example of a unique, fire-dependent ecosystem in the North Carolina Coastal Plain.

- 2:15 177 **Dumas, Shay, Howard Neufeld, Melany Fisk, and James Sobjeraj.** Appalachian State University – Community and ecosystem responses following fire in the Linville Gorge Wilderness Area.
- 2:30 178 **Wigent, Cass A., Claudia L. Jolls, and Sarah E. Johnson.** East Carolina University – Responses to drought and salinity in seabeach amaranth (*Amaranthus pumilus* Raf.).
- 2:45 179 **Brown, Christopher and S. Reza Pezeshki.** The University of Memphis – The combined effects of salt and drought on *Spartina alterniflora* under a simulated tidal pulse.
- 3:00 **Break**
- 3:30 180 **Allen, Philip B.<sup>1</sup>, Jake F. Weltzin<sup>1</sup>, and Paul J. Hanson<sup>2</sup>.** <sup>1</sup>University of Tennessee and <sup>2</sup>Oak Ridge National Laboratory – A 3-Year cohort study of the recruitment and survival of deciduous forest tree species in response to altered precipitation regimes.
- 3:45 181 **Weltzin<sup>1</sup>, J. F., P. B. Allen<sup>1</sup>, R. J. Norby<sup>2</sup>, E. Buckner<sup>1</sup>, E. C. Engel<sup>1</sup>, L. Souza<sup>1</sup>, and S. Wan<sup>2</sup>.** <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Oak Ridge National Laboratory – Community and ecosystem response to global change: the Old-field Community Climate and Atmospheric Manipulation (OCCAM) project.
- 4:00 182 **Souza, L<sup>1</sup>, P.B. Allen<sup>1</sup>, J.F. Weltzin<sup>1</sup>, R.J. Norby<sup>2</sup>, and S. Wan<sup>2</sup>.** <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Oak Ridge National Laboratory – Leaf and ecosystem-level gas exchange responses to global change: the Old-field Community Climate and Atmospheric Manipulation (OCCAM) Project.
- 4:15 183 **Parisher, Emily S. and Gary L. Walker.** Appalachian State University – Characterization of plant community structure on climbed and unclimbed cliff faces in the Obed River gorge.
- 4:30 184 **Miller, Bradley<sup>1</sup>, S. Coleman McCleneghan<sup>1</sup>, Howard Neufeld<sup>1</sup>, and Tom Horton<sup>2</sup>.** <sup>1</sup>Appalachian State University and <sup>2</sup>SUNY, College of Environmental Science and Forestry – Ectomycorrhizal fungi on *Picea rubens* in native and non-native soils: effects of different fertilization regimes.

**Landscape Ecology  
Fogelman Executive Center, Room 219**

**Presiding: Mark McKenzie, Auburn University**

- 1:30 185 **Hogland, John S. and Mark D. Mackenzie.** School of Forestry and Wildlife Sciences, Auburn University – Using remote

sensing techniques to delineate the current distribution of longleaf (*Pinus palustris*) ecosystems across Alabama, west Georgia, and east Mississippi.

- 1:45 186 **Kleiner, Kevin<sup>1</sup>, Mark Mackenzie<sup>1</sup>, and Alexa McKerrow<sup>2</sup>.** <sup>1</sup>ALCFWRU, Auburn University and <sup>2</sup>North Carolina State University – Mapping riparian wetlands from Landsat ETM+ imagery and DEM derivatives: a comparison of methods.
- 2:00 187 **Gage, Karla, Melissa Lee, and Sam Pierce.** The University of Memphis – Spatial effects in an edge environment.
- 2:15 188 **Odom, Allison<sup>1</sup> and Sean Powers<sup>2</sup>.** <sup>1</sup>Jacksonville State University and <sup>2</sup>Dauphin Island Sea Lab – Experimental determination of connectivity between estuarine habitats.
- 2:30 189 **Biernacki, Maciej<sup>1</sup> and Jon Lovett-Doust<sup>2</sup>.** <sup>1</sup>University of Memphis and <sup>2</sup>University of Windsor, Ontario, Canada – Landscape matrix and species richness in Niagara Escarpment.
- 2:45 190 **Jobe, R. Todd.** The University of North Carolina at Chapel Hill – Correlating harvested plant abundances with human accessibility on a conservation landscape.
- 3:00 **Break**
- 3:30 191 **Barone, John.** Columbus State University – The nature and extent of black belt prairies in Alabama and Mississippi at the time of European settlement.
- 3:45 192 **Carter, Robert<sup>1</sup> and Andy Londo<sup>2</sup>.** <sup>1</sup>Jacksonville State University and <sup>2</sup>Mississippi State University – Landscape scale classification of remnant fire disturbed montane longleaf pine forest in West Central Georgia.
- 4:00 193 **Hines, Martina<sup>1</sup> and Julian Campbell<sup>2</sup>.** <sup>1</sup>Kentucky Nature Preserves Commission and <sup>2</sup>The Nature Conservancy – The curious history of an anomalous landscape.
- 4:15 194 **Fralish, J. S.** Southern Illinois University, Carbondale – Chaos to structure: a general gradient model for describing forest landscape/community patterns in the Central States.
- 4:30 195 **Jason R. Singhurst<sup>1</sup>, James C. Cathy<sup>2,3</sup>, Dale Prochaska<sup>2</sup>, Hayden Haucke<sup>2</sup>, and Walter C. Holmes<sup>4</sup>.** <sup>1</sup>Wildlife Diversity Program, Texas Parks & Wildlife Department, <sup>2</sup>Wildlife Division Region III, Texas Parks & Wildlife Department, Tennessee Colony, <sup>3</sup>Texas A&M University, Texas Agricultural Experiment Station Uvalde, Uvalde, Texas. <sup>4</sup>Department of Biology, Baylor University, Waco, Texas – Past and future conservation of xeric



sandhill openings and quaking bogs at Gus Engeling Wildlife Management Area in Texas.

**Plant Distributions and Floristic Inventories**  
**Fogelman Executive Center, Room 120**

**Presiding: Margaret Cirtain**, University of Memphis

- 1:30 196 **Estes, Dwayne, Randall Small, and Eugene Wofford.** University of Tennessee, Knoxville – Studies in the genus *Gratiola* section *Nibora* (Scrophulariaceae).
- 1:45 197 **Faulkner, A.A. and S.P. Faulkner.** Department of Biological Sciences, Delta State University – Current distribution and range expansion of the invasive tree, *Triadica sebifera* (Euphorbiaceae), in Mississippi.
- 2:00 198 **McCoy, John W. and Bobby D. Keeland.** USGS National Wetlands Research Center, Lafayette, LA – *Chamaecyparis thyoides* (L.) BSP (Atlantic White cedar, Cedar) distribution along the Gulf of Mexico, especially southern Mississippi.
- 2:15 199 **Prevost, Luanna B., Patrick D. McMillan, and Timothy P. Spira.** Department of Biological Sciences, Clemson University, Clemson SC 29634 – A new species of *Ambrosia* L. from the Blue Ridge escarpment of South Carolina.
- 2:30 200 **Fleming, Chris<sup>1</sup>, Joey Shaw<sup>2</sup>, Todd Campbell<sup>3</sup>, and Daniel Simberloff<sup>2</sup>.** <sup>1</sup>Breedlove, Dennis, Young & Associates, Inc., <sup>2</sup>University of Tennessee, Knoxville, and <sup>3</sup>University of Tampa – A survey of the invasive exotic plant species of the Big South Fork National River and Recreation Area, Tennessee and Kentucky.
- 2:45 201 **Chester, Rebecca E. and Carol Goodwillie.** East Carolina University – Floristic characterization and investigation of influential factors of a wet pine flatwoods marked for restoration.
- 3:00 **Break**
- 3:30 202 **Martin, Alex, Mario Molina, Zack Murrell and Scott Taylor.** Appalachian State University – A floristic and ecological analysis of Tater Hill, a high quality wetland in the Southern Appalachians.
- 3:45 203 **Boyer, Terry<sup>1</sup>, Robert Carter<sup>1</sup>, Heather McCoy<sup>1</sup>, and Andy Londo<sup>2</sup>.** <sup>1</sup>Department of Biology, Jacksonville State University and <sup>2</sup>Department of Biology, Mississippi State University – Community analysis of pitcher plant bogs of the Little River Canyon National Preserve, Alabama, USA.

- 4:00 204 **McMillan, Patrick.** Clemson University – A floristic study of the Wadakoe Mountain Tract, Pickens County, South Carolina.
- 4:15 205 **Doffitt, Christopher Hardy.** Mississippi State University – A preliminary survey of the vascular flora of Ouachita County, Arkansas.
- 4:30 206 **Havran, J. Christopher and R. Dale Thomas.** University of Louisiana at Monroe – Preliminary checklist of the vascular flora of the Homochitto National Forest, Mississippi.
- 4:45 207 **Shiver, Cori and Michael Woods.** Troy State University – The fall vascular flora of Henry County, Alabama.



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## ABSTRACTS - PAPERS

- 1 GRIEBEL, ULRIKE<sup>1</sup>, JENNIFER A MATHER<sup>2</sup>, AND DAVID K. OLLER<sup>1</sup>.  
<sup>1</sup>University of Memphis and <sup>2</sup>University of Lethbridge - Double signaling in the Caribbean reef squid *Sepioteuthis sepioidea*

*Sepioteuthis sepioidea*, the Caribbean reef squid has one of the most complex color pattern repertoires among cephalopods. It uses a wide variety of color patterns for courtship, aggression, startling and camouflage. The color patterns can be produced directionally, i.e., on the body part closest to the receiver. They also can produce two different signals simultaneously for two different receivers, a special feature we call double signaling. The majority of double signals are produced by males during courtship when a courting male is approached by a rival male. In this situation the courting male produces a courtship signal towards the female and an aggressive signal towards the adversary. The most common combination is the aggressive pattern called Zebra with Flicker or Stripe, the two male courtship patterns. In females as well as in males we also observed combinations of courtship patterns and startling patterns when a courting animal was surprised by e.g., an approaching fish. Double signaling within one communication channel is a rare feature in communication systems and has not been reported to occur in any other non-human animal.

- 2 MATHIS, ALICIA. Southwest Missouri State University - Social behavior of terrestrial salamanders

For terrestrial plethodontid salamanders, territorial and chemosensory behaviors are influenced by a variety of factors. Both males and females aggressively defend feeding territories and both body size and recent experience influence territorial behavior. Territorial behavior can be influenced by both predation risk and parasite load, but territorial residents and intruders respond differently. Salamanders can use chemical cues to assess predation risk via conspecific alarm cues, and responses can depend on body size. Females can use chemical cues to assess parasite loads of males, but their responses depend on their own levels of parasitism. Overall, the behavior of terrestrial salamanders incorporates a wide range of influences, including both intrinsic (size, condition, territorial status) and extrinsic (predation risk, size and condition of opponent) factors.

- 3 RISCH, THOMAS AND THOMAS ROBINSON. Arkansas State University - Egg size and parental quality, an experiment to evaluate their separate effects upon chick performance in the eastern bluebird (*Sialia sialis*)

Previous studies concerning the advantages displayed by young that hatch from large eggs have found differing results depending on the degree of post-hatch care. Young hatching from large eggs often have increased hatching mass, and growth rates than conspecifics hatching from smaller eggs. We measured the length and breadth ( $\pm 0.01$  mm) from 91 clutches of Eastern Bluebirds nests that were initiated between March 24th and June 14th, 2003. We then calculated egg mass (g) using the formula:  $\text{Mass} = K \times L \times B^2$ . Each egg was labeled on the day of laying, thus we determined laying sequences for all nests. Adults were captured, color banded, measured (tarsus  $\pm 0.1$ mm), and weighed ( $\pm 0.25$  g). We relate egg size to laying date, position within the clutch, and clutch size. Egg size was related to maternal condition, but there was no significant association between paternal condition and egg size. As females in superior condition laid larger eggs, we hypothesized that pairs made up of these females may also provide better-quality care to chicks. If this is the case the relationship between egg size and chick performance may not be a result of egg size per se, but rather a result of both egg size and post-hatch both care being associated with the condition of the parents. Therefore, to

differentiate between the influence of egg quality and parental care on chick survival and growth, we conducted an egg swapping experiment, where small eggs were switched with large eggs to separate these effects.

- 4 BEDNARZ, JAMES<sup>1</sup>, REBECCA KIMBALL<sup>2</sup>, AND PATRICIA PARKER<sup>3</sup>.  
<sup>1</sup>Arkansas State University, <sup>2</sup>University of Florida, and <sup>3</sup>University of Missouri - St. Louis. - The occurrence and evolution of cooperative breeding among the diurnal raptors

Cooperative breeding, in which groups of more than two individuals raise offspring, usually in a single nest, is found in 3% of avian species. We found literature reporting groups at nests in 42 species of diurnal raptors. Cooperative breeding was found in 29% of genera and 14% of species in Accipitridae and Falconidae. Given the difficulty of behavioral observations necessary to detect cooperative breeding in raptors, combined with the large number of species that have been poorly studied, cooperative breeding in falconiforms may be more common than our data indicate. Often, there were no data on sex of the extra bird(s) or the relationships among group members. However, the available data showed several patterns. For 7 of 13 species, groups contained multiple adult males; three species exhibited a low, but regular occurrence of multiple females, which laid eggs in the same nest; while in the remaining three species, extra birds were yearlings or subadults. In general, groups did not appear to be composed of related individuals, unlike many cooperatively-breeding species. Our review suggests that the evolution of group living in many raptors may have developed independent of delayed dispersal, and that the evolution of cooperative breeding in this group depends upon the benefits of group living.

- 5 FERKIN, MICHAEL. University of Memphis - Sex and reproductive state affects scent marking and over-marking in voles

During the breeding season, the reproductive condition of female mammals changes. Females may or may not be sexually receptive. We conducted a series of experiments to determine whether reproductive condition of female meadow voles affects their scent marking behavior as well as the scent marking behavior of male conspecifics. In experiment 1, females in postpartum estrus (PPE females) deposited more scent marks than females that were neither pregnant nor lactating (REF females) or ovariectomized females (OVX females). In experiment 2, male voles scent marked more and deposited more over-marks in areas marked by PPE females than by REF and OVX females. In experiment 3, PPE females deposited more scent marks and over-marks in areas marked by males than did females in the other reproductive states. The results of these experiments showed that male and female voles may vary the number, type, and location of scent marks they deposit in areas scented by particular conspecifics.

- 6 WOLFF, JERRY. University of Memphis - Human social evolution

The recently emerged field of Evolutionary Psychology is based on the adaptationist approach that behavior and the human phenotype have been subject to sexual selection and result from reproductive competition within and between the sexes. I will present an evolutionary perspective on the roles of differential parental investment in male and female sexual strategies; how waist-hip ratio, youth, beauty, and symmetry are favored in mate choice; how paternity (un)certainly affects paternal investment; and the relationship between dominance, hormones, and sire versus mate preference. I will propose evolutionary scenarios for the roles of infanticide, promiscuity, and inheritance in the loss of female sexual freedom; the probable causes and consequences of concealed ovulation; and the role of coalitions and weapons in the origin of homicide and warfare. Lastly I will provide examples of how evolutionary medicine has been applied to human health and well-being. Evolutionary Psychology provides an ultimate explanation for why people do

what they do and attempts to explain the underlying and historical origin, motivation, and adaptive significance of human social behavior.

- 7 SPAINE, PAULINE. USDA Forest Service, Athens, Georgia 30602 - Information management strategies for exotic invasive species

Invasive species have been estimated to cost the US economy 138 billion dollars in economic damage a year. Exotic invasive plants cover 133 million acres of public and private lands and continue to spread by both intentional and unintentional means. Disturbance regimes such as fire, land transformations and mobile populations have helped to increase the movement of exotic invasive species. Several federal and state agencies are starting to define natural population models or plant community databases for natural areas. Plant populations are being examined as to whether they are self sustaining or not in a community. Executive Order 13112 and the establishment of the National Invasive Species Council in 1999 have increased the coordination on this problem of setting up plant databases. Coordination of these databases and the communication of collected information will help form policy on the management efforts of exotic invasive plants on public and private lands.

- 8 WELTZIN, JAKE F. Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996 - Biological invasions in a greenhouse world

Climate change and biological invasions are two of the foremost threats to natural ecosystems of the southeastern United States. Studies of biological invasions in this region rarely consider climate change, and vice versa. However, invasions are likely to have strong effects on communities that are responding to a changing climate, and climate change is altering the context within which potentially invasive species succeed or fail. Similarly, increasing concentrations of atmospheric carbon dioxide are expected to change the role of some invasive species in natural ecosystems. Research to date suggests that in some situations, climate and atmospheric change will enhance the impacts of biological invaders on communities and ecosystems. This talk will provide a conceptual framework for assessment of invasions in changing environments, synthesize current research and understanding at the interface of invasion biology and climate change, and identify areas of high priority for future research.

- 9 HUEBNER, CYNTHIA. USFS Northeast Research Station and Mid-Atlantic EPPC -Predicting plant invasions in forested systems of West Virginia

Western West Virginia public forests have experienced comparatively less invasion than forests in more urban regions and may serve as an optimal landscape for modeling early establishment of exotic invasive plants. Documentation of the importance of disturbance and environmental variables as predictors of invasion is lacking. I sampled the understory (herbs, shrubs, vines and tree seedlings) of 24 undisturbed (80 or more years old) and 24 disturbed (15-year old clear cuts) sites in the Monongahela National Forest Cheat Ranger District. Sites were randomly selected such that three common ecological land types were equally represented in both undisturbed and disturbed sites. Species were grouped into exclusive types: exotic invasive, exotic non-invasive, native invasive, native non-invasive weed, and native non-invasive non-weed. Eleven environmental and 7 disturbance variables were measured. Data were analyzed using logistic regression analysis. In all sites, exotic invasive weeds ranked low in relative importance values. High richness and diversity values and high levels of native non-invasive weeds and exotic non-invasive weeds best predicted invasion by exotic invasives in the undisturbed forests; only high herb richness was a reliable predictor of invasion in disturbed sites. Undisturbed sites were more likely to be invaded the closer they were to a paved road. In the disturbed sites, northeast-facing slopes, low moss/lichen cover, high bare ground cover, shallow



slopes, low light levels, and shorter distances to gravel and paved roads best predicted invasion. A combined analysis showed that harvested sites and sites with northeast facing slopes were most likely to be invaded.

- 10 RANDALL, JOHNNY. Assistant, Director, North Carolina Botanical Garden, CB# 3375, Totten Center, University of North Carolina at Chapel Hill, Chapel Hill NC 27599 – Competition for reproduction between native and alien plants

Many alien plant species have naturalized and now co-occur with native plants. Competition for reproduction between alien and native plants may contribute to the ecological disruptions caused by alien plant species in natural ecosystems. I paired native and alien taxa in two species arrays to test for competition for reproduction. For competition for pollination I paired the following native and congeneric alien taxa, respectively: *Ludwigia linifolia* and *L. peruviana*; *Clethra alnifolia* and *C. barbinervis*; *Hydrangea arborescens* and *H. macrophylla*; *Hydrangea radiata* and *H. macrophylla*; *Callicarpa americana* and *C. dichotoma*; and *Hibiscus aculeatus* and *H. syriacus*. Competition for pollination occurred to some degree within each of these species pairings. For competition for fleshy fruit dispersal, I used feeding trays with equal numbers of the following pairings: *Persea borbonia* and *Cinnamomum camphora*, and *Viburnum rafinesquianum* and *Elaeagnus umbellata*. In both of these cases, birds preferred the alien species' fruits over those of the native species. *Cinnamomum* was preferred to *Persea* 7:1 (477:72 over two weeks,  $p < 0.01$ ). *Elaeagnus* was also preferred to *Viburnum* (1,448:1,086 over three weeks,  $p > 0.01$ ). From these largely preliminary studies it is clear that competition for reproduction between alien and native plant species is a potential threat to the fecundity of native plant species.

- 11 SEYMER, JENNIFER AND DWAYNE WISE. Mississippi State University - Characterization of bivalent stretching in living spermatocytes of the cockroach, *Periplaneta americana*

During the first division of meiosis in several organisms, the bivalents elongate dramatically during prometaphase, for which phenomenon Hughes-Schrader (Chromosoma 3:1, 1946) coined the term "premetaphase stretch". Using time-lapse video and digital micrography, we have characterized premetaphase chromosome stretching in live primary spermatocytes of the cockroach, *Periplaneta americana*. Also, we have used an antibody to the tension-sensitive epitope, 3F3/2, to test whether or not this stretching increases the tension on kinetochores. Our results show that chromosomes stretch irrespective of spindle elongation and that bivalents congress and stretch at the same time. As previously described for fixed cells, we show that stretching is asynchronous among bivalents in the same cells: some bivalents stretch as others recoil. Bivalents elongate up to three times their original length. Since the chromosomes of *P. americana* are nearly uniform in size, the length difference can be attributed to stretching. Results of experiments with the 3F3/2 antibody show that stretched chromosomes have less bright (less phosphorylated) kinetochores than do unstretched ones. Clearly, then, chromosome stretching is associated with increased tension on the kinetochore. Staining with an antitubulin antibody indicates that there is no increase in the number of kinetochore microtubules in stretched bivalents. We discuss these results in the light of current models of chromosome congression and kinetochore behavior.

- 12 HUDSON, BETH AND KENNETH SHULL. Appalachian State University - Meiotic chromosome pairing in an interspecific hybrid

Questions concerning the precise mechanism for homologous chromosome pairing during prophase I of meiosis remain largely unanswered after several decades of research due to the extensive variation in the manner in which meiosis occurs in sexual organisms. In

wheat, a pairing control gene, *Ph1*, restricts chromosome pairing and recombination in hybrid polyploids to ensure that only homologous chromosomes pair. During meiosis in diploid hybrids of wheat and its relatives, either all of the chromosomes will pair, or none of the chromosomes will pair. Conversely, in the interspecific hybrid *Lilium* X 'Black Beauty' (*L. henryi* and *L. speciosum*) some of the chromosomes pair while others do not. By employing chromosome banding techniques, the homology within crossover regions in *L. X 'Black Beauty'* was assessed to determine if the chromosome pairing is based on recognition of homologous sequence or simply random pairing between chromosomes regardless of homology. Banding within crossover regions was found to be homologous in this hybrid, and the chromosomes always paired with the same partner when they paired. This indicates that pairing is not occurring randomly but preferentially. Based on this observation and others, it is probable that homologous chromosome pairing is initiated based on homology near the telomeres. Chromosome pairing then appears to be regulated by each chromosome or chromosome regions independently instead of by a whole genome control as seen in wheat. Therefore, *Lilium*, a genus with essentially no polyploidy, appears to have evolved in a different manner from those plants that can undergo polyploid evolution.

13 SHULL, KENNETH AND BETH HUDSON. Appalachian State University - Banding of meiotic chromosomes in plants

A variety of chromosome banding techniques in animals has been very useful in the study of phylogenetic relationships, chromosome rearrangements, human diseases based on chromosomal abnormalities and in the production of cytogenetic maps. Although there are some other techniques published, chromosome banding in plants has generally been confined to C-banding, and that with somewhat limited success. Meiotic chromosome banding has been even more difficult. We report here a method of banding meiotic chromosomes in plants. Cells in stages ranging from diplotene to anaphase I were fixed in modified Carnoy's solution, treated with ethyl acetate and stained with iron aceto-carmine. This technique gives consistent results and shows many more bands than C-banding. It should be useful in providing the same type of information in plants that has been so important in the cytogenetic studies of animals.

14 BILLINGTON, NEIL<sup>1</sup>, RACHAEL KOIGI<sup>1</sup>, BRIAN GRAEB<sup>2</sup>, AND DAVID WILLIS. <sup>1</sup>Troy State University and <sup>2</sup>South Dakota State University. - Hybridization and introgression between walleye and sauger in three main-stem Missouri River reservoirs in South Dakota determined by protein electrophoresis

Hybridization and introgression between walleye (*Sander vitreus*) and sauger (*S. canadensis*) was examined in Lake Sharpe, Lake Francis Case, and Lewis and Clark Lake, three main-stem reservoirs on the Missouri River in South Dakota. Muscle and liver samples were collected and frozen from fish caught by gill nets in mid-August to mid-September 2002. Cellulose acetate electrophoresis was conducted at four diagnostic protein-coding loci (*ALAT\** and *IDDH\** from liver and *mMDH-1\** and *PGM-1\** from muscle). In Lake Sharpe, 5% of fish identified as walleye by morphology possessed sauger alleles, 5% of fish identified as sauger possessed walleye alleles, and a putative hybrid was actually a walleye; in all 6% of fish were misidentified by morphology. In Lake Francis Case, 11% of fish identified as walleye by morphology possessed sauger alleles and 5% of fish identified as sauger possessed walleye alleles; in all 10% of fish were misidentified by morphology. In Lewis and Clark Lake, 39% of fish identified as walleye by morphology possessed sauger alleles, 9% of fish identified as sauger possessed walleye alleles, and three of four putative hybrids were confirmed as hybrids; in all 23% of fish were misidentified by morphology. Fisheries managers must be aware that morphological examination is unreliable for separating walleye, sauger and their hybrids compared to protein electrophoresis. It is essential that potential brood fish of both species be screened

by protein electrophoresis when both species co-occur, or where hybrid saugeye have been stocked, prior to them being spawned.

- 15 LYNCH, JENNIFER<sup>1</sup>, NEIL BILLINGTON<sup>1</sup>, AND JOHN PITLO<sup>2</sup>. <sup>1</sup>Troy State University and <sup>2</sup>Iowa Department of Natural Resources - Hybridization and introgression between sauger and walleye from Pool 13 of the Mississippi River

Hybridization and introgression between two North American percid fishes, sauger (*Sander canadensis*) and walleye (*S. vitreus*), has been documented in numerous studies along with difficulty in determining hybridization rates by morphology compared to protein electrophoresis. Sauger and walleye co-occur in Pool 13 of the Mississippi River and Iowa Department of Natural Resources personnel have observed suspected hybrids. We collected 44 *Sander* specimens collected from Pool 13 by electrofishing in October 2003. Fish were identified to species or as hybrids in the field by morphology and then frozen. Protein electrophoresis was conducted at four protein-coding loci that are diagnostic between sauger and walleye: mMDH-1\* and PGM-1\* from muscle and ALAT\* and IDDH\* from liver. Of 44 fish examined, 20 (45 %) were identified as sauger, 21 (48%) as walleye and three (7%) as hybrids by morphology. Electrophoretic analysis revealed that 16 (36%) fish were sauger, 17 (39%) were walleye, and 11 (25%) were hybrid or introgressed individuals. All three fish originally identified as hybrids by morphology were confirmed as hybrid individuals (one F<sub>1</sub> hybrid and two backcrosses to walleye). Four fish identified as sauger by morphology contained walleye alleles, all were backcrosses to sauger by electrophoresis. Of the four fish identified as walleye by morphology that contained sauger alleles, two were backcrosses to walleye, one was a multi-generation hybrid, and one was a backcross to sauger. In all, 8/44 (18%) fish were misidentified by morphology. Electrophoretic screening is recommended for reliable identification of *Sander* specimens especially if hybridization is suspected.

- 16 SMITH, KIMBERLY. Howard University - Mycelial Studies on DNA Relatedness between Wild Type *Neurospora dodgei* and a Spontaneous Mutant

The objective of this study was to determine differences that might exist between the DNA content of *Neurospora dodgei* and a spontaneous mutant. Total DNA isolation, hybridization and Random Amplified Polymorphic DNA (RAPD) analysis were undertaken in an effort to determine the possible sites of genetic alterations in chromosomal, mitochondrial, or endogenous plasmid DNAs between the two putative taxa. Hybridization experiments utilizing mitochondria encoded genes, COX2, 19S rRNA, ATPase 9 and 6, revealed intensity and electrophoretic mobility differences between the taxa. On average, restricted wild-type DNA hybridized with greater intensity than mutant DNA and unrestricted wild type DNA hybridized at a higher position on the membrane than the mutant suggesting a difference in copy number of the genes, and a deletion event. RAPD analysis using parsimony and patristic distances demonstrated genetic variability, in the range of 27%, between wild type and mutant *N. dodgei*, suggesting that the two taxa are distinct. It is the conclusion of this study that the spontaneous mutant of *N. dodgei* is not conspecific with *N. dodgei* wild and that the phenotypic slow growth characteristic is due to altered mitochondria.

- 17 SUCAET, YVES and CHRISTI MAGRATH. Troy State University - ARS containing intergenic regions have a higher incidence of transcription termination sequences as compared to the rest of the intergenic space in *Saccharomyces cerevisiae*

Transcription termination is mediated, in part, by short sequence motifs called transcription termination sequences (TTSs). These short DNA sequences are involved in 3'-end formation and signal the ternary complex to dissociate. Autonomous Replication

Sequences—ARs—are regions usually found in the intergenic space that introduce replicative function to otherwise non-replicating plasmids. The overlap of ARs and transcription termination sequences within the intergenic space led to the hypothesis that ARs are protected from transcriptional interference during replication by terminators. A positional map was constructed of the transcription termination sequences in the intergenic space of the model organism *Saccharomyces cerevisiae* using the SGD—*Saccharomyces* Genome Database. Occurrences of transcription termination sequences correlate with intergenic region size. Since ARs are usually localized to the intergenic space, the ratio of transcription termination sequences in the ARs and in the ARS containing intergenic regions as compared to the rest of the intergenic space was examined, and a two-fold over-representation of transcription termination sequences in the ARS containing intergenic regions in comparison to the other intergenic space was found. Therefore, our results offer support for a role for transcription termination sequences as molecular shields for the ARs.

- 18 STOCKDALE, HEATHER, KENNETH SHULL, AND MICHAEL WINDELSPECHT. Appalachian State University - A quantitative analysis of mating and courtship behavior of *Drosophila melanogaster*

Mating behavior in wild-type *Drosophila melanogaster* has long been understood. If mating is to occur, the female must accept the male after he performs an extensive courtship that involves wing vibration and the production of a courtship song. However, male flies with abnormal wings are unable to replicate the courtship song, yet the males from a variety of stocks with wing mutations, including vestigial (vg), are still successful in mating. This suggests that females are assessing male fitness in ways that do not involve the courtship song. We videotaped the courtship and mating of virgin male and female *D. melanogaster* from a stock with vestigial wings and virgin male and female wild type *D. melanogaster*. We found that during courtship, males with vestigial wing mutations initially approach females from the side at a right angle. This is unlike the courtship behavior of the wild type males, which initially approach females from behind. This behavior difference may have an effect on how females assess male fitness when a courtship song is not produced. There appears to be a single sex-linked gene that accounts for this behavior. Using a strain with specific chromosomal markers, we were able to determine a chromosome location for this behavior difference.

- 19 NAMENYE, KRISTIN AND DAVID CROWLEY. Mercer University - Complementation of a bacterial repair mutant with a haloarchaeal gene

Nucleotide excision repair is a general repair mechanism that is well defined in Bacteria and Eukaryotes but not yet in Archaea. NER in *E. coli* requires *uvrA*, *uvrB*, *uvrC* and *uvrD* genes. Halobacterium NRC-1 is an ideal model organism for studying archaea because its entire genome is sequenced. There are homologues to *E. coli* *uvrA*, *uvrB*, *uvrC* and *uvrD* genes in the *Halobacterium* genome. This leads to a question of whether or not the *uvrA* gene from *Halobacterium* will complement an *E. coli* *uvrA*- mutant. To determine if complementation of the *E. coli* *uvrA* mutant with the *Halobacterium* *uvrA* gene occurs, the *Halobacterium* *uvrA* gene will be cloned onto pBAD 102 arabinose expression vector. Then, the *E. coli* *uvrA* mutant will be transformed with the plasmid containing the *Halobacterium* *uvrA* gene. If the complementation is successful, the *E. coli* cells that have been transformed with the plasmid containing the *Halobacterium* *uvrA* gene will show increased resistance to UV light. If complementation is successful, it will show that it is possible for a halophilic protein to function in a mesophilic environment. Also, it will be confirmed that *Halobacterium* *uvrA* is a functional homologue to *E. coli* *uvrA*.

- 20 OUTLAW, DIANA AND GARY VOELKER. The University of Memphis - Exploring the evolution of migration in the avian family Motacillidae

Many models dealing with the evolution of avian migration are based on New World migratory systems. Using both parsimony and maximum likelihood based algorithms, we tested the applicability of several New World based models to the evolution of migration in the avian family Motacillidae, a largely Old World avian family. Using a molecular phylogeny containing the majority of species in this family, we investigated the potential interactions of biogeography, ecology (habitat) and breeding latitude with migratory and sedentary behavior. Our results suggest that habitat and migration are not correlated in the manner predicted by ecologically based hypotheses, but do suggest the importance of seasonality and geography in explaining the patterns of migrant evolution. We also clearly establish tropical latitudes as the ancestral region for clades within this family. These latter conclusions support, in part, aspects of geographical models, which suggest that geography and competition are important in generating migratory behavior, and in generating new species. Our results further suggest that, despite recent results of quantitative genetic studies addressing the relative plasticity of migratory behavior and physiology, migration is not easily lost if wintering grounds are saturated by resident congeners. While we understand the limitations of applying generalizations to a complex evolutionary system such as migration, we have delineated here a broad methodology for statistically testing little explored evolutionary hypotheses relating to migration, in a phylogenetic context.

21 LARGE, DANIELLE<sup>1</sup>, SUZANNE DAVIS<sup>2</sup>, JIM FORTNEY<sup>2</sup>, AND LAURA GIBSON<sup>3</sup>. <sup>1</sup>Alderson-Broadus College and the WV-BRIN, <sup>2</sup>West Virginia University, and <sup>3</sup>West Virginia University School of Medicine - Effects of Chemotherapy on Matrix Metalloproteinase Expression in Leukemia

Previous studies have demonstrated that during and after treatment with chemotherapeutic agents, leukemic cells are afforded considerable protection by their interaction with components of the bone marrow microenvironment, specifically fibroblastic bone marrow stromal cells [1]. A hallmark of acute lymphocytic leukemia (ALL) may be the ability of the malignant cells to remodel the bone marrow microenvironment to better suit proliferation. Matrix metalloproteinases (MMP) are a family of structurally and functionally related zinc-dependent endopeptidases collectively capable of degrading all of the extracellular matrix (ECM) components. Specifically, Gelatinase A (MMP-2), Gelatinase B (MMP-9) and Collagenase-3 (MMP-13) enzymatically cleave the ECM proteins that hold malignant cells in the marrow and allow the leukemic cells to change the composition to affect optimal growth. Based on this promise, excessive expression of MMP members may contribute to the metastatic phenotype of ALL as it does with many other cancers [2]. Additionally, previous studies indicate MMPs function as survival factors in some tumor models [3]. This study focuses on the resulting change of expression of MMPs in acute lymphocytic leukemia cells *in vitro* after treatment with chemotherapeutic drugs in concentrations that correspond to standard clinical doses in patients with ALL. Throughout this study, it has been demonstrated that expression of MMP proteins by ALL cells, specifically MMP-2, is upregulated with treatment of chemotherapy drugs. Utilizing a transformed cell line with nonfunctional protein kinase B (dnAKT) an increase in MMP protein expression in leukemic cells was observed that exceeded the change observed in cells with functional AKT. These data indicated that AKT acts as an upstream effector in the signaling pathways of MMP production during chemotherapy treatment.

22 WISE, ASHLEY<sup>1</sup> AND SULEIMAN BAHOUTH<sup>2</sup>. <sup>1</sup>Christian Brothers University and <sup>2</sup>University of Tennessee, Memphis – Characterization of MAPK activation by the human 1-adrenergic receptor

The  $\beta_1$ -AR is a G<sub>S</sub>-coupled receptor whose activation by catecholamines increases heart rate and force of myocardial contractions through cyclic AMP-mediated activation of the

cyclic AMP-dependent protein kinase (PKA). However, the mechanism by which the  $\beta_1$ -AR causes the phosphorylation and activation of MAPK (mitogen-activated protein kinase), which is involved in enlargement and remodeling of the heart, is unknown. We analyzed the signaling pathway for  $\beta_1$ -AR-mediated activation on MAPK in HEK-293 cells expressing the human  $\beta_1$ -AR and a number of point mutants to determine the role of PKA and G proteins in this pathway. Our experimental protocol was to pretreat cells with H-89 that inhibits PKA and pertussis toxin (PTX) that inhibits the G protein  $G_i$ , then characterize their effects on catecholamine-mediated phosphorylation of MAPK. We discovered that MAPK activation by the  $\beta_1$ -AR is PKA and  $G_i$  independent. Furthermore, we mutated a critical serine to prevent PKA from phosphorylating the  $\beta_1$ -AR. This mutation did not affect the phosphorylation of MAPK, indicating that the signaling pathway for the activation of MAPK by the  $\beta_1$ -AR is distinct from that used by the  $\beta_2$ -AR which is sensitive to PKA, PTX and serine mutagenesis. These data indicate that elements downstream from the G protein were not involved. Therefore, we uncoupled the  $\beta_1$ -AR from  $G_s$  by neutralizing the DRY motif in loop III of the receptor. These mutations inhibited isoproterenol-mediated stimulation of MAPK indicating that elements upstream to PKA and  $G_i$  were involved in  $\beta_1$ -AR-mediated activation of MAPK. Supported by grants from NIH and SE-AHA.

- 23 MOORE, SHAWN AND GERHARD KALMUS. East Carolina University; Dept. of Biology - The possible anti-inflammatory effects of *Cassia occidentalis* shown by the inhibition of histamine release from MC/9 mast cells

The purpose of this study is to test the anti-inflammatory effects of *Cassia occidentalis*, a plant used medicinally as a treatment for rheumatism and acute inflammation, which is native to the Old World tropics; however it is found locally in North Carolina, which is commonly known as Coffee senna. To test this question, quantities of histamine released from MC/9 mouse mast cells in the presence of *C. occidentalis* extracts at various concentrations will be observed. The *Cassia occidentalis* was found in Pender County (North Carolina) along the edges of corn fields and was collected under the supervision of the mentioned county's agricultural extension agency. The leaves underwent a Soxhlet extraction using methylene chloride and absolute methanol. The MC/9 cells were activated to release its granule histamine by the use of Compound 48/80, which acts to cause an influx of extra-cellular calcium due to its ability to inhibit calmodulin and activate G proteins. The amount of histamine release can be tested using an Enzyme-linked Immunosorbent Assay (ELISA), obtained commercially, which operates under the competitive ELISA schema. Results indicate that *C. occidentalis* at a concentration of 10,000 $\mu$ g/ml, extracted with methylene chloride has the ability to prevent release of histamine from MC/9 cells, as well as *C. occidentalis* at a concentration of 100 $\mu$ g/ml, extracted with methanol also has the capacity to inhibit the release of histamine from the MC/9 mast cells.

- 24 FREEMAN, JENNIFER<sup>1</sup>, SHAILA KOTADIA<sup>2</sup>, AND A. LANE RAYBURN<sup>1</sup>.  
<sup>1</sup>University of Illinois at Urbana-Champaign and <sup>2</sup>University of Texas Southwestern Medical Center - Comparing the cytotoxicity and cell cycle effects of common food additives to agrochemicals contaminating potable water

The advent of minimum tillage has resulted in farmers becoming more reliant on chemical means for weed control. A problem associated with herbicide use is that application mainly occurs in early spring, which is usually a period of heavy rains. The timing of herbicide application allows for an increased chance for agrochemical runoff resulting in potable water contamination. Herbicide contamination of drinking water is a growing concern. The potential health risks associated with herbicide contamination in water supplies is a highly debated topic. Comparing the herbicides with food additives may demonstrate that the risk presented by agrochemicals is minimal and therefore pose no more of a threat than approved food additives. Initially the cytotoxicity of herbicides was

compared to two groups of food additives, artificial sweeteners and preservatives. Herbicides were found to be the most cytotoxic followed by preservatives. Sweeteners were the least cytotoxic. From the cytotoxicity data, a non-cytotoxic range of chemical concentrations were utilized in the next set of experiments. Herbicide and food additives were evaluated for the type of effect the chemicals were having on the cell cycle. Inhibition of the cell cycle, inhibition of the cell cycle in conjunction with chromosome breaks, clastogenicity and no cell cycle effect were the four different types of responses found as a result of chemical exposure. When evaluating possible human exposures at the concentrations of chemicals determined to have detrimental cellular effects, the general population is no more at risk to herbicides than FDA approved food additives.

- 25 GIBSON, PHIL<sup>1</sup>, AMELIA TOMLINSON<sup>2</sup>, AND CAYENNE ENGEL<sup>3</sup>. <sup>1</sup>Agnes Scott College, <sup>2</sup>Indiana University, and <sup>3</sup>University of Tennessee, Knoxville - Pericarp characteristics and the expression of heterocarpy in *Grindelia ciliata* (Asteraceae)

Heterocarpy is a reproductive strategy in which reproductive output is partitioned between two or more groups of morphologically and ecologically dissimilar fruits. By partitioning offspring among two or more ecologically divergent groups, detrimental impacts of environmental heterogeneity on seedling establishment is reduced because the differing structural, dispersal, and dormancy traits among fruit morphs counterbalance contrasting spatial and temporal dispersal risks. We investigated heterocarpy in *Grindelia ciliata* (Asteraceae). *G. ciliata* capitula produce up to three structurally dissimilar achene morphs. Ray achenes are the heaviest, have a rounded shape, produce a non-functional pappus, and have a physical dormancy mechanism. Disc achenes are the lightest, have an elongate shape, produce a functional pappus, and germinate readily. Peripheral disc florets occasionally produce achenes that have the persistent pappus of disc achenes and the shape of ray achenes. Structural and functional characteristics were compared among *G. ciliata* achene morphs to evaluate how variation in these traits shapes the expression of heterocarpy. We identified significant differences in pericarp allocation and anatomical features among achene morphs that are ecologically important features of heterocarpy in *G. ciliata*. The results also indicate that plants modify patterns of achene morph production in response to environmental variation. Results of these studies are evaluated in a phylogenetic context to identify potential developmental and structural antecedents that may dictate the evolution of heterocarpy.

- 26 MCMULLEN, CONLEY AND ALEJANDRO STELLA. James Madison University - Pollen-ovule ratio and pollen size of selected Galápagos Islands endemics

Studies were conducted on 18 endemic species of Galápagos flowering plants. Information on flower color, size, pollen-ovule ratio, pollen size, visitors, breeding system based on bagging experiments, and predicted breeding system based on pollen-ovule ratio were collected. The majority of species have relatively small, white or yellow flowers. Based on pollen-ovule ratio, 16 are classified as xenogamous, while two are facultatively autogamous. Sixteen species produce pollen grains less than 60 µm in diameter. Flower visitors are uncommon compared to the mainland and wind pollination is relatively unimportant. Seventeen species produce perfect flowers, while one is dioecious. Based on bagging experiments, the majority exhibits facultative autogamy. Flower color and size, paucity of pollen vectors, and bagging studies suggest that self-compatibility has a high selective value in this archipelago, while pollen-ovule ratio and pollen size suggest that most species are xenogamous. We propose that the latter characters, being conservative floral features, are indicative of the breeding systems of the endemics' mainland ancestors rather than the current breeding systems.

- 27 LEE, MELISSA, KARLA GAGE, AND SAM PIERCE. The University of Memphis - Analyses of patterns of resource distribution in plants using projected surface areas of leaf and root

The well-being of plant may be assessed by a variety of quantitative measures based on changes in size and mass. Recent studies suggest that patterns of resource allocation may be better reflected by measures of plant root and surface areas, which reflect the area of interaction a plant has with the surrounding environment. Comparative studies have indicated that evaluation of the projected surface area, in particular, leaf surface area, is an accurate and precise method of measuring plant performance. The objective of present study is to quantitatively evaluate plant performance using aboveground biomass, belowground biomass, leaf number, plant height, maximum root depth, projected surface area, leaf surface area, and root surface area. Relationships will be studied in two species, *Cucumis melo*, and *Spartina alterniflora*. The plants will be grown in a greenhouse and evaluated periodically using both destructive and nondestructive techniques. Nondestructive measurements are based on digital imaging techniques. Statistical analyses including ANOVA, ANCOVA, correlation analysis, and multivariate regression analysis will be used to identify any significant relationships among quantitative parameters of plant growth. It is expected that a significant relationship will be found between leaf surface area and other plant growth parameters. Statistically significant relationships among plant characteristics may allow for development of nondestructive, species specific standard indices to evaluate nondestructively plant resource allocation patterns, plant health, productivity, and allow for inter-study comparisons. Nondestructive methods are needed for study of rare and/or valuable plants, as well as for nondestructive repeated measurements of plant performance.

- 28 CRUM, M.L., J.J. ZACZEK, J.A. PREECE, AND S.G. BAER. Southern Illinois University, Carbondale - Genetic and environmental influences on sap sugar concentration of silver maple (*Acer saccharinum*)

Research was conducted to examine the genetic and environmental influences on the sap sugar concentration of silver maple trees. Silver maple trees in 1990 were planted in a randomized complete block design on two field sites in Carbondale, Illinois; Chautauqua Bottoms, a bottomland site and Thunderstorm Road, an upland site. Twelve provenances of silver maple were used to represent the native range in North America. Within each provenance there were 4 clones represented in each of 5 blocks at both sites. These trees were tapped and sap sugar concentration (SSC) data was collected over a three year time span. Differences among clones were detected using a blocked one-way mixed model with repeated measures design. The differences among provenances were detected using a nested repeated measures design. Thunderstorm Road silver maples had a significant ( $p=.0047$ ) clone by year interaction. The provenance by year interaction at Thunderstorm Road was not significant. There was a significant ( $p<0.0001$ ) clone by year interaction and provenance by year interaction at Chautauqua Bottoms indicating that relative SSC performance for clones and provenances at that site varied over years. Ranking of clone and provenance performances will also be presented.

- 29 ATWOOD, AARON, JOHN E. PREECE, AND JAMES ZACZEK. Southern Illinois University, Carbondale - Positional effects on forced shoot production and rooting of shoots from northern red oak and cherrybark oak boles and branches

Shoot forcing and subsequent rooting of shoot cuttings, from excised sections of dormant tree branches and boles, is a promising method of producing cuttings for vegetative propagation. Not all shoots forced from dormant boles and branches may produce cuttings that readily produce adventitious roots. Therefore, it is imperative to know if position of shoot origin across bole and branch length affects forced shoot production and rooting of



shoot cuttings. This research seeks to determine which bole or branch positions will produce the greatest number of vigorous shoots and rooted cuttings of these shoots from excised dormant branch and bole sections of northern red oak (*Quercus rubra*) and cherrybark oak (*Quercus pagoda*). Ten trees of each species with diameters at breast height between ten to twenty centimeters were harvested, and then the boles and branches were divided into forty centimeter sections and randomly arranged on greenhouse benches under intermittent mist. Logistic regression analysis demonstrated northern red oak shoot production decreased from basal to distal portions of the bole. Proximal branch positions showed greater shoot production than distal branch positions. Cherrybark oak showed no relationship between shoot production and bole and branch position. Rooting ability of cuttings will be analyzed by logistic regression to determine if possible differences exist between basal and distal bole sections and proximal and distal bole sections.

- 30 DURHAM, T. JUSTUN AND S.K. BALLAL. Tennessee Technological University - Electrophoretic and western blot investigation of rubisco, alkaline phosphatase, and lactate dehydrogenase isozymes in three genera of Lemnaceae

Populations of three genera of Lemnaceae were examined to determine relatedness. *Lemna*, *Spirodela*, and *Wolffia* species were collected from various water bodies in Jackson, Overton, Putnam, and White County, Tennessee. The collected samples were immediately taken to the lab and frozen for future protein extraction using ethanol. The protein extract was subsequently loaded into a 12% polyacrylamide gel for separation. Western blot analysis was performed on ribulose-1, 5-bisphosphate carboxylase oxygenase (rubisco), alkaline phosphatase, and lactate dehydrogenase. Relatedness of the populations was determined by electrophoretic separation banding patterns and confirmation of proteins through Western blot analysis.

- 31 HAMISSOU, MIJITABA. Jacksonville State University - Roles of three inducer signals of osmolyte synthesis in five taxonomic groups of plants

Increasing demands for food quality and quantity are two major causes for over irrigation and over fertilization of agricultural lands. These two factors combined are contributing to increase in soil salinity. Stress due to soil salinity of irrigated lands is an impediment to plant growth and development. Plants cannot extract water from the soil unless the water potential in the root is less than the water potential in the surrounding soil. Plants growing in saline soils must also cope with the potential toxic effects of Na<sup>+</sup> ions. Tobacco plants are known to cope with soil salinity by synthesizing *osmotin*, a 26-Kd alkaline protein and localizing it in the vacuoles. *Glycine betaine*, another osmolyte synthesized by the Chenopodiaceae, is believed to be synthesized in the chloroplast then transported through the phloem to the growing tissues. The objectives of this study are to investigate the role 3 inducers signals of *osmotin* and *glycine betaine* biosynthesis: salinity, ethylene, and ABA in the osmotic adjustment of five taxonomically different plant species. All plants were screened on Petri dish plates containing media supplemented with 150 – 300 mM NaCl or in pots containing mixture of potting soil and solid NaCl at a ratio of 100:1.5, in the presence of ethylene, and ABA. The plants were rated based on their ability to germinate and grow their seedling vigor, and their molecular stress responses.

- 32 FOSTER, KARI<sup>1</sup>, SEDONIA SIPES<sup>1</sup>, AND BETH MIDDLETON<sup>2</sup>. <sup>1</sup>Southern Illinois University and <sup>2</sup>National Wetlands Research Center, Carbondale - Effects of heating and scarification on germination of the rare species *Trifolium reflexum*

Fire suppression, loss of large grazing mammals and poor dispersal are possible causes of rarity for the putative fire fugitive, *Trifolium reflexum*. In order to determine the germination requirements of this species and conduct a preliminary seed bank

assessment, five sites in southern Illinois, south-central Kentucky and south-eastern Missouri either currently or historically containing populations were sampled. Soil samples indicated the presence of a *T. reflexum* seed bank at the current sites. Heating the soil did not increase germination of *T. reflexum*. Seeds germinated from seed banks if watered daily, but the pattern of germination in plots near versus far from individuals of the species varied between sites (water\*plot location\*site interaction;  $p < 0.0001$ ). Germination was higher from seed banks collected near individuals at Little Grand Canyon, but at Mammoth Cave germination was higher in seed banks collected farther from individuals of the species. Percent germination of greenhouse-raised seeds varied between sites and treatments (site\*treatment interaction;  $p = 0.0156$ ). Wet- and dry-heated seeds had lower germination percentages than seeds that were not heated or scarified (0–3.9%, 0–9.3%, 22.0–32.9% and 41.5–55.8%, respectively). Although *T. reflexum* is thought to be dependent upon fire, it was not apparent in this study that fire is always necessary for germination. Other disturbance, such as grazing by large mammals, may be necessary to break the hard seed coat. Managers can benefit from the knowledge that seeds of this fugitive species germinate if scarified, but may not necessarily benefit from fire.

- 33 BIERNACKI, MACIEJ<sup>1</sup> AND JON LOVETT-DOUST<sup>2</sup>. <sup>1</sup>University of Memphis and <sup>2</sup>University of Windsor, Ontario, Canada. - Effects of heat accumulation on phenology of watermelon, *Citrullus lanatus* (Cucurbitaceae)

Effects of temperature were quantified on watermelon growth and development. A new measure of heat accumulation, daylight degree-hours was evaluated, to predict plant phenology from planting to maturity. Watermelon (*Citrullus lanatus* cv. Sugar Baby) plants were seeded in pots at 12 weekly intervals in a greenhouse from April through June. In general, plants became established after accumulation of c. 10% of total heat accumulated, flowered at c. 35%, and fruited at c. 45%. Coefficient of determination for daylight degree-hours was 98% vs 91% for degree-days. Dry weight production was dominated by fruit and increased significantly with increased temperature. Root growth was optimal at temperatures significantly lower than that associated with optimal growth of above-ground structures. Mean leaf surface area per plant increased over all seeding occasions, to nearly 3500 cm<sup>2</sup>, while root surface area increased over the first seven seeding occasions, to 2000 cm<sup>2</sup> and then decreased. Root surface area was significantly affected by changes in the length of small roots (with diameter <0.5 mm). Roots with diameter <0.5 mm, and root tips were most responsive to temperature, compared to other roots. Water use per unit leaf area increased from 0.2 mL cm<sup>-2</sup> at 14 °C, to about 1.5 mL cm<sup>-2</sup> at 45 °C. It increased even more per unit root surface area from 0.3 mL cm<sup>-2</sup> at 14 °C, to about 3.2 mL cm<sup>-2</sup> at 45 °C. Water use was 4 to 10 times greater per unit of leaf area in watermelon, and 8 to 12 times greater per unit of root area, than in common weeds amaranth and crabgrass.

- 34 PIERCE, SAMUEL, MELISSA LEE, AND KARLA GAGE. The University of Memphis - Interactive effect of light and temperature on plant phenology

Accurate prediction for timing of growth stages of plants in agricultural sciences may lead to improved management. Historically, models quantifying plant phenology were related to heat accumulation, called growing degree-days. Growing degree-days were based on measures of temperature alone. Use of the degree-day measurement alone is problematic because it ignores the interactive effects of light and temperature on plant development. Recent studies of agricultural crops have indicated that *daylight degree-hours* are better to predict plant development than degree-days. Also it was observed that increased solar irradiance and longer day-length correlated with the higher temperatures of summer. To quantitatively model the effects of temperature and light on plant development, I propose a field experiment in which individual plants are subject to combinations of temperature and length of day. Planting will take place from late April to

early July at two-week intervals. Hourly averaged air temperature, day length and relative humidity will be measured from germination to fruit maturity. Light intensity, plastochron interval, and soil moisture will be measured periodically throughout the study. The objective of this study is to develop a quantitative model for the effects of daylight degree-days plant phenology.

- 35 HAWKINS, TRACY, CAROL BASKIN, AND JERRY BASKIN. University of Kentucky - Dormancy-breaking and germination requirements for seeds of three eastern deciduous forest *Sanicula* species

Dormancy-breaking and germination requirements and potential to form persistent soil seed banks were determined for *Sanicula canadensis*, *S. gregaria*, and *S. trifoliata*. Seeds of all three species had underdeveloped embryos ( $\leq 0.5$  mm in length). Warm (25/15 °C) followed by cold (1 °C) stratification was effective in breaking dormancy in  $100.0 \pm 0\%$  of the *S. canadensis* seeds but in only  $29.3 \pm 4.8\%$  and  $43.3 \pm 1.7\%$  of those of *S. gregaria* and *S. trifoliata*, respectively. On the other hand, cold stratification not preceded by warm stratification broke dormancy in only  $38.7 \pm 1.9\%$ ,  $29.3 \pm 4.8\%$ , and  $0.0\%$  of *S. canadensis*, *S. gregaria*, and *S. trifoliata* seeds, respectively. Further, percent seed germination was highest at a temperature regime of 15/6 °C. Under natural temperatures in a nonheated greenhouse, autumn-sown seeds of the three species germinated the following spring to percentages similar to those of laboratory germination tests, and additional seeds germinated in the spring of years 2, 3, and 4. This study shows that (1) some seeds of *S. canadensis* and of *S. gregaria* have nondeep complex morphophysiological dormancy (NDCMPD) and others deep complex morphophysiological dormancy (DCMPD), (2) all seeds of *S. trifoliata* have NDCMPD, and (3) all three species have the capacity to form a persistent soil seed bank.

- 36 CIRTAIN, MARGARET<sup>1</sup>, JOHN PREECE<sup>2</sup>, AND SCOTT FRANKLIN<sup>1</sup>. <sup>1</sup>The University of Memphis and <sup>2</sup>Southern Illinois University, Carbondale. - Restoration of *Arundinaria gigantea* (Walt.) Walt Ex Muhl. canebrakes using micropropagation

*Arundinaria gigantea* (Walt.) Walt. Ex Muhl. canebrakes, North America's only native bamboo, are a critically endangered ecosystem, with this declining habitat impacting many species. Attempts to reestablish canebrakes using vegetative propagation methods have had limited success. The goal of this study was to develop micropropagation methods to facilitate *A. gigantea* reintroduction. I have tested media compositions and plant growth regulator concentrations for best growth conditions and, in addition, have compared explant size ranges for establishment. I have selected Murashige and Skoog medium and 0.1 $\mu$ M thidiazuron (TDZ) as preferred for shoot development, determined root development to be enhanced with coumarin and indole-3-butyric acid, and suggest a 4 to 6 mm culm diameter range of explant size to be used for further studies. Implementation of micropropagation methods for canebrake restoration may enable reestablishment of these historically vast stands of *A. gigantea*, providing habitat for many species and opportunity to study this endangered ecosystem.

- 37 HUDSON, SHARON AND MARGARET CIRTAIN. University of Memphis - Reintroduction of native bamboo through vegetative culm propagation

*Arundinaria gigantea* (Walt.) Walt. ex Muhl (giant cane) forms dense stands that are ecologically important habitat. This native bamboo has been devastated by various anthropogenic factors, which, combined with lack of sexual regeneration, have rendered drastic decreases in the southeastern United States. The ultimate research goal is to reintroduce canebrakes. However, with no seed, a method of multiplying individuals for planting new sites must be developed. The specific objective of this research was to

determine which of two mediums, sand or a perlite-vermiculite mixture, yields the greatest growth from culm cuttings, a macropropagation technique. My hypothesis is that shoot growth as well as number of cuttings producing shoots will be greater on sand. One year old bamboo culms were harvested and cut at the internodes to a length of 20 cm; twelve nodes were placed laterally in each tray (six trays per medium) and they were watered and fertilized. Trays were placed on a growing bench with a continuous light source. After three weeks, average height and total number of cuttings producing shoots were calculated for each tray. There was no significant difference ( $F = 1.21$ ;  $p > F = 0.28$ ) between growth of nodal shoots on sand (mean = 1.40 cm, standard deviation = 0.96) compared to perlite-vermiculite mixture (mean = 0.88 cm; standard deviation = 0.54). Number of cuttings producing shoots were also not significantly different ( $F = 2.5$ ,  $p > f = 0.14$ ), but perhaps biologically meaningful; number of cuttings producing shoots was 1.5 times greater on the sand medium.

- 38 CALDWELL, LAURA AND SCOTT FRANKLIN. The University of Memphis - Restoration of *Arundinaria gigantea* canebrake Strawberry Plains Audubon Center, Marshall County, Mississippi Dahomey National Wildlife Refuge, Bolivar County, Mississippi

The decline in *Arundinaria gigantea* has called for an effort in restoration. To explore the most successful means of restoration, *Arundinaria gigantea* individuals were transplanted from local populations to study plots on Dahomey National Wildlife Refuge in Bolivar County, Mississippi and Strawberry Plains Audubon Center in Marshall County, Mississippi. Twenty-one plots at Strawberry Plains and eight plots at Dahomey NWR were constructed, each containing sixteen *Arundinaria* rhizomes. Diameter of original culms, as well as diameter and height of new culms were recorded from July to September of 2003. Initial mean diameter of new shoots at the Dahomey NWR site was 5.526 mm, and initial mean height was 0.464 m. Final mean diameter was 5.644 mm, and final mean height was 0.443 m. Initial mean diameter for new shoots at the Strawberry Plains site was 5.018 mm, and initial mean height was 0.702 m. Final mean diameter was 4.725, and final mean height was 0.535 m.

- 39 ESTES, DWAYNE<sup>1</sup> AND CHRIS FLEMING<sup>2</sup>. <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Breedlove, Dennis, Young & Associates, Inc. - *Clematis morefieldii* Kral (Ranunculaceae), a federally endangered species, discovered in Tennessee.

*Clematis morefieldii* Kral (Ranunculaceae) is a rare vine described in 1987 by Dr. Robert Kral from Madison County, Alabama. In 1992, the United States Fish and Wildlife Service listed the species as federally endangered due to its limited range, small population sizes, and destruction of habitat. *Clematis morefieldii* is a member of subgenus *Viorna*, a group notable for its narrow endemics. It is restricted to the southwestern Cumberland Plateau where it grows on rocky, wooded limestone slopes near seeps or washes. Indicator species often include *Juniperus virginiana*, *Cotinus obovatus*, *Rhus aromatica*, *Quercus muehlenbergii*, *Carya carolinae-septentrionalis*, *Hypericum frondosum*, *Solidago auriculata*, *Polymnia canadensis*, and *Scutellaria ovata*. A few rare or restricted endemic species commonly associated with *C. morefieldii* are *Neviusia alabamensis*, *Viburnum bracteatum*, *Silphium brachiatum*, and *Blephilia subnuda*. When Kral described the species, he suggested it may exist in suitable habitat found in adjacent areas of Alabama and Tennessee. On June 05, 2003, we discovered a small population of 18 individuals in southwestern Franklin County, Tennessee, 12.5 km northeast of the nearest Alabama population. Our find represents the first report for *C. morefieldii* outside of Madison County, Alabama and extends its known range into Tennessee.

- 40 EAKIN, DAVID A. Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 - SEM confirmation of species-specific characteristics in the moss genus *Regmatodon* (Regmatodontaceae)

*R. declinatus* and *R. orthostegius* have been recognized as the only two species in the genus *Regmatodon*. Since the species distinctions are almost exclusively restricted to the sporophyte, further confirmation of these distinguishing characters was sought at the SEM level of resolution. The final results of these studies are presented.

- 41 SMALL, RANDALL<sup>1</sup>, EDGAR LICKEY<sup>1</sup>, JOEY SHAW<sup>1</sup>, AND WARREN HAUKE<sup>2</sup>.  
<sup>1</sup>University of Tennessee and <sup>2</sup>Denison University - Amplification of non-coding chloroplast DNA for phylogenetic studies in Pteridophytes and Lycophytes

Phylogenetic studies at the interspecific level in angiosperms often employ a variety of non-coding chloroplast DNA (cpDNA) sequences for which "universal" PCR primers are available. Interspecific studies of pteridophyte and lycophyte phylogeny are fewer in number, however, and only a small number of non-coding cpDNA regions have been explored in these lineages. In a recent study we evaluated levels of variation in 21 different non-coding cpDNA regions in seed plants. One purpose of the present study is to determine which of these regions can also be amplified in pteridophytes and lycophytes using the PCR primers designed for seed plants. Taxon sampling for this portion of the study includes representatives of all lycophyte families (Lycopodiaceae, Selaginellaceae, and Isoetaceae); *Ptilotum*; *Equisetum*; eusporangiate ferns (*Ophioglossum* and *Angiopteris*) and several species representing the phylogenetic diversity of leptosporangiate ferns. In addition to this broad survey, cpDNA sequence variation in one region that was particularly variable in seed plants (the *trnS* [GCU] - *trnG* [UCC] intergenic spacer + the *trnG* [UCC] intron) is being evaluated in Ophioglossaceae to compare levels of variability of this region with data previously obtained from three other cpDNA regions (the gene *rbcl*, the *trnL-trnF* intergenic spacer, and the *rpl16* intron).

- 42 LICKEY, EDGAR<sup>1</sup>, RANDALL SMALL<sup>1</sup>, AND SYDNEY BACCHUS<sup>2</sup>. <sup>1</sup>University of Tennessee and <sup>2</sup>University of Georgia - Genetic variation in non-coding chloroplast and nuclear DNA regions in *Taxodium* (Cupressaceae)

The delimitation and circumscription of taxa within *Taxodium* has been a contentious issue among many researchers. Three entities are usually recognized (baldcypress, Montezuma baldcypress, and pondcypress), but the rank at which these taxa are recognized varies among authors. Previous work based on morphology, allozymes, and an anonymous nuclear DNA locus indicate that although there are differences between taxa, these differences may become blurred in sympatric populations and in intermediate habitats. Natural populations of Montezuma baldcypress are allopatric from both bald and pondcypress, and recent work indicates that there may be temporal reproductive isolation between bald and pondcypress. These data suggest that there is probably limited gene flow between taxa, but genetic data to test this hypothesis is currently lacking. To assess genetic variation within and among populations of *Taxodium*, both non-coding chloroplast and nuclear DNA sequences are being evaluated. A survey of over 11,000 bp of non-coding chloroplast DNA between one bald and one pondcypress revealed only three indel and four nucleotide substitution differences between individuals. Sequences of two nuclear genes (*G3PDH* and *PGI*) are also being explored. Restriction digestion of PCR-amplified fragments of both chloroplast and nuclear regions will be used to assess the geographic and taxonomic distribution of genetic variation.

- 43 BECK, JOHN AND RANDALL SMALL. University of Tennessee, Knoxville - Preliminary investigation of *Sida* and related genera (Malvaceae) based on analysis of chloroplast DNA *rpl16* intron sequences.

The genus *Sida* (Malvaceae, tribe Malveae) is a species-rich group with a global distribution. Generic circumscription of *Sida* has historically been problematic, however, and a number of segregate genera have been proposed to accommodate species originally placed in a large and heterogeneous *Sida* s.l. *Sida* s.s. is currently divided into eleven sections based on morphological data, and along with the segregate genera, comprise an informal group known as the *Sida* alliance. A recent phylogenetic analysis of the *Sida* alliance based on nuclear ribosomal ITS sequences recovered a group of *Sida* species (including the segregate genus *Dendrosida*) that represent the *Sida* "core." This analysis also suggested that *Sida* is polyphyletic and a number of species currently classified in *Sida* are actually more closely related to other genera than to the *Sida* core. To complement and extend the phylogenetic analysis based on ITS sequences we have sequenced a noncoding chloroplast DNA region (the *rpL16* intron) for species currently classified in *Sida* and segregate genera. The goal of the study is to assess the monophyly of the named sections of *Sida*, the relationships among *Sida* and related genera, and to provide a framework for subsequent more focused studies of individual groups of *Sida* species.

- 44 SIRIPUN, KUNSIRI CHAW AND EDWARD SCHILLING. University of Tennessee, Knoxville - Comparative analysis of phylogenetic relationships of *Eupatorium* diploid and polyploidy populations using molecular approaches

One of the problems of *Eupatorium* is the presence of species with multiple cytotypes and reproductive systems. This combined with natural hybridization, obscures the delineation and relationships among species. The objective of this study was to investigate in detail the relationships and variation in *E. rotundifolium* and *E. sessilifolium*, using molecular markers. Both species include diploid, sexual populations that have relatively restricted geographical distributions and widely distributed, polyploid, apomictic populations. One hypothesis to be tested for each species was whether the polyploid apomicts were monophyletic and could be traced to a single origin. A second hypothesis was whether the polyploid apomicts were autopolyploids or if they were of hybrid origin involving different species. DNA sequence data from the nuclear ITS and the chloroplast-encoded *trnC-ycf6* regions were sought to produce a species level phylogeny for the genus. Data from ISSR markers were used to make a detailed comparison of populations within each species. The results help to clarify the extent to which hybridization and potential multiple origins were involved in generating the morphological diversity that complicates the taxonomy of *Eupatorium*.

- 45 GOODWILLIE, CAROL, KERRY PARTIS, JENNIFER NESS, JONATHAN KORNEGAY, AND MARY CATHERINE KNIGHT. East Carolina University - The distribution and genetic basis of variation in self-incompatibility in *Leptosiphon jepsonii* (Polemoniaceae)

*Leptosiphon jepsonii* (formerly *Linanthus jepsonii*), a northern California spring annual, shows extraordinary variation in self-incompatibility (SI), a genetic mechanism by which plants recognize and reject self pollen. Most plants of this species exhibit a floral age-dependent form of (SI) that confers delayed selfing. In both field and growth room studies, self-pollination of these plants produces few to no pollen tubes when flowers are first open, but growth of outcross-pollen-tubes indicates that stigmas are receptive during this phase. By the second day of a flower's duration, however, self-pollen-tubes grow readily, and pollen-tube numbers in self- and outcross-pollinated flowers are not significantly different. Plants sampled from across the species distribution, however, range from fully self-compatible to fully SI, and populations vary dramatically in the frequency of these reproductive types. Preliminary crossing data suggest that this variation may have a simple genetic basis. Phylogenetic reconstruction of the genus has shown that selfing

evolved in parallel in multiple independent lineages. Using AFLP markers, we are characterizing genetic relationships among populations of *L. jepsonii* to determine whether parallel transitions in the mating system are occurring at the population level as well. Floral age-dependent SI may be an adaptive and evolutionarily stable strategy that promotes cross-fertilization while assuring reproduction in the absence of pollinators. Alternatively, it may represent a transitional step in the evolution from SI to complete selfing.

- 46 ROBERTS, ROLAND P. Department of Biological Sciences, Towson University, Towson, MD 2125 - The systematics of *Chrysothamnus* and related genera: A model for the evolution of desert flora?

Nuclear ribosomal ETS and ITS sequence data indicate that the genus *Chrysothamnus*, as defined by Anderson, is polyphyletic. Phylogenetic analyses employing several optimality criteria on the independent and combined data portray traditional *Chrysothamnus* in four distinct lineages. Two lineages, one centered around *Chrysothamnus pulchellus* and the other around *Chrysothamnus viscidiflorus*, are composed of species that display similarities in both morphological characteristics and altitudinal distribution. Several taxa in the two lineages display classical adaptations for survival in the hot, arid environments. In addition, the lineages display a similar pattern in the relationship of lower elevation and alpine species. The relationships revealed among taxa within these two lineages might be indicative of the pattern of evolution of desert flora.

- 47 HAEFNER, KERRY D.<sup>1</sup> AND REBECCA D. BRAY<sup>2</sup>. <sup>1</sup>University of Louisiana at Monroe and <sup>2</sup>Old Dominion University - Morphological evidence for introgressive speciation in *Isoetes*: Support for the Matthews and Murdy hypothesis

The southeastern U.S. granitic outcrops harbor an assemblage of diminutive, ephemerally aquatic *Isoetes* species that occur at a range of ploidy levels (*I. melanospora*: 2n=22; *I. piedmontana*: 2n=22, 33, 44; *I. tegetiformans*: 2n=22). A 1969 study of these rock outcrop quillworts revealed some populations representing intermediates between *I. piedmontana* and *I. melanospora* based on megaspore color, intermediate leaf morphologies, and phenolic spot patterns. These intermediates were attributed to introgression; the concept of species in *Isoetes* was then deemed difficult to interpret based on these characters. Introgression leads to the hypothesis of an initial fertile, diploid hybrid formed between *I. piedmontana* and *I. melanospora* despite their apparent phylogenetic differences. Based on a suite of characters using largely leaf measurement ratios and analysis with UPGMA, *I. melanospora* and *I. tegetiformans* form an intergrading group, and are distinguished from each other vegetatively based on size and corm morphology. Plants sampled from six pools at the 40 Acre Rock, South Carolina population formed a distinct group most similar to *I. melanospora*. The addition of *I. piedmontana*, using the same characters, breaks the 40 Acre Rock cluster into groups that are either intermediate between *I. melanospora* and *I. piedmontana*, or most similar to *I. piedmontana*. Normally-formed spores and diploidy (2n=22) in the 40 Acre Rock material are consistent with hybrids formed between *I. melanospora* and *I. piedmontana*. The 40 Acre Rock population likely represents an allopolyploid species.

- 48 MELLICHAMP, LARRY. University of North Carolina at Charlotte - How do pitcher plants (*Sarracenia*; Sarraceniaceae) keep from eating their pollinators?

There are some 10 species of *Sarracenia* (Sarraceniaceae) pitcher plants in the Southeastern United States. They thrive in sunny wetland savannas where periodic fires keep habitats open. They produce tubular leaves that attract, catch, and digest invertebrate prey, from which they derive supplemental nutrients that allow them to have a

competitive advantage in the relatively poor soils. Each species may be identified by its distinctive showy flower in conjunction with its characteristic leaf morphology. While there have been few studies, it is accepted that bumblebees are the most effective pollinators. The generally protogynous flowers are produced in spring, and are designed to encourage foraging for pollen and to favor cross pollination. It is known that bumblebees can be attracted to and become prey for the pitchers. It has also been shown that each *Sarracenia* species may catch a somewhat different array of invertebrate prey so as to avoid competition for this resource when several species grow together, as they usually do. Now, if we assume it is desirable to have as many individual pollinators as possible servicing the population, we might wonder how do the different species of *Sarracenia* keep from catching their own pollinators? This may be accomplished by a combination of timing (flowers bloom before pitchers open), spatial separation (tall flowers and short pitchers), and specialization for certain prey (having pitcher mouths that exclude pollinators). The hypothesis that *Sarracenia* species have evolved various methods for pollinator-trapping avoidance has neither been expressed nor tested to my knowledge.

- 49 KNAPP, WESLEY M. Delaware State University – Taxonomic status of *Juncus longii*, a putative taxon within the *Juncos marginatus* complex (Juncaceae sect. Graminifolii)

The taxonomic status of the Southeastern U.S. species *Juncus longii* Fernald has been debated almost since its first description in 1937. Taxonomic treatments of the *Juncus marginatus* complex vary widely. Treatments by Radford et. al (1968) and Fernald (1950) recognize three species (*Juncus biflorus*, *J. longii* and, *J. marginatus*), whereas other treatments such as Brooks in the Flora of North America (2000) recognize only one species, *J. marginatus*. My field and herbarium studies cover most of eastern North America. The number of specimens located in the field and in herbaria suggests *J. longii* is a globally rare species with a known range of Maryland, Virginia, the Carolinas, and Mississippi. Preliminary multivariate and univariate statistical analyses of several morphological characters suggest that *Juncus longii* is a species distinct from *Juncus marginatus* and *Juncus biflorus*, with all three species being identifiable by a number of characters. Ecological differences are also apparent. *Juncus longii* is restricted to early successional seepages with exposed sandy soils. *Juncus marginatus* and *J. biflorus*, however, are found in less specialized habitats. I have documented syntopic occurrences of *Juncus longii* with *J. marginatus* and *J. marginatus* with *J. biflorus*, suggesting the morphological differences used to identify these species are not a reflection of environmental conditions. By clarifying the taxonomic status and ecology of *Juncus longii*, the geographic range and conservation status of this species may be clarified.

- 50 TWYMAN, WALTER DAN AND T. WAYNE BARGER. Tennessee Technological University - History and technology collide: The electronic databasing of the Paul L. Hollister Herbarium at Tennessee Technological University

The Paul L. Hollister Herbarium, located at Tennessee Technological University, houses more than 8,000 specimens of plants. The history of the herbarium has been documented and now serves as a valuable resource of plant information, particularly for plants located within the Highland Rim and Cumberland Plateau physiographic regions of Tennessee. The herbarium is currently undergoing a modernization to an electronic database format. This databasing will allow the herbarium to become more dynamic and allow users to sort information using wide variety of fields (including, but not limited to, the latest scientific name, synonyms, by plant family, by collector, etc.) The entire database will be accessible world wide through the internet and will allow for greater information collection and sharing. This ushers in the technological age for the Paul L. Hollister Herbarium and creates a readily available research tool for academic and personal use. This project will



also create a more stable environment, thereby facilitating the loaning and trading of plant specimens with other institutions in order to improve the quality of herbaria worldwide.

- 51 FARMER, SUSAN B. University of Tennessee, Knoxville, TN 37996-1100 - Phytogeographic survey of Trilliaceae.

Trilliaceae are plants of North Temperate forests with a holarctic distribution, and the family has been proposed to be Arcto-Tertiary in origin. Even though it has a pan-north temperate distribution, there is a high degree of endemism within the family; only one species has a widespread distribution. Of the six genera, three are monotypic endemics. There are many interesting distributional patterns in the family relating to morphology, merosity, and ploidy levels. The center of diversity of tribe Trillieae is in the southeastern United States; the center of diversity for tribe Parideae is in China. Molecular phylogenetic analyses show that the basal most lineage is restricted to the Siskiyou Range of the Pacific Northwest; in addition, the basal lineages in the major clades appear to be restricted to Asia or the western U.S. This suggests that the origin of the family is in this region with subsequent radiations to Asia and eastern North America.

- 52 GILLESPIE, EMILY L., ZACK E. MURRELL, AND GARY L. WALKER. Appalachian State University -- Phylogeography of *Carex eburnea* and the systematics of *Carex* Section *Albae*.

*Carex eburnea* Boott (*Carex* Section *Albae*) is a North American boreal species distributed in the northern latitudes from Alaska to Nova Scotia. Disjunct glacial relict populations are found in the Ozark Mountains, the southern Appalachian Mountains, and a southern-most station at Ketona Dolomite Glade in Alabama. The southern populations are generally associated with north-facing limestone cliffs and glades, and often co-occur with other boreal disjunct bog species. In addition to *C. eburnea*, *Carex* Section *Albae* includes *C. mckittrickensis*, a segregate of *C. eburnea* endemic to the Guadalupe Mountains of Texas, *C. alba*, a Eurasian species, and *C. ussuriensis*, an Asian species. The objectives of this study were to 1) describe the phylogeography and population genetic structure of *Carex eburnea* using Inter-Simple Sequence Repeat (ISSR) and morphometric analyses, and 2) examine species delineation and species relationships within *Carex* Section *Albae*. A distribution map was generated for *C. eburnea* and *C. mckittrickensis* from herbarium records. Populations were sampled at different latitudes, physiographic provinces and habitats throughout the range of *C. eburnea*. Sixty-six ISSR primers were screened, of which eight were variable and reproducible; 51 bands were included in the data set and analyzed using PAUP. Genetic diversity was evaluated in the context of post-glacial migration. The systematics of *Carex* Section *Albae* was examined using *Carex brunnea* (*Carex* Section *Graciles*) as the outgroup for character polarization of morphological and molecular data for phylogeny reconstruction. Morphometric data were compiled for several reproductive and vegetative characters and evaluated using multivariate analysis to explore species boundaries.

- 53 JONES, RONALD L. Department of Biological Sciences, Eastern Kentucky University, Richmond, KY -- A reclassification and reassessment of the vascular flora of Kentucky

The number of vascular plant taxa in Kentucky has often been quoted at greater than 3000. A reclassification and reassessment of the vascular flora has revealed that considerably fewer taxa are present in the state. The current estimate of the numbers of species and lesser taxa is 2618, with 2047 of these being native species, and 571 being non-native species. This number of native species is comparable to the numbers recently published for Pennsylvania and Ohio, but is several hundred fewer than the totals for Missouri and Tennessee. A number of segregate families and genera are now recognized,

following current concepts. About 15% of Kentucky's native plants are of conservation concern, including twelve plant species that are federally listed. Only two taxa are true Kentucky endemics--- *Solidago albopilosa* and *Leavenworthia exigua* var. *laciniata*. Eight taxa are endemic to Kentucky and Tennessee, and five taxa are endemic to Kentucky and two other states. Twenty-four state records have been added in the last 4 years, and species new to science have been discovered in Kentucky at the average rate of one per year for the last 24 years. The Kentucky flora currently faces many serious threats, including habitat alterations, exotic diseases, invasive plants, and overharvesting.

- 54 KEATON, MOLLY<sup>1</sup>, JULIO BONILLO<sup>2</sup>, DENNIS HANEY<sup>1</sup>, AND C. BRANNON ANDERSON<sup>1</sup>. <sup>1</sup>Furman University and <sup>2</sup>Universidad Metropolitana - Impact of drought upon fish assemblages in two South Carolina piedmont streams

The effects of drought on fish assemblages were studied in the Indian Creek (228 km<sup>2</sup>) and Kings Creek (46 km<sup>2</sup>) watersheds located in the piedmont of South Carolina. Water and fish samples were collected at 13 localities during drought conditions in 2000 and again under post-drought conditions in 2003. Abundance, species richness, and Simpson's diversity were calculated for each locality, and the masses and lengths of individual fishes were measured to determine total biomass and length distributions for each species. Assemblages were significantly different from 2000 to 2003 (chi-square test for association;  $p < 0.05$ ). Generally, dominance of the Cyprinidae (minnows) declined following the drought due to lower numbers of *Nocomis leptocephalus* and *Notropis lutipinnis* in 2003 collections. Abundance of Catostomids (suckers) and Ictalurids (catfish) was also decreased post drought. Conversely, Centrarchids (sunfish) increased in dominance in 2003. Many more juveniles and young of the year were observed in 2003 collections, suggesting that most species exhibited greater reproductive success following the drought. The significant differences in water chemistry observed between the two years were not associated with any change in fish assemblage structure. Instead, we attributed the observed differences to changes in habitat structure associated with higher rainfall during post-drought conditions. Finally, sample localities showed high variability in common measures of assemblage structure, including abundance, species richness, and diversity. We hypothesize that the observed variability in community structure is caused by the heterogeneous habitat structure and morphology of these small piedmont streams.

- 55 ROTMAN, ROBIN<sup>1</sup>, DENNIS HANEY<sup>2</sup>, AND GREG LEWIS<sup>2</sup>. <sup>1</sup>University of the South and <sup>2</sup>Furman University - Relationships between stream and watershed characteristics and fish abundance and diversity in the Little River basin, South Carolina

As part of an interdisciplinary study of the Little River basin, South Carolina, we examined the relationships between fish community structure, stream nutrient chemistry, and watershed geomorphology from June to August 2003. The Little River is a fifth-order tributary of the Saluda River in the central piedmont of South Carolina. We found a significant difference ( $p < 0.05$ ) in fish diversity between the eastern and western tributaries of the Little River. While both sets of tributaries exhibited similar species richness, the eastern tributaries were characterized by lower overall fish abundance and fairly even distribution of species, resulting in higher Simpson's diversity (4.13). The western tributaries, in contrast, had greater fish abundance, primarily due to large populations of *Notropis lutipinnis* (yellowfin shiner) and *Nocomis leptocephalus* (bluehead chub). The disproportionately large numbers of these two species accounted for the lower Simpson's diversity (2.25) in the western tributaries. Of the 27 stream geophysical and geochemical parameters we measured, stream gradient, drainage area, and total stream length upstream of each sample site were the factors most highly correlated with fish distribution patterns and diversity. In particular, eastern tributaries had higher channel gradients, resulting in structurally more diverse habitats than in western tributaries. As habitat

generalists, *N. lutipinnis* and *N. leptocephalus* may better be able to utilize the low gradient habitats of the western tributaries, resulting in the uneven population distribution and diversity seen in the Little River drainage.

- 56 ADAMS, KEENAN AND TRAVIS PERRY. Furman University – Stream chemistry and growth rates in the bluehead chub (*Nocomis leptocephalus*) in Greenville County, South Carolina.

Water quality is known to affect numerous aspects of fish physiology and this may be reflected in altered growth rates. This study examines the relationship between the concentration of several stream chemicals and the growth rates of bluehead chubs (*Nocomis leptocephalus*). As part of a larger study, several streams were sampled for biological and chemical assessment. We performed analyzed these data to determine whether growth rates in *N. leptocephalus* populations varied significantly with the concentration of  $\text{NO}_3$ ,  $\text{SO}_4$ , and  $\text{H}_2\text{PO}_4$  across streams and sites within streams. Preliminary analyses indicate that there is a significant negative correlation between growth rate and  $\text{NO}_3$  concentration. Also, a t-test comparing two streams demonstrated that the stream with higher  $\text{SO}_4$ , and  $\text{H}_2\text{PO}_4$  concentrations had significantly lower growth rates.

- 57 GREENBERG, CATHRYN<sup>1</sup> AND STANLEE MILLER<sup>2</sup>. <sup>1</sup>US Forest Service, Southern Research Station and <sup>2</sup>Clemson Bob and Betsy Campbell Museum Natural History - Soricid response to canopy gaps created by wind disturbance in the southern Appalachians

We used drift fences with pitfall traps to test whether soricid abundance, richness, and demographic parameters differed among intact multiple-tree windthrow gaps, salvaged gaps, and mature forest in a xeric southern Appalachian forest type during 1997-1999. We also tested whether capture rates were correlated with rainfall, and whether similar-sized species did not co-occur as predicted by multi-species assemblage rules. We captured six species: *Blarina brevicauda* (northern short-tailed shrew), *Cryptotis parva* (least shrew), *Sorex cinereus* (masked shrew), *S. fumeus* (smoky shrew), *S. hoyi* (pygmy shrew), and *S. longirostris* (southeastern shrew). Tree basal area, forest structural features, and arthropod abundance differed among treatments, but species richness and abundance of most shrews did not. Captures during June - October were higher in 1998 than in 1997, although 1998 summer rainfall was low. Rainfall was correlated with shrew activity explained little of the variability in capture rates. The sex ratio within each species was similar among gap treatments and controls, but differed from 1:1 for *S. hoyi*, *S. longirostris* and *S. fumeus*. The soricid assemblage did not conform to multi-species assemblage rules; three small-bodied species co-occurred in similar numbers at all study sites. Our results suggest that forest management that mimics conditions created by multiple windthrows in xeric forest of the southern Appalachians is unlikely to affect shrew communities adversely, at least in the short-term.

- 58 WELLS, CARRIE N. AND RAY S. WILLIAMS. Appalachian State University - The effects of habitat corridors on the genetic structure of an open habitat butterfly, *Precis coenia*

Habitat loss and fragmentation have become the primary causes of modern species loss and extinction. As natural habitat loss accelerates due to human invasion, habitat corridors are becoming an increasingly popular option for managing fragmentation of natural landscapes. Recent findings generally support the positive influence of habitat corridors on plant and animal movement and their relative population sizes. We investigated the influence of habitat corridors on the genetic structure of the common buckeye, *Precis coenia* at Savannah River Site, Aiken, South Carolina. One hundred

eleven butterflies from a model corridor system of connected and unconnected patches were assayed for allozyme variability across 9 loci. Of the 9 loci analyzed, 6 were found to be polymorphic. Percent polymorphism in patches connected by a corridor (66.67%) was higher than in unconnected patches (55.56%). Expected heterozygosities in patches connected by a corridor ( $H_e = 0.1847$ ) were greater than those in isolated patches ( $H_e = 0.1595$ ). Observed and expected heterozygosities were similar within connected and unconnected patches, suggesting mixing of alleles. When compared to 'source' populations of buckeyes outside of the model corridor system at SRS, genetic variability within patches was lower, suggesting that either the number of generations or a small number of founding individuals may be shaping the genetic structure. Greater allele frequencies in connected patches suggest that corridors may increase gene flow in *P. coenia*.

- 59 MILLWOOD, MARY AND ROGER SAUTERER. Jacksonville State University - Effects of water and sediment extracts near the Anniston, AL Monsanto site on developing frog embryos by the FETAX assay and immunoblotting for CYP 1A.

The Anniston (Al) Monsanto plant heavily contaminated local soils and watersheds with PCB-laden runoff from on-site landfills. To assess potential toxic effects of this contamination on a model species under controlled laboratory conditions, we analyzed water and aqueous sediment extracts from three sites on Snow and Choccolocco Creeks on developing *Xenopus* embryos by the FETAX assay and are attempting to quantitate CYP 1A in embryos by immunoblotting. The FETAX assay shows inhibition of embryonic growth with the most pronounced effects shown using samples from Snow Creek near the plant. Less pronounced growth inhibition was seen using water and sediment extracts from Choccolocco Creek sites farther from the Monsanto plant. Effects were stronger using sample waters rather than sediment extracts at all three sites. None of the sites showed increases in embryonic mortality or malformations. We are attempting to investigate CYP 1A embryos in control and experimental embryos using immunoblotting with antibodies against CYP 1A. Currently tested antibodies show possible weak cross-reaction using S-9 4-day embryo extracts and adult liver S-9 extracts, but have high background. We are currently searching for new antibodies that may offer stronger signals and less background, and these antibodies will be used to determine when CYP 1A is detectable in embryos and whether embryos raised in sample waters and sediments show induction of CYP 1A. We tentatively conclude that uncharacterized agents in sample water and sediment extracts cause embryonic growth inhibition and that these agents may be associated with the Monsanto plant.

- 60 KNIGHT, MIKE. The University of Memphis - Do higher order effects govern the outcomes of biological invasions? An examination of the interactions of larval Cuban treefrogs and native frogs in Florida

Interactions between species are often modified by various biotic or abiotic factors, termed "higher order effects." The presence of such higher order effects is usually taken as evidence that the dynamic behavior of a community cannot be predicted based solely on knowledge of interactions between subsets of species within the community (Billick and Case, 1994; Wooten, 1994). Addressing higher order effects is particularly important in the study of biological invasions, which are having a major impact on the structure and function of Earth's ecosystems, and affecting global patterns of biodiversity (Elton, 1958; Mooney and Drake, 1986; Simberloff, 1997; Vitousek et al., 1997). The outcome of biological invasions often has been assumed to be unpredictable (Ehrlich, 1986), suggesting that higher order effects influence the interactions between exotic and native species in the invaded ecosystem. Using the invaded amphibian communities of south Florida, I am examining how exotic and native frog species interact with each other and the environment to develop predictions for the dynamics of multi-species assemblages,

and ultimately, the outcome of an invasion. Larvae of the invasive Cuban Treefrog (*Osteopilus septentrionalis*) and two native species (Squirrel Treefrog, *Hyla squirella* and Narrowmouth Frog, *Gastrophryne carolinensis*) are raised in 75L (20 gal) artificial ponds utilizing a randomized replacement-series design that examines relative intensities of intra- and interspecific interactions and how these interactions are modified by various higher order effects. Higher order effects can act independently or synergistically to alter the outcome of interactions within the community or initiate interactions not otherwise occurring, thus potentially tipping the natural balance in favor of either exotic or native species.

- 61 JENNINGS, JASON B.<sup>1</sup>, MICHAEL L. KENNEDY<sup>1</sup>, AND ALLAN E. HOUSTON<sup>2</sup>.  
<sup>1</sup>Department of Biology, The University of Memphis, Memphis, TN 38152 and  
<sup>2</sup>Ames Plantation, Grand Junction, TN 38039 – Predation on artificial nests of northern bobwhites at varying distances from habitat edge

Predation of Virginia opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), and striped skunks (*Mephitis mephitis*) on nests of northern bobwhites (*Colinus virginianus*) was investigated in relation to proximity of forest edge. The study was conducted at the Ames Plantation in Fayette and Hardeman counties, Tennessee, during 2002 and 2003. Artificial nests, baited with eggs of northern bobwhites, were placed in raccoon-size live traps at six distance categories (0-10 m, 11-20 m, 21-30 m, 31-40 m, 41-50 m, and >50 m) from forest edge. Association between nest predation and distance to forest edge was assessed using a chi-square analysis. Results reflected predation on nests, but there was no statistically significant ( $P > 0.05$ ) relationship between nest predation and distance to forest edge at the intervals tested.

- 62 LESAK, ADRIAN<sup>1</sup>, WANG YONG<sup>1</sup>, AND CALLIE JO SCHWEITZER<sup>2</sup>. <sup>1</sup>Alabama A&M University and <sup>2</sup>Southern Research Station, USDA Forest Service - Initial response of small ground-nesting birds to five levels of overstory retention

We examined first- and second-year response of ground nesting songbirds to varying degrees of overstory tree removal in the oak-hickory forests of the southern Mid-Cumberland Plateau region in northeastern Alabama. Three 20-ha complete block replicates of five experimental treatments (15 treatment units, 4 ha/unit) were used. The five treatments were operational shelterwood stands with target overstory retention levels of approximately 0, 25, 50, 75, and 100%. The residual basal area and resultant canopy cover of these overstory retentions were compared among treatments and both showed three distinct conditions: closed canopy, open forest, and clearcut. Territory spot-mapping was used to quantify the population density of each bird species and their relative use of the treatments. Plots were surveyed 10 times during the breeding season between mid-April and July 2002 and 2003. The territory density of ground-nesting songbirds showed a linear trend of increase from clearcut (0% retention) to the control (100% retention). However, the difference of territory density between 50% and 100% retention was relatively small. The amount of overstory retention and relative bird use (bird detections/visit) had an even stronger linear trend. These results suggest forest regeneration practices such as the shelterwood technique may have an immediate negative effect on the territory establishment and habitat use of ground-nesting songbirds.

- 63 EDGE, JUSTIN AND CHRISTOPHER MOWRY. Berry College - An ecological study of eastern coyotes (*Canis latrans*) in northwest Georgia

The eastern coyote (*Canis latrans* var.) is now a common resident of the southeastern U.S. Previously, it was restricted to the Great Plains of the West, but within the last 50 years coyotes have expanded their range to include most southeastern states. This can be attributed to the coyote's broad range of prey, their adaptability, as well as the

extirpation of gray and red wolves (*Canis lupus* and *Canis rufus*), whose ecological niche is now filled by the coyote. Coyotes were first reported in the state of Georgia in the 1950s. We began studying the coyote population on northwest Georgia's Berry College campus in 2002 by collecting photographs, footprint counts, scat samples, recordings of coyote vocalization, as well as physical measurements from a young male killed by a vehicle. Berry College comprises more than 28,000 acres of land, much of it undeveloped and designated as either Georgia Department of Natural Resources Wildlife Management Area or Refuge. Data thus far is consistent with typical *C. latrans* morphological features, but at least one individual is noticeably larger with black coat coloration. We suspect that hybridization with feral dogs might be occurring. Preliminary results show coyotes living sympatrically with bobcats (*Felis rufus*). Prey items include white-tailed deer, rabbits and mice. Habitat use consists primarily of hardwood forest areas in lower elevations. Howling and footprint data indicate a single group consisting of six to ten individuals, including the presence of pups. Home range size is estimated to be 32.4 km<sup>2</sup>.

- 64 AYOUN, NADIA. University of Tennessee, Knoxville - Effects of geography versus habitat on genetic structure of a desert spider, *Agelenopsis aperta*

In the past, phylogeography has been primarily used to track historical events of species, such as colonization of islands or population fragmentation. A little used but potentially powerful application of phylogeography is to trace the evolutionary history of adaptations to different habitats. The desert spider, *Agelenopsis aperta*, presents a unique opportunity to complete just such a study. An extensive background database exists for *A. aperta* on the genetic basis of adaptations to different habitats: arid and riparian. Furthermore, riparian patches are widely distributed throughout the spider's range of the desert southwest United States making migration between patches unlikely. In order to assess whether adaptations arose once and spread throughout the range of *A. aperta* or arose multiple times via recent natural selection, I used mitochondrial DNA sequences to examine population history of riparian patches and surrounding arid populations distributed across the range of *A. aperta*. Riparian patches exhibited identical mitochondrial DNA haplotypes to surrounding arid populations. On the other hand, geographically distant populations were genetically distinct. These population genetic patterns indicate that adaptations arose as a result of recent natural selection.

- 65 MYHALYK, TRACY AND RAY WILLIAMS. Appalachian State University - The effects of fire on ground beetle assemblages and herbivory of *Kalmia latifolia* in the Linville Gorge Wilderness Area

The objective of this study was to determine the effects of fire on ground beetle assemblages and the successive changes in phenolics and herbivory of *Kalmia latifolia* over time in a Southern Appalachian forest. A location within Linville Gorge Wilderness Area was chosen along a fire boundary where eight burned and eight unburned plots (30 m x 30 m) were established 0.8 km apart. Pitfall traps were used to compare macroarthropod abundance, diversity, evenness, and richness over four months in summer 2003. Leaves from *K. latifolia* shrubs were randomly collected from each plot for visual herbivory analysis and three *K. latifolia* shrubs per plot were sampled over time for phytochemistry analyses. Abiotic factors such as moisture content of soil and temperature at the litter layer were also assessed. Three beetle families had a significantly higher abundance in the burned site (Carabidae, Scolytidae, and Staphylinidae) compared to the unburned site. Percent herbivory was significantly greater in the burned versus unburned site and may be related to the higher phenolics within *K. latifolia* leaves in the burned plots. Fire resulted in changes in plant resource base as nitrogen mineralization was potentially increased and soil/litter architecture was altered.

- 66 CLINE, GEORGE, TABA HAMISSOU, MARK MEADE, JAMES RAYBURN, AND FRAND A. ROMANO III. Jacksonville State University - Preliminary notes on the biology of the freshwater jellyfish (*Craspedacusta sowerbii*) in northeastern Alabama

The freshwater jellyfish (*Craspedacusta sowerbii*) a hydrozoan with a complex lifecycle and a cosmopolitan distribution. Little is known about the biology and ecology of this organism, as its distribution is patchy, and its occurrence is strongly seasonal. In Alabama, *C. sowerbii* is documented from 15 sites in 13 counties. The study site is a flooded quarry in northeastern Alabama. A sharp thermocline is found between 25-40 ft deep, where jellyfish tend to congregate around midday. Conductivity, turbidity, pH, and dissolved oxygen were collected at the surface, 15, and 30 ft using a water quality probe. Jellyfish were collected with plastic storage bags by scuba divers and returned to the lab to observe behaviors, to collect life history data, and for molecular and genetic analyses. Jellyfish first appeared in late June or early July. Population densities peaked in August though October. Numbers dropped dramatically in the late October and early November samples before the dive site closed in late-November. Gonadal tissue was collected from specimens collected from August – September. All specimens had active sperm in at least one gonad. These specimens were then prepared for protein, genomic, and mtDNA analyses using RFLP. Some specimens were maintained in 10-gallon aquaria and fed brine shrimp. Jellyfish alternated bouts of swimming vertically with variable length periods of resting on the bottom of the tank. Videotape demonstrating feeding activity is presented.

- 67 AKIN, JONATHAN. Northwestern State University - Fighting and assessment in male ground skinks

I examined agonistic behavior in male ground skinks (*Scincella lateralis*) competing for food in laboratory encounters. While males were only overtly aggressive (i.e., bit an opponent) in a few encounters, 40% of male-male encounters included parallel wriggling, a behavior in which participants mutually oppose their bodies and undulate the lower trunk and tail for periods of as little as 5 seconds to upwards of 5 minutes. These wriggling encounters ended with one of the pair abruptly breaking off and leaving. I found that males that remained last in the encounter ate significantly more food than lizards that left the encounter early. These results suggest that parallel wriggling in male skink permits males to assess each other's fighting ability and perhaps reduces fight escalation.

- 68 ANDREWS, KIMBERLY. SREL/University of Georgia - How does the snake cross the road? - An interspecific comparison of snake behavior.

To investigate the impacts that roads have on snake populations, we must first understand how impacts vary interspecifically. If a species demonstrates avoidance behavior, the issue is one of barrier effects, which signify eventual habitat fragmentation and genetic isolation. For species that readily cross the road, road mortality itself is a concern. The likelihood of mortality is determined by the behavior of a species around and while crossing the road, such as crossing speed and reactions to vehicles. The speed with which the animal crosses establishes the amount of time spent in the road. Data will be presented from behavioral trials performed on a closed road on Savannah River Site, Aiken, SC. Additionally, reactions of snakes to a passing vehicle are examined to demonstrate that the time spent in the road is lessened or prolonged in accordance with a flee or freeze reaction to the vehicle. By studying snake behavior around roads, solutions for transportation design issues may better target and protect more sensitive species.

- 69 COBB, VINCENT A., TIMOTHY WORRALL, J. JEFFERY GREEN, JAKE PRUETT, AND BRAD GLORIOSO. Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee 37132 - Initial den location behavior in a litter of timber rattlesnakes

Several species of live-bearing pit vipers have been observed to exhibit a brief maternal attendance behavior with the mothers staying near the neonates until their first ecdysis event. Both mother and neonates then disperse. Although it is thought that neonates may follow maternal or conspecific pheromone trails, few field data have documented this event. In September 2003, we radiotracked a postpartum timber rattlesnake along with her four neonates. Initial movement behavior of two neonates appeared to be associated with the movement of the mother, but, within one week those two neonates were making movements clearly independent of the mother. Movements by the other two neonates appeared independent from the mother as well. Total movement distance by all five snakes during the first 10 days varied considerably (mother: 22 m; neonates: 3, 21, 49, and 154 m). Continued movements were sporadic with individuals staying several days in single locations. Movements of all individuals, except one neonate, converged to a single wooded rocky hillside for hibernation. During their movements to the hibernacula region, one neonate was found with a subadult female and another neonate was found again with its mother. These findings support the notion that conspecific trails are used by neonates during their initial den location.

- 70 MOREAU, KENNETH AND JONATHAN AKIN. Northwestern State University - Agonistic behavior and tail loss status in male ground skinks

Tail regeneration is well-documented in many species of lizards. We examined the effects of tail length among male *Scincella lateralis* with varying tail conditions: fully intact, autotomized, and regenerated. We found that males were significantly more aggressive with either an intact or regenerated tail when compared to tailless individuals. Moreover, individuals with regenerated tails behaved significantly less aggressively when compared to males with intact tails. In light of the fact that tail status is a conspicuous and honest signal, social status with respect to dominance behavior and, perhaps, contest settlement during escalation does appear to be influenced by tail autotomy.

- 71 CARR, MEGHAN AND BEN FORREST. Memphis Zoo - Microhabitat use of Pan's box turtles (*Cuora pani*)

We began to collect data on the microhabitat use of four Pan's box turtles (*Cuora pani*) (two males, two females) in January 2003. One male and one female are housed in each of the two identical cages. Data collected within 20-minute time spans showed that the conditions often vary by 3° Celsius for water and air, and 10% humidity within the cages. During Stage One, water depths were the same on both sides of each cage – five centimeters. The male in Cage Once spent less than 25% on the left side, while the three others spend greater than 70% on that side. Using the different surface areas for each side to as the expected values for a Chi-square analysis, all four animals used the sides of the cage at rates significantly different than expected. The data from limited observations of body surface temperatures indicate that their surface is more similar to water, versus air, temperatures. Stage Two is characterized by the manipulation of raising the water level on the right cage side to 10 centimeters; the left side was maintained at five centimeters. Observations indicate a strong occurrence of all animals on the right side, with the deeper water. Across the stages, the body weights for the males (M1 and M2) essentially showed no change. F2 showed a slightly increasing trend and F1 is showing a relatively large increase in her weights over time. Increased weight can indicate increasing health, lowered stress, or gravid status in females. Additionally, the females are often angled between or against cage or cover material surfaces. Stage Three is not complete



and we have not tabulated results. We will compare the results of Stage One, Two, and Three.

- 72 CLINE, GEORGE, ROBERT CARTER, AND JASON ADAMS. Jacksonville State University - Analysis of calling frog communities in northeastern Alabama

For herpetologists, one of the outstanding features of the southeast is the great diversity of the amphibians, and especially the frogs. This diversity leads to complex interactions among species that sometimes makes analysis of community data very difficult. We re-examined data from calling frog communities from 22 sites on Fort McClellan, Calhoun Co., AL. Sites were coded for elevation (upland = > 900 ft; lowland = < 900 ft), and given 1 of 7 codes for habitat type. Frogs were identified by call and verified by hand capture. Calling intensity was coded from 0-3, using the Wisconsin Call Index. Sixteen species were observed in this study. We analyzed the data using DCA (for ordination) and TWINSPLAN (Cluster Analysis). Four groups of species were observed. One group consisted of a single site that featured only 2 species (*Bufo americanus* and *Bufo fowleri*). The second group consisted of 10 sites that were all low elevation sites. These sites were all clustered around a series of permanent ponds associated with the golf course, and the Reilly Lake/Swamp/Airfield complex. The third group consisted of 7 sites that were mostly higher elevation sites. These second and third groups included the sites with the greatest species diversity (13 species), but also had the greatest habitat diversity. The final group of 4 sites consisted of mostly lower elevation sites, all of which had *Pseudacris brachyphona*.

- 73 GIBBONS, WHIT. SREL – University of Georgia – How productive can an isolated wetland be?

Ellenton Bay, a Carolina bay on the Savannah River Site (SRS) in South Carolina, is an isolated wetland for which herpetofaunal records have been kept for 36 years. Fifty years ago the wetland would have been assessed as degraded because of its location in the center of several hundred acres of cotton and cornfields. However, with the establishment of the SRS, the wetland is now protected and has since been reforested around the margins. The construction of an encircling drift fence with pitfall and funnel traps that were checked at least twice daily for a full year has permitted several key questions to be addressed regarding the herpetofaunal productivity at the site, the most basic being, How productive can a formerly degraded wetland be? What conclusions can be made about such a recovery? What factors contribute to these types of recoveries? What are the implications about how critical metapopulation processes are to a wetland community's success? The captures in a single year of more than 359,000 individuals and 1.5 metric tons of reptiles and amphibians belonging to 59 species provide the data necessary to address these and other questions related to the environmental importance of natural wetlands to regional biodiversity and to the proper management of wetland systems.

- 74 HOLMES, SHERRY AND KEN MARION. University of Alabama at Birmingham - The status of the populations of the flattened musk turtle (*Stemotherus depressus*) in Bankhead National Forest and Smith Lake, Alabama, and the possible effects of stream conditions on trapping success

Past work on the population status of *S. depressus* indicated that its numbers were declining. It is currently listed as threatened under the endangered species act. Trapping in two consecutive seasons shows that *S. depressus* is spotty in distribution in both streams and lakes within its geographic range. Although there are apparently some moderate to dense populations present, inconsistent trapping results in streams point to the possibility that trapping success is at least partially dependent on stream conditions. Lacustrine populations appear to be doing well in isolated coves and pockets in Smith

Lake and there is recruitment occurring in these populations. This research was made possible by the support of the U.S.D.A. Forest Service, Alabama Power, The Nature Conservancy of Alabama, and the Birmingham Audubon Society.

- 75 MAKOWSKY, ROBERT<sup>1</sup>, THOMAS PAULEY<sup>1</sup>, AND LAWRENCE WILSON<sup>2</sup>.  
<sup>1</sup>Marshall University and <sup>2</sup>Fernbank Science Center - Sexual dimorphism in the eastern hellbender, *Cryptobranchus a. alleganiensis*

The Eastern Hellbender, *Cryptobranchus a. alleganiensis*, is a large, aquatic salamander found in higher order, cold-water streams in the Ohio River drainage. Males will commonly fight for possession of the best breeding sites (usually under rocks) and will also guard the eggs they fertilize. Past research has shown that when urodela species practice male combat, the males normally reach a size as large if not larger than females. Based on these behaviors, it would be expected that males become larger than females. Contrary to this prediction, it is thought that females reach a larger overall length than males. Due to tremendous size overlap though, determining gender based simply on total length (TL) can be nearly impossible. This research examined whether there are other sexual dimorphic characters present all year. Preserved specimens (n=105, f=52, m=53) from different populations were measured for TL, snout-vent length (SVL), thoracic girth (TG), head width (HW), and mass. Gender was determined by checking for the presence of follicles. All measurements were then divided by the specimen's TL or SVL, so size-corrected ratios were also compared. Pair-wise comparisons (t-tests) were made between males and females for each measurement and ratio. Males were found to differ significantly from females for the ratio TG/TL ( $P < .05$ .) Principal component analyses revealed distinct differences between the sexes. This study suggests there is a way to reliably sex hellbenders without dissection. Further work examining the morphological changes associated with preservation is needed to allow these findings to be applicable to live specimens.

- 76 OSBOURN, MICHAEL S. AND THOMAS K. PAULEY. Department of Biological Sciences, Marshall University, Huntington, West Virginia -- Phenotypic variation among cave-dwelling spring salamanders, *Gyrinophilus* spp. Cope (Plethodontidae), in West Virginia, Virginia, and Tennessee

Green and Brant's 1966 survey of salamanders in West Virginia caves revealed that Spring Salamanders, *Gyrinophilus* spp., are the most frequently encountered salamanders in subterranean habitats in the state. In 1977, Bersharse and Holsinger described *Gyrinophilus subterraneus*, the West Virginia Spring Salamander, from one cave population in Greenbrier County. Some have suggested that *G. subterraneus* is an extreme variant of the widespread *G. porphyriticus*. In an attempt to document the degree of variability among cave-dwelling *Gyrinophilus* species, Principle Components Analysis (PCA) was applied to measurements of 20 external morphological characters. This analysis was based on 106 specimens of cave-dwelling *Gyrinophilus* spp. from the U. S. Natural History Museum (USNM) and West Virginia Biological Survey collection (WVBS). Specimens analyzed included; 5 metamorphosed and 11 larval *G. subterraneus*, 33 metamorphosed and 24 larval *G. porphyriticus*, 1 metamorphosed and 20 neotenic *G. palleucus palleucus*, and 6 neotenic *G. gulolineatus*. Eye diameter was the source of the greatest variation between species. Separation was pronounced between *G. p. palleucus* and *G. gulolineatus* and weaker between *G. subterraneus* and *G. porphyriticus*, where some overlap occurs in PCA. A grant from the West Virginia Division of Natural Resources Wildlife Diversity Program supported this research.

- 77 OSBOURN, MICHAEL S. AND THOMAS K. PAULEY. Department of Biological Sciences, Marshall University, Huntington, West Virginia --The natural history of cave-dwelling spring salamanders, *Gyrinophilus* spp. Cope (Plethodontidae), in West Virginia.

Surface populations of Spring Salamanders, *Gyrinophilus porphyriticus* ssp., have been widely studied in cool mountain streams, seeps, and springs throughout their broad range in the Appalachian region. In West Virginia, however, they are also commonly found in caves. Green and Brant's 1966 survey of salamanders in West Virginia caves revealed that *G. porphyriticus* are the most abundant salamanders in subterranean habitats in the state. In 1977, Besharse and Holsinger described the West Virginia Spring Salamander, *Gyrinophilus subterraneus*, from one cave population in Greenbrier County. Since then, there has been little investigation into the natural history of cave-dwelling Spring Salamanders. We monitored two cave populations of *G. porphyriticus* using mark-recapture techniques with the objective of investigating the ecology, life histories, and population structure of these troglomorphic salamanders. This study has provided insight into the secretive lives of some of the top predators of West Virginia cave ecosystems and should be valuable for the conservation of these species. Grants from the West Virginia Division of Natural Resources Wildlife Diversity Program and the West Virginia Association for Cave Studies supported this research.

- 78 PHU, LINH D.<sup>1</sup>, MICHEAL S. OSBOURN<sup>1</sup>, JEFF BAILEY<sup>2</sup>, AND THOMAS K. PAULEY<sup>1</sup>. <sup>1</sup>Department of Biology, Marshall University and <sup>2</sup>West Virginia Division of Environmental Protection - The use of streamside salamanders as indicators of headwater stream health in West Virginia

The health of headwater streams in the United States has been assessed using various types of bioindicators, including benthic invertebrates and fishes. In our study funded by the USGS and the US EPA we examined the potential use of streamside salamanders as another type of bioindicator. Forty-four randomly selected sites in West Virginia were surveyed using complete census and multiple pass removal sampling techniques over the course of 2 years. Environmental parameters were recorded and included temperature, pH, relative humidity, turbidity, cobble count, etc. Using the program CAPTURE, we were able to calculate detection probabilities and population estimations from our removal sampling. Multivariate regression analysis was also used and showed correlations between habitat data and salamander abundance. This data indicates that stream salamanders can serve as bioindicators to headwater stream health.

- 79 MCEWAN, RYAN AND BRIAN MCCARTHY. Ohio University - Tree-ring analysis of the largest remaining stand of American chestnut (*Castanea dentata* [Marsh.] Borkh.), West Salem, Wisconsin

One of the most important events to impact the Eastern Deciduous Forest was the demise of the American chestnut (*Castanea dentata* [Marsh.] Borkh.) due to the pathogenic fungus *Cryphonectria parasitica* (Murrill) Bar. When *C. parasitica* was accidentally introduced in 1904, chestnut was a dominant forest species throughout much of the eastern United States. By 1950, however, the chestnut blight had swept down the Appalachian Mountains ravaging chestnut forests, and by 1960 American chestnut was functionally extinct as canopy tree throughout its native range. We conducted a tree-ring analysis of a chestnut-dominated stand, in southwestern Wisconsin, that escaped the blight due to it being outside the natural range of host and pathogen. Chestnut currently comprises  $15 \text{ m}^2 \cdot \text{ha}^{-1}$  BA and makes up  $> 37\%$  of the relative importance value (RIV) in this formerly oak-hickory forest. Non-blight infected chestnut growth ( $5.12 \pm 0.35 \text{ mm} \cdot \text{yr}^{-1}$ ) was nearly twice that of other hardwoods (OH) found in the stand ( $2.8 \pm 0.32 \text{ mm} \cdot \text{yr}^{-1}$ ). A blight signal was clear in the chestnut growth chronology beginning in the late 1990s

with mean growth rates of infected chestnuts descending from  $4.8 \pm 0.10 \text{ mm} \cdot \text{yr}^{-1}$  to  $3.2 \pm 0.42 \text{ mm} \cdot \text{yr}^{-1}$ . Chestnut establishment in the stand occurred sporadically in the first 40 years of the growth chronology followed by a recruitment pulse ca. 1978. This analysis offers a unique glimpse into the ecology of the species that was previously unavailable.

80 WHITE, DAVID<sup>1</sup> AND JOAN WALKER<sup>2</sup>. <sup>1</sup>USDA FS Southern Research Station and <sup>2</sup>USDA Forest Service - A monitoring plan to detect change in abundance of ramps (*Allium tricoccum* Ait.) in the upper Nantahala River watershed

In response to concerns about impacts of ramp harvesting in the Nantahala and Pisgah National Forests of North Carolina we initiated a pilot study on ramp monitoring in 1998, and followed up with implementation in 1999. Objectives are to (1) characterize the distribution and size of ramp populations within two areas of the Upper Nantahala River Watershed, (2) quantify abundance and change through time in ramp populations representing a range of environmental and disturbance conditions, and (3) evaluate the effectiveness of the sampling design for detecting year-to-year change at designated statistical power and significance levels. Results from the pilot study indicated (1) cover and density are equally suitable to assess abundance; (2) permanent plots should be used instead of temporary plots; and (3) 15-25, 10 m transects are likely sufficient to detect change through time in a given ramp patch. To help identify suitable patches for monitoring, ramp patches within two, 2600 ha study areas were located, mapped and tentatively classified based on disturbance and accessibility criteria. From the distribution data, the sample unit was defined as a ramp patch at least 0.25 ha in spatial extent, relatively dense ( $\geq 20 \text{ ramps m}^{-2}$ ), and relatively continuous (less than 1/3 of a patch is occupied by areas with ramp density  $\leq 1 \text{ m}^{-2}$ ). From the pool of mapped and classified patches, 21 were randomly selected for permanent plot installation in 1999 and 2000 and have been re-measured annually through 2003. Effectiveness of the design and initial results will be discussed.

81 SILLETTI, ANDREA, JOAN WALKER, AND DAVID WHITE. USDA Forest Service, Southern Research Station - Abundance of Ramps (*Allium tricoccum* Ait.) in the Southern Appalachians: variability in time and space

*Allium tricoccum* (known as ramps or wild leek) is a culturally significant herb harvested in the early spring. Population declines attributed to over-harvesting in its northern range have led to concerns about the status *A. tricoccum* in the southeast. We implemented a monitoring plan to establish baseline abundance data and to characterize interannual variation. In 1999, ramp patches in the Upper Nantahala River Watershed were inventoried and we randomly selected 21 plots from patches with more than ~20 ramets/m<sup>2</sup>. We measured cover and density along permanently marked transects for a total of 5 years. We observed year-to-year variation in abundance in half of the plots, but change was not directional and small (average of -7.5 to 7.5%/ year) overall compared to previous studies which report annual changes of 8 - >50%. Relatively small variation in our study may be function of sampling over a larger area giving a better estimate of patch performance, compared to the small plot sampling of previous studies. We also used multiple regressions to determine which factors best predicted ramp abundance at a given site. Soil disturbance, species diversity ( $H'$ ) and richness (S), and the distance from a hiking trail explained over 40% of the variation in ramp density, while factors such as patch size, elevation, and climate variables were not significant. Data indicate that relatively dense patches (as we selected) are stable in the short term (5 yrs.) under current harvest pressures, but lower densities associated with soil disturbance and accessibility suggest possible negative harvest effects over long time periods.

- 82 HULL, JAMES, ELIZABETH SLAVIK, AND KENNETH LETENDRE. Towson University - Pollination ecology in populations of differing size of *Gentianopsis crinita* at Soldiers Delight, Maryland.

Fringed gentian (*Gentianopsis crinita* (Frole.) Ma.) is a state-endangered species found in serpentine soils at Soldiers Delight Natural Environment Area, Maryland. The dramatic decline of populations of this species is examined in relation to its pollination ecology. For populations of different size, the effect of hand-pollination from near and distant pollen sources is compared to open insect pollination. In addition insect visitation rates are compared between small and larger populations. Seed germination percentage is used as an index of effective pollination. The results indicate that fringed gentian does not self-pollinate. Further, results indicate no difference in seed germination regarding distance of pollination source. Insect visitation suggests that a wide range of potential pollinators utilize the flowers, however the efficiency of each insect type for pollination is unknown. The context of pollination limitation is discussed relative to the population decline.

- 83 WANG, WEI<sup>1</sup>, SCOTT FRANKLIN<sup>1</sup>, AND JOHN OUELLETTE<sup>2</sup>. <sup>1</sup>Department of Biology, University of Memphis and <sup>2</sup>Memphis Zoo - Regeneration of Songhua bamboo (*Fargesia qinlingensis*) following herbivory by giant pandas

Regeneration of Songhua bamboo (*Fargesia qinlingensis*) following herbivory by giant pandas was studied in Foping National Natural Reserve, Shaanxi, China. Seven panda herbivory sites were chosen from the panda's summer habitat. Herbivory, cutting (mimicking herbivory), and control plots were set up at each site in 2002. Basal diameters of all new shoots were measured in 2002 and 2003. Assuming plots had already responded to herbivory (time since herbivory was unknown), we tested differences in new shoots density and average diameter between herbivory and control plots with a paired t-test using the 2002 data. Density was not significantly different ( $t = 1.618, p = 0.144$ ), but mean diameter was significantly less ( $t = -4.931, p = 0.001$ ) in herbivory plots ( $7.366 \text{ mm} \pm 0.281$ ) compared to control plots ( $8.138 \text{ mm} \pm 0.340$ ). We further tested the effects of herbivory by comparing the cutting (mimicked herbivory) and control plots using repeated measures ANOVA. Density of new shoots increased from 2002 to 2003 for control plots and decreased for cutting plots, but neither the time ( $F = 0.01, p = 0.906$ ) nor the time\*treatment interaction ( $F = 0.31, p = 0.589$ ) were significant. Diameter had the same trend as density, but was again not significant for time ( $F = 0.39, p = 0.542$ ) or time\*treatment interaction ( $F = 0.89, p = 0.363$ ). Although insignificant, the mimicked herbivory (cutting) sites corroborate the differences found between control plots and those receiving giant panda foraging, suggesting herbivory may negatively affect bamboo regeneration.

- 84 ALBRECHT, MATTHEW AND BRIAN MCCARTHY. Ohio University - The population biology and life history of black cohosh (*Actaea racemosa* L.; *Ranunculaceae*), an economically important eastern woodland herb

Black cohosh (*Actaea racemosa* L.) is a long-lived perennial herb native to deciduous woodlands in eastern North America. An individual plant consists of a single stem (infrequently two or three) that arises from a large, knotty rhizome that bears elongated roots. Because of its therapeutic properties, the rhizome is harvested from forest environments and sold in the lucrative medicinal plant market. We conducted two observational studies to establish baseline population parameters in southern Ohio. In our first study, we measured above and below ground variables on both reproductive and nonreproductive individuals. We found that a "rough" estimate of plant age could be obtained by counting the number of stem scars on the rhizome. Based on age estimates, we found that reproductive plants were older ( $\bar{x} = 10.24 \pm 0.70$  yrs) than nonreproductive plants ( $\bar{x} = 6.91 \pm 0.38$  yrs). In our second study, we established a  $100 \text{ m}^2$  permanent plot

in each of 14 black cohosh patches distributed across four mixed-oak forests. In total, 1,971 ramets were censused and marked to monitor their long-term demographic fate. Sexual reproduction varied among patches, with between 0 – 38% of plants producing a reproductive shoot. Sexually reproductive plants experienced two forms of herbivory that negatively impacted fecundity. In early summer, lepidopteran larvae damaged floral buds, while in mid to late summer invertebrates damaged developing seeds and fruits. Future work will incorporate the effects of pre-dispersal seed predation and harvesting in a population growth model.

- 85 FARRAH, KATHERINE<sup>1</sup>, JOAN WALKER<sup>2</sup>, TIMOTHY SPIRA<sup>1</sup>, AND JAMES RIECK<sup>1</sup>. <sup>1</sup>Clemson University and <sup>2</sup>U.S. Forest Service - Breeding system and timing of inbreeding depression in the rare plant *Shortia galacifolia*

*Shortia galacifolia* is endemic to the escarpment regions of the southern Blue Ridge Mountains. Although there have been studies on the distribution, seed germination and pollination of the rare plant *Shortia galacifolia*, very little is known about its reproductive biology. We report the results of a breeding system and inbreeding depression study. We conducted a controlled, replicated field experiment with pollination treatments: open-pollinated, selfed, and crossed within and between two nearby populations. Additional experiments included caging flowers to exclude pollinators and adding pollen to open-pollinated flowers to determine if seed production is pollen limited. Germination and seedling growth tests were conducted in a light and temperature controlled environment. Response variables included fruit set, seed mass, germination percentage, germination rate, number of seedlings to develop true leaves, seedling survival at 7 months, aboveground biomass, and rosette diameter. Data were analyzed using analyses of variance, chi-square and Kruskal-Wallis tests, and paired t-tests. Results show *S. galacifolia* has a mixed mating system and requires insect pollinators for fruit and seed set. The study populations had intermediate selfing rates ( $S_{\text{site } 1} = 0.38$ ;  $S_{\text{site } 2} = 0.48$ ). Supplemental pollen treatments increased seed mass, indicating *S. galacifolia* can be pollen limited. The coefficient of inbreeding depression ( $\delta$ ) was greater in the seed and survivorship stages than in the growth stage. Results suggest that artificial gene flow may be needed to counter inbreeding depression, but used with caution to prevent outbreeding depression. Management actions should include protecting as many populations as possible, as well as providing for pollinators.

- 86 JOHNSON, SARAH E., CLAUDIA L. JOLLS, AND CASS A. WIGENT. East Carolina University - Success of the federally threatened seabeach amaranth (*Amaranthus pumilus*, Raf.) at two elevations

Seabeach amaranth (*Amaranthus pumilus*) is a federally threatened annual plant endemic to the Atlantic Coast. We used a GIS model of habitat for *A. pumilus*, based on elevation and vegetation cover, to help define habitat and test the success of *A. pumilus* transplants grown above (HIGH) and within (IN) the predicted elevations. Paired plots at Cape Hatteras (12 plots, 324 plants) and Cape Lookout (6 plots, 162 plants) National Seashores were constructed to evaluate the influence of elevation on survivorship, transplant growth, reproductive success, and damage by herbivores after 10 wk. Survival of transplants was equal between elevations; however, IN transplants were significantly larger in diameter than those at higher elevations at both seashores. The data suggest that while transplants at HIGH elevations may form seeds sooner, overall seed set may not differ between elevations at Cape Hatteras. There was no significant difference in phenology or reproductive success between elevations at Cape Lookout. Transplants in the IN research plots also appeared to suffer lower levels of herbivory than did those closer to the dune line at both seashores. Despite equivalent survival at higher elevations, increased size and decreased herbivory within our model elevation range suggest that preservation and reintroduction efforts should focus on areas between 0.77 and 2.0 m above mean high

water with very low vegetation cover, as predicted by our model, areas most suitable for success of *Amaranthus pumilus*.

- 87 MATTHEWS, CHARLOTTE, G. LEWIS, AND T. PERRY. Furman University – Inter and intra specific competition in the bunched arrowhead (*Sagittaria fasciculata*): the role of native and invasive species.

In South Carolina, *Murdannia keisak*, an exotic Asian spiderwort, has invaded seepages containing populations of the endangered bunched arrowhead (*Sagittaria fasciculata*). From May to September 2003, we looked for evidence of: (a) effects of interspecific competition on *S. fasciculata* from *M. keisak* and an abundant native plant, *Lycopus virginicus*, and (b) effects of intraspecific competition on *S. fasciculata* in a seepage at Furman University, Greenville, South Carolina. We measured numbers of plants of each species in circular plots (2500 cm<sup>2</sup>) centered on 53 *S. fasciculata* plants. We also measured raceme height, numbers of flowers and fruits, and estimated total leaf area of each plant. We hypothesized that these variables would decrease as densities of conspecifics and other species increased. Raceme height and leaf area of *S. fasciculata* was negatively correlated with the density of *L. virginicus* and with total interspecific competitor density but was not significantly correlated with *M. keisak* density. Flower number was negatively correlated with total interspecific competitor density. Leaf area and number of flowers and fruits was positively correlated with the density of conspecifics. Water depth was positively correlated with density of *S. fasciculata* and negatively correlated with the density of *L. virginicus* and with total interspecific competitor density. At this time, *M. keisak* does not appear to negatively affect *S. fasciculata* at this particular location. However, our results suggest that lowering water levels (e.g., due to change in climate or land use) may make *S. fasciculata* populations more susceptible to effects of interspecific competition.

- 88 EULISS, AMY, MELANY FISK, COLEMAN MCCLLENAGHAN, AND HOWARD NEUFELD. Appalachian State University - Growth, reproduction, and mycorrhizal associations of *Houstonia montana* in varying environments

*Houstonia montana* (Small) is a federally listed endangered plant (April 5, 1990) exclusively found in the southern Appalachians at elevations greater than 1200 meters. Populations vary in environmental conditions from that of shaded or sunny rock outcrops to open grassy balds. To understand more about the distribution and persistence of this plant, our study assesses abiotic and biotic differences between population localities, variability in plant health across different populations, and the role of mycorrhizas on plant health and reproductive success. Phenology was fairly consistent across a study site, whereas reproductive success varied. Seed viability ranged from 51% to 80% across sites, and plants at sites with lower viability also exhibited more extensive leaf damage, such as necrosis and chlorosis. Total percent mycorrhizal colonization varied from 1-30% across sites. Mycorrhizal colonization consistently decreased from time of flowering to that of seed maturation across all sites. As a follow up to this study, a greenhouse experiment is being conducted to determine the independent and combined effects of nitrogen additions and light on the health of *H. montana* and the endomycorrhizal associations. At the conclusion of these studies, we will have a better understanding of the basic biology of this rare and endangered plant, which will aid in future investigations for plant decline.

- 89 HUGHES, NICOLE M. AND HOWARD S. NEUFELD. Appalachian State University - Biochemical and ecophysiological functions of anthocyanins in leaves of the evergreen herb *Galax urceolata* (or, why *Galax* turns red in the winter).

*Galax urceolata* is an evergreen understory herb that exhibits a dramatic change in leaf color from green to red under high light, low temperature conditions. This color change is due to anthocyanin synthesis in peripheral mesophytic cells. The purpose of this study was to examine the mechanisms and possible functions of anthocyanin synthesis in *Galax*, in light of both traditional and less-explored hypotheses of color change. The hypothesis that anthocyanins function as light-screens was tested by running a spectral analysis on red and green leaves, and by using chlorophyll fluorescence to compare PSII efficiency of anthocyanin-protected adaxial and unprotected abaxial surfaces. Anthocyanins were found to significantly reduce incoming radiation, primarily in green wavelengths. Red leaves also exhibited lower PSII efficiency than green adaxially, though abaxial levels appeared comparable between the two groups. The hypothesis that anthocyanins act as antioxidants was tested and supported by comparing the DPPH radical-scavenging activities of naturally occurring red versus green leaves in preliminary trials. An additional hypothesis explored in this study was the possibility that anthocyanins act as a surrogate carbon sink when source levels exceed sink requirements. When major veins on one half of a leaf were severed, that half of the leaf turned red, suggesting that carbohydrate accumulation stimulates anthocyanin production. In summary, results of these analyses suggest that anthocyanins may be protecting high light *Galax* leaves by acting as light-screens, antioxidants, and possibly a surrogate carbon sink. Additional data on the effects of anthocyanins on whole-leaf ecophysiological processes are still being collected.

90 NEUFELD, HOWARD<sup>1</sup>, ALAN DAVISON<sup>2</sup>, ARTHUR CHAPPELKA<sup>3</sup>, KENT BURKEY<sup>4</sup>, AND PETER FINKELSTEIN<sup>5</sup>. Appalachian State University, <sup>2</sup>Department of Biological Sciences, University of Newcastle, <sup>3</sup>School of Forestry and Wildlife, Auburn University, <sup>4</sup>USDA-ARS Air Quality Research Unit Plant Science, and <sup>5</sup>Atmospheric Modeling Division-NOAA at USEPA, Research Unit - Foliar injury caused by exposure to ozone reduces the absorbance of light in leaves of cutleaf coneflower (*Rudbeckia laciniata* var. *digitata*)

One of the most common symptoms of ozone exposure in plants is known as flecking or stipple, resulting in stimulation of either anthocyanin or phenolic synthesis in the various cells in the epidermis facing high light. Stippled cells change from green to either red or dark purple, whereas in other species, particularly those that produce phenolic-like substances, these cells change from green to dark purple or even brown. Eventually, these cells die and cause wide-spread necrosis over the leaf surface. Similar pigmentation changes also result after pathogen attack, and have led to the hypothesis that ozone induces a generalized pathogen response, probably because both agents result in the accumulation of toxic reactive oxygen species (ROS). Despite the widespread occurrence of pigmentation induction from these agents, almost nothing is known about the potential adaptive significance of such a response. We hypothesize that the synthesis of epidermal pigments reduces the amount of excess light reaching the mesophyll of stressed leaves, limiting further production of ROSs and thereby preventing additional oxidative damage. Spectral scans of injured (>50% stipple) and noninjured leaves of cutleaf coneflower show that injured leaves, when compared to noninjured leaves: absorb less radiation, particularly in the yellow to red wavelengths (550-700 nm), have greater reflection, and transmit more visible radiation. Furthermore, severely injured leaves absorb 50% less radiation in the visible wavelengths than non-injured leaves. Thus the hypothesis that these pigments act as light filters is supported, but whether this reduces ROSs in these injured leaves remains to be investigated.

91 PEOPLES, SETH<sup>1</sup>, HOWARD NEUFELD<sup>1</sup>, PETER FINKELSTEIN<sup>2</sup>, ALAN DAVISON<sup>3</sup>, ARTHUR CHAPPELKA<sup>4</sup>, AND KENT BURKEY<sup>5</sup>. Appalachian State University, <sup>2</sup>Atmospheric Modeling Division-NOAA at USEPA, Research Unit, <sup>3</sup>School of Biological Sciences, University of Newcastle, <sup>4</sup>School of Forestry and



Wildlife, Auburn University, and <sup>5</sup>USDA-ARS Air Quality Research Unit, Raleigh, NC - Seasonal development of stand structure for cutleaf coneflower (*Rudbeckia laciniata*) at two sites in Great Smoky Mountains National Park: Influences on ozone uptake

We have been investigating cutleaf coneflower (*Rudbeckia laciniata*) responses to ozone at several stages of organization, including biochemical, physiological, and at the population level. Movement of ozone from atmosphere to leaf is determined in large part by atmospheric and canopy resistances, which are functions of stand height, density, proximity to other vegetation, ozone concentration, relative humidity and wind speed. Our goal was to parameterize an ozone uptake and deposition model being developed by one of us (Finkelstein) as a function of stand development. Canopy structure (height, stem density, leaf position and area, and leaf area index (LAI,  $m^2/m^2$ ) was monitored approximately biweekly in five plots at Clingman's Dome and ten at Purchase Knob in Great Smoky Mountains National Park. Plants began to leaf out in late May, and the LAI began to accumulate until values as high as  $\sim 7.0$  for 1.6 m tall stands were reached in mid-July at Clingman's Dome. Stands were very dense (up to 59 stems/ $m^2$ ) and reduced light and ozone penetration at ground level to  $\sim 0.5\%$  of full sunlight and  $\sim 40\%$  of above canopy values. LAIs, but not stem densities, were lower at Purchase Knob ( $\sim 5.5$ ) and even lower if the plants grew beneath a forest canopy (LAI  $\sim 2.5$ , LAI of forest  $\sim 2.5$ ). Light and ozone values were reduced to a correspondingly smaller extent than at Clingman's Dome. As LAI increases through the growing season, light and ozone are progressively attenuated in stands of coneflower, which in turn, affects the magnitude of ozone uptake by leaves.

92 COCKING, DEAN, AMIR ALLAK, JENNIFER LODER, AND WENDY PENDLETON. Department of Biology, James Madison University, Harrisonburg, VA 22807 - Vegetation as a collecting surface for atmospheric mercury deposition and a potential entry point for herbivore and detritivore bioaccumulation

The discovery of Hg associated with the leaves of plants growing on Hg contaminated South River floodplain soil due to localized dust deposition was expected. The presence of traces of Hg associated with vegetation surfaces at a control site located 6 km upstream from the point contamination source was not originally anticipated. However, it is consistent with growing evidence of global atmospheric mercury contamination. The industrial site in the center of Waynesboro, VA, which was the source of inorganic and elemental Hg release in the first half of the 21<sup>st</sup> century, is no longer actively using the metal. The question being asked is whether a physical model using inexpensive passive atmospheric deposition collectors is suitable for evaluating this pathway for contamination and ultimately differentiating between local, landscape and regional sources. This assay indicates that widespread and patchy traces of atmospheric deposition occur locally in Waynesboro, VA, and these results are compared with data collected from urban locations in Staunton, VA, and Harrisonburg, VA, which are respectively 20 and 60km removed from the contaminated South River flood plain. Atmospheric deposition therefore is identified as a route for Hg entry into terrestrial ecosystems that are not known to have local substrate contamination.

93 CHILTON, RACHAEL AND DAVID ORVOS. Sweet Briar College - Bioaccumulation of mercury in lichen (*Hypogymnia physodes*) near a coal-fired power plant

Lichens have been used as biomonitors of environmental trace element pollution. Lichens accumulate elements from the air via extracellular ion exchange processes, intracellular uptake, and wind-blown particles. This research examined the bioaccumulation of mercury

in lichen, *Hypogymna physodes*, near the John E. Amos power plant in Putnam, West Virginia. The plant, owned by American Electric Power, releases over 800 pounds of mercury annually. Lichen samples were taken over a wide geographical area upwind and downwind of the plant. Samples were manually cleaned and dried at 60 C prior to digestion in nitric and hydrochloric acids at 95 C. Digested samples were analyzed using cold vapor atomic absorption spectrometry with a detection limit of approximately 1 ng. Powdered milk was used as a control material and lichen standard reference material was used to determine efficiency of the analytical method. Mercury has been detected in some lichen samples to date. Lichen mercury concentrations will be mapped using ESRI's ArcGIS software to determine the sphere of influence of the John E. Amos power plant.

- 94 JUDAH, LEANN AND SIGURDUR GREIPSSON. Troy State University - Metal contamination of soils and plants at three polluted sites in southeast Alabama

Large amounts of waste chemicals from industrial sites are continuously produced resulting in the release of metals into the environment. Soils of industrial sites are often contaminated with metals, which causes much concern that vegetation in these areas is being threatened. Soils are the major receptacle for metal pollution resulting in reduction in soil quality and ecosystem degradation. This study compared the metal concentrations in soils and plants at three contaminated sites to three reference sites five miles away from each contaminated site. Soil and native plant samples (n = 5) were collected at each contaminated and reference site, and the metal concentrations were analyzed using atomic absorption spectrophotometry. The data was statistically analyzed to determine if significant differences existed between metal concentration of soil and plants of the contaminated sites and nearby reference sites. This study aims at identifying metal-hyperaccumulating native plants in southeast Alabama.

- 95 BROOKS, CARROLL. Brevard College - Employing DNA sequence analysis software in the undergraduate biotechnology laboratory

Consistent with the increasing number of employment opportunities in the biotechnology arena, undergraduate education is incorporating laboratory experiences, which accurately mimic the real-world procedures. DNA sequence analysis software can add such a dimension to the undergraduate laboratory experience. This presentation will describe the integration of educational software from DNASTAR Inc. into a Bio-Rad Laboratories, Inc. DNA fingerprinting laboratory exercise.

- 96 DAVIDSON, PAUL AND PAUL KITTLE. University of North Alabama - A micro-aquarium for the culture and examination of aquatic life

A micro-aquarium of our own design is a worthy alternative to traditional lab procedures where the culture and examination of small aquatic life is required. Constructed of 75 X 50 X 1 mm microscope slides, the micro-aquarium has a capacity of ca. 4.5 ml. Many aquatic organisms can be maintained in them for weeks or months with minimal effort (e.g. *Amoeba proteus* and other sarcodines, *Paramecium* and other ciliates, planarians, rotifers, gastrotrichs, tardigrades, annelids, fingernail clams, amphipods, cladocerans, copepods, isopods, ostracods, water mites, various insect larvae, water molds and algae). Only a few minutes every 10-15 days are required to replace evaporative water loss and attend to any nutritional needs. For examination of specimen details, the design utilizes capillary retention of water when the micro-aquarium is laid flat upon a microscope stage. Compared to standard slide mounts of aquatic life (hanging drop mounts or traditional wet mounts), no preparation time or cleanup is required, hence cultures remain ready for examination at any time. For the general study of "pond water" the micro-aquarium is an excellent chamber for the *in situ* observation of the microcosm that develops. Methods for constructing the micro-aquarium and observational techniques will be presented. The

micro-aquarium is also an excellent photographic chamber. For images of small, aquatic life, see [www2.una.edu/microaquarium](http://www2.una.edu/microaquarium).

- 97 SAUTERER, ROGER. Jacksonville State University - Investigating the role of calcium ions in sea urchin fertilization: A laboratory exercise

Calcium ions are critical for the formation of the fertilization membrane, the slow block to polyspermy in newly fertilized eggs. Both influx of external calcium ions and release of calcium ions stored in the smooth ER contribute to cortical granule exocytosis and fertilization membrane formation. A series of laboratory exercises that can be completed in a 2 - 3 hr lab allow students to investigate the relative roles of exogenous and endogenous calcium ions in fertilization membrane formation in sea urchin eggs by using the calcium ionophore A23187 and the calcium chelator EGTA. Sea urchins are readily available and easy to obtain gametes from, and the fertilization membrane formation is easily observed under a microscope. Students fertilize eggs with sperm in the presence or absence of EGTA, and incubate unfertilized eggs in A23187 and/or EGTA. The results clearly show to students that influx of exogenous calcium ions contributes more to proper fertilization membrane formation than release of stored internal calcium ions, as eggs fertilized in EGTA or incubated in A23187 + EGTA show only partial fertilization membrane formation. The care of sea urchins, gamete collection, and experimental details will be described for instructors wishing to incorporate these experiments into their cell or developmental biology laboratories.

- 98 GOODVILLIE, CAROL, LISA CLOUGH, AND DAVID KNOWLES. East Carolina University - Investigative ecology: Long-term field experiments for undergraduates

We have implemented a long-term field experiment that serves as a focus for an undergraduate ecology course required for biology majors at East Carolina University. The study addresses fundamental questions concerning the role of disturbance and nutrient availability in structuring plant communities and is expected to yield publishable data while providing educational opportunities. At a former Voice of America site less than ten miles from campus, eight experimental plots have been established, and subplots within each have been randomly assigned to four treatments: control, fertilized, mowed, and fertilized+mowed. Undergraduate students have participated in the study since its inception, setting up plots, assigning treatments, collecting baseline soil data and applying fertilizer treatments. We expect that the project will provide a number of benefits to undergraduate students: familiarity with the local flora, training in vegetation sampling and methods for community analysis, experience with spreadsheet programs and large data sets, and an understanding of the necessity for long-term, large-scale experiments in ecology. Most importantly, we anticipate that involvement in a "real" ecological study will generate interest and excitement in our students.

- 99 FERZLI, MIRIAM, MICHAEL CARTER, ERIC WIEBE, AND TRINA ALLEN. North Carolina State University - Using the laboratory report to promote scientific thinking and learning in college biology students

By incorporating lab reports into laboratory investigations, students are given the opportunity to become involved with the process of science by learning how to ask scientific questions, explain them, defend them, and communicate their findings. The problem is that lab reports are increasingly being left out of college science courses or reworked as "fill-in-the-blanks" or short answer assignments. Such a format defeats the purpose of teaching students how to think and work like scientists. In an effort to remedy this problem, we developed LabWrite, an in-depth web-based tutorial that guides students through the process of science before, during, and after their lab experiments. Labwrite

creates a framework for authentic scientific practice to take place in the laboratory environment. In a control group experimental study, lab reports from biology students using Labwrite showed significantly better understanding of scientific concepts and a higher level of scientific thinking than biology students receiving traditional lab report writing instruction. Findings support the idea that students need to do more than just memorize science facts. They need to be able to engage in the processes and methods of scientific discovery, including developing the critical thinking and communication skills necessary to understand everyday phenomena and conduct basic decision-making.

- 100 EAKIN, DAVE<sup>1</sup>, RUTH BEATTIE<sup>2</sup> AND KELLI HARRIS<sup>1</sup>. <sup>1</sup>Eastern Kentucky University and <sup>2</sup>University of Kentucky - An assessment of the role of multimedia in enhancing student learning

The number of multimedia products commercially produced in biology has increased exponentially. If students have different learning styles then different instructional approaches must be used to accommodate these styles. Although some research suggests that students benefit from using computer-based instructional materials - few studies have been conducted on the role of multimedia in enhancing student learning. This research covered a 4-week period using human subjects from a University of Kentucky summer course: *Introduction to Biological Principles*. We predicted that students who used multimedia to aid them in their learning would perform better on course examinations. The results, however, did not reflect higher or lower scores. There is a saying, "What is perceived - Is!" i.e., what people perceive as true - not necessarily what is true - becomes their reality. Perhaps the driving force behind the proliferation of multimedia tools is not that they help student performance - but simply that students perceive them to help.

- 101 ALIFF, JOHN V. Georgia Perimeter College - Comparing student satisfaction with group and individual case studies in anatomy and physiology

Case studies help students understand the multiple issues involved in the explanation of natural phenomena. Students can experience open-ended problem-solving where the student scientists, working individually and in teams, consider competing hypotheses and use deduction and induction over a long series of experimental observations, and may arrive at multiple solutions. Step-wise, case studies should be designed to allow the students to recognize multiple issues, research background on what we know about the issues, brainstorm for connections, pose specific questions, and investigate the questions using the scientific method. Student satisfaction was surveyed comparing face-to-face and on-line classes, and group versus individual case studies. Data indicate greater satisfaction with group case studies in face-to-face classes, less in on-line classes. Face-to-face classes preferred group studies to individual case studies, with the converse holding true for on-line classes. All students prefer case studies to traditional writing assignments that explain a current topic in Human Anatomy and Physiology.

- 102 EAKIN, DAVID A. Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 - Development of an honors science seminar around a single essential topic - Water: The matrix of life

The use of single topic science seminars is common among Honors programs. The development, presentation and reception of a course based solely on water as the matrix of life will be presented. In addition to traditional in-class lectures and discussions, the Blackboard course management program was used to administer all other aspects of the course. The value of such programs to enhance student participation and interaction will be presented.

- 103 BROOKS, JANIE. Brevard College - Evolution versus faith? Techniques for teaching evolutionary biology at a church-affiliated liberal arts institution.

Evolutionary biology can be a controversial subject, one which often is taught poorly or ignored in high school instruction. Thus, students often come into their first introductory biology course with many misconceptions about the field. This observation especially characterizes students at Brevard College, a Methodist-affiliated liberal arts college in western North Carolina. This talk will describe resources and techniques that can demystify the process of evolution, allow students to wrestle with science and faith issues, and help them to understand the strengths and limitations of a scientific approach to studying life. Since students differ in their learning needs in the classroom, these techniques strive to incorporate all sensory modalities into the learning experience, leading to an examination of evolution using auditory, visual, and kinesthetic experiences. From this variety, students are exposed to different forms of expression and are encouraged to contribute their own thoughts and ideas to the class. Evolutionary biology is a dynamic field, where our current state of knowledge is simply the basis for further study and investigation. Therefore, the goal is to guide students away from seeking which facts to memorize, to help them critically examine old myths and misconceptions about evolution, and to encourage them to explore the contributions of science in the examination of life.

- 104 PITTS, DAVID. University of Tennessee at Martin - Factors influencing nest cavity choice by Carolina chickadees

Carolina Chickadees (*Poecile carolinensis*) are relatively common non-migratory birds that nest in cavities throughout woodlands of the southeastern states. In spite of their abundance, many aspects of chickadee reproductive biology have not been intensively studied. One reason for this is the limited success most investigators have had in enticing chickadees to use nestboxes where nesting activities could be more easily documented. For the last 12 twelve years I have been studying how different characteristics of cavities influence chickadee utilization of these cavities. My approach has been to make available pairs of nest cavities in which the members of each pair differ in only one feature. Chickadees show a statistically significant preference for cavities that are (i) small in diameter, (ii) have a small entrance hole, (iii) are deep, and (iv) that contain wood chips. Numerous other variables apparently influence chickadees as they search for suitable nest cavities.

- 105 GRASSI, N.<sup>1</sup> AND J. PARGA<sup>2</sup>. <sup>1</sup>Armstrong Atlantic State University Biology/Anthropology and <sup>2</sup>University of Texas at Austin - The Effects of temporary contraception on group dynamics in the ring-tailed lemur (*Lemur catta*)

Contraception use among endangered species in captivity is occasionally required to reduce overcrowding, prevent inbreeding and maintain genetic diversity within a population. Because some hormonal treatments have the potential to increase levels of aggression within a group to unacceptable levels, it is important to know the behavioral and social effects of such treatments in captivity. This study investigated the effects of contraception on the levels of aggression exhibited by female ring-tailed lemurs (*Lemur catta*), small-bodied prosimian primates which live in social groups consisting of related females, their pre-reproductive offspring and unrelated males. The study group consisted of eighteen free-ranging ring-tailed lemurs on St. Catherine's Island, GA USA. Three of the group's seven adult females were treated with temporary contraception in the form of a surgically placed melengestrol acetate (MGA) timed-release implant prior to the beginning of the breeding period. Behavioral data were collected during the MGA treatment period, and were compared to baseline data collected on the same females the previous year, when no females received contraception. Although increased levels of

aggression were noted among the females that received contraception during the MGA treatment period, the social cohesion of the group was maintained (i.e. troop fission did not occur). This study provides important information on the levels of aggression exhibited by adult female lemurs given MGA-contraception, which will help to inform zoological institutions on the safety of using such treatments in social groups of this species.

- 106 VAUGHN, ASHLEE<sup>1</sup> AND MEGHAN CARR<sup>2</sup>. <sup>1</sup>Christian Brothers University and <sup>2</sup>Memphis Zoo - A comparison study of Sulawesi macaques (*Macaca nigra*) at the Memphis Zoo

The research took place at the Memphis Zoo and Aquarium and involved the four-member Sulawesi macaque group, consisting of two adult males (M1, M2), one adult female (F1), and one sub-adult male (M3). M2 became classified as an adult between the two summers. The main objective of the project was to compare the behavioral data collected in the summer of 2002 with that of 2003. There were two ways used to collect behavioral data, and an ethogram was used to classify the behaviors. In addition to behavior, weather conditions, temperature, humidity, the estrous condition of the female, and the proximity of the group members to the focal animal were also recorded. Using the 2003 data, the effect F1's ischial callosities level on M2's aggression were examined. M1, the oldest male, did not come out during the data collection period in 2003. The other three individual animals showed some differences in their behavior between the two summers. The observed macaques did not change significantly in the focus of their aggression. In a comparison of F1's degree of swelling of ischial callosities, M2 showed more aggression overall and toward F1 when she was at 75% of maximum swelling. In conclusion, there have been behavioral changes in the group since the summer of 2002. These changes may relate to the lack of M1's involvement combined with the maturation of M2. The ischial callosities levels of F1 appear to have had an effect on the behavior of M2. (Supported by Assisi Foundation Internship.)

- 107 PIERCE, ANDREW AND MICHAEL FERKIN. The University of Memphis - Food deprivation induced changes in reproduction in meadow voles (*Microtus pennsylvanicus*)

Two hypotheses have been proposed to explain how food availability affects the sexual behavior of mammals. First, is the metabolic fuels hypothesis, which states that, in times of low food availability, animals will inhibit their sexual behavior. Second, is the reproduction at all costs hypothesis, which states that, in times of low food availability, animals will show either no changes or enhancement in sexual behavior. We tested between these two hypotheses using behavioral measures of attractivity, proceptivity, and receptivity in ad lib fed, food deprived, and refeed female and male meadow voles. In female voles, attractivity was inhibited after 24 hours of food deprivation, whereas 6 hours of food deprivation was sufficient to inhibit proceptive and receptive behavior. Female voles that had been food deprived for 24 hours and refeed recovered attractivity, proceptivity, and receptivity in 48, 72, and 96 hours, respectively. In contrast, 24 hours of food deprivation was sufficient to inhibit male attractivity, but not sufficient to inhibit proceptivity or receptivity. Male and female voles appear to respond to food deprivation by down-regulating reproductive behaviors, supporting the metabolic fuels hypothesis.

- 108 DELBARCO, JAVIER AND MICHAEL FERKIN. The University of Memphis - Increases in sperm investment in relation to the risk of sperm competition in a mammal species

Sperm competition occurs when the sperm of two or more males compete to fertilize the available eggs of a particular female. Sperm competition theory predicts that a male should increase his sperm investment when the risk of sperm competition increases. By

increasing the total number of sperm allocated to a female, a male can overcome the sperm from other males and thus increase his probability of siring a higher proportion of offspring. A study was conducted in meadow voles, *Microtus pennsylvanicus*, to test the prediction that sperm investment increases when the risk of sperm competition increases. Ten males were paired with females in two conditions: 1) sperm competition risk, and 2) no sperm-competition risk. In the first condition, 20 grams of bedding soaked with urine and feces from a donor male were placed in the pairing cage previously to the introduction of the focal male. In the second condition, distilled water was used instead of urine and feces. This study was the first time in which the risk of sperm competition has been manipulated using odors of conspecifics. This is relevant in species that communicate mainly through odors, such as the meadow vole. After male satiety, all sperm were extracted from the female reproductive tract and sperm counts conducted using a hemocytometer. It was found that male meadow voles allocate significantly more sperm when there is a risk of sperm competition.

- 109 HARGETT, ALLISON, KATHERINE LONG, AND MEGAN GIBBONS. Birmingham-Southern College - The response of spotted salamander larvae (*Ambystoma maculatum*) to chemical and visual cues of bass (*Micropterus salmoides*) and crayfish (*Orconectes rusticus*)

Many amphibians exhibit defensive behaviors that have evolved through the co-evolution of predator and prey. These behaviors sometimes entail the ability to recognize and respond to potential predators via olfaction. The purpose of this study was to determine if spotted salamander larvae (*Ambystoma maculatum*) could detect and respond to a vertebrate (bass) and/or an invertebrate (crayfish) predator via visual or chemical stimuli. The salamanders were tested in seven different treatment groups. During each five-minute trial, the salamander's activity time was measured and recorded. Analyses showed that salamanders exhibited more activity when exposed to crayfish chemicals than in the control condition, but did not show significant differences in activity when exposed to bass cues. These findings are particularly interesting because the salamanders used in this experiment were from a population that is exposed to crayfish, but not fish predators.

- 110 HUMBER, MEREDITH, MEGAN GIBBONS, AND ALLISON HARGETT. Birmingham-Southern College - Training red-backed salamanders in egg discrimination

In many organisms, egg recognition is an important aspect of parental care. Prior studies have shown that under laboratory conditions, female red backed salamanders (*Plethodon cinereus*) do not preferentially associate with their own eggs over the eggs of another female. We conducted an experiment in which we trained females of *P. cinereus* to move toward either their own eggs or the eggs of another female. A difference in learning curves for these two groups would indicate that salamanders were able to discriminate their own eggs from unrelated eggs. Although there were no significant differences in learning curves between the groups, reaction times indicated that learning took place and that the salamanders that were trained to move toward their own eggs made correct choices faster than those trained to move toward another females eggs. This method could be used in further studies investigating discrimination and learning.

- 111 SHULL, KENNETH<sup>1</sup> AND AMANDA ALDRIDGE<sup>2</sup>. <sup>1</sup>Appalachian State University and <sup>2</sup>Davidson College - Factors affecting mate choice in *Drosophila melanogaster*

Over the past several years our laboratory has investigated mate choice and male behavior in several mutant strains of *Drosophila melanogaster*. These studies have focused on stocks with wing mutations such that the male cannot make the standard

courtship song. This is a summary of our findings. In tests for mate preference, female *Drosophila melanogaster* from various wing mutation stocks were offered males from the same stock and males from other stocks. Overall, females chose males of their own phenotype over males from any other wing mutation stock. When offered males from their own stocks and Or-R "wild-type" males, the females showed no preference. Controls indicate that even Or-R females show no preference when given a choice between Or-R males and vestigial males. These results suggest that, despite the fact that in true wild-type populations the males' wing song plays an important part in courtship, in captive populations the wing song has little, if any, importance. Since these stocks have been isolated for many generations, and females from stocks with wing mutations have not been exposed to normal males, it is likely that the females are assessing male fitness in other ways. It is possible that, under the proper circumstances, there would be little gene flow between various stocks of flies, even in allopatric populations.

- 112 GHAFARY, JULIE, JONATHAN ALLEN, AND LINDSAY BOYETT. Birmingham-Southern College - The effects of crayfish and bass predators on activity level of green treefrogs (*Hyla cinerea*)

We investigated the response of green treefrog tadpoles (*Hyla cinerea*) to two types of predators: crayfish (*Procambarus clarkii*), and largemouth bass (*Micropterus salmoides*). Each tadpole was exposed to three experimental conditions, in random order: 1) visual and chemical cues of crayfish, 2) visual and chemical cues of bass, and 3) no predator cues. During each trial, we added food to the test chamber and recorded activity levels of tadpoles. Tadpoles appeared to show more activity in the presence of crayfish than in the presence of bass, but there was no difference in the activity levels of tadpoles in the control and bass conditions. These results may be explained by the evolutionary history of this population of the tadpoles, which were collected from a vernal pond that dries periodically and contains no fish predators.

- 113 WINNE, CHRISTOPHER<sup>1</sup> AND MICHAEL KECK<sup>2</sup>. <sup>1</sup>Savannah River Ecology Laboratory and <sup>2</sup>Grayson County College - Daily activity patterns of whiptail lizards (Squamata: Teiidae: *Aspidoscelis*): a proximate response to environmental conditions or an endogenous rhythm?

Animal activity patterns are influenced by both exogenous and endogenous factors. While most circadian biologists would probably assume that circadian clocks drive activity patterns, it is also well known that environmental stimuli may mask endogenous rhythms by either increasing or suppressing activity. For example, stimuli such as high temperatures, dehydration, or satiation may suppress activity, while hunger may increase activity. Because of the potential for exogenous factors to mask circadian rhythms, understanding the proximate causes of field activity patterns in animals can be elusive. This may be particularly true in ectothermic taxa, which often exhibit a stronger physiological link to temperatures in their habitat than do endotherms. In this study we used a unique experimental approach to test four hypotheses regarding daily activity patterns in diurnal lizards, using two species of whiptail lizards as our model organisms. We found that cessation of daily activity occurred with routine periodicity (1) without the influence of increasing afternoon temperatures, (2) without being influenced by feeding time, (3) without being limited by water availability, and (4) under a reversed photoperiod-temperature cycle. Our study complements the more traditional studies that use constant temperature and/or darkness regimes, and provides strong evidence that circadian cycles can play a critical role in not only the initiation but also the *cessation* of activity. While the ultimate cause of the unusual circadian rhythm in *Aspidoscelis* may be related to extreme temperature, limited water supplies, or some other exogenous factor, clearly, the rhythm persists in the absence of limiting environmental conditions.



- 114 SIKKEL, PAUL C. Department of Biology, Murray State University - The effects of intruder pressure and ectoparasites on reproductive tactics in territorial damselfish

In many reef fishes, both sexes defend permanent territories, but spawning occurs in male territories alone. Thus, to spawn, females must leave their territories unguarded, creating a tradeoff between spawning and territory defense. A combination of field experiments and observations were used to quantify the costs of territorial absence during spawning and their effects on female reproductive tactics in territorial damselfishes, particularly the Caribbean yellowtail damselfish, (*Microspathodon chrysurus*). When absent from their territories for the duration of spawning, females experience a significant increase in intruder pressure that increases exponentially with time away. Intrusion costs are minimized by spawning at dawn. However, this creates an additional, opportunity, cost associated with a reduction in time spent with cleaners. Females appear to minimize both costs by making frequent returns to the territory during spawning to evict intruders and visit cleaning stations. Females also visit cleaning stations while spawning at male nests. Females with higher intruder pressure make more frequent spawning trips and spawn closer to their territories. Territorial intruder pressure and ectoparasites thus appear to influence spawning tactics and mate choice in territorial marine fishes.

- 115 GIBSON, ANGELA AND ALICIA MATHIS. Southwest Missouri State University - Experience with predators and conspecifics influences habitat choice by rainbow darters

We tested whether experience with predatory and nonpredatory stimuli influences habitat choice by rainbow darters, *Etheostoma caeruleum*. First, we exposed darters in two different habitats (woody debris and rocks) to chemical stimuli from predators (sculpins) and nonpredators (stonerollers, blank control). When subsequently offered a choice between the two habitat types, darters previously exposed to predatory stimuli preferred the rock habitat regardless of the habitat occupied in the training trials. Rocks are the most common shelter available to rainbow darters in their natural stream habitat, and so attraction to this habitat could be an antipredator response. Habitat choice was not different from random for darters previously exposed to the nonpredatory stimuli. In a second experiment, we found that exposure to chemical stimuli from injured conspecifics did not influence subsequent habitat choice. However, habitat choice was influenced by prior exposure to chemical stimuli from non-injured conspecifics. Darters preferred the rock habitat if they had previously experienced conspecific cues in that habitat, indicating that social facilitation can also influence use of habitat.

- 116 GREENE, YANCEY AND TRAVIS PERRY. Furman University - Survey techniques and habitat suitability for *Rana chiricahuensis*

The Chiricahua leopard frog, *Rana chiricahuensis*, is found in Mexico, Arizona, and New Mexico, but is being threatened by habitat destruction and fragmentation, disease, and nonnative predators. As such, the U.S. Fish and Wildlife Service recently designated *R. chiricahuensis* as threatened under the 1973 Endangered Species Act. This study had two primary objectives: (1) to determine what constitutes suitable habitat by comparing occupied and unoccupied habitat patches with respect to several environmental variables; and, (2) to determine the most cost effective survey techniques for censusing *R. chiricahuensis* populations. The study was conducted on the Ladder Ranch in Sierra County, New Mexico. We found no significant differences among occupied and unoccupied habitat patches with the exception of the presence of garter snakes (*Thamnophis spp.*). Garter snake occurrence was higher on occupied patches. Also, we found no significant differences among survey techniques, but we did find that a slow paced visual survey with binoculars gave the most consistent census numbers. The

failure to find significant environmental differences among occupied and unoccupied patches may well be the result of low sample sizes. Only four habitat patches were found to be occupied by *R. chiricahuensis*. Probably the most important information to be gained from this study is the difficulty in studying a species for conservation purposes once it has become so rare as to be listed.

- 117 PATRICK, REID AND TRAVIS PERRY. Furman University - Population ecology of *Ambystoma maculatum* at an ephemeral pond in Greenville County, South Carolina

Amphibian populations around the world are threatened by changes in their environment. These changes include anthropogenic threats like habitat fragmentation due to development and pollution of habitat from runoff. This study monitored aspects of the ecology of a breeding population of the spotted salamander, *Ambystoma maculatum*, such as effective population size, reproductive rates, larval density, larval growth, and survivorship to metamorph with the goal of contributing to a long-term database that will allow the stability of one population to be tracked. The study population breeds in a small ephemeral pond in northern Greenville County, South Carolina. A drift fence and pitfall traps were used to determine that the effective population utilizing the pond has decline from 390 to 182 since the previous year. Salamanders caught were marked and released. Number of eggs deposited was estimated with an egg mass count. Chi-squared analysis showed nonrandom distribution of larval in the pond. Data from box sampling, showed that as time progressed, the larvae became less numerous and moved into deeper waters as they grew. Growth rates of both larvae and metamorphs were not significantly different from the previous study. The pitfall traps also allowed us to determine survivorship from egg to metamorph was less than 1%.

- 118 FELIX, ZACHARY<sup>1</sup>, YONG WANG<sup>1</sup>, AND CALLIE SCHWEITZER<sup>2</sup>. <sup>1</sup>Alabama A&M University and <sup>2</sup>USDA Forest Service, Southern Research Station - Demographics of *Bufo americanus* populations in relation to several silvicultural techniques in northern Alabama

The eastern American toad is usually considered a habitat generalist. However, we predicted that demographics of toad populations would vary in relation to different levels of overstory tree retention. We predicted that, due to physiological constraints, smaller sized individual would be encountered less often on clearcuts and other treatments with low levels of basal area. Sex ratios might also differ because of differing survival rates. There seemed to be a relationship between body size (SVL and mass) and treatment, with larger average body sizes on clearcut and control plots, and smaller sizes in plots with intermediate levels of harvest. Sex ratios were not significantly different among treatments. The ratio of juvenile to adult toads also seemed to vary by treatment. These results suggest that subtle changes in population structure of American toads may occur in response to habitat changes associated with silviculture.

- 119 JONES, TELENA AND ALVIN DIAMOND. Troy State University - Preliminary results of the comparison of herpetofaunal abundance and diversity in different forest cover types and their response to timber harvesting

Various forest management practices may have different effects on reptiles and amphibians. In this study, we are examining plantation and naturally regenerated pine or pine dominated forest and the effects of thinning on the abundance and diversity of herpetofauna. One drift fence array is centrally located within each study area. Drift fence arrays consist of three 15.24m long silt fence arms with a central box trap. A wire mesh funnel trap is located at the end of both sides of each arm and an 18.9 L bucket is buried at the midpoint of each arm. Three cover boards are placed systematically at each site.

Twelve PVC refuge traps for tree frogs are also placed systematically. Data has thus far been collected for a period of six months during 2003. Approximately 1,878 individual reptiles and amphibians were captured and released. Results from first year data indicate a greater diversity in the naturally regenerated pine stand and a greater total abundance in the thinned loblolly pine stand.

- 120 TAKAHASHI, MIZUKI AND MATTHEW PARRIS. University of Memphis - Effect of hydroperiod on developmental polymorphisms of the eastern newt

Recent studies provide evidence that ecological factors play a role in parapatric speciation. There are four subspecies of the eastern newt (*Notophthalmus viridescens*) distributed parapatrically and this species expresses developmental polymorphisms, which reflect adaptations to variable environments. Larvae potentially can become terrestrial efts, aquatic lunged adults, or aquatic gilled adults. Pond hydroperiod is an important environmental parameter for aquatic amphibians, and it varies regionally. Previous work indicates that frequency of developmental polymorphisms varies among subspecies. Our research tested the hypothesis that there were genetically based differences among subspecies in developmental polymorphisms in relation to pond hydroperiods. We collected adults of three subspecies (*N. v. viridescens*, *N. v. dorsalis*, and *N. v. louisianensis*) for breeding. Hatched larvae were distributed into 36 replicated artificial ponds with different hydroperiods: constant water, short hydroperiod (4 week-drying), and long hydroperiod (8 week-drying). We measured four responses: survival, mass at metamorphosis, larval period, and developmental outcome. Our result indicated that *N. v. viridescens* produced a significantly higher proportion of efts than *N. v. dorsalis* under shorter hydroperiods. Under longer hydroperiods, *N. v. viridescens* had shorter larval periods than *N. v. dorsalis*, but had significantly smaller metamorphic body masses than both *N. v. dorsalis* and *N. v. louisianensis*. These results suggest *N. v. viridescens* may be more adapted to shorter hydroperiods, whereas under longer hydroperiods, the other two subspecies perform better. Accordingly, strong selection imposed by different hydroperiods could lead to life history divergence and potentially speciation if accompanied by assortative mating within subspecies.

- 121 CORDOVA, CORY AND JONATHAN AKIN. Northwestern State University - Prevalence and persistence of *Salmonella* in wild-caught Iguanid and Scincid lizards

With the increasing popularity of keeping reptiles as pets, especially lizards, the spread of *Salmonella* from reptile to human due to improper handling is once again of concern in light of previous outbreaks in the pet turtle trade. In this study, we examined specimens of wild-caught *Scincella lateralis* and *Anolis carolinensis* found *Salmonella* in approximately 45% of those sampled. In addition, we compared whether temperature and humidity affected the persistence of *Salmonella* over time. We concluded that cage hygiene and population source were important determinants for the prevalence and persistence of *Salmonella*. These results suggest that the risk of *Salmonella* infection from pet lizards is real but we suggest steps to minimize cross-contamination between lizards and humans.

- 122 WILLIAMS, K. L. AND M.G. FRICK. Caretta Research Project, Savannah Science Museum – Tag returns of loggerhead sea turtles (*Caretta caretta*) from Wassaw National Wildlife Refuge, GA.

Much of what is known about sea turtle biology is attributed to research conducted on nesting females, due to the accessibility of these animals when on the beach. Long-range tag return data obtained from individual loggerheads may be helpful when determining population estimates, nesting ranges, seasonal dispersal patterns, and possible foraging areas. The most cost-effective method of marking sea turtles is to apply internal (PIT) and

external (metal "cattle ear") tags. The Caretta Research Project has run a saturation-tagging project on Wassaw National Wildlife Refuge, GA since 1973. The purpose of this paper is to report 31 years of tag returns from loggerhead sea turtles tagged on Wassaw National Wildlife Refuge, GA.

- 123 GREEN, JEFFERY AND VINCENT COBB. Middle Tennessee State University - The daily thermal profile of black racers (*Coluber constrictor*) in middle Tennessee

This study investigated the daily thermal patterns of six free-ranging black racers (*Coluber constrictor*) in Middle Tennessee. Snakes were followed for seven to 42 days between July and September 2003. Temperatures were recorded every 15 min via miniature temperature loggers surgically implanted into the coelomic cavity of the snakes. Thermal physical models constructed of appropriately painted copper pipes were used to explain potential variation in snake body temperatures as related to model temperatures. In addition to the models, daily point locations of snakes, and a total of 24 hours spent observing individual snakes, made it possible to make suggestions on habitat availability and utilization based on temperature ranges measured for each habitat. Our results indicated that *C. constrictor* had an average emergence time of 8:46am, operated at a high midafternoon temperature ( $T_b = 35.5^\circ\text{C}$ ), and had an average daily high and low temperature of  $35.5^\circ\text{C}$  and  $20.5^\circ\text{C}$ , respectively. Temperature ranges for the various habitat types frequently overlapped with one another, indicating that snakes could potentially encounter a wide temperature range in any of the measured habitat types. However, a higher proportion of observations placed *C. constrictor* in either ecotone habitats or forest habitats. This study offers a better understanding of the thermal ecology of snakes, and how the available thermal habitat influences body temperature selection.

- 124 LOUGHMAN, ZACHARY AND THOMAS K. PAULEY. Marshall University - Reproductive biology of *Regina septemvittata* (Queen Snake) in West Virginia

Reproductive biology of *Regina septemvittata* was studied in Ohio County, West Virginia during the 2003 summer season. Ten gravid snakes were collected between 28 July and 7 August and housed in aquaria until parturition. Data collected on adult female snakes included snout-vent length, total body length, pre-parturition mass, post-parturition mass, relative clutch mass, and behavior during capture. Data collected on neonates included snout-vent length, total body length, mass, and gender. Number of neonates per clutch ranged between 6 and 10 with a mean number of 8 per clutch. Of 81 neonates, 36 were male and 45 were female. The mean relative clutch mass for adult females was 0.34. Gravid females were also notably more aggressive than non-gravid snakes during capture. When West Virginia *R. septemvittata* were compared to a Kentucky population several differences were observed. Adult Kentucky snakes had a significantly higher snout-vent lengths ( $P = < .001$ ) and mean clutch size ( $P = < .001$ ) than West Virginia *R. septemvittata*. However preparturition mass did not differ significantly ( $P = .264$ ). Between the two localities, relative clutch mass was not significantly different. Neonate West Virginia *R. septemvittata* had significantly smaller snout-vent lengths ( $P < .001$ ) and masses ( $P < .001$ ). Overall West Virginia *R. septemvittata* were smaller than Kentucky snakes in all but one reproductive aspect (preparturition mass). These findings concur with the hypothesis that as latitude increases, size decreases within a snake species.

- 125 SUTTON, WILLIAM B. AND THOMAS K. PAULEY. Department of Biological Sciences, Marshall University, Huntington, WV. - Discovery of *Aeromonas hydrophila* and *Pseudomonas spp.* skin infections and other malformations of *Rana pipiens* in West Virginia

Over the past few decades, biologists have been attempting to uncover the cause(s) of the Global Amphibian Decline (GAD). There are many potential factors linked to the GAD, such as increased UV light, habitat degradation, and pollution. More recently, researchers are discovering that infections and malformations are also major components of the GAD. In 2003, two male specimens of *Rana pipiens* were confirmed to have skin infections caused by Red-leg disease, *Aeromonas hydrophila*, at Greenbottom Swamp in Cabell County, WV. Using sterile techniques, two distinct bacterial colonies were isolated from ulcers on the frogs' legs. Using Biolog, the colonies were positively identified as *Aeromonas hydrophila* (99.2% +/- 0.374) and mixed colonies composed of *Pseudomonas fulva* and *P. maculicola*. Three additional specimens of *Rana pipiens* and one of *R. catesbeiana* were discovered with hind-limb malformations, including undeveloped phalanges, malformed toes, and polydactyly. Also, numerous specimens of *R. pipiens* (n= 31) were found with skin tumors on the urostyle, rostrum, lip, and dorsal surface. The presence of infections and tumors suggest that the immune system of the affected frogs is compromised by some additional stress, such as the factors listed above. The presence of malformations and *Aeromonas hydrophila* infections in these frog populations should serve as an indicator of a greater problem occurring at this particular swamp. Funding: WVDNR.

- 126 MUNDEN, ANDREA<sup>1</sup>, STEPHEN LANDERS<sup>1</sup>, AND SCOTT PHIPPS<sup>2</sup>. <sup>1</sup>Troy State University and <sup>2</sup>Weeks Bay National Estuarine Research Reserve - Settlement of the suctorian *Lernaeophrya capitata* in Weeks Bay, Alabama

*Lernaeophrya capitata* is a ciliated protozoan known from brackish water environments. The cell is flattened and attached directly to substrates, projecting groups of tentacles into the water to capture its prey, other ciliated protozoans. Currently there is no agreement regarding the generic name, as the species has been assigned to the genus *Dendrosoma* and is considered a synonym of *Trichophrya* according to different sources. Our study has analyzed the settlement of *L. capitata* from Weeks Bay, Alabama, using glass slides that were submerged in the bay each month over the course of a year. Data from one of the sites indicates settlement only in March, April, and June, with a density of up to 12 cells/cm<sup>2</sup> and an average cell length of 134 µm. Analysis of a number of cell characteristics is currently underway, as well as analysis of additional sites in the bay.

- 127 NELSON, CHARLES H. The University of Tennessee-Chattanooga - Ultrastructure of the *Pteronarcys* hammer (Insecta: Plecoptera: Pteronarcyidae) and testing hypotheses concerning the number of origins of this structure in Systellognatha

The morphology of the signal producing 'hammer' of *Pteronarcys* males is examined with the aid of scanning electron microscopy. This structure is compared to the 'hammer' exhibited by males in the family Perlidae. Hypotheses of single, dual, or multiple origins of the 'hammer' in the family-group Systellognatha are examined by tracing this character on recent cladograms of Plecopteran family relationships.

- 128 WARRINER, MICHAEL<sup>1</sup>, EVAN NEBEKER<sup>2</sup>, STEVEN TUCKER<sup>2</sup>, AND TERENCE SCHIEFER<sup>2</sup>. <sup>1</sup>Arkansas Natural Heritage Commission and <sup>2</sup>Mississippi State University - The influence of forest type on saproxylic beetle assemblages in east-central Mississippi

Insects dependent upon dead wood, wood-decaying fungi, or other organisms within dead wood for some portion of their life cycle have been termed saproxylic. Beetles comprise a large component of the saproxylic fauna within forests and play vital roles in the initial fragmentation and breakdown of dead wood. At present, little base-line information exists regarding species composition and status of saproxylic beetles in forests of the

southeastern United States. To evaluate the influence of forest type on saproxylic beetle assemblages, we surveyed bottomland hardwood, upland hardwood, and mixed pine/hardwood forests in east-central Mississippi during the summer of 2000. Groups of beetles, representing specific functional groups (xylophagous, fungivorous, predaceous) in dead wood habitats, were targeted for use in analyses. Target groups included the Cerambycidae (xylophagous), Erotylidae (fungivorous), and Cleridae (predaceous). Overall, species richness and abundances of the target saproxylic groups was similar across all three forest types. Most beetle species were shared among the three forest types, with bottomland hardwood and mixed pine/hardwood hosting the most similar species assemblages. Functionally, bottomland hardwood and upland hardwood forests differed in terms of numbers of fungivorous and predaceous beetle species, with bottomland hardwood containing significantly larger numbers of both groups. Although the three forest types host similar assemblages of saproxylic beetles, bottomland hardwood forests appear to represent higher quality habitat for some species.

- 129 TANNAHILL, CHRISTINA L. AND LINDA S. FINK. Sweet Briar College - The effects of Japanese stilt grass, *Microstegium vimineum*, on earthworm abundance and diversity in central Virginia.

This project investigated the effects of *Microstegium vimineum* (Japanese stilt grass), a highly invasive alien grass, on the abundance and diversity of earthworms. Eight sites were censused in a mature oak-tulip poplar forest in Amherst County, Virginia. Worms were collected from patches of stilt grass, patches of Christmas fern, and bare leaf litter from each of the eight sites, using a mustard suspension as a vermifuge. There were significantly more earthworms under the *Microstegium*, but the same morphospecies were present under all three cover types. The results support the findings of Kourtev et al (1999, *Biological Invasions* 1:237-245) for *Microstegium* in New Jersey, and demonstrate that changes in soil invertebrate communities may be an important ecological effect of some plant invasions.

- 130 PISANI, KRISTY A. AND STEPHEN C. LANDERS. Department of Biological and Environmental Sciences, Troy State University - The effect of salinity changes on *Hyalophysa chattoni*, an apostome ciliate symbiotic on grass shrimp.

Salinity tolerance was analyzed for *Hyalophysa chattoni*, a symbiotic protozoan commonly found on many decapod crustaceans. For these experiments, host shrimp, *Palaemonetes pugio*, were acclimated to artificial seawater concentrations ranging from less than 1 ppt to over 35 ppt. Molted exoskeletons of the shrimp were collected in order to obtain the swimming protozoans released at ecdysis. These protozoans are found within the molt, bloating while they feed on exuvial fluid. The protozoans were measured at feeding and also after settlement and encystment in order to determine their ability to adapt to salinity changes. The data indicate that trophont size correlates to these changes. The average trophont size is 38  $\mu\text{m}$  x 34  $\mu\text{m}$  at 0.5 ppt, and increases to 63  $\mu\text{m}$  x 59  $\mu\text{m}$  at 20 ppt. At 20, 25, 30, and 35 ppt, length and width values are consistent with those values collected at 20 ppt. This study was supported by a Graduate Research Fellowship funded by the National Oceanic and Atmospheric Administration.

- 131 POLLARD, JOSEPH. Furman University - Responses of herbivores to cadmium hyperaccumulation in *Thlaspi caerulescens*

Certain plants hyperaccumulate heavy metals to high concentrations in their tissues, and it has been proposed that this phenomenon may represent a defense against herbivory. Previous research on this hypothesis has previously considered nickel and zinc. The current study investigated the effects on herbivores of cadmium hyperaccumulated by the European crucifer *Thlaspi caerulescens*, a species in which some ecotypes

hyperaccumulate much more cadmium than others. Using three herbivores, *Schistocerca gregaria* (generalist), *Mamestra brassicae* (oligophagous) and *Pieris brassicae* (crucifer specialist), we compared insect feeding preferences and survival on *T. caerulescens* plants with contrasting shoot cadmium concentrations, resulting either from cultivation in substrates with differing cadmium availability, or from ecotypic differences between plants grown in a uniform substrate. In non-choice feeding tests, high-cadmium plants were toxic toward all herbivores. In preference tests, there was less feeding on high-cadmium plants. Behavioral studies suggested that this results from post-ingestive learned avoidance of cadmium rather than inherent distastefulness, but that specialists are more easily deterred than generalists. The high-cadmium ecotype was avoided, but also had lower acceptability when grown in cadmium-free medium, because of an unidentified plant property acting as a rapid deterrent. This emphasizes that elemental defenses do not operate in isolation, but in the context of the whole suite of plant physicochemical characteristics.

- 132 ALLEY, VALERIE E., MARK D. FARR, JIMMY L. ALLEY, JR. AND ANDREW C. MILLER. Environmental Laboratory, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi 39180-6199 - [A Stream Monitoring Program at Ft. Benning Military Reservation, Georgia](#)

We used Rapid Bioassessment Protocols (RBP) to study streams at Fort Benning, an 182,000-acre military reservation near Columbus, Georgia. The purpose was to develop the aquatic component of an ecosystem-monitoring program that will be passed on to base personnel to monitor, protect, and preserve lotic systems. The reservation is along the fall line in eastern Georgia and is within two sub-ecoregions of the Southern Plains: Sand Hills and Southeastern Plains and Hills. In spring 2003, we sampled twenty-seven 100-m reaches in 1<sup>st</sup> to 5<sup>th</sup> order streams. In each we measured pH, DO, specific conductance, rated stream habitat characteristics, and collected a 5-min macroinvertebrate sample. Preliminary analyses indicated that streams fit into three categories: low pH (4 to 5) with moderately high percent coarse woody debris (CWD) (40-85%), moderate pH (5 to 6) with moderately low percent CWD (10-40%), and moderate to high pH (>6) with low percent CWD (<10%). Substratum in the majority of the streams consisted of sand with little or no coarse-grained material. Chironomidae dominated in low pH reaches (>70%) but were less abundant in the high pH reaches (<40%). Trichoptera, ephemeroptera, and plecoptera were uncommon in all reaches, presumably because of low pH, little CWD, or lack of coarse-grained substratum. Stream pH and CWD appear to be most important in structuring the macroinvertebrate assemblage, which is unrelated to sub-ecoregion characteristics.

- 133 DANIEL, HAL AND CLAUDIA JOLLS. East Carolina University - [Man eating insects: The ABC's of entomophagy](#)

The purpose of this presentation is to introduce the audience to human insect consumption from anthropological, biological and culinary points of view. More specifically, we will discuss insect consumption around the world, the evolutionary and nutritional aspects of humans using insects as food, and conclude with various examples of easily prepared and tasty recipes of "southern" insects. It is anticipated that the audience will gain valuable information as to how to eliminate the western psychological bias against insect consumption, will gain pedagogical information as to how to use entomophagy in the classroom, and will develop a greater understanding of what has been called "the food of the future".

- 134 LANDERS, STEPHEN. Troy State University - [Apostome ciliated protozoa from decapod crustacea in St. Andrew Bay, Florida](#)

Apostome ciliates are common external symbionts of crustaceans. The protozoans feed on exuvial fluid released at molting, and harmlessly swim through the abandoned exoskeleton while pinocytosing fluid. Though many species and variants of the genus *Hyalophysa* have been reported in North America from numerous decapods, the apostome diversity on crustaceans from Florida has not been examined. This study has examined the apostome species found on crustacea in St. Andrew Bay. Those collected include *Hyalophysa chattoni*, many variant types of *H. chattoni*, as well as the genus *Gymnodinioides*. The host animals examined include *Hippolyte zostericola*, *Tozeuma carolinense*, *Palaemon floridanus*, *Eurypanopeus depressus*, *Callinectes sapidus*, *Palaemonetes* spp and *Farfantepenaeus* spp. The ciliature of the apostome found on *Hippolyte zostericola* is particularly distinct and may represent a new species. This study was supported by a grant from the PADI Foundation, and faculty development grants from Troy State University.

- 135 HENSON, RICHARD. Appalachian State University - Scorpion diversity and distribution within Big Bend and Guadalupe Mountains National Park Texas

One thousand seven hundred thirty five scorpions representing 17 species and three families were collected within Texas two mountainous National Parks (Big Bend and Guadalupe Mountains) between 1986 and 2003. These scorpions were found in habitats ranging from loose shifting sand to rocky substrates with some being highly specialized to habitat and others residing in more generalized habitats. Both of these desert islands, with their varied life zones, possess the most diverse scorpion populations in Texas. Big Bend is represented by 16 species and Guadalupe Mountains by 7 species. The spatial distribution of these scorpions is dependent on several physical characteristics including temperature, precipitation, soil and substrate characteristics.

- 136 MEYER, HARRY A. McNeese State University, Lake Charles, Louisiana - Tardigrada of the Florida Keys

Terrestrial species of the Phylum Tardigrada can be found in cryptogams (moss and lichens), soil, and leaf litter. Outside of a few localities that have been intensively sampled, the distribution of tardigrades in North America is poorly known. This is especially true of the United States south of Tennessee and east of Texas. On the Florida mainland, 23 species of tardigrades have been reported: 20 species in a survey of cryptogams from throughout the state and 6 from leaf litter at a single site. This study is the first to report tardigrade species collected in the Florida Keys. At six sites extending from Key Largo to Key West (five state parks and one urban site), leaf litter and cryptogams were collected in January, 2003. Suitable cryptogam substrates were sparse at the state parks. After the material was soaked in deionized water, the tardigrades were removed and mounted in Hoyer's medium. Tardigrades were not found at the urban site. A total of 66 tardigrades were present in samples from the five state parks. Four species were present: *Milnesium tardigradum*, *Macrobotus* cf. *harmsworthi*, *Macrobotus* cf. *hufelandi*, and *Macrobotus psephus*. The same species of *Macrobotus* cf. *harmsworthi* is also found in leaf litter on the Florida mainland. The cosmopolitan predatory species *Milnesium tardigradum* was the most abundant and widely-distributed tardigrade species. *Macrobotus psephus* is a South American species. Tardigrade diversity in the Florida Keys appears to be lower than in the Florida mainland.

- 137 DAFOE, ROBERT AND FRANK ROMANO. Department of Biology, Jacksonville State University, Jacksonville, AL 36265 - Marine meiofauna of the subtidal regions of Sand Island, AL, NE Gulf of Mexico, USA

A marine meiofauna survey of subtidal regions of Sand Island, AL in the northeast region of the Gulf of Mexico was initiated 2000. Samples were taken at mile intervals from the



Pelican Bay side (east) and the Gulf of Mexico side (west). A sample consisted of 500 cc's of sand collected from the subtidal zone. Samples were washed alternately with freshwater and saltwater (3 washes each) and strained through a nested sieve series (500  $\mu\text{m}$  – 63  $\mu\text{m}$ ). Freshwater subjects the meiofauna to osmotic shock that causes them to release their hold on sand grains. Materials collected on the 125 and 63  $\mu\text{m}$  sieves were preserved in 10% buffered formalin, stained with rose bengal, and stored in 70% isopropyl alcohol. Meiofauna were counted and tardigrades extracted from samples. A total of 20,045 meiofaunal organisms have been observed from 45 samples. Nematodes account for 52.9%, harpactocopepods account for 30.9%, Foraminifera account for 10% and tardigrades account for 0.01% of the collection. Miscellaneous organisms make up the remainder of the collections containing organisms such as, bivalves, cnidarians, polychaetes, and kinorhynchids. Bay side samples have greater numbers of nematodes and less tardigrades and harpactocopepods while Gulf side samples have a greater number of harpactocopepods and tardigrades.

- 138 COLLINS, BEVERLY<sup>1</sup> and LORETTA BATTAGLIA<sup>2</sup>. <sup>1</sup>Savannah River Ecology Lab and <sup>2</sup>Southern Illinois University, Carbondale - Regeneration strategies in bottomland hardwood forests

Regeneration strategies based on flood and shade tolerances often are used to explain regeneration patterns and species distributions in bottomland hardwood forests. We asked 1) if more inclusive 'regeneration strategies' can be identified by incorporating plant colonization traits, specifically seed size and dispersal mode, along with flood and shade tolerances, and 2) if these more comprehensive strategies predict field regeneration patterns sufficiently to be useful for understanding and managing floodplain forest ecosystems with complex dynamics driven by flooding patterns and periodic wind disturbance. We compiled published values of tolerances and colonization traits for bottomland species from the literature, and synthesized this information to identify groups of species with theoretically similar regeneration strategies. We used empirical evidence from three floodplain datasets to test whether the *a priori* groups were useful predictors of regeneration patterns. We compared regeneration responses of these species to canopy openness, flooding gradients, and distance from forest edge. There was varying correspondence between observed and predicted; species with different published tolerance levels overlapped substantially, tolerant species were frequently reclassified with less tolerant ones, and some species that were discriminated into their *a priori* groups exhibited a trend opposite to predictions. Nevertheless, species responses indicated flood and shade tolerance are coarse filters on plant establishment following a dispersal filter on species arrival, or colonization, and strategies based on these factors can help explain or predict regeneration patterns in bottomland hardwood forests.

- 139 BATTAGLIA, LORETTA<sup>1</sup> AND DAVIS PRITCHETT<sup>2</sup>, PETER MINCHIN<sup>1</sup>. <sup>1</sup>Southern Illinois University, Carbondale and <sup>2</sup>University of Louisiana, Monroe - Dispersal of bottomland hardwood forest species during old-field succession

We examined the seed rain of bottomland hardwood forest species in a 160 x 200 meter abandoned soybean field in northeast Louisiana, following 18 years of secondary succession. Our objectives were to characterize patterns of seed dispersal, determine whether dispersal limitation exists for the dominant species and, if so, whether it accounts for current patterns in the vegetation. In August 2002, we deployed 67 seed traps spaced 10 meters apart along 3 transects perpendicular to the forest remnant at the south edge of the field. Traps were emptied every 6 weeks beginning in September 2002. We captured a total of 439 seeds (6.82/m<sup>2</sup>). Dispersal of *Fraxinus pennsylvanica*, the dominant species in the extant vegetation and second in seed rain (21%), was highest within 30 meters of the forest edge. *Crataegus viridis* had the highest number of seeds (29%), all of which were collected at the same station, adjacent to a reproductive individual in the field. Dispersal of

heavy-seeded *Quercus* spp. and *Carya aquatica* were limited to within 10 meters of the forest edge. Most species still appear to be limited by dispersal, but this limitation is beginning to disappear with the maturation of in-field recruits.

- 140 ENGEL, E.C. AND J. WELTZIN. University of Tennessee, Knoxville - What factors drive the response of an old-field plant community to the interactive effects of CO<sub>2</sub>, temperature, and soil water availability?

Plant community composition and ecosystem function may be altered by global atmospheric and climate change (atmospheric [CO<sub>2</sub>], temperature, and precipitation). An ecological experiment at Oak Ridge National Laboratory (ORNL) Environmental Research Park investigates interactive effects of [CO<sub>2</sub>], temperature, and soil moisture on an old-field plant community. The OCCAM (Old-field Community Climate and Atmospheric Manipulation) project utilizes open-top chambers equipped with rain shelters with experimental plant communities constructed of seven common old-field species, including C<sub>3</sub> and C<sub>4</sub> grasses, forbs, and legumes. We monitored the cover and morphological characters of individuals within subplots. Initial responses indicate that *Plantago lanceolata* (C<sub>3</sub> herb) responded negatively to increased temperature, and positively to increased soil water availability, although the response appears to be ameliorated by elevated [CO<sub>2</sub>]. *Trifolium pratense* (C<sub>3</sub> legume) and *Solidago canadensis* (C<sub>3</sub> forb) exhibited increased growth in elevated temperature plots, with very slight positive responses to [CO<sub>2</sub>]. *Andropogon virginicus* (C<sub>4</sub> grass) responded positively to increased temperature, without a dramatic effect of elevated [CO<sub>2</sub>]. Responses to varying soil water availability were masked by negligible treatment differentials in the initial stages of the experiment. Species specific responses may be explained by inter- and intraspecific interactions include competitive exclusion. Concurrent examination of plant response to both biotic and abiotic factors facilitates a more complete understanding of how communities may shift with changing abiotic conditions.

- 141 CHANDY, SHIBI AND DAVID GIBSON. Southern Illinois University, Carbondale - Partitioning of diversity at different scales in the Shawnee National Forest, Illinois

Ecological systems are heterogeneous and the processes that generate this natural heterogeneity operate over multiple scales of space and time. To develop an understanding of how ecological communities are structured it is important to recognize how processes change spatially and temporally. It is also critical to factor out the scale that contributes most to diversity, as it will aid in implementing management plans. Permanent plots established in the two physiographic regions of the Shawnee National Forest (Ozark Hill Division and the Shawnee Hill Division) provided a baseline to understand the partitioning of diversity at different scales. In this study, additive relationships between diversity components were used to calculate the relative contribution of alpha and beta diversity to the overall diversity of the landscape. Trees and sapling numbers were counted and herbaceous percent cover was estimated for sixty-seven permanent plots. We used species richness, and Shannon's and Simpson's diversity measures to account for the effects of diversity at different scales. Results show that for all measures of diversity the tree and sapling was greatest at the landscape level, whereas for the herbaceous layer the alpha (plot-level) diversity was highest.

- 142 WEST, NATALIE AND DAVID GIBSON. Southern Illinois University, Carbondale - Microhabitat analysis of exotic species in Illinois shale barrens

Shale barrens are rare natural communities in Illinois. The occurrence of these forest openings can be partly attributed to edaphic conditions, but disturbances, such as fire, are also important in maintaining them. Past ecological studies of three shale barrens held in the Illinois Nature Preserve System have focused on the plant community structure, but

none have yet concentrated on exotic species, a serious threat to native plant communities and a growing concern for land managers. Different factors contributing to the success or failure of exotics can be attributed to characters of a particular plant, as well as habitat conditions present at the time of introduction. Because all habitats are heterogeneous, available resources will vary across time and space. To better understand the invasion risk to these areas, the three barrens were surveyed for exotic species. Ecological variables were used to characterize microhabitats occupied by exotics and compared to random points within the barrens to ascertain whether exotic species occur throughout the whole of available habitat, or are present only in a subset of microsites. Preliminary results suggest that exotic species are clustered in areas of low light, high levels of soil moisture, and high cover of non-woody species. This information will be beneficial to site managers hoping to maintain the barrens community structure and identify management strategies that might limit spread of exotic plants.

- 143 MADDEN, KATHRYN<sup>1</sup>, REBECCA SHARITZ<sup>1</sup> AND DONALD IMM<sup>2</sup>. <sup>1</sup>Savannah River Ecology Laboratory and <sup>2</sup>USFS-Savanna River. Savannah River Ecology Laboratory - Comparisons of vegetation, canopy, and soil composition of selected Fall-line sandhill TES plant populations.

Sandhill communities, perhaps due to fragmentation, have experienced a disconnected development, resulting in a mosaic of pine-oak woodlands along the Southeastern Fall-line. Independent of surrounding landscape composition, Fall-line sandhill communities have retained some level of ecological integrity providing habitat for many Plant Species of Conservation Concern. We selected ten target sandhill threatened, endangered, and sensitive (TES) plant species populations for survey: *Astragalus michauxii*, *Baptisia lanceolata*, *Carphephorus bellidifolius*, *Chrysoma pauciflosculosa*, *Liatris secunda*, *Nolina georgiana*, *Phaseolus polystachios*, *Stylisma pickeringii*, *Warea cuneifolia*, and *Warea sessilifolia*. Twenty known co-occurring populations of the TES plants were selected for survey at the Savannah River Site in South Carolina and at Fort Gordon and Fort Benning in Georgia. Assessments included surveyed vegetation and canopy composition and soil characteristics in sandhill communities with and without selected TES plants. Initial observations include TES plant abundances vary among and between installations perhaps in response to canopy openness and also percentage of co-occurring vegetation. Additional data on soil moisture, slope, and aspect are compared to evaluate patterns on a landscape and community level.

- 144 VANDERMAST, DAVID<sup>1</sup>, MICHAEL JENKINS<sup>2</sup>, AND PETER WHITE. <sup>1</sup>University of North Carolina-Chapel Hill and <sup>2</sup>Great Smoky Mountains National Park - Environmental correlates of long-term change in the high-elevation hardwood forests of Great Smoky Mountains National Park

Many studies in eastern forests suggest that, given enough time, community composition and structure are not stable as disturbance and successional changes occur. Though compositional and structural changes in forest communities are well-documented, environmental correlates associated with these changes have been infrequently reported. In this paper we document changes in the composition and structure of high-elevation hardwood forest communities of Great Smoky Mountains National Park over a 25 year period, and report on environmental factors correlated with these changes. Between 2000-2002, 41 0.1 ha plots that were established in the late 1970's were resampled and soils and topographic data were collected. Of the 41 plots, 21 lost and 20 gained basal area during the period. Loss of basal area was strongly correlated with slope %, and soil chemical properties such as high exchangeable aluminium, and low soil calcium and magnesium. Population level changes in these forests will also be discussed.

- 145 IVERSEN, COLLEEN<sup>1</sup> AND SCOTT D. BRIDGHAM<sup>2</sup>. <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>University of Oregon – Effects of nutrient availability on nutrient-use efficiency at multiple levels of ecological organization in peatlands

The adaptive use of resources by plants is a common topic in ecology, and is generally expressed as a resource use efficiency. Nitrogen-use efficiency (NUE), in particular, has been the subject of several studies, as nitrogen is one of the primary growth-limiting factors in many terrestrial systems. In its most basic form, NUE is a ratio between a unit of carbon fixed in photosynthesis per unit of nitrogen uptake or availability; this is an index of the capacity of a biological system to utilize limiting resources. We examined how anthropogenic increases in nutrient availability affect plant NUE response at multiple levels of ecological organization (the leaf, whole-plant, functional group, species, and community level) in large-scale fertilization experiments in nutrient-limited peatland ecosystems in northern Minnesota and the Upper Peninsula of Michigan. We extended NUE theory to include carbon and resource allocation within the entire plant (above- and belowground), and further incorporate parameters such as the mean residence time of nutrients in biomass, and plant efficiency in resource uptake from the available soil pool. We find that plant NUE response to nutrient addition is dependent on the organizational level examined, resource uptake efficiency and allocation, and also on life-form and growth habit. Nutrient addition to these low-nutrient systems may change nutrient limitation from one nutrient to another, or shift community composition to species better able to utilize increased nutrients.

- 146 DILUSRO, JOHN, BEVERLY COLLINS, LISA DUNCAN, AND CHRIS CRAWFORD. Savannah River Ecology Laboratory - Soil respiration and fine root production in southeastern mixed pine forests of varying soil texture

Soil respiration represents a major flux of carbon from forest ecosystems. Soil CO<sub>2</sub> flux serves as an integrative measurement for the respiration of soil organisms and roots and the decomposition of organic matter within the soil. We sampled mixed pine forests on soils of varying textures at Ft. Benning, Georgia. The forests are managed via prescribed burning on three-year rotations. All sites were burned in 2000 prior to the study. Soil CO<sub>2</sub> flux measurements were completed quarterly with sampling commencing in September 2001. An infrared gas analyzer was used to measure CO<sub>2</sub> flux via permanently installed soil rings in each plot. Soil texture varied from 7% clay in the sandy site to 26% clay in the clayey site. Soil respiration rates in September 2001 were 5.81 μmol/m<sup>2</sup>/s on the sandy site and 4.66 μmol/m<sup>2</sup>/s on the clayey site. September soil temperature at 10cm was also greater on the sandy site (25.4°C) than the clayey site (24.8°C). Root production measured via root ingrowth in 2002 over a 90-day sampling interval was also greater in sandy sites (n=4) (160.7 g/m<sup>2</sup>) than clayey sites (n=4) (137.3 g/m<sup>2</sup>). Quarterly soil flux and environmental measurements were begun on six additional forest stands in 2002 to further investigate soil CO<sub>2</sub> flux on a range of soil textures. In addition to providing estimates of annual carbon loss for these stands we seek to determine the controlling factors on efflux rates at these sites.

- 147 COLLINS, CHRISTA, MICHAEL MULLEN, AND MICHAEL STEWART. Troy State University - Assessing the ecological health of urban impacted streams in the Choctawhatchee and Pea Rivers watershed

Non-point source pollution is a major contributor to water quality problems in the United States. Impervious surfaces contribute to increases in non-point source pollution in urban areas as well as to hydrologic changes that impact both water and habitat quality in streams. Previous studies have indicated that percent impervious cover acts as an indicator of an urban stream's health and provides an estimate of the hydrological impact of urbanization. The purpose of this study was to use Geographical Information Systems

(GIS) to calculate percent impervious cover, evaluate its effect on the ecological health of the watershed, and to use benthic macroinvertebrates as biological indicators to assess ecological integrity of urban streams in the watershed. Macroinvertebrate samples were collected from 20 urban-impacted streams and four least-impacted streams lacking significant urban influence in the Southeastern Plains of Alabama (US EPA, 2000). Macroinvertebrates were identified and compared to landuse variables using statistical analysis. Results suggest that GIS is a useful tool for examining the relationship between impervious surface and the extent of environmental degradation.

- 148 PILARCZYK, MEGAN, CHRISTA COLLINS, KRISTY PISANI, BONNIE HAMITER, AND JONATHAN MILLER. Troy State University - The impact of urbanization on fish assemblage diversity and biological integrity in the Southeastern Plains ecoregion, Alabama

Urbanization is one of the leading causes of stream impairment due to ever expanding cities, and is an increasing concern in the United States. Previous studies have shown the negative impact of urbanization on biological integrity by assessing stream communities. Fish assemblages were sampled in eighteen urban-impacted streams and three least-impacted streams in the Choctawhatchee and Pea Rivers watershed in order to determine the impact of urbanization. Fish were collected using a battery-powered backpack electroshocker, preserved in 10% formalin, and identified to species. Of the 3,654 fish caught from the 21 sample sites, 38 species were identified. The number of species at each site ranged from 2 to 22. Data analysis included calculation of species diversity using the Shannon-Weiner diversity index and use of an Index of Biological Integrity (IBI) previously established for the Choctawhatchee and Pea Rivers watershed. Results suggest that fish assemblages are adequate indicators for determining the influence of urbanization on the biological integrity of streams.

- 149 BENTON, PAUL AND WILLIAM ENSIGN. Department of Biology, Kennesaw State University - The effect of road crossings on stream fish movement in small Etowah Basin streams

The effects of road crossings on stream fish movements have been poorly documented. This study assessed movement of fish across three types of road crossings (clear span, box culvert and tube culvert) in six streams in the upper Etowah River basin. In each stream, reaches upstream and downstream of the crossings were divided into three contiguous cells, each cell encompassing a single pool and riffle sequence. Fish in each cell were captured, tagged with fluorescent elastomer tags, and released. One month later, fish were collected from the same cells and inspected for tags. Using recapture data, we estimated the average probability of both upstream and downstream movement between contiguous cells. Across the six streams a total of 1407 fish were tagged and 29% of the tagged fish were recaptured. The probability of upstream movement was 6.3% and the probability of downstream movement was 3.5%. Movement both upstream and downstream across box and tube culverts fell below the lower 95% confidence intervals of these estimates, indicating that these culvert types act as impediments to fish movement. We observed no evidence that fish moved up or downstream across the culvert in streams with tube culverts. Streams with box culverts showed no downstream fish movement and an average of 1.2% probability of upstream movement. Movement across the clear span crossings did not differ from movement between contiguous cells. Therefore, clear span bridges should be favored when developing roads over creeks to minimize effects on fish movement.

- 150 HUPP, CLIFF R.<sup>1</sup>, RICHARD H. DAY<sup>2</sup>, DANIEL E. KROES<sup>1</sup>, AND CHARLES R. DEMAS<sup>3</sup>. <sup>1</sup>USGS, Reston, VA, <sup>2</sup>USGS, Lafayette, LA, <sup>3</sup>USGS, Baton Rouge, LA - Sediment trapping and carbon sequestration in the Atchafalaya River Basin, Louisiana

Lowland bottomlands are recognized for trapping substantial amounts of sediment; recent studies indicate that they may also be important sinks for carbon. The Atchafalaya River Basin, the largest contiguous forested bottomland in the United States (3584 km<sup>2</sup>), receives up to 30% of the Mississippi River flow and 100% of the Red River flow. This combined flow typically inundates the backswamps several times a year often for prolonged periods. Marker horizons for estimation of sediment deposition have been established at 90 floodplain-sampling stations along a broad transect across the central Basin. Suspended sediment is monitored just below the confluence of the Red and Mississippi waters, upstream, and downstream near the mouth of the Basin. Additionally, deposition has been analyzed for particle size, loss on ignition, and total carbon. Deposition rates vary from trace amounts to over 100 mm/yr with an average of 15 mm/yr. This sediment is highly organic, derived from allochthonous and, presumably, autochthonous sources. Hydraulic connectivity of a site may strongly affect sedimentation rates. This forested wetland potentially traps 4.3 billion kg of sediment annually, based on the average deposition rate and the average annual flow in the middle of the basin (3024 m<sup>3</sup>/s), which inundates approximately 40% of the bottomlands. Percent organic material at each site ranged from 1.7% to 69% with an average of about 10%. Thus, it is estimated that 435 million kg of organic material may be trapped annually within the Basin, suggesting lowland bottomlands may play an important role in global carbon cycling.

- 151 KROES, DANIEL R. AND CLIFF R. HUPP. U.S. Geological Survey, 430 National Center Reston, VA 20192 - Patterns of riparian sedimentation and subsidence along channelized and unchannelized reaches of the Pocomoke River, Maryland

The Pocomoke River and its drainage basin, historically a blackwater system, was intensively ditched and channelized by the mid-1900s. Fluvial processes in response to channelization have resulted in channel incision, head-cut erosion, and levee perforation along most reaches upstream of tidal influence. Six sites were selected to study the range of floodplain sedimentation dynamics in relation to channel reaches that are headwater (site 1), upstream incised channelized (sites 2 and 3), near downstream limit of channelization (site 4), below channelization (site 5), and tidal (site 6). Short-term (clay pad analysis, 3 yrs) and long-term (dendrogeomorphic techniques) sediment deposition rates and composition were determined at each site. Site 1 had mean short- and long-term deposition rates of 1.2 mm/yr, sites 2 and 3 had 0.6 mm/yr (mean short-term), while mean long-term deposition was -5.6 and -11.9 mm/yr; site 4 had a rate of 2.9 mm/yr (mean short-term) and 1.5 mm/yr (mean long-term); site 5 had 2.8 mm/yr (short-term) and 1.7 mm/yr (long-term); and site 6 had, 3.6 mm/yr (mean short-term) and 1.31 mm/yr (mean long-term). Our results suggest that channelization limits contact between stream flow and the riparian zone, resulting in increased sediment delivery downstream with little or no sediment retention by channelized reaches. Drainage of floodplains (lowered water table) has led to oxidation of organic sediments, resulting in subsidence. The channelized reaches now may be an increased source of organic carbon to the atmosphere and nutrients to the Pocomoke River. Unchannelized reaches show increased sedimentation rates relative to the historical system as a result of upstream changes in river geomorphology. The overall sediment storage and carbon sequestration functions of this river system have been impaired by channelization.

- 152 HACKLER, MEDORA, SHANNON SMITH, RACHAEL CHILTON, REBECCA AMBERS, AND DAVID ORVOS. Sweet Briar College - A comparison of aquatic macroinvertebrates and fishes in dam-regulated and unregulated streams

Dams are known to alter the geology, chemistry, and biology of streams and rivers. The impact of large dams has been the focus of many studies while the effects of small dams are not as well established. This investigation examined the effects of a dam on a small stream located in Sweet Briar, Virginia, on the fishes and aquatic macroinvertebrates of the regulated stream, as well as a geomorphologically similar stream located nearby. Macroinvertebrates were collected both qualitatively and quantitatively and the data were analyzed using a number of indices including the Shannon-Wiener, Simpson, and Sequential Comparison. Fishes were collected by electrofishing, identified, and the data analyzed using an Index of Biotic Integrity that was developed for the Central Virginia region. Preliminary analysis of the samples indicates acceptable species diversity for fishes and macroinvertebrates but demonstrates variation between the two sites. In particular, the diversity and abundance of fish populations appears to be different even though the two sites are geographically close and habitats are similar.

- 153 TYCHUS, ADEWALE, PETER FOTANG, LAFAYETTE FREDERICK, AND RAYMOND PETERSEN. Howard University - The occurrence of water molds in *Sarracenia purpurea* pitchers.

Microscopic examination of pitcher plant (*Sarracenia purpurea* L.) water samples from a number of populations revealed the apparent absence of water molds (*sensu lato*) with one exception. A species of *Achlya* was detected in samples of pitcher plant liquid obtained from a West Virginia population in which mosquito and midge larvae were absent. Based on these initial observations it was hypothesized that the species-specific dipteran larvae of *S. purpurea*, *Wyeomyia smithii* and *Metrocnemus knabi*, eliminate water molds or, at least, suppress their development in the community of pitcher plant liquid. To test this, a controlled *in vitro* experiment was conducted in which pitcher plant and bog water samples from four (4) sites were assayed for the occurrence of water molds. This was done by placing boiled and cracked hemp seed in water samples from which any dipteran larvae were removed. Of the sites sampled: two had both mosquito and the midge larvae present, in one only *M. knabi* was present, and in the fourth and last site no dipteran larvae were present in the leaves. Water molds of the genera *Achlya* and *Saprolegnia* grew on hemp seeds immersed in bog water samples from all four sites, and in pitcher plant water samples obtained from the one site in which dipteran larvae were absent. No water molds were detected in hemp seed cultures inoculated with water samples obtained from pitchers in which dipteran larvae were present. These findings support the hypothesis that the species-specific mosquito and midge larvae of *S. purpurea* serve to prevent water molds from becoming established in the inquiline community of its leaves and, as such, it is suggested that this helps to maintain the 'stable' community ecology of the pitchers.

- 154 DAULTON, NATHAN M.<sup>1</sup>, ELIANA CRISTINA VENTURA<sup>2</sup>, AFONSO C.D. BAINY<sup>2</sup>, AND MARIA R.F. MARQUES<sup>2</sup>. <sup>1</sup>Christian Brothers University and <sup>2</sup>Universidade Federal de Santa Catarina - Antioxidant responses of the brown mussel *Perna perna* exposed to lead and paraquat

Xenobiotics have been identified with causing oxidative stress in several aquatic organisms. Different molecular and biochemical defense responses can be elicited upon exposure to these compounds. Antioxidant enzymes are among the cellular protective mechanisms, which are employed to counteract, free radicals generated within the cell and can be measured and used as biomarkers. In the present study the *in vivo* effects of lead and paraquat were evaluated in the brown mussel, *Perna perna*, under laboratory conditions. One group (n=7) was exposed to lead at a nominal concentration of 1 ppm, and a second (n=7) exposed to paraquat at a nominal concentration of 10 ppm for 48 hours. A third group (n=7) was simultaneously exposed to both lead and paraquat for the

same time interval. Glutathione S-transferase (GST), catalase (CAT) and superoxide dismutase (SOD) activities were measured in the gills of exposed animals. There was no significant difference from control groups observed in GST or SOD activity for the experimental conditions. However, the CAT activity was observed to be significantly higher in the groups exposed to lead, possibly signifying an alteration in the heme synthesis pathway. Funding for this project was provided by NIH grant # 1T37TW00123-03.

- 155 MCNALLY, KELSEY. Louisiana State University - Developing a risk assessment model for *Schistosoma haematobium* in Kenya based on climate and remotely sensed data

It is important to be able to predict the potential spread of water borne diseases when building dams or redirecting rivers. This study was designed to test whether the use of a growing degree day (GDD) climate model and remotely sensed data within a geographic information system, could be used to predict both the distribution and severity of *Schistosoma haematobium*. Growing degree days are defined as the number of degrees centigrade over the minimum temperature required for development. The base temperature and the number of GDD required to complete one generation varies for each species. A monthly climate surface grid containing the high and low temperature, rainfall, potential evapotranspiration, and the ratio of rain to PET was used to calculate the total number of GDD provisional on suitable moisture content in the soil. The latitude and longitude for known snail locations were used to create a point file. A 5km buffer was made around each point. Mean values were extracted from buffer areas for Advanced Very High Resolution Radiometer (AVHRR) data on land surface temperature (Tmax) and normalized difference vegetation index (NDVI). The values for Tmax ranged from 15-28 and the NDVI values were 130-157. A map query found all areas that meet both criteria and produced a model surface showing the potential distribution of the vectors for this disease. Results indicate that the GDD and AVHRR models can be used together to define both the distribution range and relative risk of *S. haematobium* for control program planning and better allocation of health resources.

- 156 LI, SHUWEN<sup>1</sup>, L. MARTIN<sup>1</sup>, S. REZA PEZESHKI<sup>1</sup>, AND F. SHIELDS<sup>2</sup>. <sup>1</sup>The University of Memphis and <sup>2</sup>USDA-ARS National Sedimentation Laboratory – Effect of simulated herbivory and flooding on photosynthesis and growth in black willow (*Salix nigra*)

Herbivory and flooding are common occurrences that influence species composition and diversity in wetland ecosystems. Black willow (*Salix nigra*) naturally occurs in floodplains and riparian zones of the southeastern United States. Cuttings (posts) from this species are used as a bioengineering tool for streambank stabilization. The present study was conducted to investigate the effects of herbivory and flooding on cutting survival and growth. Under greenhouse conditions, photosynthetic and growth responses to simulated herbivory and flooding treatments were quantified. Over a 51-day experimental period, potted cuttings (0.65 cm in diameter and 30 cm long) were subjected to three levels of herbivory: no herbivory (control), light herbivory, and heavy herbivory; and three levels of moisture regimes: no flooding (control), continuous flooding, and periodic flooding. Results indicated that neither continuous nor periodic flooding had any detectable effects on plant photosynthetic performance that was measured periodically on selected leaves. Photosynthesis was increased in response to heavy and light herbivory due to increased stomatal conductance. Leaf chlorophyll content was stimulated under light herbivory treatment. In addition, heavy herbivory resulted in improved total height growth across moisture regimes at the end of the experiment. Increased root/shoot ratio was observed in continuously flooded cuttings for both heavy and light herbivory treatment groups. This



study provides evidence that black willow can survive at restoration sites where both extensive herbivory and flooding are commonly present.

- 157 MARTINEZ, ANGELIQUE M. Middle Tennessee State University - The use of species diversity as an ecological indicator in southeastern U. S. estuaries: Dynamic and hierarchial linear models

Estuaries in the Gulf of Mexico contain valuable resources for both commercial fisheries and recreation. However, evidence has shown that this valuable ecosystem may be in decline (Davies, 1989). The purpose of this research was to test and develop a model that uses species diversity as an ecological indicator of these ecosystems and to determine if estuaries are permanently affected by disturbances. Data were obtained from the Environmental Monitoring and Assessment Program (EMAP), which included estuarine systems sampled from Texas to the Florida Panhandle from 1991 to 1994. Two models were tested, a dynamic linear model (DLM) and a hierarchial linear model (HLM). The DLM can take into account changes in means and variances of observations made on a system that is continually evolving over time. The HLM procedure involves analyzing data that are dependent or related such as estuaries in the Gulf of Mexico. Abiotic variates including depth, dissolved oxygen, temperature, salinity, pH, transmissivity, and total organic carbon (TOC) were used to predict diversity. Results show that depth and TOC were significant predictors of diversity in the DLM and depth and temperature were significant predictors in the HLM. Results also revealed that diversity in estuaries is not permanently affected by disturbance or that any disturbance in the four-year period was constant. Overall, species diversity can be a useful ecological indicator in Southeastern U. S. estuaries.

- 158 GEORGE, ROBERT Y. George Institute for Biodiversity and Sustainability, GIBS, 305 Yorkshire Lane, Wilmington, North Carolina 28409 - How to protect tropical and deep-sea coral reefs off Southeastern United States: New conservation and management strategies

1998 *El-Nino* related global warming induced severe loss of thermally sensitive staghorn coral *Acropora* communities in Florida's coral-dominated marine sanctuaries. Experimental studies revealed that elk-horn *Porites* corals and brain coral *Monastrea annularis* are less impacted by global warming phenomena and the latter with extremely low growth rates. Therefore, fast-growing *Acropora* corals are more suited for restoration efforts. Nevertheless, eutrophication stress, coral diseases, invasion of alien species, tourism, trapping, bottom-trawling and illegal recreational fishing practice retard coral restoration efforts. New conservation and management strategies are now required for the newly discovered cold coral reefs in the outer shelf, Haterras-Florida slope and Blake Plateau off Florida, Georgia, South Carolina and North Carolina coasts within the 'Exclusive Economic Zone' (EEZ) or federal waters and in the High Seas (beyond 200 miles or national jurisdiction). *Oculina varicosa* banks off central Atlantic Florida from Cape Canaveral to Fort Pierce received the status of EFH-HAPC (Essential Fishery Habitats-Habitat Areas of Particular Concern) in the jurisdiction of the South Atlantic Fishery management Council (SAFMC). However, deep-sea *Lophelia pertusa* coral reefs off the coast of Southeastern United States are yet to be designated as EFH-HAPC. Abundance of commercially important fish, shrimp and crab species and high biodiversity in *Lophelia* reef complex call for immediate need to protect, conserve and manage these deep-sea coral ecosystems off Southeastern United States.

- 159 BLAUDOW, R.A.<sup>1,2</sup>, J.A. COLE<sup>2</sup>, AND L.B. COONS<sup>1,2</sup>. <sup>1</sup>Integrated Microscopy Center and <sup>2</sup>Department of Microbiology and Molecular Cell Sciences, The University of Memphis, Memphis, Tennessee - Evidence that multiple second messengers regulate calcium dependent fluid movement in isolated salivary glands of partially fed *Dermacentor variabilis*

Previous experiments have demonstrated that dopamine stimulates fluid uptake in isolated salivary glands of partially fed Ixodid ticks and that this process occurs partly through a G-protein coupled receptor activated adenylate cyclase and cAMP second messenger pathway. We present evidence that identifies another cyclic nucleotide second messenger pathway that stimulates salivary gland fluid uptake in the Ixodid tick *Dermacentor variabilis*. Our experiments show that the membrane permeable cGMP analog, 8-Br-cGMP, increases fluid uptake in isolated *D. variabilis* salivary glands and that fluid movement into the glands is dependent on extracellular calcium transport into the cell. Downstream inhibition of the cGMP signal suggests that a second messenger system unique from the cAMP pathway mediates the events that lead to calcium efflux. Previous experiments from our lab established that the production of nitric oxide and cGMP in these salivary glands is also dopamine dependent. Together, these results suggest that a dopamine stimulated second messenger pathway that includes cGMP and its downstream targets is responsible for the calcium dependent fluid movement into the salivary glands of *D. variabilis*.

- 160 COONS, L.B.<sup>1,2</sup>, J.L. TZEFAKES<sup>1</sup>, R. BLAUDOW<sup>1,2</sup>, S. FRASE<sup>1</sup>, L. BOYKINS<sup>1</sup>, CORTA THOMPSON<sup>3</sup>, AND C.M. WILLIAMS<sup>1</sup>. <sup>1</sup>Integrated Microscopy Center, University of Memphis, <sup>2</sup>Department of Microbiology and Molecular Cell Sciences, and <sup>3</sup>Department of Biology, Christian Brothers University - Programmed cell death is involved in tick salivary gland degeneration

The salivary glands of female ixodid ticks degenerate after the replete tick drops off the host. This study was designed to determine if this degeneration is due to necrosis or programmed cell death (apoptosis). We sampled tick salivary glands from day one following drop off through oviposition. To differentiate between necrosis and apoptosis we viewed salivary gland cells using scanning electron microscopy, light microscopy and transmission electron microscopy. We also applied a fluorescent nuclear stain which we evaluated using confocal laser scanning light microscopy. As a final test we used a TUNEL reaction that preferentially labels DNA strand breaks generated during apoptosis. Throughout the sampling period we observed some cells in the salivary gland with the characteristic morphology of apoptosis. These cells had nuclei that stained with TUNEL, stained with the fluorescent nuclear stain, and showed a disassembly of cytoplasmic organelles that is characteristic of apoptosis. The number of cells showing apoptotic characteristics increased over time with the largest number of salivary gland cells displaying all these traits found in ovipositing ticks. Ecdysone is known to cause impairment of fluid uptake in *in vitro* models of salivary gland degeneration. We treated cultured salivary glands with edcysone and compared the results to untreated cultured glands. Morphological changes in some cells occurred that were similar to salivary glands from detached ticks. These results support the conclusion that programmed cell death is responsible for ixodid salivary gland degeneration and that ecdysone is involved.

- 161 DIXON, A.B., D.J. MARSH, M.E. WILSON, J.L. PATE, R.A. DAILEY, AND E.K. INSKEEP. Wingate University - Effect of breed type on late embryonic and fetal mortality and concentrations of progesterone, estradiol 17 $\beta$  and vascular endothelial growth factor (VEGF) in the ewe

Embryonic and fetal mortality contribute to economic loss in the sheep industry. A study was conducted to determine differences due to breed-type (face color) in late embryonic and fetal losses and in concentrations of progesterone, estradiol-17 $\beta$ , and VEGF in maternal serum. Ultrasonography was used to count embryos and fetuses on d25, 45, 65, and / or d85 of gestation. Mortality was estimated from differences among consecutive counts at ultrasonography and at birth. Serum samples on d25, 45, 65, and / or d85 were assayed for hormones and VEGF. Analysis of variance was used to determine effects of

face color on the number of embryos or fetuses and concentrations of progesterone, estradiol, and VEGF. Black-faced ewes had greater late embryonic and fetal loss from d25 to term than white- or mottled-faced ewes, respectively. Black-faced ewes had greater fetal loss than mottled-faced ewes from d45 to term and white- or mottled-faced ewes from d85 to term. Black-faced ewes had lower progesterone to d65 than white- or mottled-faced ewes. Estradiol was lower in white-faced ewes on d25 than mottled-faced ewes. On d45 and 65, mottled-faced ewes had greater estradiol than black- or white-faced ewes. Black-faced ewes tended to have greater estradiol on d85 than white- or mottled-faced ewes. VEGF to d65 was lower in mottled-faced ewes than in white-faced ewes. It is concluded that late embryonic and fetal survival vary with breed-type and might be associated with breed-type differences in concentrations of hormones, possibly reflecting breed-type differences in seasonality.

- 162 RAYBURN, JAMES, JIMMY CHILDERS, AND JASON WISENER. Jacksonville State University - Developmental Toxicity of Phloxine B to *Palaemonetes pugio* (grass shrimp embryos)

Phloxine B is a photo-active dye that is proposed as a potential pesticide. It has been shown to kill fruit flies that consume bait with Phloxine B in it. Phloxine B is a red dye that is relatively non-toxic to humans. This dye is being evaluated for potential non-target aquatic species effects. The photo-activity of Phloxine B suggests that differences in toxicity may be seen between the light and in the dark exposures. Some uses of Phloxine B may include uses near estuarine or marine water systems. The developmental toxicity of Phloxine B is evaluated using the Shrimp Embryo Teratogenesis Assay – Palaemon (SETAP). This assay exposes *Palaemonetes pugio* Embryos during early embryo development from just after ova-positon though hatch of the embryo (~12-15 days at 27°C). Concentrations ranging from 1 to 100 mg/L Phloxine B are exposed to two sets of 12 embryos per concentration. One set is left in the light for the test duration and one set is placed in the dark during the test duration. Using Cytel<sup>®</sup> ToxTools program the risk estimate for mortality was determined for Phloxine B in the light and in the dark. The estimated LC50 for Phloxine B both in the light and in the dark is about 40 mg/L with no major differences between the light and dark exposed embryos. This indicates that phototoxicity may not happen to grass shrimp embryos, which may be related to Phloxine B inability to diffuse through the embryo coat.

- 163 HAYGOOD, MARK, ASHLEY WARD, BENJIE BLAIR, MARK MEADE, AND CHARLES OLANDER. Jacksonville State University – Phloxine B, a xanthene photoactive dye, is a successful treatment against *Ichthyophthirius multifiliis* in channel catfish, *Ictalurus punctatus*

*Ichthyophthirius multifiliis* (*Ich*) is a parasitic protozoa that infects freshwater fish. Scale-less fish, particularly *Ictalurus punctatus*, are more susceptible to this disease, because the parasite is able to easily penetrate the epithelial layers. Currently, there are many successful therapeutants against *Ich*, such as malachite green and methylene blue bathing. Theoretically, these chemicals target a crucial stage, the free-floating theront stage. By eliminating this stage, the life cycle will cease proliferation. Due to the toxic nature of these treatments, they are only approved for use on ornamental fish. Phloxine b, a xanthene photoactive dye, approved by the Food and Drug Administration (FDA), has shown to negatively impact *Tetrahymena pyriformis*, which is in the same family as *I. multifiliis*. Various concentrations of Phloxine b (0,1, and 5 parts per million) were applied to catfish using a 2:5 infection rate. Frequencies of trophonts were measured in a 1-cm<sup>2</sup> area directly lateral to the dorsal fin. Image analysis pro software was utilized to observe infection rate. An inverse correlation has been noted between the reduced frequency of trophozoites and the increased concentration of phloxine b.

- 164 CHAPLIN, ASHLEY. Columbus State University - The Effects of a One-Tesla Magnet on Human Fibroblast Cell Growth

Research regarding the link between electromagnetic fields and cancer has generated much controversy. The results of various studies have provided evidence supporting a possible link to the absence of a connection. Recent experiments involving *Xenopus* embryos indicate that huge magnetic fields of approximately 17 Tesla (one Tesla = 10,000 Gauss) can change the second and third cleavage planes of development. These planes will orient, vertically or horizontally, to the direction of the applied magnetic field. The potential effects of magnetic fields on the growth of human fibroblast cells were investigated in this study. Cell cultures were split and the new cultures were exposed to a one Tesla magnetic field for approximately thirty-six hours during their growth phase. Half of the exposed cultures were counted for proliferation rate and the remainder of the cultures were analyzed for patterns of growth. The statistics showed that the data for the control and experimental groups were both significantly different from a random pattern. Since both the control and experimental groups had significant results, it can be concluded that the growth patterns of fibroblasts from the experimental group were no different than those in the control group. The results of this study indicate that magnets do not appear to have an effect on fibroblast growth rates or patterns. This work supports the contention that the reports of positive responses to magnetotherapy are due to a placebo effect. It also weakens the argument that electromagnetic fields cause cancer by increasing the growth rates of cells.

- 165 PATEL, MANISH<sup>1</sup>, LEANDRO BERTOGLIO<sup>2</sup>, AND ANTONIO CAROBREZ. <sup>1</sup>Christian Brothers University and <sup>2</sup>Universidade Federal de Santa Catarina - Anxiolytic effects of 8 OH DPAT are abolished in test-experienced rats submitted to the elevated plus maze

Research has shown that prior test experience compromises the anxiolytic effect of benzodiazepines (BZs) either in rats or mice, which are submitted to the Elevated Plus Maze (EPM) animal model of anxiety. This phenomenon is referred to as "One Trial Tolerance." However it remains to be determined whether a similar event occurs when testing drugs that possess binding-sites on the 5-HT<sub>1A</sub> receptor, such as 8 OH DPAT (a known 5-HT<sub>1A</sub> agonistic drug). In this present study, this issue was taken into account using both maze-naïve and maze experienced (free exploration of the EPM 48 h earlier for 300s) rats pretreated systemically before each trial with either 8 OH DPAT or saline and submitted to the EPM. The results confirmed the anxiolytic profile of 8 OH DPAT, represented by an increased open arm exploration and decreased risk assessment behavior, in maze-naïve rats. However, in maze experienced rats, 8 OH DPAT anxiolytic effects were not observed, suggesting that prior maze experience compromised the drug's anxiolytic activity, while increasing open arm avoidance. Thus, the "one-trial tolerance" phenomenon might also be extended to other drugs that bind to the 5-HT<sub>1A</sub> receptor complex. Supported by NIH 1T37TW00123-03

- 166 BELCHER, RICHARD AND SIGURDU GREIPSSON. Troy State University - Role of cytochrome P-450 in the oxidative desulfuration of bensulide

Bensulide is an herbicide that is used on agricultural crops and turfgrasses. Since bensulide binds strongly to soil it disrupts remediation of farmlands, however it can possibly be broken down into the highly mobile bensulide oxon. This derivative is formed by oxidative desulfuration which may be carried out by the cytochrome P-450 found in the soil bacterium, *Bacillus megaterium*. Using ultraviolet spectroscopy and HPLC, bensulide was added to cytochrome P-450 to determine if it undergoes oxidative desulfuration. Peaks found in bensulide's HPLC results resembled some of those found with the end product's except for one, which could account for bensulide oxon. Furthermore, ultraviolet

studies on the reaction confirmed that a reaction does in fact occur between bensulide and cytochrome P-450.

- 167 BOOPATHY, RAMARAJ AND EARL MELANCON. Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310 - Metabolism of nitrophenol by a *Klebsiella* sp.

The metabolism of nitroaromatic compounds by a *Klebsiella pneumonia* isolated from a regional wetland was studied. The isolate has the metabolic capability to degrade nitrophenol to phenol, when it was grown with nitrophenol as the sole nitrogen source. The isolate did not use nitrophenol as the sole carbon source. The metabolic pathway showed that the *Klebsiella pneumonia* reduced the nitro group to an amino group to produce aminophenol as a major metabolite. This aminophenol was oxidatively deaminated to phenol. For every mole of nitrophenol metabolized, 1 mole of phenol was produced and the phenol did not undergo further metabolism. The isolate also used several other nitroaromatic compounds including nitrotoluenes and nitrobenzenes as its nitrogen source. Even though this organism did not degrade the nitroaromatics completely, it may be useful in degrading nitroaromatics in contaminated soil and water containing other aromatic degraders in a syntrophic condition in nature.

- 168 COLVIN, BEN, ADAM LOWERY, AND MICHAEL LAND. Northwestern State University - Commercial demand and processing methods for microbial reduction and acceptance of softshell turtle meat (*Trionyx* spp.)

Wild turtle populations have been in dramatic decline. The demand of turtle meat is basically unknown in the United States because of its classification as 'other' or minor species in harvest reporting. However in Asian countries, many species have been hunted to near extinction. The efficient culture of softshell turtles (*Trionyx* spp.) has not been quantified for the purpose of restocking or commercial production. To encourage a shift from wild caught turtles to a domestic supply, a survey of chefs was conducted to determine the basic demand for turtle meat as well as the source and species of product purchased. A screening survey for pathogenic microbial flora was conducted on processed specimens. The turtle meat was then processed under a variety of conditions and the processes compared for shelf life. Shelf life was determined for fresh product, organic acid dips and vacuum packaging treatments. The most effective treatments were determined and treated product was presented to culinary institutions acceptance evaluation.

- 169 LYLES, CHRIS, DERICK WENNING, AND MICHAEL LAND. Northwestern State University - Evaluation of copper salts on *Salmonella enteritidis* growth under varying conditions in broiler production

Copper is a dietary supplement used in the poultry industry to aid the digestive lining of chickens. Copper sulfate is the industry standard, but an alternative form of copper is available as a copper chloride complex. When the copper complex was used as a feed additive, *Salmonella* loads were observed to decrease during processing. A comparison of copper sulfate and the copper chloride complex on *Salmonella enteritidis* were evaluated under planktonic, in-vitro and in-vivo conditions. The copper chloride complex lowered *Salmonella* counts compared to the standard additive copper sulfate and the control.

- 170 LAND, MICHAEL AND RYAN TERRY. Northwestern Sate University - Survey of coliform and pathogen leakage of peritoneal cavity of game taken with shot gun and microbial reduction strategies

Hunting is an integral in rural life even in today's culture. Game ranging from deer to ducks is universally taken with a shot gun. Shot guns project multiple pellets that spread in their pattern coverage as the projectiles travel toward their target. Upon impact, these pellets enter the target causing massive trauma. Hunting time varies and harvested game may lie in a game bag for a few or many hours in a variety of environmental conditions. During this time, the resultant damage to the intestinal lining allows bacterial contamination of the cavity, muscles, points of entry and exit. A survey of bacteria was taken from wound areas and skin. Aerobic plate counts of processed game utilizing 'traditional' methods were compared to the same practices incorporating an organic acid treatment and the resultant shelf life extensions were evaluated.

- 171 GREENE, CHRIS, STEVE BARGER, WANDA STORY, STEPHAN MOSS, DAWN CASTLE, AND HENRY SPRATT. University of Tennessee at Chattanooga - The effect of nitrogen or phosphorous addition on microbial mineralization of biphenyl in floodplain soils from the Chattanooga Creek superfund site

Mineralization of biphenyl by natural microbial communities in soils collected from floodplain sites along the Chattanooga Creek EPA Superfund site was measured. Soils and creek water were collected following applicable regulations and transported to a laboratory at UTC. At the lab soils were sieved, and placed in three 600 cm<sup>2</sup> porcelain pans (mesocosms) to a depth of 2 cm. Based on soil moisture content, biphenyl was added to each mesocosm (50 mg/l). Either NO<sub>3</sub>-nitrogen (+N) or PO<sub>4</sub>-phosphorous (+P), or both (+N+P) was then added to the three mesocosms to a total of 3.5 mg NO<sub>3</sub> and 1 mg PO<sub>4</sub>. Mesocosm soil was homogenized and incubated (room temperature) for 168 hours. Five times during this incubation aliquots of soil were removed from each mesocosm to produce slurries (1 cc soil in 100-ml filter sterilized creek water) to which <sup>12</sup>C-biphenyl was added (50 mg/l), followed by the addition of 0.09 μCi <sup>14</sup>C-biphenyl to initiate mineralization studies. Periodically over 72 hours <sup>14</sup>CO<sub>2</sub> was removed from traps in the microcosms and rates of biphenyl mineralization were calculated. Appreciable rates of biphenyl mineralization were observed, ranging from 0.2 to 1.2 μg/g dwt/h. Overall, the +N+P mesocosm exhibited the highest mineralization rates after 168 h of incubation (0.91 μg/g dwt/h), with +P and +N soils somewhat lower (0.42 and 0.22 μg/g dwt/h, respectively). These data suggest that the microbial communities in these soils actively mineralize biphenyl, and will respond favorably to nutrient addition – critical findings to any potential biostimulation plan for bioremediation of these soils.

- 172 MILLER, SUZANNE, CHRIS GREENE, WANDA STORY, STEPHAN MOSS, STEVE BARGER, DAWN CASTLE AND HENRY SPRATT. University of Tennessee at Chattanooga - Biphenyl mineralization by bacterial cultures isolated from floodplain soils from the Chattanooga Creek Superfund Site

Mineralization of biphenyl was determined for bacterial cultures isolated from soils amended with biphenyl. The soil used was collected from a floodplain site along the Chattanooga Creek EPA Superfund site, and incubated with biphenyl for 168 h. Bacterial numbers in the soils studied ranged from 5.9 e6 to 4.9 e7 cfu/g. Thirty cultures were selected for further analysis. These cultures were tested for biphenyl mineralization in a minimal medium with biphenyl as sole carbon source. Of these cultures, 23 were able to grow on the biphenyl, as evidenced by the formation of a yellow cleavage product of the biphenyl. To further assess these cultures, two, which did not produce the yellow cleavage product, plus three that did were inoculated into sterile microcosms with basal salts medium to which <sup>12</sup>C-biphenyl was added (50 mg/l), followed by the addition of 0.09 μCi <sup>14</sup>C-biphenyl to initiate mineralization studies. Periodically <sup>14</sup>CO<sub>2</sub> was removed from traps in the microcosms and rates of biphenyl mineralization were calculated. Rates of biphenyl mineralization ranged from 2 to 94 ng/h. Interestingly, all cultures mineralized the <sup>14</sup>C-

biphenyl, suggesting that the colorless cultures do so following a metabolic pathway that does not produce the yellow product. Tentative identification of these cultures (growth medium techniques) suggests that they are either *Pseudomonas* or *Acinetobacter*. Molecular sequence analyses to precisely identify all 23 cultures are currently underway. These data suggest that the Chattanooga Creek floodplain soils contain abundant biphenyl degrading bacteria that may be useful in bioremediation of these soils.

- 173 VAN DEUSEN, KATHERINE, DAWN CASTLE, AND HENRY SPRATT. University of Tennessee at Chattanooga - Stimulation of *nahAC* gene production in naphthalene-spiked polycyclic aromatic hydrocarbon contaminated soils

Chattanooga Creek, declared a superfund site by the EPA, is one of the most polluted waterways in the southeast United States. Polycyclic aromatic hydrocarbon (PAH) concentrations exceed 14,000 ppm at some locations in the creek due to the dumping of coal tar wastes by surrounding factories. It is acknowledged that microbes use PAHs as a carbon and energy source, but it is unclear what factors control PAH degradation in natural microbial communities. The purpose of this study was to assess the effects of pre-exposure to PAHs on the abundance of the *nahAC* gene, an important gene in the naphthalene degradation pathway. Microcosms with soil from a clean site or with chronically contaminated soil were amended with naphthalene and the abundance of the *nahAC* gene was measured quantitatively using real-time PCR. In previously exposed soils, *nahAC* copy number increased within 8 days of naphthalene amendments, and exceeded 7.87e7 copies/g dry soil by day 21. In the spiked non-contaminated soils, *nahAC* copy number also increased by day 8, but never exceeded 1.02e7 copies/g dry soil. These data suggest that soil microbes previously exposed to PAHs could respond more quickly to the addition of new contaminants. Sequence data suggests that the *nahAC* genes retrieved from naphthalene-amended microcosms were similar to *Comamonas* sp., *Burkholderia* sp., and *Ralstonia* sp. *nahAC* genes. Knowledge that pre-exposure to PAH contaminants allows a faster response in gene production by the microbial community gives insight into the potential for bioremediation in this area.

- 174 WELCH, NICOLE TURRILL. Middle Tennessee State University, Murfreesboro, Tennessee - What is inhibiting table mountain pine (*Pinus pungens* Lamb.) regeneration following prescribed fire?

Table Mountain pine (*Pinus pungens* Lamb.) is a fire-dependent species endemic to the southern Appalachian Mountains. Cones of *P. pungens* are serotinous and stand regeneration is thought to require medium to high-intensity fires that release seed, expose mineral soil, and open the forest canopy. Historically, *P. pungens* forests have been maintained by lightning- and human-caused fires. Following more than 65 years of fire suppression practices, table mountain pine is not regenerating whereas hardwood species are. Today, most table mountain pine stands have increased densities of chestnut oak (*Quercus prinus* L.) and scarlet oak (*Q. coccinea* Muench.) as well as fire-intolerant species such as red maple (*Acer rubrum* L.). Indeed, the greatest percentage of the landscape (65.5%) and largest mean patch size (901.2 ha) are mixed pine-hardwood cover type for areas where table mountain pine cover type is expected (southwest-facing slopes between 305-1220 m in elevation) on the Chattahoochee National Forest, Clayton, Georgia. Regeneration of *P. pungens* often is more successful by wildfire than by prescribed fire, as current prescribed burning guidelines limit our ability to achieve medium to high-intensity burns. Furthermore, something seems to be inhibiting *P. pungens* regeneration in some stands, even following medium- or high-intensity prescribed fires. Future studies will assess the relationships between mountain laurel (*Kalmia latifolia* L.), soil chemistry, and *P. pungens* seed germination.

- 175 KUPPINGER, DANE<sup>1</sup>, PETER WHITE<sup>1</sup>, AND MICHAEL JENKINS<sup>2</sup>. <sup>1</sup>University of North Carolina at Chapel Hill and <sup>2</sup>National Park Service, Great Smokey Mountains - Biotic and abiotic factors that affect the invasion success of *Paulownia tomentosa* following wildfires in pine and oak-pine forests of the Southern Appalachian mountains.

While fire has become a valuable management tool in recent years, understanding and minimizing the detrimental effects of prescribed fire is becoming critical as its use increases. Of these detrimental effects, invasion by exotic species, is particularly alarming as it presents the potential to undermine the beneficial effects of prescribed fires. Regardless, natural, intentional, and accidental fires are once again becoming part of the landscape. It is therefore important to determine the landscape, watershed and stand variables that favor the spread of exotic species into natural areas following fire. Using data from five sampling locations in the Southern Appalachians, we found that the abundance of *Paulownia tomentosa* following fire in mountain forest habitats is affected by a number of biotic and abiotic factors namely live canopy, shrub, and herbaceous cover, amount of bare soil, and depth of humus and litter.

- 176 SHELINGOSKI, SUSAN<sup>1</sup>, THOMAS WENTWORTH<sup>1</sup>, JON STUCKY<sup>1</sup>, AND RICHARD LEBLOND<sup>2</sup>. <sup>1</sup>North Carolina State University and <sup>2</sup>North Carolina Natural Heritage Program - Wells Savannah, an example of a unique, fire-dependent ecosystem in the North Carolina Coastal Plain

Wells Savannah is a 47-hectare tract of fire-suppressed pond pine woodland located in Pender County, in the Lower Coast Plain of North Carolina. Unique, species-rich savanna communities were discovered during 1997 in the regularly-mowed rights-of-way of two power lines that cross the tract. The ecological significance of Wells Savannah led to its protection by the North Carolina Coastal Land Trust in 2002. To assist in developing a restoration plan for this tract, we used multivariate analyses to place soils and vegetation in the context of other savanna ecosystems in the region. We acquired data from 16 permanent plots in Wells Savannah and nearby Holly Shelter Game Land, and we combined these with similar data from 120 permanent plots available from the Carolina Vegetation Survey database. Using cluster analysis and non-metric multidimensional scaling, we found that the sedge-rich vegetation of the power line corridors at Wells Savannah is quite distinct from that inventoried in other savannas of the region. The unique vegetation of this tract is associated with poorly drained hydric soils with unusually high (greater than 40%) silt content. The unique vegetation and soils of Wells Savannah warrant its continued protection and restoration, and our findings indicate a need to revise the existing classification of savanna vegetation types.

- 177 DUMAS, SHAY, HOWARD NEUFELD, MELANY FISK, AND JAMES SOPBIERAJ. Appalachian State University - Community and ecosystem responses following fire in the Linville Gorge Wilderness Area

At a previous meeting we reported preliminary results from our investigation of community and ecosystem responses following the 2000 fire in the Linville Gorge Wilderness Area. In order to better understand the post-fire recovery of the thermic-oak pine community, we report final results from our comparative study of burned and unburned plots in the Gorge. Eight 30 x 30 m plots in both burned and unburned areas of the Gorge were sampled post-fire for community composition and ecosystem responses. The fire was mostly a ground fire, although it did crown when it encountered pines that had previously been killed by bark beetles. Fire removed 50% of the litter layer and killed nearly all aboveground stems of the dominant (> 90% of shrub stems) *Kalmia latifolia* shrubs. However, 86% of the *Kalmia* sprouted and are still alive. The loss of the shrub layer resulted in large (~15%) increases in solar radiation reaching the forest floor in the burned



areas, as determined by hemispherical photography. This higher radiation load increased soil heating in the burned plots compared to unburned, as assessed by mean maximum temperatures, and by a heating hour index. The loss of the litter layer, and the increased temperatures (which may have dried out the soils) resulted in significantly lower soil respiration rates, as measured with a Li-Cor 6200, and less leaf litter decomposition in the burned vs unburned plots. Less N and P accumulated in the litter in the burned plots, presumably related to the lower respiration rates.

- 178 WIGENT, CASS A., CLAUDIA L. JOLLS, AND SARAH E. JOHNSON. East Carolina University - Responses to drought and salinity in seabeach amaranth (*Amaranthus pumilus* Raf.)

Seabeach amaranth is a federally threatened annual of Atlantic barrier islands. It inhabits a narrow elevation range along the shore. Drought and or soil salinity may help determine upper and lower elevation boundaries of amaranth habitat. In 2003, we subjected lab grown individuals to five drought treatments (0, 1, 2, 3 and 4 days without watering) and 6 salinity treatments (0, 2, 5, 10, 20 and 30 ppt) for eight weeks. Numbers of leaves, nodes and total plant diameter were used to calculate an index of plant size. After eight weeks, we found significant differences in mean plant size among drought treatments ( $F = 27.173$ , d.f. = 4, 122,  $p < 0.001$ ) and salinity treatments ( $F = 517.716$ , d.f. = 5, 153,  $p < 0.001$ ). Survival was reduced to 68% and 45% for the two longest drought treatments. Similarly survival was reduced to 74% and 52% in the two highest salinity groups. These data suggest that seabeach amaranth may be able to tolerate only sustained soil salinities below 10 ppt and that frequent or permanent water is necessary for its growth and survival. Information about spatial and temporal microsite variability in soil water content and salinity the field are needed.

- 179 BROWN, CHRISTOPHER AND S. REZA PEZESHKI. The University of Memphis - The combined effects of salt and drought on *Spartina alterniflora* under a simulated tidal pulse

A study quantifying the role of the interactive forces of salt and drought on the physiology, growth, and survival of *Spartina alterniflora* was conducted in a climate controlled greenhouse. The experiment consisted of three levels of salinity (<5 ppt, 15-20 ppt, and >35 ppt) as well as three water levels: drought (water level maintained at least 20 cm below the soil surface at high tide), moderate flooding (water level maintained between 20 cm below the soil surface at low tide and 10 cm below the soil surface at high tide), and flooding (water level maintained 3-5 cm above the soil surface at high tide). Following initiation of the treatment, soil redox potential (Eh, mV) along with selected plant physiological functions, growth and survival responses were measured periodically for 28 days. Preliminary results indicated a reduction in plant gas exchange in all drought treatments in combination with increased salinity. Likewise, mean growth (height and weight) was lower in those plants under drought conditions as well as under increased salinity. Leaf chlorophyll content was also reduced in those plants that were subjected to increased salt as well as drought. Survival under drought/high salt was 58% whereas plants under all other treatments had 100% survival. Our preliminary data, therefore, support the hypothesis that the combined effect of drought and salt may have an additive or synergistic effect on plant physiological functions and/or growth.

- 180 ALLEN, PHILIP B.<sup>1</sup>, JAKE F. WELTZIN<sup>1</sup>, AND PAUL J. HANSON<sup>2</sup>. <sup>1</sup>University of Tennessee and <sup>2</sup>Oak Ridge National Laboratory - A 3-Year cohort study of the recruitment and survival of deciduous forest tree species in response to altered precipitation regimes

Global climate change is predicted to alter precipitation regimes and therefore available soil moisture. Changes in spatial and temporal patterns of soil moisture may affect the distribution, structure, composition, and diversity of forests of the southeastern U.S., where potential evapotranspiration is predicted to exceed future summer precipitation. The Walker Branch Throughfall Displacement Experiment (TDE) at Oak Ridge National Laboratory was designed to modify soil water availability in a temperate upland oak forest of eastern Tennessee. Within this experiment, which proportionally added to or subtracted from naturally occurring precipitation events, we investigated recruitment and survival rates of four native tree species: *Quercus prinus* (chestnut oak), *Cornus florida* (flowering dogwood), *Liriodendron tulipifera* (yellow poplar), and *Acer rubrum* (red maple). Seedling recruitment rates after one growing season (2000) were species-specific, and ranged from 0% for *A. rubrum* and *L. tulipifera* to 43% for *Q. prinus*. For *Q. prinus*, results failed to support our hypothesis that seedling recruitment is constrained by soil water content: emergence, survival, and recruitment rates of seedlings from planted acorns did not differ between wet and dry plots. Results for *C. florida* tended to support the hypothesis that low soil moisture contents may constrain its establishment. No *C. florida* seedlings survived through the summer on the dry plot, whereas seedling survival on the wet plot was as high as 31%. These species-specific responses to changes in soil moisture suggest that changing precipitation regimes may affect plant community composition and diversity through changes in rates of seedling emergence and survival.

181 WELTZIN<sup>1</sup>, J. F., P. B. ALLEN<sup>1</sup>, R. J. NORBY<sup>2</sup>, E. BUCKNER<sup>1</sup>, E. C. ENGEL<sup>1</sup>, L. SOUZA<sup>1</sup>, AND S. WAN<sup>2</sup>. <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Oak Ridge National Laboratory - Community and ecosystem response to global change: the Old-field Community Climate and Atmospheric Manipulation (OCCAM) project

Changes in the concentration of carbon dioxide in the atmosphere ([CO<sub>2</sub>]), coupled with concurrent changes in climate, including increases in tropospheric temperatures and changes in precipitation regimes, are likely to affect the structure and function of managed and natural communities and ecosystems. However, there have been relatively few investigations of how these various factors of global change may interact to affect in-situ communities in natural field settings. To meet this shortcoming, we describe an experiment designed to investigate the interactive effects of [CO<sub>2</sub>], temperature, and soil water availability on a constructed ecosystem with plants typical of an old-field system, including C<sub>3</sub> and C<sub>4</sub> grasses, forbs, and legumes near Oak Ridge, Tennessee. Experimental plots are constructed in field soil, and are contained within 4-m diameter open-top chambers used to control environmental factors. Soil moisture contents to depths of 35 cm were greater under elevated than ambient [CO<sub>2</sub>], particularly in dry plots. Aboveground biomass and leaf area index (LAI) were greater under elevated [CO<sub>2</sub>] than ambient [CO<sub>2</sub>], but differed little between wet and dry plots. These results, coupled with preliminary data on leaf-level stomatal conductance for two plant species, suggest that soil water budgets are affected more by CO<sub>2</sub>-induced reductions in stomatal conductance than by changes in canopy production or architecture. Increases in temperature tended to reduce biomass production, LAI, and soil moisture, although these effects were attenuated with additions of [CO<sub>2</sub>] or water. Moreover, temperature effects on biomass production depended on species. In sum, results indicate that [CO<sub>2</sub>], soil moisture, and temperature, factors likely to both change and covary over the next several decades, will have interactive, direct and indirect effects on production and composition of typical old-field plant communities and ecosystems.

182 SOUZA, L<sup>1</sup>., P.B. ALLEN<sup>1</sup>, J.F. WELTZIN<sup>1</sup>, R.J. NORBY<sup>2</sup>, AND S. WAN<sup>2</sup>. <sup>1</sup>University of Tennessee, Knoxville and <sup>2</sup>Oak Ridge National Laboratory - Leaf and ecosystem-level gas exchange responses to global change: the Old-field Community Climate and Atmospheric Manipulation (OCCAM) Project

Increasing concentrations of carbon dioxide [CO<sub>2</sub>] coupled with increases in global temperatures and changes in precipitation events are likely to impact leaf and ecosystem-level processes, including the exchange of carbon and water. Studies in the past have mainly focused on one or two climatic factors, particularly on the responses of vegetation to CO<sub>2</sub>. To improve our understanding of global climate change on biological systems, we investigated the interactive effects of CO<sub>2</sub>, temperature, and soil water availability on a constructed old-field ecosystem, including C<sub>3</sub>, C<sub>4</sub>, and nitrogen-fixing plant functional types near Oak Ridge, Tennessee. Predawn water potential, and leaf and ecosystem-level gas exchange measurements were performed inside 4-m diameter open-top chambers. We chose a representative species of each functional type to perform predawn water potential measurements, leaf-level and ecosystem-level gas exchange. Preliminary data suggests that CO<sub>2</sub>-induced reductions in stomatal conductance may be a contributing factor which ameliorates plant water stress, but reduces leaf-level carbon assimilation. Alternatively, ecosystem assimilation and soil respiration are optimized under increased soil water availability and elevated CO<sub>2</sub>. In sum, leaf and ecosystem-level responses to global climate change can ultimately influence community composition in old-field systems.

- 183 PARISHER, EMILY S., AND GARY L. WALKER. Appalachian State University - Characterization of plant community structure on climbed and unclimbed cliff faces in the Obed River gorge

Many rare or endemic species have been found on cliff faces around the world, but most of the world's cliff ecosystems remain unexplored by biologists, and little is known about ecosystem processes on cliffs. There is a growing concern however, that biodiversity on cliffs may be threatened by impacts from recreational rock climbing. Several recent studies have validated this concern. The Obed River gorge in Tennessee boasts one of the richest floras in the southeastern United States and is also a popular rock climbing destination. Vascular plants, bryophytes, and lichens were sampled on cliff faces, cliff edges, and on talus slopes along sixteen climbed and sixteen unclimbed transects in six different cliff areas of the Obed River gorge and its tributary, Clear Creek. Cliff-face flora was sampled from pairs of 1m<sup>2</sup> plots located at three-meter intervals along the transect. Unclimbed transects were paired with and adjacent to climbed transects. Abiotic factors including aspect, slope, surface heterogeneity, and light were measured for each pair of plots. Canonical Correspondence Analysis (CCA) is being performed to determine the relative importance of each of these abiotic factors, as well as the impact of rock climbing, in shaping the cliff-face plant communities of the Obed River cliffs. Preliminary results indicate some impacts of foot traffic in the talus slopes of climbed areas on vascular and non-vascular species. Abiotic results are pending. In addition, preliminary sectioning of a *Juniperus virginiana* snag in the talus slopes yielded eight-hundred annual rings.

- 184 MILLER, BRADLEY<sup>1</sup>, S. COLEMAN MCCLENEGHAN<sup>1</sup>, HOWARD NEUFELD<sup>1</sup> AND TOM HORTON<sup>2</sup>. <sup>1</sup>Appalachian State University and <sup>2</sup>SUNY, College of Environmental Science and Forestry - Ectomycorrhizal fungi on *Picea rubens* in native and non-native soils: effects of different fertilization regimes

The endangered southern Appalachian spruce-fir ecosystems are threatened by invasive pests, over harvesting, and competition from faster growing northern hardwood trees. Restoration efforts to restore spruce-fir forests begin with generation of nursery seedlings for outplanting. The goal of this project was to (1) identify indigenous ectomycorrhizal (ECM) fungi on red spruce (*Picea rubens*) seedlings and (2) to see if ECM improve seedling development. Seedlings were grown in a greenhouse in two forest soil types: spruce (S) and northern hardwood (H), and under conventional and exponential fertilization regimes. Exponential fertilization can improve N-P-K uptake by seedlings and significantly increase ECM colonization. Seedlings are currently being harvested and analyzed over two growing seasons for seedling height, stem diameter, aboveground and

belowground biomass, and nutrient content. Ectomycorrhizas are being identified by morphological and molecular techniques and their colonization rates measured. The dominant ECMs on red spruce seedlings following the first winter hardening were the early successional fungi *Thelephora terrestris*, *Cenococcum sp.*, and *Laccaria laccata*. First year results show a total of 21 ECM morphotypes, six unique to seedlings grown in H soils, and one morphotype unique to S soils. Seedlings grown in H soils exhibited significantly higher ECM colonization rates than either S or control treatments, but control seedlings (grown in peat soil) exhibited significantly greater total biomass and height. Results from this research could be used by nurseries to help improve spruce regeneration success in this endangered ecosystem.

- 185 HOGLAND, JOHN S. AND MARK D. MACKENZIE. School of Forestry and Wildlife Sciences, Auburn University - Using remote sensing techniques to delineate the current distribution of longleaf (*Pinus palustris*) ecosystems across Alabama, west Georgia, and east Mississippi

Longleaf ecosystems have severely decreased in total area since pre-European settlement. These dramatic losses are the principle reason for the listing of many plants and animals as endangered, and have been the driving factor for recent longleaf ecosystem restoration efforts. While studies have documented the regional decline of longleaf ecosystems (i.e. Sandhills, Flatwoods and Savanna, Rolling Hills, and Mountain), they provide little information on fine scale fragmentation patterns and current locations. This lack of information often limits the efficacy of longleaf ecosystem restoration efforts. To better aid restoration efforts, we have begun identifying the current location and extent of longleaf ecosystems across Alabama, West Georgia, and East Mississippi using Landsat ETM+ imagery and ancillary data sets. Currently, our study indicates that there are statistically significant (alpha 0.05) differences in spectral reflectance among longleaf ecosystems and other common coniferous and deciduous ecosystems in Alabama. We are exploiting these differences to create a fine grain (30 m) longleaf ecosystems distribution map. A series of classification models, designed specifically to use Landsat ETM+ imagery and ancillary data sets, are being generated and validated using training data collected in the field. The best fitting and most parsimonious model will be used to map the current distribution of longleaf ecosystems. Results of this research will support the land cover mapping efforts of the Alabama GAP project.

- 186 KLEINER, KEVIN<sup>1</sup>, MARK MACKENZIE<sup>1</sup>, AND ALEXA MCKERROW<sup>2</sup>. <sup>1</sup>ALCFWRU, Auburn University and <sup>2</sup>North Carolina State University - Mapping riparian wetlands from Landsat ETM+ imagery and DEM derivatives: a comparison of methods.

Although mapping land cover using satellite imagery is increasing in popularity, wetlands are frequently a difficult cover type to extract. A common technique to increase wetland delineation accuracy is to incorporate other data layers into the classification. National Wetland Inventory (NWI) maps have proven especially useful in this endeavor, as they are the most accurate wetland maps available for large area mapping. Unfortunately, NWI maps are not available in a digital form throughout the United States. As a potential surrogate to NWIs, we are testing the accuracy of riparian zone delineation using satellite imagery and digital elevation model (DEM) derivatives. Accuracy of each method is assessed by comparison to NWIs. The DEM derivatives being considered are slope, flow accumulation, and path distance (a measure integrating slope and elevation). Additionally, satellite image measures of tasseled cap wetness, an IR band ratio, and an unsupervised classification are assessed. Error matrices are presented which suggest that path distance and slope are the most accurate methods for mapping riparian wetlands.

- 187 GAGE, KARLA, MELISSA LEE, AND SAM PIERCE. The University of Memphis - Spatial effects in an edge environment

Edge environments create unique habitats with a diverse range of microclimates. Species diversity may be different in these environments than in the surrounding landscape. I plan to take a novel approach in studying the spatial effects of edge zones. I will be analyzing the spatial relationships among soil moisture, light, and temperature. I expect that these factors have major effects on community composition of edge zones. Soil moisture, light, and temperature oscillate in diurnal and seasonal cycles. The planned study will spatially map these three factors temporally to determine their importance in plant phenology. Field plots encompassing edge zone and both types of adjacent environments will be selected to minimize differences and maximize the number of controlled factors. Spatial information on moisture, light, and temperature will be taken at each plot at planned time intervals. Three species of plants will be examined throughout the study areas and used as phenological indicators of environmental conditions. For each species, I will observe plant morphology and time of completion of growth stages ranging from seed germination to senescence. The information will be used to create spatial and temporal databases on plant performance, moisture, light, and temperature for each plot. Data will be analyzed for patterns. The general goal of my research is to develop a quantitative model of edge zone and its effects on plants.

- 188 ODOM, ALLISON<sup>1</sup> AND SEAN POWERS<sup>2</sup>. <sup>1</sup>Jacksonville State University and <sup>2</sup>Dauphin Island Sea Lab - Experimental determination of connectivity between estuarine habitats

In most marine, terrestrial, and freshwater systems structured habitats occur as mosaics of patches. Understanding the factors responsible for migrations of animals between patches is critically important in ecology and conservation biology. Many estuarine/marine structured habitats such as oyster reef beds occur in patches that can serve as sources or sinks for migrants. In this study we varied habitat characteristics of oyster reefs to determine what effects migration rates of two prey species, juvenile blue crabs, *Callinectes sapidus*, and grass shrimp, *Palaemonetes*. Reef attributes that were varied included position of the reef (upstream, downstream), reef size (large, small), and vertical relief (high, low). We also manipulated conditions in the corridor between habitats by varying the density of predators as well as the type of predator (aggressive versus docile). Trials were set up in 2.45 m. long flow through tanks with an upstream and downstream patch of reef. Two reefs were offered in each trial, one with presumed better habitat characteristics than the other. Results were analyzed at 24 hours using a t-test. Preliminary results have shown that the location of habitat did influence migration rates for the more mobile prey species, grass shrimp. There was also a trend that habitat attributes such as increased size and vertical relief influenced migration for grass shrimp. Predators did influence grass shrimp density probably through direct consumption and this varied with reef position. The results of this study will be used to develop design criteria for oyster reefs used in large scale oyster reef restoration.

- 189 BIERNACKI, MACIEJ<sup>1</sup> AND JON LOVETT-DOUST<sup>2</sup>. <sup>1</sup>University of Memphis and <sup>2</sup>University of Windsor, Ontario, Canada - Landscape matrix and species richness in Niagara Escarpment

We investigated effects of land-use of land surrounding 89 natural areas (NA) in the Niagara Escarpment World Biosphere Reserve, Ontario, Canada. Seven land-use categories were mapped and quantified using GIS. Biodiversity information was taken from published data for these NAs. Stepwise logistic regression was used to identify factors significantly affecting presence/absence of each biotic groups at a NA, and stepwise parametric regression for factors affecting the number of species in each biotic

group. Results show that type and proportion of land-use at different contour-distances from the edge of each NA had significant effects on species richness. Results of logistic analyses indicated that the likelihood of presence of most biotic groups was enhanced most by increased area of the NA, followed by increased proportions of surrounding land occupied by neighboring patches of other NAs and Escarpment Rural Areas. The likelihoods of finding species among the plants, birds, herptiles and mammals recorded for the region were decreased by greater proportions of land designated for mineral resource extraction and for minor urban centers. Results demonstrate that land-use in the matrix surrounding NAs may play an important role in long-term protection of biota, particularly for rare and endangered species. Conservation management should always be focused on multiple species and diverse groups of biota.

190 JOBE, R. TODD. The University of North Carolina at Chapel Hill - Correlating harvested plant abundances with human accessibility on a conservation landscape

Accessibility is the resistance of a landscape to direct human contact. The intensity and spatial distribution of this resistance is important on landscapes of conservation significance, because many human impacts are directly correlated with the degree of human contact. These impacts can range from the harvesting of rare plants, to the spread of exotic invasives, to erosion. Despite the obvious importance of accessibility for measuring human impacts, ecology has, heretofore, lacked a quantitative model for measuring it. I have developed a multivariate model that quantifies human accessibility by relevant means (e.g. walking, hiking, etc.) on conservation landscapes. This model uses surface distance, the human physiology associated with walking on slopes, impedances associated with crossing hydrologic features, and the relative difficulty of walking on and off trails to calculate the relative accessibility of any point on a landscape. I used this model to determine the correlation of accessibility with the presence and abundance of a set of illegally harvested plants in Great Smoky Mountains National Park (GMSNP). The plant dataset consisted of .10 ha plots covering a wide range of accessibilities within GSMNP. The set of harvested plants included ginseng (*Panax quinquefolium*), goldenseal (*Hydrastis canadensis*), and bloodroot (*Sanguinaria canadensis*). For comparison, the correlation of accessibility with plants not frequently harvested was also analyzed. This analysis serves as an example for future applications of the accessibility model. Extended applications may include other types of anthropogenic disturbance, exotic invasion spread, and the representation of landscape sampling strategies.

191 BARONE, JOHN. Columbus State University - The nature and extent of black belt prairies in Alabama and Mississippi at the time of European settlement

The Black Belt region of Alabama and Mississippi is an area of rich soils on top of Cretaceous-age chalk. Early European explorers described this area as a mix of bottomland and upland forests and open grasslands. The extent and nature of these grasslands has been disputed, however. The goal of this project has been to describe the type of grasslands present, their extent and distribution within the Black Belt and how these grasslands compare with other open habitats in the Southeast. Using historical accounts, I show that these grasslands were tallgrass prairies, similar to those found further west. Maps based on the original General Land Office surveys of the two states show that these prairies formed an archipelago of areas (up to 400 km<sup>2</sup>) with particular concentrations south of Montgomery, Alabama and along the Alabama-Mississippi border. A comparison of the floras of prairie fragments remaining with the floras from other open habitats in the Southeast (such as limestone glades) show that prairies are quite different in composition, but that the prairies are similar to other blackland prairies in Arkansas. Few examples of Black Belt prairies remain and only a handful are being actively

preserved. I estimate that in excess of 99% of the original prairie habitat has been destroyed since settlement, primarily as a result of agriculture.

- 192 CARTER, ROBERT<sup>1</sup> AND ANDY LONDO<sup>2</sup>. <sup>1</sup>Jacksonville State University and <sup>2</sup>Mississippi State University - Landscape scale classification of remnant fire disturbed montane longleaf pine forest in West Central Georgia.

Fire disturbed ecosystems are characteristic of the southeastern Coastal Plain of the United States. Less well known are fire disturbed mountainous regions of the Piedmont and Appalachian region that support longleaf pine (*Pinus palustris*) ecosystems. The Pine Mountain Range in the Piedmont of West Central Georgia, USA has remnant longleaf pine ecosystems that occupy steep slopes with shallow soils. The montane longleaf pine ecosystems contain an unusual species composition of coastal plain (*Quercus margaretta*) and Appalachian (*Vaccinium pallidum*) species. Landscape scale analysis of ecosystems revealed four major ecosystems influenced by topography and fire history.

- 193 HINES, MARTINA<sup>1</sup> AND JULIAN CAMPBELL<sup>2</sup>. <sup>1</sup>Kentucky Nature Preserves Commission and <sup>2</sup>The Nature Conservancy - The curious history of an anomalous landscape

The Inner Bluegrass region of Kentucky is characterized by rolling plains and fertile, deep, calcareous soils; a landscape ideally suited to support rich and diverse forests. However, based on early pioneer reports and botanical evidence, at least some portions of this region historically had been dominated by oak-ash savanna woodlands, a community type generally associated with xeric, thin soils. The reasons for this apparent paradox have been a source for speculation and attracted attention from many botanists. Over 200 years of intense agriculture and development in the region have resulted in a drastically altered landscape that provides few clues to structure and composition of pre-settlement plant communities. However, previous studies have described pre-settlement vegetation remnants and suggested a number of possible disturbance factors maintaining Bluegrass savanna, including grazing by large ungulates (elk, bison), drought, and natural and anthropogenic fires. Based on an analysis of these data, a model was developed that integrates a number of disturbance factors and their possible role in shaping a pre-settlement Inner Bluegrass landscape and its changes over time. Important questions regarding disturbance dynamics, natural succession, and restoration issues are being addressed at Griffith Woods, with circa 80 hectare the largest known remnant of Bluegrass savanna, in Harrison County, KY. This site was recently acquired by the University of Kentucky and The Nature Conservancy and will serve as the center for research on plant communities in the Kentucky Bluegrass region.

- 194 FRALISH, J. S. Southern Illinois University, Carbondale - Chaos to structure: a general gradient model for describing forest landscape/community patterns in the Central States

Based on previous research on forest communities in Illinois, Kentucky and Tennessee, a general ecological model has been developed for interpreting forest community patterns and processes across the landscape. Past ecological and physiological research that has shown three major environmental resource factors control the primary response of most terrestrial (upland and wetland) woody plant species. These resources are 1) light or lack of it, 2) soil water (too little, too much, optimum) and 3) soil oxygen or a lack of it. A fourth factor, disturbance, has a major effect on species distribution. It is the effect of disturbance that appears to cause chaos in the distribution of forest communities. The general ecological model for the central hardwood forest region is a construct that combines species distribution (normal or Gaussian) curves (continua) with a soil moisture/oxygen gradient from xeric to mesic to hydric. The model integrates the ecological/physiological

characteristics responsible for species response to variations in environmental resources. Disturbance, or lack of it, may be responsible for major changes in the landscape patterns, and the landscape model has been subdivided to reflect this effect. The submodels integrate and show the consistency in patterns of species characteristics such as functional and realized niches, shade tolerance, stem size, growth rates,  $r$  and  $k$  reproductive strategies as well as a third type, seed size, and type of seed dispersal. Stand composition, basal area and diversity also show consistent patterns. The effect of disturbance on stand and species characteristics (e.g., species richness) changes with location along the gradient.

- 195 SINGHURST, JASON R.<sup>1</sup>, JAMES C. CATHY<sup>2,3</sup>, DALE PROCHASKA<sup>2</sup>, HAYDEN HAUCKE<sup>2</sup>, and WALTER C. HOLMES<sup>4</sup>. <sup>1</sup>Wildlife Diversity Program, Texas Parks & Wildlife Department, Austin, Texas 78704, <sup>2</sup>Wildlife Division Region III, Texas Parks & Wildlife Department, Tennessee Colony, Texas 75861. <sup>3</sup>Texas A&M University, Texas Agricultural Experiment Station Uvalde, Uvalde, Texas 78801. <sup>4</sup>Department of Biology, Baylor University, Waco, Texas 76798-7388. Past and future conservation of xeric sandhill openings and quaking bogs at Gus Engeling Wildlife Management Area in Texas.

Field studies in the Gus Engeling Wildlife Management Area (GEWMA), which consists of approximately 4465.5 ha (11,034.1 acres), of the Post Oak Savannah of Anderson County, Texas, have resulted in an annotated checklist of the vascular flora describing its remarkable species richness (*Southeastern Naturalist*, 2(3):347-368). A total of 930 taxa (excluding family names) belonging to 485 genera and 145 families are recorded. Asteraceae (124 species), Poaceae (114 species), Fabaceae (67 species), and Cyperaceae (61 species) represented the largest families. Six Texas endemic taxa occur on the site: *Brazoria truncata* var. *pulcherrima* (*B. pulcherrima*), *Hymenopappus carrizoanus*, *Palafoxia reverchonii*, *Rhododon ciliatus*, *Tradescantia humilis*, and *T. subacaulis*. Eleven vegetation alliances occur on the property, with the most notable being sand post oak-bluejack oak, white oak-southern red oak-post oak, and beakrush-pitcher plant alliances. Between 1950 and 1960, the State of Texas acquired GEWMA. The purpose of the purchase was to create a wildlife management area to serve as a land base for a Post Oak Savannah ecological area. Today, the area is the largest intact state-owned portion of the Post Oak Savannah is considered to be one of the most natural examples of pre-European settlement Post Oak Savannah in the state. The latter trait is apparently related to the presence of a very well developed vegetation alliance, the beakrush—pitcher plant bogs. This study will present historical context, burning history for maintaining xeric sandhill openings and quaking bogs, Post Oak Savanna stand age determination, landscape change, and future conservation needs to maintain GEWMA.

- 196 ESTES, DWAYNE, RANDALL SMALL, AND EUGENE WOFFORD. University of Tennessee, Knoxville - Studies in the genus *Gratiola* section *Nibora* (Scrophulariaceae)

The genus *Gratiola* (Scrophulariaceae) contains ca. 25-30 species of annual or perennial wetland-adapted herbs that are distributed mostly throughout temperate zones. The center of diversity for the genus appears to be the southeastern United States where ten species occur. In the most recent treatment of the genus, two sections of *Gratiola* in North America were recognized, sect. *Gratiola* and sect. *Nibora*. Section *Nibora* is restricted to the Nearctic region and contains six species: *G. ebracteata*, *G. heterosepala*, *G. flava*, *G. floridana*, *G. neglecta*, and *G. virginiana*. Two putatively new species were discovered while conducting fieldwork in the southeastern United States and are similar to the widespread *G. neglecta*. To clarify the relationships within sect. *Nibora* we will use both morphological, including scanning electron microscopy, and molecular tools. Preliminary morphological analysis has revealed consistent differences in leaf morphology, seed size,



pubescence, and habitat between the two putative new species and other members of the section. In addition, a preliminary molecular study of representative taxa of sect. *Nibora* suggest that noncoding chloroplast DNA sequences will yield sufficient variation to resolve relationships within the section.

- 197 FAULKNER, A. A. AND S. P. FAULKNER. Department of Biological Sciences, Delta State University, Cleveland, Mississippi, 38733 - Current distribution and range expansion of the invasive tree, *Triadica sebifera* (Euphorbiaceae), in Mississippi

Chinese tallowtree (*Triadica sebifera* (L.) Small) is an exotic, warm temperate tree that has naturalized throughout the Gulf and Atlantic Coastal Plain states, including Mississippi. This invasive tree suppresses native tree and shrub establishment, and can form dense monospecific stands in wetland landscapes and disturbed sites. To establish this species' current range in the state, we employed a variety of survey methodologies as follows: (1) we conducted a detailed examination of herbarium records for tallowtree in the state, (2) we interviewed county foresters and extension agents, (3) we conducted road surveys along large landscape-scale longitudinal and latitudinal transects, and (4) using our database, we mapped occurrences and records via GIS/GPS technology. Map layers were created to reflect known county distributions; within counties, areas of heavy infestation were also designated. Finally, we attempted to correlate current distribution with map layer environmental data, including soil type, physiography, topography, mean annual precipitation and mean low temperatures. While tallowtree is highly adaptable and grows on a variety of soil types, topographies and drainages, severe infestations are somewhat restricted to areas of the state showing mean winter temperatures no lower than about 10-12 C°, i.e., the central and lower coastal plain. Winter warming trends may lead to expansion into previously uninfested areas. Also, this study has recorded naturalization in a few isolated, disjunct locations in the state, mostly urban or suburban areas. Within these urban "heat islands," *Triadica* has the potential to become a problem plant.

- 198 MCCOY, JOHN W. AND BOBBY D. KEELAND. USGS National Wetlands Research Center, Lafayette, LA 70506 - *Chamaecyparis thyoides* (L.) BSP (Atlantic White cedar, Cedar) distribution along the Gulf of Mexico, especially southern Mississippi

*Chamaecyparis thyoides* (Atlantic White Cedar) is a canopy tree found in coastally restricted forests from Maine to Mississippi. The largest concentration of cedar is found primarily along the Atlantic coast, and these locations are well documented and studied. However, cedar is not well documented along the Gulf of Mexico, and locations for past and present stands are not well known. A survey of herbarium specimens and the few papers available discussing cedar along the Gulf of Mexico--especially Mississippi--was used to help describe its current and past distribution. Additionally, information from botanists, ecologists, and foresters familiar with the area was used to construct an enhanced natural history for this species in its southern range. This distribution information along with soils, elevation, watershed, and hydrologic data will help model the occurrence of existing cedar and help predict where cedar could be successfully regenerated into forest stands.

- 199 PREVOST, LUANNA. B., PATRICK D. MCMILLAN, and TIMOTHY P. SPIRA. Department of Biological Sciences, Clemson University, Clemson SC 29634 - A new species of *Ambrosia* L. from the Blue Ridge escarpment of South Carolina

Five species of *Ambrosia* L. are currently known to occur in the Carolinas and Virginia. A morphologically distinctive taxon has recently been collected from Pickens and Greenville counties, South Carolina. This species occurs sympatrically with *A. artemisiifolia* L. at each study site but occupies a unique microhabitat. Populations of *Ambrosia* sp. nov. are restricted to undisturbed remnant glade communities on the margins of rock outcrops in the upper piedmont and Blue Ridge escarpment. *Ambrosia* sp. nov. displays distinct reproductive and vegetative morphology. It may be distinguished from *A. artemisiifolia* by its larger seed, longer staminate raceme containing more heads of discoid flowers, more heavily divided leaves, glabrous stem and leaf surfaces, and degree of branching. Plants of *Ambrosia* sp. nov. exude aromatic compounds that are uncharacteristic of *A. artemisiifolia*. Gas chromatography detected significantly higher quantities of the volatile terpene beta-phellandrene within the new species, whereas *A. artemisiifolia* had elevated levels of beta-pinene. Future research will include chromosome counts of the new species, and pollination studies to test the interfertility of *Ambrosia* sp. nov. and *A. Artemisiifolia*.

- 200 FLEMING, CHRIS<sup>1</sup>, JOEY SHAW<sup>2</sup>, TODD CAMPBELL<sup>3</sup>, AND DANIEL SIMBERLOFF<sup>2</sup>. <sup>1</sup>Breedlove, Dennis, Young & Associates, Inc., <sup>2</sup>University of Tennessee, Knoxville, and <sup>3</sup>University of Tampa - A survey of the invasive exotic plant species of the Big South Fork National River and Recreation Area, Tennessee and Kentucky

An invasive exotic plant species inventory was conducted in the Big South Fork National River and Recreation Area (Tennessee and Kentucky) during the growing season of 2002. There is increasing concern on the affect of invasive species because of their potential detrimental impacts on native ecosystems. These impacts include competition for resources, hybridization with native species, augmented nitrogen fixation, altered hydrological and fire cycles, and increased sedimentation. The primary goals of this study were to (1) provide the park administration with a baseline inventory of the invasive exotic plant species and (2) to prioritize sites or species for management in an effort to assist the park administrators with the development of a proper management and eradication protocol. Because the park is relatively large, ca. 50,000 ha, surveys were concentrated at 60 sites that were determined to be either highly disturbed in the past (e.g., old homesteads, mines) or especially vulnerable to invasion (e.g., river corridors). At each site and for each invasive exotic species, data were collected regarding abundance, location within the site, and perceived threat to native species and rare habitats. Thirty-two invasive species were determined to be in need of management. Using data collected from each of the 60 surveys, the sites were prioritized according to perceived threat and recommendations for each site were composed that accounted for invasive species richness, relative abundance of each invasive species, unique occurrences (e.g., species found at only one site), methods of dispersal, and potential encroachment into native plant habitats.

- 201 CHESTER, REBECCA E. AND CAROL GOODWILLIE. East Carolina University - Floristic characterization and investigation of influential factors of a wet pine flatwoods marked for restoration

The threatened, and quite diverse, longleaf pine (*Pinus palustris*) community is of particular interest for restoration efforts. This study was an investigation of the plant community of a regularly disturbed, wet mineral flat identified as a potential site for longleaf pine restoration in the North Carolina coastal plain. The site, a former Voice of America property, has been maintained by mowing and burning since the 1960's. Objectives of the study were to characterize remnant plant associations for comparison to existing longleaf pine communities, and investigate the effects of man-made ditches and disturbance regimes on plant community composition. Areas within the study site have

experienced varied disturbance histories. This provides an uncommon opportunity to investigate basic ecological questions important to restoration. Information gained will help guide the implementation and management of restoration efforts. In addition, the study will yield basic insights into factors driving plant community structure.

- 202 MARTIN, ALEX, MARIO MOLINA, ZACK MURRELL AND SCOTT TAYLOR. Appalachian State University - A floristic and ecological analysis of Tater Hill, a high quality wetland in the Southern Appalachians

A vascular plant inventory and ecological study was conducted on \_\_\_\_\_ha between Tater Hill, and Harmon Knob, Watauga County, North Carolina, during the growing seasons of 2002 and 2003. This site contains one of the higher quality protected wetlands in the southern Appalachians and contains several unique elements, including the state threatened *Ilex collina*, the State Candidate *Saxifraga pensylvanica*, the State and federal threatened/special concern *Lilium grayi*, and the significantly rare *Lonicera canadensis*. This area and its surrounding northern hardwood and rich cove forests are underlain by amphibolite, a basic rock that is rich in calcium, magnesium, iron, and aluminium. To examine habitat heterogeneity within the wetland, nine 10 x 10 meter plots, each with three 1 x 1m nested plots were surveyed. Plots were established in sets of three, one placed in a high water area, one in a wet to dry transitional area, and one in a marginal upland dry area. Water wells placed within each plot were examined through biweekly measurements of groundwater and daily measurements of precipitation. Soil seed banks were investigated to provide clues to the vegetation history and predict future community dynamics. Soil cores extracted from the established plots and ten perimeter locations were subjected to saturated or natural conditions in an outdoor setting to determine the makeup of the seed bank. Results from this study were used in development of a management plan for this site.

- 203 BOYER, TERRY<sup>1</sup>, ROBERT CARTER<sup>1</sup>, HEATHER MCCOY<sup>1</sup>, AND ANDY LONDO<sup>2</sup>. <sup>1</sup>Department of Biology, Jacksonville State University and <sup>2</sup>Department of Biology, Mississippi State University - Community analysis of pitcher plant bogs of the Little River Canyon National Preserve, Alabama, USA.

Pitcher plant bogs of the Little River Canyon in northern Alabama, USA contain the federally endangered green pitcher plant (*Sarracenia oreophila*). The bogs are located on exposed sites bordering the canyon rim. *Sarracenia oreophila* requires abundant sunlight and open conditions for survival. Fire suppression and infrequent prescribed burns has resulted in the development of a thick midstory and decline in *Sarracenia oreophila* populations. Analysis of the bog vegetation revealed three communities types with different species compositions, soil and landform characteristics and fire regimes.

- 204 MCMILLAN, PATRICK Clemson University - A floristic study of the Wadakoe Mountain Tract, Pickens County, South Carolina

A floristic study was completed for approximately 1000 acres in the Wadakoe Mountain tract of the Jim Timmerman Natural Area at Jocassee Gorges in Pickens County, South Carolina. The study site is located in the Blue Ridge escarpment region at elevations ranging from 274 to 777 meters. This study has documented 889 vascular plant species including 91 that are considered rare in South Carolina, 16 species that have not been previously reported from South Carolina and the discovery of two apparently undescribed taxa. The Wadakoe Mountain tract contains what is arguably the largest concentration of state-level rare species found in any one area of similar size in the state of South Carolina. Many of these species were found in association with circumneutral soils derived from amphibolite of the Poor Mountain Formation and are more abundant in the Midwestern United States. Natural community composition and diversity was also

sampled with two globally rare natural communities documented from the site. A summary of the floristic affinities, natural community composition and diversity patterns noted at the site will be presented.

- 205 DOFFITT, CHRISTOPHER HARDY. Mississippi State University - A preliminary survey of the vascular flora of Ouachita County, Arkansas

A Preliminary survey of the vascular flora of Ouachita County, Arkansas was conducted between May 1999 and May 2002. Information compiled from specimens collected by the author, voucher specimens on deposit in the University of Louisiana at Monroe Herbarium (NLU) and The University of Arkansas at Monticello Herbarium (UAM), and pertinent botanical literature were used to compile a list of the vascular plants found in the county. This list reveals a vascular flora consisting of 142 families, 482 genera, and 1,031 specific or sub-specific taxa. An annotated list of vascular plants with comments on abundance, habitat, and general information on location within the county follows.

- 206 HAVRAN, J. CHRISTOPHER AND R. DALE THOMAS. University of Louisiana at Monroe - Preliminary checklist of the vascular flora of the Homochitto National Forest, Mississippi

A survey of the vascular plants of the Homochitto National Forest was conducted from September 2002 through November 2003. The forest is situated on 300 mi<sup>2</sup> in southwestern Mississippi and is located predominately within the Long Leaf Pine Region of the state. The forest contains eight natural plant communities ranging from the predominant loblolly-shortleaf pine forest to long leaf pine and bottomland hardwood forests. In addition to field surveys, information from specimens previously collected by the co-author and those deposited in local herbaria were used to compile a flora consisting of 134 families, 396 genera, and 775 specific or sub-specific taxa. Of the 775 species recorded, *Carex decomposita* Muhl., *Dryopteris x australis* (Wherry) Small, *Schizandra glabra* (Brickell) Rehder, and *Trillium foetissimum* J.D. Freeman, are listed as Mississippi PETS Plants. Two previously unknown populations of *Mianthemum racemosum* (L.) Link were documented, possibly suggesting an extension of the southernmost range of the species. In addition to the vascular flora, climactic, demographic, and physiographic data pertaining to the region are also presented. Data obtained throughout the survey will be utilized by wildlife biologists in future management regimes throughout the forest.

- 207 SHIVER, CORI AND MICHAEL WOODS. Troy State University - The fall vascular flora of Henry County, Alabama

Henry County is located in the southeastern corner of Alabama in an area of the Coastal Plain Province commonly known as the "Wiregrass Region". The county encompasses a 1,450 square km (145,040 ha) area. It is bordered to the south by Houston County, the north by Barbour County, and Dale County to the west. The Chattahoochee River and the state of Georgia form the eastern border. The fall floristic survey of Henry County was conducted from August 2003 through December 2003. Six primary collecting sites were chosen as representative of the various major habitats within the county. In order to gain a more complete floristic list, collections were also made from additional areas to increase the probability of a more comprehensive floristic survey. Preliminary results indicate approximately 400 taxa occur within Henry County during the fall season. The Birmingham Audubon Society has provided financial support for this project.

## ABSTRACTS - POSTERS

- P1 MAXWELL, CHERIE<sup>1</sup>, FRANK ROMANO<sup>1</sup>, AND TERRY RICHARDSON<sup>2</sup>.  
<sup>1</sup>Jacksonville State University and <sup>2</sup>University of North Alabama - A behavioral study of *Viviparous georgianus*.

A behavioral study was performed on two population of the ovoviviparous snail, *Viviparous georgianus*. One population inhabits a temporary wetland known as Hatchett Ridge Wetland, while the other inhabits the permanent wetland Round Island Creek. The snails at both sites differ in size and breeding cycles. This study focused on three behaviors: feeding, breeding and estivation. Studies were performed to determine whether the difference in habitats caused behavioral differences and/or possible genetic differences. Preliminary results indicate that there are many behavioral differences between the two populations. Future research may indicate that the two populations are separate species.

- P2 HERR, JARED, ARTHUR STRUNK, AND DARWIN JORGENSEN. Roanoke College - The relationship between respiratory pump function and the gill circulation in the American lobster, *Homarus americanus*.

The American lobster is a migratory crustacean arthropod that moves about underwater primarily by walking. We are interested in characterizing respiratory and cardiovascular systems support of underwater movement, and in particular how these two systems are integrated at the level of the gas exchange organs, the gills. Lobsters have two gill sets each occupying a laterally-located, enclosed space, the branchial chamber (BC). Each BC has a muscularly-driven pump, the scaphognathite (scaph) that generates a cyclic, suction pressure in the BC to move water unidirectionally past its gill set. We wanted to determine if the suction pressure generated by scaph movement has an effect on the gill circulation. We monitored hydrostatic pressure in each BC concurrently with hemolymph pressure in the pericardial space (PS) and the infrabranchial sinus (IBS) bilaterally (allowing for the calculation of pressure drop [  $\Delta P$  ] across the gill circulation) in lobsters as they walked at a steady rate on a submerged treadmill. Increased scaph activity during exercise resulted in a 2+-fold increase in ventilation rate bilaterally. Concurrent with increased scaph activity, BC pressure decreased bilaterally while at the same time,  $\Delta P$  decreased up to 5-fold. The decrease in  $\Delta P$  suggests a possible passive dilatory effect of BC pressure on the gill circulation bilaterally during periods of elevated ventilatory activity. Our data also indicate functional mismatch between the two gill sets over a range of activity levels.

- P3 PARSONS, JOY<sup>1,3</sup>, AARON ERFELY<sup>2</sup>, CHERYL SMITH<sup>2</sup>, LENNIE SAMSELL<sup>2</sup>, KEVIN ENGELS<sup>2</sup>, YOU-LIN TAIN<sup>2</sup>, JONATHON CHRISTY<sup>2</sup>, ALEX CANFIELD<sup>2</sup>, AND CHRIS BAYLIS<sup>2,3</sup>. <sup>1</sup>Alderson-Broadus College, <sup>2</sup>West Virginia University, Department of Physiology and Pharmacology, Robert C. Byrd HSC, and <sup>3</sup>The West Virginia Biomedical Research Infrastructure Network - Do high levels of aldosterone trigger kidney fibrosis.

For many years, angiotensin II (All) has been known to be a profibrotic agent causing damage in kidney, heart, and blood vessels. Recent evidence suggests that aldosterone (Aldo) directly damages kidney, heart, and blood vessels by promoting fibrosis. This may be the most significant action of Aldo contributing to cardiovascular disease, rather than those related to excessive sodium and water retention. Fibrosis can occur either by stimulation of extracellular matrix and/or by inhibition of the pathway of extracellular matrix degradation. We are working to develop a novel technique to investigate the profibrotic actions of Aldo in the kidney, using tissues from the Sprague Dawley (SD) rat, which is susceptible to development of fibrotic damage. In addition the Wistar Furth (WF) rat is resistant to kidney fibrosis. Studies are being done in this strain for comparison.

- P4 WINNE, CHRISTOPHER, LUKE FEDEWA, AND WILLIAM HOPKINS. Savannah River Ecology Lab - Quantitative genetics of thermal sensitivity in swimming performance of neonate black swamp snakes, *Seminatrix pygaea*.

Understanding the relationship between maximum performance and performance breadth is a central issue in understanding the evolution of thermal performance in ectotherms. In evolutionary biology, organisms are often assumed to follow the principle of allocation in which there is a tradeoff between maximum performance and performance breadth, and the presence or absence of such a tradeoff in thermal physiology has been demonstrated (using models) to affect the tempo of evolutionary changes to changing environmental temperatures. Currently our understanding of performance tradeoffs is primarily limited to a few quantitative genetic studies of invertebrate organisms and laboratory studies on bacterial evolution. The few studies that have focused on such tradeoffs in vertebrate organisms generally have been studies of phenotypic tradeoffs among closely related species. In this study, we measured the thermal dependence of maximum swimming velocity in 79 neonate black swamp snakes (*Seminatrix pygaea*), from 14 litters born in a common garden environment. All snakes were raced twice down a 3m racetrack at 6 temperatures (10, 15, 20, 25, 30, and 35C). We estimated broad sense heritabilities for performance breadth and maximum performance, as well as analyzed our data to determine whether or not there is a genetic or phenotypic tradeoff between maximum performance and performance breadth.

- P5 LAMOUNTAIN, HEIDI L. AND MICHAEL L. KENNEDY. The University of Memphis, Memphis, TN 38152 - Measures of biodiversity of small mammals in three habitat types in western Tennessee.

During fall 2001 and 2002, winter 2003, and spring 2002 and 2003, biodiversity of small mammals in three habitat types (forest, field, forest/field edge) was assessed at the Milan Army Ammunition Plant in Carroll and Gibson counties in western Tennessee. Animals were sampled using Sherman live traps baited with rolled oats. Thirty transects of 10 traps each for fall 2001 and 2002, winter 2003, spring 2003, and 30 transects of 15 traps each for spring 2002 were employed to capture small mammals in each habitat type. Estimates of biodiversity were determined using the Shannon-Wiener index. Species richness was greatest in edge and field habitats for all seasons except winter 2003. Species evenness was greatest in field habitat for all season except spring 2003 where it was greatest in edge. The white-footed mouse (*Peromyscus leucopus*) and cotton rat (*Sigmodon hispidus*) had greatest species abundance depending on habitat and season. Catch per unit effort was greatest in edge and least in forest habitat for all seasons except fall 2002 where edge and field had the same evenness value.

- P6 JOHNSON, PHILIP L.<sup>1</sup>, MICHAEL L. KENNEDY<sup>1</sup>, AND STEVE W. STEPHENSON<sup>2</sup>. <sup>1</sup>The University of Memphis, Memphis, TN 38158 and <sup>2</sup>Milan Army Ammunition Plant, Milan, TN 38358 - An assessment of population density of white-tailed deer (*Odocoileus virginianus*) in western Tennessee.

Infrared-triggered cameras were used to estimate population density of white-tailed deer (*Odocoileus virginianus*) at the Milan Army Ammunition Plant in Carroll and Gibson counties, western, Tennessee, during fall 2002 and winter 2003. Density estimates were derived from photographs taken at 20 sites during 21 days of sampling. Each site was baited with shelled corn, and cameras were set to record photographs at 10 minute intervals. Based on photographs of male, female, and juvenile animals, density was estimated as one per 4.8 ha during fall and one per 3.7 ha during winter. Based on reports in previous studies, estimates derived in the present investigation reflected relatively high densities of white-tailed deer at the study site.

- P7 AKINS, JAMES D.<sup>1</sup>, BRIAN D. CARVER<sup>2</sup>, AND MICHAEL L. KENNEDY<sup>1</sup>.  
<sup>1</sup>Department of Biology, The University of Memphis, Memphis, TN 38152 and  
<sup>2</sup>Department of Biology, Freed-Hardeman University, Henderson, TN 38340 - An examination of species richness in mammals using scent-station methodology in three habitats.

Species richness for mammals was assessed in relation to three habitats (wet, dry, moist) in western Tennessee. Assessments were made using standard scent-station procedures. Survey lines consisted of 10 scent stations placed at 0.32 km intervals along a continuous route. Each station consisted of a circle of sifted sand 1 m in diameter. A cotton ball saturated with bobcat urine was attached to a wooden applicator stick placed in the center of the circle. Stations were operated for 1 night. The presence of one or more tracks of a species at a station verified the presence of that species occurring in the represented habitat type. Species richness was greatest in dry habitat (ANOVA;  $P = 0.021$ ).

- P8 BAINBRIDGE, BEN AND TRAVIS PERRY. Furman University - Effects of mowing and vegetation type in a small mammal community in an old-field habitat in the piedmont of South Carolina.

This study examined the main and interactive effects of mowing and vegetation type in small mammal abundance, species richness, and diversity in an old-field habitat in Greenville County, South Carolina. Small mammals were captured by live trapping over a five-month period. Statistical analysis revealed a significant effect of mowing on diversity ( $F = 4.391$ ,  $df = 1$ ,  $P = 0.04$ ), abundance ( $F = 9.035$ ,  $df = 1$ ,  $P = 0.004$ ), and species richness ( $F = 4.682$ ,  $df = 1$ ,  $P = 0.034$ ) such that all three characteristics were higher in the unmowed plots. The plots that were not mowed this year were burned in 2001. A year and a half after the burn, species richness, abundance, and diversity were all still higher in the unburned plots. However, upon mowing the unburned plots higher levels of species richness, diversity, and abundance moved to the unmowed/burned plots, negating the effects of the previous burn. This suggests that overhead cover and predator avoidance are important factors structuring small mammal communities. Further studies will determine if species richness, abundance, and diversity eventually return to higher levels in the unburned plots.

- P9 SILVANO, AMY L.<sup>1</sup>, KEVIN K. KLEINER<sup>1</sup>, BENTON TAYLOR<sup>1</sup>, ELISE R. IRWIN<sup>2</sup>, MARK D. MACKENZIE<sup>3</sup>, MICHEAL S. MITCHELL<sup>2</sup>, AND JAMES B. GRAND<sup>2</sup>. <sup>1</sup>Auburn University, Alabama Cooperative Fish & Wildlife Research Unit; <sup>2</sup>USGS, Alabama Cooperative Fish & Wildlife Research Unit; <sup>3</sup>Auburn University, School of Forestry & Wildlife Sciences - ALABAMA GAP ANALYSIS PROJECT: Managing Biological Diversity with Geographic Information Systems.

Alabama is a state rich in biological diversity (biodiversity). However, the number of species threatened with extinction has dramatically increased over the years. Current management approaches put forth to curtail the loss of this biodiversity have generally been focused at the species level through individual recovery programs. Although these conventional approaches have been effective for a handful of species, they are costly, inadequate to combat increasing extinction rates and neglect the issues contributing to species imperilment such as loss of habitat, fragmentation and degradation of ecosystems. In an effort to provide resource managers with the information needed to make more informed decision towards biodiversity conservation, the Alabama Cooperative Fish and Wildlife Research Unit at Auburn University is conducting a regionally integrated Gap Analysis Project (GAP) for the State of Alabama. GAP employs the use of Geographic Information Systems (GIS) to identify unprotected biodiversity or "gaps," biological elements that are underrepresented or not protected in lands currently managed for long-term conservation (i.e. wildlife refuges, parks, or privately managed lands). GAP

is an analytical process, which assesses the conservation of species and their habitats collectively by mapping the distribution of plant and animal communities for comparison against patterns of land use and land management. The information developed through GAP can be used by land managers, planners and researchers to institute management plans, validate changes in land use practices and identify areas that are important for future conservation.

- P10 FITZPATRICK, MATT. University of Montana – Use of a modified habitat suitability index model to quantify Columbian sharp-tailed grouse habitats in the Upper Blackfoot Valley, Montana.

Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) (CSTG) historically occupied much of the shrub-steppe habitat west of the Continental Divide. In the Intermountain West, these areas were some of the first to be converted to agriculture. Consequently, CSTG have suffered precipitous population declines throughout their range. In western Montana, where CSTG are associated with patchy sagebrush and grassland plains of intermountain river valleys, the species is near extinction. In 1996, fewer than 30 individuals were estimated to live in the upper Blackfoot Valley, the last site in Montana where CSTG are known to exist. Reintroduction of CSTG may be the only way to sustain CSTG populations in Montana. Using remotely sensed data, geographic information systems, and a modified version of an existing Columbian sharp-tailed grouse Habitat Suitability Index procedure, a model was developed to quantify CSTG habitat quality over a large region in the upper Blackfoot Valley of western Montana. Output was used to determine if reintroduction of CSTG is warranted by comparing model predictions to a minimum threshold of habitat suitability. Model predictions were also used to locate potential sites for reintroduction and areas likely to benefit from special management, conservation and/or restoration. The results suggest that there exists habitat of sufficient suitability to warrant reintroduction of CSTG to the upper Blackfoot Valley. Two areas with the highest potential for CSTG reintroduction were identified. Recommendations include on-the-ground review of areas identified as having high habitat suitability and restoration of existing habitats before reintroduction occurs.

- P11 FERGUSON, HEATHER<sup>1</sup>, DIANE NEUDORF, AND WILLIAM LUTTERSCHMIDT. <sup>1</sup>Shorter College and <sup>2</sup>Sam Houston State University – Influence of habitat on nest-box microclimate and nest success of Carolina wrens (*Thryothorus ludovicianus*).

We analyzed temperature data collected from eight Carolina Wren nests in nest boxes and the success of those nests between 19 – May and 10 – July 2003 in Walker County, Texas. We placed data-loggers in the nests during the beginning of the incubation period and left them until the nest succeeded or failed. Nest sites fell into three categories: open, pine, or hardwood. The nest temperatures of the incubation and nestlings stages were averaged according to their nest and habitat. Control and experimental data found that open habitat around nests yielded warmer temperatures and pine habitats yielded the coolest temperatures. According to egg-hatching nest success percentages, hardwood habitats had the highest success while pine habitats had the worst success. It is possible that nest success could be correlated with the mid-range, more stable habitat temperatures of the hardwood sites, however larger population studies would have to be conducted.

- P12 MILLS, EDWARD AND JANET MULLIGAN. Wingate University – Habitat factors influencing beaver (*Castor canadensis*) lodge-site selection in the southern Piedmont of North Carolina



Union County, located in the southern piedmont of North Carolina, has seen increased beaver activity over the past 15-20 years. As a suburb of Charlotte, this region has experienced tremendous human population growth and land development in recent years, but beaver activities continue undeterred. Because there have been few studies of habitat selection by beavers in this region, and because landowners experiencing beaver problems often ask for help, we have opportunities to study habitat factors that make certain sites attractive to beavers. Previous studies conducted in other parts of North America have shown that beavers may respond to one or more habitat variables such as stream flow, stream gradient, food availability, habitat diversity, tree diameter, stem density, percent cover, and others. We measured several characteristics (tree species diversity and richness, tree diameter, tree/stem density, percent cover, and the availability of important food tree species) adjacent to beaver colonies at five different locations, and at five control sites away from beaver colonies. Preliminary analysis suggests that availability of preferred foods, tree diameter, and tree/stem density are important factors that may influence beaver site selection.

P13 MCLAREN, DANIEL, MARK MEADE, AND BENJIE BLAIR. Jacksonville State University - SEM examination of the larval stages of *Macrobrachium rosenbergii*.

The Malaysian freshwater prawn *Macrobrachium rosenbergii* is gaining popularity as a commercial food source and has a very high reproduction rate in artificial environments. Previous studies of the freshwater prawn have mainly focused on hatchery techniques. Classification of larval stages was originally conducted in the 1960's using light microscopy and 35mm photography. Other than this work, little has been done to examine the different developmental stages associated with the larval phase of growth. Females extrude up to 76,000 eggs dependent upon body size and multiple morphological stages can be found at any given time. Twelve larval stages have been previously reported and there were four main features associated with the classification of the different stages: eyestalks, pleopod formation, telson/uropod development, and number of rostrum teeth. Larvae were reexamined to confirm the classification parameters set in earlier studies. Ovigerous females were hatched and reared at JSU. Larvae were collected and examined using a JOEL 5600 scanning electron microscope. The SEM allowed for early detection of developmental characteristics. This project was funded in part by NSF-CCLI Grant #0088299.

P14 MOSER, BERNICE AND JAMES RAYBURN. Jacksonville State University - Evaluation of developmental toxicity of interaction between caffeine and pseudoephedrine using frog embryo teratogenesis assay-Xenopus (Fetax).

Pseudoephedrine and caffeine are found in many over-the-counter drugs including decongestants and weight loss chemicals. Both are proven central nervous system stimulants, and there has been much discussion about potential interactions of these chemicals on human health. Frog Embryo Teratogenesis Assay-Xenopus (FETAX) was used to determine the developmental toxicity of pseudoephedrine and caffeine mixtures and to determine if synergism or antagonism occurs between the two. FETAX is a 96 hour developmental toxicity assay that screens for direct acting teratogens. Both have both been evaluated for developmental toxicity in FETAX but not as mixtures. Potentiating effects of caffeine on the cardiovascular teratogenicity of ephedrine in chick embryos has been shown. Due to the similarities between pseudoephedrine and ephedrine we wanted to determine if synergism occurred between pseudoephedrine and caffeine. The 96-hr LC50, 96-hr EC50, MCIG, and TI were determined for pseudoephedrine and caffeine in various mixtures. We tested five binary mixtures of the two chemicals. The mixtures were based on the toxic units of each chemical; where one toxic unit was equal to the 96-hr LC50. The toxic unit mixtures tested was pseudoephedrine to caffeine at toxic unit ratios of 0:1, 1:0, 3:1, 1:1, and 1:3. The 0:1 and 1:0 test the individual chemicals by themselves.

Toxic units were plotted on an isobole graph to determine if synergism, concentration response or antagonism occurred.

- P15 COOK, LESLIE, CHRISTOPHER PARADISE, AND BARBARA LOM. Davidson College - Malathion causes earlier hatching and stunted growth in developing zebrafish, *Brachydanio rerio*.

While pesticides are used to minimize insect damage to crops, many pesticides also exert detrimental effects on non-target organisms. Malathion is an organophosphorous pesticide widely used to control mosquitoes in urban areas and pests such as boll weevils in agricultural areas. The zebrafish is a model organism for developmental and genetic research because they are readily available, freshwater fish that produce large numbers of embryos daily. Zebrafish are sensitive to environmental changes, also making them a good model vertebrate for testing pesticide toxicity. Previous research examining non-lethal effects of malathion on adult zebrafish revealed that malathion causes skeletal deformities, enhances egg resorption into the ovaries, decreases hepatic cell number, and reduces cellular levels of nucleic acids, amino acids, and proteins. The non-lethal effects of malathion on developing zebrafish embryos, however, have not been analyzed. By exposing zebrafish embryos to non-lethal doses of malathion, the teratogenic effects of malathion can be classified and quantified. We optimized methods for zebrafish embryo production and survival. We then exposed zebrafish embryos to a range of sub-lethal malathion concentrations that are similar to environmental concentrations after pesticide application to quantify the non-lethal effects of malathion on a developing vertebrate. Malathion exposure consistently elicited more rapid hatching from the chorion, significantly shorter body length (~80% of controls), and significantly reduced eye diameters (~80% of controls). Malathion's action as an acetylcholinesterase inhibitor and the metabolites of malathion are likely responsible for the teratogenic effects of malathion.

- P16 KOIGI, RACHAEL<sup>1</sup>, NEIL BILLINGTON<sup>1</sup>, AND WILLIAM GARDNER<sup>2</sup>. <sup>1</sup>Troy State University and <sup>2</sup>Montana Department of Fish, Wildlife, and Parks - Genetic variation, hybridization and introgression in Montana sauger populations.

Concern has been expressed about the decline of sauger (*Sander canadensis*) populations in Montana. Habitat loss, the effect of diversion dams, and hybridization with introduced walleye (*S. vitreus*) are among factors that have been blamed upon this decline in sauger. Until this study, there was no information on genetic variation in Montana sauger populations, but several studies have reported hybridization between walleye and sauger ranging from 0-15%. We used protein electrophoresis to survey genetic variation within and among Montana sauger populations, and to detect hybridization and introgression between introduced walleye and native sauger. Genetic variation was found at two (*SOD\** and *PGM-1\**) of 25 protein-coding loci screened to date, although only a single heterozygote was found at *PGM-1\**; this does not include loci that were diagnostic between the two species. However, significant differences in allele frequencies were found among Missouri River sauger populations and among Yellowstone River populations at *SOD\**. This is the first time that genetic variation has been reported at the *SOD\** locus in sauger. Because there is significant genetic population structure in each of the two main river systems these populations will need to be managed separately and stock transfers should not be conducted. Hybridization rates ranged from 0-20% in the Missouri River, 8-11% in the Milk River, and 0-10% in the Yellowstone River. Hybridization with walleye is a serious threat to the genetic integrity of Montana sauger and brood stock used for supplemental stocking should be genetically screened to prevent the inadvertent spawning of hybrids.

- P17 SEGALAS, CHENEIN, MARK MEADE, AND FRANK ROMANO. Jacksonville State University - Isozyme variation among Gulf of Mexico goatfish.

Goatfish are members of the family Mullidae. They are characterized by fleshy barbels located near the mouth, which they use to find food along the floor of the ocean. Varying in color from red to pink, with yellow fins and dark lines on the body, these fish are found in 100-200m of water. Four species are typically found in the Atlantic. This study focused on three Gulf of Mexico species that are often difficult to key using morphological features solely. Isozyme profiling was used to determine if these species could successfully be identified using chemical profiles. The three species analyzed were collected and morphologically identified in the fall of 2002 and 2003 during trawling surveys conducted by NOAA. Muscle tissue was excised and total proteins extracted for analysis. IEF electrophoresis was used to separate soluble proteins, which were then stained for various glycolytic and Krebs' cycle isozymes.

P18 BELLYEU, HEATH, BLAKE AMOS, ROBIN GORMAN, ROBERT CARTER, AND MARK E. MEADE. Department of Biology, Jacksonville State University, Jacksonville AL 36265. – Genetic variation between coastal and montane longleaf pine, *Pinus palustris*, populations.

Longleaf pine, *Pinus palustris*, ranges from Virginia to Texas primarily in the Coastal Plain Physiographic Region. In Alabama and Georgia the longleaf pine range extends into the Piedmont, Blue Ridge, and Ridge and Valley Physiographic regions. These regions have much different soils and experience colder winters with more snow and ice. These environmental differences between coastal and mountain longleaf pine forest could have resulted in genetic variation between the populations. To examine this hypothesis needle samples from various populations ranging from N.E. Alabama to the Gulf of Mexico were collected and analyzed using IEF electrophoresis techniques. Isoforms from various metabolic enzyme systems (e.g., IDH, LDH, MDH) were scored on gels and used to determine genetic identity (J). Based on limited data, heterozygosity and overall genetic diversity among the populations examined appears minimal.

P19 TATUM, TATIANA C., R. B. MCCLOSKEY, PATRICK J. TRANEL, AND A. LANE RAYBURN. University of Illinois at Urbana-Champaign - In vitro root propagation for chromosome analysis in *Amaranthus*.

When examining the exchange of genetic information among species, the investigation of how traits are passed between species is important. Field introgression of herbicide resistance between closely related *Amaranthus* species is an ever increasing problem and requires focus on how genetic exchange occurs at the chromosomal level. One major obstacle to this is obtaining the chromosomes necessary to perform microscopy. Soil-grown *Amaranthus* sp. produce very thin, delicate roots. The technique used in the process described herein provides for much more substantial roots, allowing for easier treatment and squashing. Seeds were planted in a soil-less mixture, and then cuttings and leaves were taken from plants. The cuttings were sterilized and place in MS media, while leaf tissue was analyzed by cytometry to obtain DNA content analysis. Media tubes were kept in a growthroom; the cuttings were removed, rinsed, placed in a mitotic inhibitor solution and then placed in fixative. Any emergent leaves were collected and reanalyzed to compare pre- and post-propagation DNA content. These data were used to determine if the culturing of the tissue altered the DNA content. The in vitro procedure produced significantly larger roots than those in the standard soil-less mix. Furthermore, no deleterious effects of the DNA content were observed. The larger roots cultivated using this process thereby facilitates chromosome squashing for the use in modern molecular cytogenetic techniques.

- P20 MCNALLY, LACEY R., WILLIAM G. HENK, AND RICHARD K. COOPER. Louisiana State University - Laser pressure catapult microdissection and DNA amplification from single Japanese quail, *Coturnix coturnix*, chromosomes.

We present a new approach to allow isolation of individual macro- and microchromosomes of the Japanese quail using laser pressure catapulting microdissection (LPC). This method was coupled with PCR and nucleotide sequencing to demonstrate a potential method for transgenic animal identification. The goals of this research were to: (i) develop microscope slides to enable the microdissection of a single 0.5  $\mu\text{m}$  microchromosome; (ii) demonstrate the feasibility of LPC for removing single avian chromosomes; (iii) PCR amplify the B-actin gene from single avian chromosomes; and (iv) obtain the nucleotide sequence of the B-actin gene from a single chromosome. The newly developed slides allowed for the microdissection of a single microchromosome, macrochromosome, or cell nucleus with the LPC function of the position ablative laser microbeam (P.A.L.M) microscope. Two regions of the B-actin were PCR amplified and sequenced from single chromosomes obtained by LPC.

- P21 MUSA, HUSSEIN B., JENNIFER L. FREEMAN, AND A. LANE RAYBURN. University of Illinois at Urbana-Champaign - Comparison of nuclei isolated from various organisms for use as internal standards for observing DNA content variation in plants.

Over the past several years, a controversy has been occurring within the literature with respect to intraspecific nuclear DNA content variation in plants. While certain species such as maize have been excluded from the controversy, reported DNA content variation in many plants species has come under close scrutiny. Serious doubts as to whether intraspecific DNA content variation exists and, if it exists, the extent of this variation. In this study, intraspecific DNA content variation was determined by flow cytometry in different populations of maize and soybean. In order to more precisely determine if any intraspecific DNA content variation exists various organisms were used as internal standards. The internal standards include various plant species such as sorghum, rye, amaranthus species. In addition, various animal nuclei isolated from chicken, *Xenopus*, and Chinese Hamster Ovary cells were used as internal standards. The consistency of interspecific DNA variation with each internal standard will be presented.

- P22 TRINACHARTYANT, WACHAREEPORN, BETTA FRANCIS, AND A. LANE RAYBURN. University of Illinois at Urbana-Champaign - Alteration of chemotherapeutic-induced DNA damage by a common health food supplement.

In the US, use of health food supplements has increased rapidly in the last decade, especially in cancer patients. Concerns have been raised whether specific health food supplements taken during chemotherapy interact with chemotherapeutic agents. If interactions occur, they could enhance the action of chemotherapy or interfere with it by decreasing the conventional medication efficacies. We investigated interactions between an over-the-counter health food supplement, Fruit of Life<sup>TM</sup> (advertised to consist of highly active antioxidants) and a chemotherapeutic agent, cytosine arabinoside (ara-C). Outbred mice were fed a semi-synthetic diet, supplemented with 0%, 0.2%, or 1.0% of Fruit of Life<sup>TM</sup>, for 4 weeks. Ara-C was administered ip to half of the control and treated mice, 72 hours prior to sacrifice. Prior studies had demonstrated that this dose of ara-C damages DNA in bone marrow without causing acute illness in the mice. Bone marrow was collected from all treatment groups and flow cytometry was used to determine DNA damage. There were no significant differences in DNA damage between negative controls and mice fed 0.2% and 1.0% Fruit of Life<sup>TM</sup>. Combined treatments of ara-C with 0.2% or 1.0% Fruit of Life<sup>TM</sup> significantly decreased DNA damage compared to the ara-C treated mice on an unsupplemented diet. These results suggest that the health food supplement

of interest (Fruit of Life™) interacts with the chemotherapeutic agent (ara-C) to decrease DNA damage caused by ara-C to normal bone marrow cells. Future studies are needed to determine how Fruit of Life™ may alter the effectiveness of ara-C during chemotherapy.

- P23 THOMPSON, KRSTAL<sup>1</sup>, SYDHA SALIHAS<sup>2</sup>, STACEY SYLVESTER<sup>2</sup>, AND NILAY MUKHERJEE<sup>2</sup>. <sup>1</sup>Alderson Broaddus College and <sup>2</sup> Department of Orthopedics, West Virginia University - TGF- $\beta$  expression in ATDC5 cell line.

Articular cartilage is a specialized connective tissue that occurs on the ends of long bones in our joints. The cartilage can be damaged or worn away, causing osteoarthritis. A potential way to repair the cartilage is to regenerate the cartilage by stimulating precursor cells to differentiate into chondrocytes. The gene of interest in this research is Transforming Growth Factor Beta. TGF- $\beta$  has been known to induce the cartilaginous phenotype by stimulating the synthesis of collagen II and proteoglycans. The cell line used is ATDC5. RNA was limited, and thus we have elected to use q RT-PCR. Sybr-Green was added in order to determine the level of expression for the specific gene of interest. The cycle at which the fluorescence crosses a threshold is recorded (Ct) and serves to quantify the level of expression of the gene of interest. Using Jellyfish, a computer program, primers were ordered for TGF- $\beta$  1, TGF- $\beta$  Receptor 1, TGF- $\beta$  Receptor 2, and GAPDH, a housekeeping gene. cDNA of different dilutions were run to generate dilution curves and PCR efficiencies of greater than 90% were accepted. In this work, a method for quantitative RT-PCR using the Sybr-green assay was developed. The optimization of PCR conditions for TGF- $\beta$  and its receptors are still in progress. This will help to determine the regulation of TGF- $\beta$  1 during the process of chondrogenesis in our system. In the future, this information may be used to manipulate cells to produce functional articular cartilage that can be implanted in patients who have osteoarthritis.

- P24 HOUSTON, JESSICA, MARY CONNELL, AND JOANNE HOLDEN. Appalachian State University - The *psaB* gene from the marine brown algal *Scytosiphon lomentaria*.

The *psaB* gene encodes one of two apoproteins both of which are an integral part of the reaction center of photosystem I. A set of degenerate primers were designed to amplify around a flavin adenine dinucleotide (FAD) binding site and used to screen a cDNA library for novel genes involved in light reactions. A touchdown PCR (TD-PCR) protocol was utilized to amplify target cDNA from *Scytosiphon lomentaria*. A 600 bp amplification product resulted. Multiple samples of this product were pooled and filter concentrated and the resulting samples cloned into a pCR 2.1-TOPO cloning vector. Resulting clones were screened to confirm the presence of the 600 bp insert. Vectors found to contain the desired insert were sequenced using a LI-COR Global Edition IR<sub>2</sub> DNA Sequencing System and IR700 labeled M13 forward primers. After the sequence was obtained, a BLAST search was performed and the sequence identified as a *psaB* gene fragment. Sequence comparison of this fragment to the same *psaB* gene section from selected other algae showed a 90% identity to *Pylaiella*, 80% to *Odontella*, 78% to *Porphyra*, 75% to *Chlamydomonas*, 76% to *Chlorella* and 55% to *Synechocystis*. Subsequently, primers specific to the 5' and 3' ends of the *psaB* gene were designed and used to amplify the 5' and 3' section of the gene. Amplification products were cloned and sequenced as above. Resulting sequences were analyzed and will be reported.

- P25 ROMER, CARRIE<sup>1</sup>, DANIEL DORSET<sup>1</sup>, CHRISTOPHER MEYER<sup>1</sup>, MICHAEL THOMPSON<sup>2</sup>, AND REBECCA SEIPELT. <sup>1</sup>Middle Tennessee State University and <sup>2</sup>Vanderbilt University - Cloning and characterization of yeast leukotriene A4 hydrolase.

Human leukotriene A4 hydrolase is a bifunctional enzyme that converts the eicosanoid intermediate leukotriene A4 into leukotriene B4, a molecule that recruits leukocytes to endothelium. It also possesses an aminopeptidase activity, hydrolyzing one amino acid at a time from the amino terminus of its peptide substrates. Budding yeast possess a gene which encodes a protein that is highly similar to leukotriene A4 hydrolase. To characterize the yeast protein and its substrates more fully, we used polymerase chain reaction (PCR) to amplify the gene from yeast genomic DNA and to add an affinity tag for protein purification. The DNA fragment was ligated into a yeast expression vector and colonies were screened by PCR for the presence and orientation of the DNA insert. Three clones with the correct orientation were identified and transformed into yeast. Further studies will involve protein expression and purification, analysis of substrate specificity, and characterization through mutational analysis.

P26 MCCLANAHAN, ANA M. AND JOHN STILLER. Biology Department, East Carolina University - Environmental PCR targets algal components using new phytoplankton-specific primers.

The use of environmental PCR provides an alternative method to survey microscopic biotic diversity in a variety of habitats that are not amenable to traditional direct counting and culturing techniques. With increased interest in early detection of toxic algal blooms, microalgae as primary producers, and use of phytoplankton as bioindicators, environmental PCR has come into increasing use in analyses of microalgal flora. Because of the extreme evolutionary diversity of phytoplankton, however, primers that can recover their sequences also target non-photosynthetic plankton, often preferentially. Therefore, PCR primers that screen phytoplankton genes from those of other prokaryotic and eukaryotic organisms would be beneficial. This study reports the design of just such a set of primers and the results of their use on a pooled aquatic sample with a large amount of biodiversity. Although most of this diversity is recovered through environmental PCR using traditional universal primers, our "algal-specific" primers amplify genes only from the photosynthetic members of the community. Based on comparative visual observations, these sequences appear to correspond, both quantitatively and qualitatively, to the general composition of the phytoplanktonic community. Therefore, these primers should prove invaluable for reducing complications from non-algal

P27 FAY, LAUREN, DARLENE LOPRETE, AND TERRY HILL. Rhodes College - Generation and characterization of a calcofluor hypersensitive mutant of *Aspergillus nidulans* showing a hyperbranched growth morphology.

Fungal cell shape is maintained by the form and integrity of the cell wall, an extracellular matrix consisting mainly of polysaccharides and glycoproteins. The wall is a dynamic organelle, which is developmentally modified during every stage of growth and reproduction. The architectural relationships between the numerous components that make up the wall are incompletely known, as are the steps by which the complex fabric of the wall is assembled and modified. Here we report the generation and phenotypic characterization of a mutant strain of the filamentous fungus *Aspergillus nidulans*, which shows evidence of having a defect in cell wall integrity. The phenotype includes hypersensitivity to the chitin synthase inhibitor Calcofluor White (CFW) – this trait has been tied to cell wall defects in the yeast *Saccharomyces cerevisiae* (e.g., M. Lussier et al., 1997, Genetics 147: 435-450). In addition, the mutant shows reduced growth rate, increased branching, and an irregular hyphal diameter under non-selective conditions. Work is underway to identify the responsible gene by complementation of the mutation using a random-fragment wild type genomic library.

- P28 CHEN, YI. Alderson-Broadbudd College - Inhibition of hypoxia-inducible factor 1 $\alpha$  and vascular endothelial growth factor by anti-cancer drugs in human ovary carcinoma cells.

Hypoxia-inducible factor 1 (HIF-1) is a heterodimeric basic helix-loop-helix transcription factor composed of HIF-1 $\alpha$  and HIF-1 $\beta$ /aryl hydrocarbon nuclear translocator subunits. HIF-1 expression is induced by hypoxia, growth factors, and activation of oncogenes. In response to hypoxia, HIF-1 activates the expression of many genes including vascular endothelial growth factor (VEGF) and erythropoietin. HIF-1 and VEGF play an important role in angiogenesis and tumor progression. In this study, we will study the mechanisms of angiogenesis and determine which angiogenetic pathways are involved in the ovarian carcinoma cells. We will demonstrate that anticancer drugs, fara and VP16 inhibit HIF-1 activity through the expression of HIF-1 $\alpha$  but not HIF-1 $\beta$  subunit, and decreases VEGF expression in OVCAR-3 human ovary carcinoma cells. We will also study the signaling pathway involved in anti-cancer drugs inhibited HIF-1 $\alpha$  and VEGF expression and determine whether phosphatidylinositol 3-kinase/Akt signaling or mitogen-activated protein kinase pathway is required for HIF-1 expression.

- P29 CACERES, CYNTHIA<sup>1</sup>, KIM RIES<sup>1</sup>, CLAUDIO TOLEDO<sup>2</sup>, RAQUEL PIRES<sup>2</sup>, MALINDA FITZGERALD<sup>1</sup>, AND ANTON REINER<sup>3</sup>. <sup>1</sup>Christian Brothers University, <sup>2</sup>Lab Neuroscience University of Sao Paulo, Brazil, and <sup>3</sup>University of Tennessee, Memphis - Distribution of AMPA-type glutamate receptor subunits in oculomotor and facial motor nuclei in rat and chicken brain.

AMPA-type glutamate receptors (GluR) subunits was studied in the oculomotor and facial motor neurons of the rat and chicken brain, using antibodies directed against AMPA receptor subunits GluR1 and GluR 4, and one that detects both GluR2 and GluR3 subunits. Neuronal perikarya in the oculomotor complex of both the rat and chicken were observed to be immunopositive for GluR2/3 and GluR4. In both species, the predominate subtype appeared to be GluR4. In the facial motor nucleus of the rat and chicken, both anti-GluR2/3 and anti-GluR4 labeled nerve cell bodies. Neither the oculomotor nor the facial motor neurons of the rat or chicken immunolabeled for GluR1. Our present data indicate that part of the neuronal response of oculomotor and facial neurons to glutamate is mediated via AMPA-type glutamate receptors possessing some combination of GluR2, GluR3 and GluR4 subunits. The similarity observed between species in the types of subunits found in oculomotor and facial nuclei suggest an evolutionarily conservative role for glutamate transmission in the activation of these cranial motor nuclei Supported by NIH MIRT award (1T37TW00123-03, MECF), NIH EY-05298 (AR), and FAPESP 00/04536-2 (CABT).

- P30 MUSA, SHAMSIDEEN O. AND A. LANE RAYBURN. University of Illinois at Urbana-Champaign - Health supplements and chemotherapy agents: A helpful or harmful combination.

The purpose of this project is to examine the interaction between the chemotherapy agent Ara-C along with colcemid in combination with caffeine and health supplements in mammalian cells. This interaction will be examined by performing cytotoxicity assays with chemotherapy agents alone and in combination with health supplements on Chinese Hamster Ovarian Cells (CHO cells) *in vitro*. The cytotoxicity assays are performed in a 96 well plate under sterile conditions. As directed by protocol, media is added first, followed by the chemical, and lastly, cells are added. The amount of media and concentration of chemical added to each well is determined by different calculations and the cytotoxicity of the chemicals. There is a positive and negative control in each plate to facilitate the analysis of data. 100 microliters of a  $3 \times 10^4$  concentration of cells suspended in media is added to each well except those serving as the negative control. The plates are then

incubated for 72 hours and afterwards it is stained with 50% Crystal Violet according to protocol. The confluency of the individual wells is determined by a microplate reader using the Ascent Program software. Once this data is collected, it is fitted to a curve using Sigma Plot software, allowing the concentration of chemical that kills 50% of the cells to be found.

- P31 HILL, PIERSON, BILL JOHNSON, AND MICHAEL DORCAS. Davidson College - Utilization of edge habitat by black rat snakes (*Elaphe obsoleta*).

Rat Snakes (*Elaphe obsoleta*) can be found throughout the Eastern and Midwestern United States. Within this wide range, populations experience varying degrees of habitat fragmentation due to human development. Such habitat destruction often leads to an increase in "edge" habitats where intact and disturbed areas come in contact. Over the course of 3 years, we tracked the movements of 13 rat snakes on the Davidson College Ecological Preserve, in Davidson, NC, which has numerous anthropogenically created "edge" habitats. Snakes were tracked twice per week. When a snake was located, we recorded its general habitat, microhabitat, behavior, body position, exposure to the sun, and GPS coordinates. Using a geographical information system (GIS) we identified field and forested habitats and overlaid the GPS coordinates of each snake location. Our data indicate that black rat snakes use "edge" habitats more frequently than either field or forested habitats. We hypothesize that "edge" habitat is favorable for rat snakes because it has higher abundances of prey, such as rodents and nesting birds, compared to intact forest. "Edge" habitat may also possess more basking sites and available cover for snakes. We speculate that anthropogenically created "edge" habitat on the Davidson College Ecological Preserve may actually affect black rat snake populations positively.

- P32 DOZEMAN, VANESSA AND THOMAS K. PAULEY. Department of Biological Sciences, Marshall University, Huntington, West Virginia - Use of an artificial pond by amphibians and reptiles in West Virginia.

A farm pond approximately 40 years old and located in Wayne County, West Virginia was studied to determine the ingress and egress of amphibians and reptiles. The period of study extended from February 2003 to November 2003. The pond is approximately 50 m long and 25 m wide and is located on a south-facing hillside at 622 ft. in elevation. A drift fence composed of landscaping cloth was constructed to completely encircle the site. Funnel traps were positioned on both sides of the fence every 5.5 meters and all traps were checked daily during the study period. The most common species found entering and exiting the pond were (in order of frequency) *Rana clamitans melanota*, *Notophthalmus v. viridescens*, *Pseudacris c. crucifer*, and *Bufo a. americanus*. Other species less frequently observed included *R. palustris*, *R. catesbeiana*, *P. brachyphona*, *Ambystoma maculatum*, *Terrapene c. carolina*, and *Scincella lateralis*. Additionally, ten other species were trapped while entering or leaving the pond. This is the first extended study of the use of an artificial pond in West Virginia and demonstrates that farm ponds can provide habitat for reproduction and foraging for many amphibian and reptile species. With the rapid loss of natural pools and ponds due to habitat alterations, artificial aquatic systems play an important role in the preservation of amphibians and reptiles in the central Appalachian Mountains.

- P33 SUTTON, WILLIAM B. AND THOMAS K. PAULEY. Department of Biological Sciences, Marshall University, Huntington, WV - Analysis of anuran community level interactions at Greenbottom Swamp in Cabell County, WV.

Community level studies are very important in determining the extent of niche partitioning between different frog species. In this study, community level interactions between *Rana pipiens*, *R. clamitans melanota*, and *R. catesbeiana* were analyzed from September 2003



until November 2003. These frog species were chosen because there appears to be exploitation of different niches. In this study, stratification along terrestrial and aquatic niches was measured in a marsh at Greenbottom Swamp. Frogs were captured within a 60m x 32m quadrant and their positions were marked with flags. The distance from the water/land interface was measured and relative positions were analyzed. There was significant niche separation between *R. catesbeiana* and *R. pipiens* ( $P= 0.001$ ). There was also niche separation between *R. clamitans melanota* and *R. catesbeiana* and between *R. clamitans melanota* and *R. pipiens*, however these distances were not significant. The results were as follows: *R. pipiens* was the most terrestrial, and *R. catesbeiana* was the most aquatic, while *R. clamitans melanota* was found in both terrestrial and aquatic habitats. Additionally, within the species groups, there was separation into different size classes. *Rana pipiens* separated into two size classes, while *R. catesbeiana* separated into three. From these results, it is apparent that there is niche partitioning between the above listed frog species and that different size classes exist among these species. Funding: WVDNR.

P34 BARCLAY, MATT AND JONATHAN AKIN. Northwestern State University - Comparing population density estimation techniques for the ground skink lizard.

The ground skink, *Scincella lateralis*, is a dweller of the leaf litter that is more often seen than captured. Studies of natural population densities of this species have involved either mark-recapture using pitfall arrays or distance sampling using visual encounters. While the results of these estimates differ widely, it is not known whether it is the technique used or the locality sampled that can explain the discrepancy in population density measures. In this study, we surveyed the same population of ground skinks in Louisiana using both methods and found that the mark-recapture method provided a lower estimate of ground skink population density compared to distance sampling.

P35 THAWLEY, CHRIS, BILL JOHNSON, AND MICHAEL E. DORCAS. Davidson College - Effects of seasonal, meteorological, and directional variables on amphibian capture in terrestrial drift fences.

Terrestrial drift fences are often employed to gather baseline data on amphibian and reptile species diversity and relative abundances. Since the spring of 1999, we have monitored two drift fences on the Davidson College Ecological Preserve to evaluate the activity patterns of amphibians and reptiles. Each fence has two arms, one running along the north-south axis and the other along the east-west axis. Over the past five years, 184 reptiles of 16 different species and 363 amphibians of 15 species have been captured, and distinct patterns of diversity and abundance have become clear. Many amphibian taxa are found principally in spring or fall, the two seasons in which the drift fence is monitored. For example, ambystomatid salamanders are captured only in the spring while narrow-mouth toads (*Gastrophryne carolinensis*) and almost all ranid frogs are captured in the fall. Capture frequency of amphibians also varies with proximate meteorological conditions. There is a marked positive relationship between the number of captures and amount of recent precipitation. The majority of amphibians are captured on the south sides of the two fences, indicating strong directional trends in movement towards a nearby stream. Some amphibian groups, especially Plethodontid salamanders, show patchy spatial distributions, indicating that these animals may not be uniformly distributed. Our data suggest several methods for improving representative data from terrestrial drift fences, such as using multiple smaller fences along different cardinal axes to assure the adequate detection of species that may show strong directional movements and patchy distributions.

P36 KAYLOR, DOUG AND RICKY FIORILLO. Shorter College - Diet of *Eurycea cirrigera* larvae in a woodland stream.

We examined the stomach contents of 48 *Eurycea cirregera* larvae in a fishless spring-fed stream (eight larvae were sampled every 4 h over a 24 h period). In addition, we characterized the benthic macroinvertebrate fauna in the creek to determine the available prey base of *E. cirregera* larvae. Overall, *E. cirregera* larvae captured more prey during the day than night and total prey abundance was greatest at 0800. The number of prey decreased throughout the remaining day and night collections and reached its lowest abundance at 0400. The diet of *E. cirregera* larvae consisted mostly of isopods, amphipods, ephemeropterans, trichopterans and chironomids. These taxa were commonly found in our macroinvertebrate sample as well, but their proportion in the diet in some cases suggested preference or avoidance of certain prey taxa. These gape limited salamanders showed selection for smaller prey (chironomids and amphipods) and some avoidance of larger prey such and isopods and trichopterans, whose size and/or behavior (case building by trichopterans) may deter or minimize predation.

- P37 DIETRICH, DAN, MICHAEL WINDELSPECHT, AND WAYNE VAN DEVENDER. Appalachian State University - Effect of sedimentation on larval salamanders in small streams in the southern Appalachian Mountains.

Sedimentation is a prevalent water quality problem in the waters of the southeastern United States. Stream substrate habitat degradation has been shown to have negative effects on fish spawning and aquatic invertebrates in several earlier studies, but little is known about the impact on salamanders in this region. Density of aquatic amphibians in the Pacific Northwest is reduced by siltation so a similar effect may be present in eastern salamanders. This study compares aquatic salamander species richness and density in five similar low-order streams affected by sedimentation with that in two relatively pristine streams. Salamander larvae were sampled using 0.25 m<sup>2</sup> quadrats placed randomly in pools and riffles. Species richness and density in each stream was compared to sedimentation, which was evaluated using visual estimates of substrate embeddedness both in pools and in riffles. Habitat quality was also estimated using a reach-averaged pebble counts and photographic measurements of substrate particle size and compared with both substrate condition and measures of salamander density. Preliminary results suggest a negative correlation between salamander abundance and sedimentation of stream substrate.

- P38 CAMPBELL, SELINA AND RICKY FIORILLO. Shorter College - Effects of predation risk on activity and substrate choice of *Eurycea cirrigera* larvae.

Southern two-lined salamander, *Eurycea cirrigera*, is common in northwest Georgia and abundant in Flower Glen, a gravel/cobble fishless spring-fed creek in Marshall Forest, a Nature Conservancy preserve located in Rome, Floyd Co., GA. Flower Glen is fishless, but adult dusky salamanders, *Desmognathus fuscus*, are syntopic with and are potential predators of *E. cirrigera* larvae. We used a laboratory experiment to examine the effects of predation risk by adult *D. fuscus* on the activity pattern and substrate choice of *E. cirrigera* larvae. Larvae were presented with a choice of gravel and cobble substrate both in the presence or absence of adult *D. fuscus*. Predators were separated from larvae with Plexiglas positioned above the substrata and a grid drawn on the Plexiglas was used to examine larval activity. Each trial was videotaped for one hour and we compare the substrate choice as well as the mean number of movements, mean distance traveled per movement, mean number of switches among substrate type, and mean time among subsequent movements among predator and non predator treatments.

- P39 PHU, LINH D. AND THOMAS K. PAULEY. Department of Biology, Marshall University - Effectiveness of turtle trapping techniques in West Virginia.

Many methods of inventory have been used worldwide to capture and observe turtle species. Some techniques include live capture with traps and nets and visual surveys with binoculars and spotting scopes. During the summer of 2003, a statewide inventory of West Virginia riverine turtles was implemented employing some of these methods. Live capture was conducted with fyke nets, catfish traps, basking traps, and large hoop nets. Visual surveys were done with spotting scopes and binoculars. The data was analyzed to determine capture efficiency and effectiveness for each method and includes a discussion on the advantages and disadvantages for each technique.

P40 DELECKI, DAVID, ANISSA DELECKI, AND GEORGE CLINE. Jacksonville State University - Patterns in carapace shape among multiple turtle species.

Turtles are one of the most common groups of reptiles in the world. Modern turtles are found in aquatic, marine, or terrestrial habitats and are distributed worldwide in tropical and temperate environments. Turtles are also one of the most unusual groups in that they possess a hard shell. The bony shell of turtles is composed of the carapace and the plastron joined together by a bridge. The carapace is the top part of the shell and is covered by a layer of scales called scutes. The plastron is the bottom of the shell that protects the ventral side of the turtle. The carapace of turtles comes in many different shapes and sizes. Most studies that have examined carapace size in turtles have involved sexual dimorphisms. In a majority of studies a single character (i.e. carapace length) has been used to focus on broad comparisons among species. In studies involving more than one carapace measurement usually only one turtle species is used. In this study calipers were used to measure the carapace length, anterior carapace width, posterior carapace width, anterior carapace height, and posterior carapace height. These measurements were then analyzed to test for patterns related to the ecology and phylogeny of turtles.

P41 DELECKI, ANISSA, GEORGE CLINE, JAMES RAYBURN, AND DAVID DELECKI. Jacksonville State University - Distribution of hellbenders (*Cryptobranchus alleganiensis*) in Alabama.

Hellbenders (*Cryptobranchus alleganiensis*) are large aquatic salamanders found in clear, fast flowing streams in the eastern United States. The bulk of the species distribution centers around the Ohio and Susquehanna River systems, but isolated populations occur in southern Missouri and northern Arkansas. Recent presentations have indicated that hellbender populations are declining throughout their range, but current data are lacking in most states. In Alabama, hellbenders are restricted to the Tennessee River drainage in the northern 10% of the state. Museum records for hellbenders are limited. Preliminary review of museum records has revealed 18 specimens from 5 counties. The bulk of the distribution is limited to 3 watersheds in these counties. Interestingly, these collections are largely limited to a 10-year period ranging from 1963-1973. The oldest specimen discovered at this time is deposited in the US National Museum from 1942. Reports of this species from colleagues at other Universities are as recent as 2002, but no large populations have been documented.

P42 MAKOWSKY, ROBERT, ZACHARY LOUGHMAN, AND THOMAS PAULEY. Marshall University - Amphibian and reptile surveys in the Gauley River National Recreation area in West Virginia.

The Gauley River National Recreation area (GRNR) is located in central West Virginia in the Allegheny Plateau region. The study area is located downstream of Summersville Lake and consisted of the Gauley River, its major tributaries, and the associated forested/riparian habitats. From 2000 to 2003, searches were conducted at all times of the year with a variety of sampling techniques. Collectively, 45 species of reptiles and amphibians were documented. Of these, 8 are considered species of special concern.

Certain habitats were found to possess much greater herpetofauna diversity than others. Some species that were expected to be there (i.e. *Eumeces a. anthracinus*) were not found, but this is probably due more to the difficulty in capturing these species than their absence. Future surveys will focus on locating the expected species that have not yet been found.

- P43 PAULEY, THOMAS<sup>1</sup>, ROBERT MAKOWSKY<sup>1</sup>, SETH MYERS<sup>2</sup>, ARIANA BREISCH<sup>1</sup>, AND CYNTHIA LUCAS<sup>1</sup>. <sup>1</sup>Marshall University and <sup>2</sup>State University of New York, Syracuse - Status of the West Virginia state collection of amphibians and reptiles.

The West Virginia Academy of Science gave Neil D. Richmond \$100 in 1935 to travel the state and collect amphibians and reptiles. These specimens and supplemental collections in 1937 and 1938 formed the nucleus for a state collection of herpetofauna. Since Richmond was not associated with a museum or University, he lacked curatorial services and a building to hold the collections. To provide curatorial services the collections were moved to Marshall College in 1939 under the care N. Bayard Green. N. B. Green maintained the collections from 1939-1971. During this time, the collections grew from approximately 1,000 to over 5,000. Michael Seidel served as curator from 1971 to 1987. Thomas K. Pauley assumed the curatorship in 1987 and continues to provide curatorial services for the collection today. Presently there are over 14,000 specimens. The WV Division of Natural Resources, United States Park Service, and United States Department of Agriculture- Forest Service have provided financial service for the maintenance of the collection.

- P44 BELK, MELANIE K.<sup>1</sup>, SCOTT A. SAPOZNICK<sup>2</sup>, JENNIFER L. DAVIS<sup>2</sup>, LESLEY E. HANSON<sup>1</sup>, ERIK D. LINDQUIST<sup>2,3</sup>, and DAVID BRUCE CONN<sup>1</sup>. <sup>1</sup>Berry College, <sup>2</sup>Lee University, and <sup>3</sup>Messiah College - Collaborative herpetological surveying as an experiential pedagogical tool.

A pedagogically oriented herpetological survey of the 28,000-acre campus of Berry College, in the Appalachian foothills of North Georgia, has been operational since August 2001. The study includes students and faculty involving collaborating undergraduate institutions. This project has given students an opportunity to exhibit leadership in field biology while providing valuable insight into the herpetofaunal composition of an area that has received little attention. As a result, species lists of reptiles and amphibians, site specific and temporal data sets, and museum voucher specimens have been generated. Through the process of incorporating students into the leadership and operation of a study, research team members reinforce important biological concepts and research methods learned in the classroom. Our survey findings on seasonal and site data on species assemblages and distribution trends are summarized.

- P45 COZZIE, LINSEY R., CHRISTINA L. SARACINA, AND C. BRIAN ODOM. Wingate University - Geographic distribution of RAPD-genetic markers among colonies of the red imported fire ant, *Solenopsis invicta* (Buren) in Union County, North Carolina.

Ten-base oligonucleotide PCR primers have proved valuable in identifying sequence polymorphisms via RAPD (random amplified polymorphic DNA) analysis. Red imported fire ant (RIFA) specimens were collected from geographically diverse locations within Union County, NC and subjected to RAPD analysis to examine genetic diversity. Global Positioning System (GPS) receivers were used to mark the position of each sampled ant colony. Topographic positions of mounds and genetic markers were then correlated.

- P46 SCOCO, ERIKA A., ADRIENNE L. BOGUSZ, AND C. BRIAN ODOM. Wingate University - Diversity of RAPD-genetic markers within a colony of the red imported fire ant, *Solenopsis invicta* (Buren) in Union County, North Carolina.

Ten-base oligonucleotide PCR primers have proved valuable in identifying sequence polymorphisms via RAPD (random amplified polymorphic DNA) analysis. Non-reproductive ants were collected from a mound located on the Wingate University campus and subjected to RAPD analysis in order to determine the diversity and prevalence of RAPD markers found within this colony.

- P47 GRAHAM, MATTHEW<sup>1</sup>, ROLANDO TERUEL<sup>2</sup>, AND VICTOR FET<sup>1</sup>. <sup>1</sup>Marshall University and <sup>2</sup>Museo de Historia Natural "Tomas Romay" - Mitochondrial DNA data on phylogeny of *Centruroides* (Scorpiones: Buthidae) from the Caribbean and North America.

First data on mitochondrial DNA phylogeny were obtained for two genes (16S rRNA and cytochrome oxidase I) from 15 species of buthid scorpions belonging to the genera *Alayotityus* (two species), *Microtityus* (one species), *Rhopalurus* (two species), and *Centruroides* (ten species). Maximum Parsimony (MP) algorithm in PAUP\* 4.10b was run under 3:1:0 transversions: transitions: gap weighting. The single MP tree obtained for all taxa illustrates an outgroup position *Alayotityus* and *Microtityus*. For ten *Centruroides* species (rooted with *Rhopalurus abudi*, Dominican Republic) the single MP tree is recovered based on 16S rRNA data, with the following high bootstrap supports: *C. exilicauda*+*C. infamatus*+*C. limpidus* (USA & Mexico), bootstrap 91%; *C. vittatus* (USA, also found in Mexico)+*C. gracilis* (Cuba, also found in Florida, Mexico, and Central America), 81%; and a Caribbean clade (73%), within which *C. bani* (Dominican Republic) forms an outgroup, and four Cuban endemic species are supported as a clade at 78%. The Cuban lineage forms two clades: *C. baracoae*+*C. anchorellus* (72%) and *C. guanensis*+*C. robertoi* (52%). Cuban fauna of *Centruroides* is confirmed as consisting of two elements: an endemic core, and a North American element (*C. gracilis*), possibly introduced. Genetic variation among four endemic Cuban species of *Centruroides* reflects the intensive endemic speciation on Cuba. *C. anchorellus* and *C. baracoae* are confirmed as separate species. Monophyly of the diverse (46 species) genus *Centruroides* has to be further investigated; our data indicate deep divergence among the Caribbean clade and at least two Mexican/USA clades.

- P48 OSBORN, RAE. Northwestern State University - Distribution and ecology of potential mosquito vectors of West Nile Virus.

The aim of the study was to survey the relative abundance and species composition of mosquitoes in urban and rural areas of Caddo and Natchitoches parishes, specifically around the cities of Shreveport and Natchitoches, LA. Sampling of mosquitoes began in July 2003 using CO<sub>2</sub> baited light traps. Sampling was completed near regions where dead birds that tested positive for West Nile Virus (WNV) were found. Larvae were sampled using a dip net and larvae reared to adult stage. Locality co-ordinates were determined using GPS for latitude, longitude, elevation of sites and distance from water. Weather data and human cases were compared with dates when mosquitoes were sampled. Mosquitoes were stored at -80°C and identified using keys. In Shreveport the most abundant species found in natural bush along the red river was: *Culex erraticus*, *Culex quinquefasciatus* and *Culex salinarius*. In the more suburban regions, *Aedes* species were the most abundant. The greatest abundance of individuals was of *Culex* species collected at Bickham-Dickson Park in Shreveport during August 2003. In October 2003, the species composition at this locality had changed to *Aedes* and *Anopheles* species. This is only the first phase of a larger study in which the presence of WNV will be determined for different mosquito species using RT-PCR.

- P49 PARENT, KATIE, VICTOR TOWNSEND, JR., AND DANIEL MARGOLIES. Virginia Wesleyan College - Ecology of harvestmen associated with beehives.

Harvestmen (Arachnida: Opiliones) are common inhabitants of forests in the southeastern region of the United States. They display considerable temporal variation in behavior with regards to feeding, mating, and habitat use. In general, they are more active at night and seek refugia during the day. In this study, we examined the ecology of harvestmen (*Leiobunum* sp.) associated with commercial beehives on the campus of Virginia Wesleyan College. Hives were sampled periodically during the afternoon and evening hours from October 9-November 22. Harvestmen were captured (by hand), measured, marked with model paint, and released at the site of capture. The following data were recorded: temperature, relative humidity, location of capture on the hive, total length, number of legs, number of mites (if present), and color pattern. In addition, observations of courtship and feeding were made. Our data indicate that harvestmen exhibit preferences for specific locations on the hives which changed with varying levels of light. During the afternoon, harvestman occupied areas of low light including crevices in the hive structure, spaces beneath plywood ramps, and hollows in the supporting concrete blocks. During the evening, harvestmen were not found in these areas, but instead were found on exposed areas on the hives. Our low recapture rates indicate that harvestmen do not exhibit fidelity to particular hives, but rather suggests that the local population is relatively large and very transient.

- P50 SUDBRINK, DONALD<sup>1</sup>, AUBREY HARRIS<sup>2</sup>, AND PATRICK ENGLISH<sup>2</sup>. <sup>1</sup>Delta State University and <sup>2</sup>Mississippi State University - Remote sensing of host plants of tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvoir), (Hemiptera: Miridae).

Tarnished plant bug (TPB), *Lygus lineolaris*, feeds and reproduces on a variety of early season wild host plant species before the crop production season begins. This pest can build up populations on the early season wild hosts that later infest agricultural crops. Vegetation management strategies can be developed to reduce initial infestation of crops by pests if wild hosts can be detected in time. From 2000-2002, field plot experiments were conducted in which several broadleaf and grass species were planted to determine TPB host preference as well as effects of herbicide applications on TPB populations. Remotely sensed imagery was collected over these plots in the spring of each year to evaluate geospatial technologies for detection of host plant species. TPB numbers were significantly higher in broadleaves vs. grasses. Among broadleaf hosts, *Raphinus sativum* had the highest TPB numbers followed by *Trifolium incarnatum*, *Vicia sativa*, and *Pisum sativum*. Herbicide applications to *V. sativa* and *V.sativa/Lolium italicum* treatment plots prevented TPB population increases, while untreated *V. sativa* and *V.sativa/Lolium italicum* plots had significant increases of TPB. Plots without herbicide treatment had 5-fold more TPB than herbicide treated pots. Remotely sensed imagery of plots revealed that grass species had higher reflectance values than broadleaves and that the two plant categories could be separated with the normalized difference vegetation index (NDVI). Other reflectance differences were detected among broadleaf species in each year. Remote sensing may be a useful tool for detection of host plants of TPB.

- P51 LOWERY, ADAM, BEN COLVIN, AND MICHAEL LAND. Northwestern State University - Black soldier fly (*Hemeticia illucens*) bioconversion of poultry viscera and poultry carcasses.

*Hemeticia illucens*, the Black Soldier Fly (BSF), is native to the Americas and the larva are voracious feeders. The adults have no working mouth parts and have a life span of two weeks. To metamorphose into the adult stage and maintain the energy needed for the

adult life span, the pupa digests and concentrates nutrients (approximately 42% protein, 38% fat and 5% chitin). BSF larva were given diets of individual chicken organs and recommended growth media was supplemented with spent and unspent cooking oils and bioconversions determined. The complete bioconversion of chicken carcasses were also determined. *Hemeticia illucens* tolerances and bioconversions of poultry 'waste' biomass was determined and optimized in a prelude to large scale poultry carcass conversion. Funding for this study was provided by the J. Bennet Johnston Foundation.

P52 MICHELIN, RUEL<sup>1</sup>, LAFAYETTE FEDERICK<sup>2</sup>, LUNIQUE ESTIME<sup>1</sup>, ELLIS BENJAMIN<sup>1\*</sup>, JACOB ADEYEYE<sup>3</sup>, AND ARTHUR WILLIAMS<sup>1</sup>. <sup>1</sup>Department of Biology, Morgan State University, Baltimore, MD 21251, <sup>1\*</sup> Department of Chemistry, Morgan State University, Baltimore, MD 21251 <sup>2</sup>Department of Biology, Howard University, Washington, DC 20056, and <sup>3</sup>Department of Natural Sciences, Coppin State College, Baltimore, MD 21256 - Purification and partial characterization of an antifungal metabolite from an unidentified *Bacillus* sp.

An unidentified *Bacillus* sp. designated HU-BIOLII when cultured on Potato Dextrose Agar (PDA) produced a metabolite that inhibits the growth of several species of filamentous fungi and yeasts. Crude extract from cultures grown in potato-dextrose broth, under shake conditions effected similar inhibitory activity on fungal growth during disc diffusion and agar dilution assays. This study sought to purify and characterize this antifungal compound. Polyethylene glycol (PEG) was used to separate the active principle from the crude extract, followed by "salting out" ammonium sulfate precipitation. The precipitated protein was subjected to Reconstituted Cellulose (RC) membrane dialysis for enhanced purification. Spectrophotometry, SDS-PAGE and Thin Layer Chromatography (TLC) were used for qualitative and quantitative analysis. "Partial" characterization of the major protein fraction was achieved following GC/MS and Infrared (IR) Spectrometry of the purified fraction. *In vitro* biochemical assays including Bradford's and Ninhydrin test positively identified the presence of protein in the medium extract. The protein resolved at 10±2 kDa during SDS-PAGE and peaked at 1.285AU during HPLC separation. GC/MS identified lactone derived compounds. The identified compound 3-Deoxy-d-mannonic lactone based on a 90% similarity between the MS spectra of unknown and reference compounds appears to be a new compound, possibly responsible for the antifungal activity. MFC experiments testing the action of this compound against isolates of *Cryptococcus neoformans* and *Trichoderma* sp. is being studied. Antibacterial experiments are also being considered. Fungi used in these experiments included *Ophiostoma ulmi*, *Candida* sp., *Fusarium* sp., *Aspergillus fumigatus*, *Aspergillus niger*, *Trichoderma* sp. and *Neurospora dodgei*.

P53 OLLER, ANNA. Central Missouri State University - Fungal molecular techniques: A useful tool in forensic science and human disease.

Fungi are well characterized for their decompositional roles in the environment. Further, many fungi from soil colonize human bodies after death, which can obstruct individual facial identification during criminal investigations. In addition, certain fungi are more prominent in different soil types, which is important to identify soil locations of criminal activity. Most fungi also serve as opportunists in various human diseases, such as respiratory and skin infections, as well as allergies. Development of rapid molecular techniques serve as accurate identifiers of fungi from expired individuals and soils, as well as current patients. Identification would also allow discovery of novel adherence and growth factors to aid in developing an inhibitory agent that could be cheaply and safely applied to skin. Genomic DNA from *Aureobasidium pullulans*, *Aspergillus niger*, *Candida albicans*, *Mucor rouxii (indicus)*, *Nocardia asteroides*, *Penicillium chrysogenum*, *Rhizopus nigricans*, *Saccharomyces cerevisiae*, and *Trichoderma viridae* was isolated and purified using standard protocols. A random amplified polymorphic DNA (RAPD) primer was used

in the polymerase chain reaction (PCR) and results were observed via electrophoresis and photographed. Each fungus demonstrated a unique banding pattern on a 1% agarose gel. Further PCR analysis will be discussed.

- P54 STEVENS, STANLEY E. AND AUGUSTUS MEALOR. Department of Microbiology and Molecular Cell Sciences, The University of Memphis, Memphis, TN - Gliding Motility in the thermophilic cyanobacterium *Mastigocladus laminosus*

Hormogonia are the differentiated, motile filaments produced by some species of cyanobacteria. *Mastigocladus laminosus*, a thermophilic cyanobacterium, is one of these. An average hormogonium of this organism consists of 14 cells. The terminal cells are distinctly tapered. The average surface velocity is about 2 μm/s at a temperature optimum of 48°C. The mechanism for gliding motility is unknown. A suggestion first published over 100 years ago proposed slime production as a propulsive force for gliding. Recent experiments suggest that motile force is generated by extrusion of liquid slime through pores located at the cell junctions and its subsequent gellation. We seek to test this notion with a thermophilic organism because extreme conditions often produce exaggerated responses. A method was developed to isolate hormogonia in quantity from the parental trichomes. Transmission electron microscopy, scanning electron microscopy, environmental scanning electron microscopy, and atomic force microscopy have been used to elucidate the ultrastructure and surface structure of these hormogonia. Spiral surface structures, potential slime extrusion events, and slime trail features have been observed. The internal ultrastructure of hormogonial cells are surprisingly different from that of cells in the parental trichome. They have fewer thylakoid membranes, less electron dense cytoplasm, and greater numbers of cyanophycin granules

- P55 BRAY, AMANDA, JOEY GUILLORY, AND MICHAEL LAND. Northwestern State University - Detection of green and blue fluorescent protein denaturation during macrophage destruction of transfected bacteria.

The process of phagocytosis and subsequent destruction of pathogens by activated macrophages can be difficult to visualize. And the destruction of the bacteria in the phagolysosome is not easily determined. *E. coli* were transfected with plasmids encoding for either blue or green fluorescent proteins. Denaturation of these proteins was determined at differing pH levels and the change in the fluorescent properties were recorded on a spectrophotometer. Similar conditions were created on a fluorescent microscope and a correlation of the recorded hues and the spectrophotometer values were determined. Activated macrophages were given access to these fluorescing bacteria and phagocytosis was allowed to proceed. The process of phagocytosis and the subsequent destruction of the fluorescent protein and bacteria were recorded and cell death was correlated with a difference in fluorescence.

- P56 COOK, ELISA<sup>1</sup>, ROBERT CAMPBELL<sup>1</sup>, MICHAEL KRASILOBSKY<sup>2</sup>, and MINKEN LIAO<sup>1</sup>. <sup>1</sup>Furman University and <sup>2</sup>Oberlin University - Characterizing antibiotic resistant *Serratia marcescens* in watersheds of upstate South Carolina.

In the summer of 2002, two tetracycline-resistant *Serratia marcescens* were isolated from a zinc-contaminated tributary of the Enoree River. The bacteria were tested for antibiotic resistance by using the Kirby-Bauer disk method and determining the minimal inhibitory concentrations (MIC). A separate study in 2003 isolated a total of 636 bacteria from Durbin Creek and the Enoree River in the upstate of South Carolina. Of these isolates, four were found to be resistant to tetracycline (30 μg/ml) and two of those identified as *S. marcescens* using BIOLOG. One of the *S. marcescens* was isolated directly downstream of a wastewater treatment plant (WWTP) on the Enoree River, and the other was found directly downstream of the WWTP on Durbin Creek. The antibiotic-resistant patterns of



these two isolates were examined by using the Kirby-Bauer disk method and determining MIC of the specific antibiotics. The current goal is to study the genotypic and phenotypic variations of these four isolates. By comparing the antibiotic-resistant patterns of these isolates, a profile of phenotypic diversity can be established. To further investigate the genotypic diversity of these four isolates, restriction fragment length polymorphisms pattern of their 16S rDNA will be compared. To study the phylogenetic relatedness of these isolate, the 16S rDNA of each isolate will be cloned and sequenced for further analyses.

P57 MEADE, MARK AND BENJIE BLAIR. Jacksonville State University - Anaerobic bacteria as probiotic for the culture of Nile tilapia *Oreochromis niloticus*.

In this study, we examined the effects of an anaerobic bacterium as a potential probiotic in the culture of tilapia fry. Nile tilapia fry (0.20-0.25 g) were held in three 260l fiberglass tanks with associated re-circulating biofilters (n=200 fish/tank). Water quality was checked initially and had the following characteristics:  $27 \pm 0.5^\circ\text{C}$ , D.O.  $\geq 6$  mg/l,  $\text{CaCO}_3$  hardness  $> 100$  mg/l, pH 8.0. Water quality was also checked daily for temperature, D.O., pH, ammonia, and nitrite for the duration of the experiment. All fish were fed a high protein commercial fish ration that contained a minimum of 50% crude protein. Feed proffered to two of the tanks was initially supplemented with anaerobic bacteria. On subsequent feedings, all fish were fed solely the high protein fish ration not containing bacteria. Survival of tilapia in each tank was  $>95\%$ . Final mean wet weights, however, were significantly different between the two treated tanks compared to the control tank. Specifically, fish supplemented with the bacteria had final mean wet weights of  $0.99\text{g} \pm 0.6$  (s.e.) and  $0.83\text{g} \pm .05$  (s.e.) whereas the control fish had final mean wet weights of  $0.62\text{g} \pm 0.3$  (s.e.). An analysis of size distribution frequencies also demonstrated that between 40 and 50% of bacteria supplemented fish were 1g or larger in size, whereas  $< 20\%$  of the control fish had attained a size of 1g. These data suggest that anaerobic bacteria may be beneficial probiotics in the culture of tilapia and may serve to accelerate growth of fry.

P58 BAGHAI-RIDING, NINA AND CHARLES SWANN. Delta State University - Maastrichtian palynomorphs from the McNairy Sand Member in northwestern Mississippi.

The Maastrichtian McNairy Sand Member of the Upper Cretaceous Ripley Formation crops out in northern Tippah and Alcorn Counties, Mississippi. Its lithology consists primarily of gray, fine-to-coarse-grained, cross-bedded sand that weathers to a yellow or reddish-brown. The middle interval of the McNairy is interbedded with gray, black, or brown organic, micaceous clay deposits that contain a high yield of diverse palynomorphs. In this study, seven samples were collected from three different localities. Five samples were obtained from a 30-foot, road-cut exposure in Alcorn County. The other two samples were collected from exposures in Tippah County. Random 300-point counts were done on each sample to examine palynological data and paleoecological inferences. Results from these data reflect a low-energy, shoreline environment that bordered the southernmost extension of a delta. Minor transgressions and regressions of the shoreline are indicated by the quantity and assortment of dinoflagellates in contrast to angiosperms. Samples near the base of the 30-foot clay interval contain an abundance of dinoflagellates (26%), as well as inner chitinous linings of foraminifera, marine acritarchs of *Baltisphaeridium*, and freshwater cysts of *Spirogyra*. Upper clay intervals possess a greater quantity of well-preserved angiosperm and gymnosperm taxa along with a minor quantity (11%) of dinoflagellates that may be the result of periodic flooding. Over 100 genera have been identified from these samples. Common genera include dinoflagellate cysts of *Cleistosphaeridium* and *Exochosphaeridium*, trilete spores of *Camarozonosporites*, *Cicatricosisporites*, and *Gleicheniidites*, monolete spores of *Laevigatosporites*.

gymnosperms of *Alisporites*, *Cycadopites*, and *Rugubivesiculites* and angiosperms of *Casuarinidites*, *Nyssapollenites*, and *Rhoipites*.

- P59 FERZLI, MIRIAM, MICHAEL CARTER, ERIC WIEBE, AND TRINA ALLEN. North Carolina State University - LabWrite: Teaching students how to write effective lab reports.

LabWrite is a comprehensive web site that guides students through the stages of the lab experience—before, during, and after the lab experiment. Its primary goal is to enhance science learning by providing the support and resources students need to develop and strengthen their ability to understand and communicate science. LabWrite has been and continues to be tested at various institutions. Findings from our studies show that students using LabWrite outperform students using traditional instruction in lab report writing. Students, who use LabWrite, write lab reports that demonstrate significant gains in conceptual understanding of the science they are studying in the lab. They also show significant gains in their abilities to reason and think scientifically. Whereas most students see lab reports as mere busywork, students using LabWrite learn to value the lab report as a learning tool. LabWrite materials also offer instructors extensive guides for teaching and grading with LabWrite.

- P60 KOKKALA, IRENE AND DONNA GESSELL. North Georgia College & State University - Group dynamics in teaching science writing.

For the last five years we have formed learning communities connecting biology student writers with English student editors. The process places emphasis on the use of reciprocal peer review, and it includes five phases: 1) The biology students write content-specific draft papers; 2) The English students review the submitted papers for grammar, logic, and rhetoric, write comments to clarify the identified errors, and suggest grades; 3) The biology professor gives feedback on the content accuracy; 4) The English professor assesses the reviews and the appropriateness of the comments given; 5) The biology students evaluate the usefulness of feedback from both sources and make changes accordingly resubmitting final manuscripts. Work is done in a collaborative environment where responsibility for individual work is distributed equally. The importance of group formation and management is crucial. Students select the group composition, and for the biology students, although we maintain the consistency of the membership of each group through the semester, we expect rotation of research, writing, and revision duties. We thoroughly explain our expectations for the group work, including our insistence on our independence from the inner workings of groups. To ensure individual contribution and discipline, we measure participation through peer evaluation. We find that peer evaluation generates honest and harsh evaluation; however, it provides students effective incentive for group coherence as the process develops. Analysis of responses through the years indicates that significant amount of effort placed during the initial stages of group development resolves many conflicts and develops strong group dynamics.

#### FRIDAY MORNING POSTERS

- P61 BRAGG, JENNIFER, CHRISTY MICHAELS, LEAH REEDY, AND CARRIE THOMAS. Sweet Briar College - Chemical and biological evaluation of the Buffalo River watershed, Amherst County, Virginia.

The water quality of the Buffalo River watershed in Amherst County, Virginia was evaluated during the summers of 2002 and 2003. Predominant land use types in this watershed include forest and pasture. Both chemical and biological parameters were analyzed, including nitrate nitrogen, reactive phosphorous, total phosphorous, fecal and total coliforms, turbidity, and macroinvertebrate diversity. Mill Creek Lake, a drinking water

reservoir for Amherst County and the Sweet Briar community, exhibited greater concentrations of nitrogen, phosphorous, fecal coliforms, and *Escherichia coli* than other areas. Bacterial concentrations were greater in 2002 than in 2003 reflecting the drought conditions of 2002. *E. coli* concentrations continue to be a concern as some of them exceed legal limits. Virginia bacterial water quality standards for recreational freshwater mandate that the mean of two or more samples during a 30-day period must not exceed 200 fecal coliform colony-forming units per 100 mL of sample water. The inlet to the lake exceeded that criterion during 2002. Elevated turbidity levels in Mill Creek Inlet have implications regarding the management of Mill Creek Reservoir. The remainder of the watershed was ecologically healthy. A Microsoft Access database was developed to facilitate data analysis. Currently, the database is being merged into the ESRI ArcGIS geographical information system to allow more in-depth data analysis.

P62 OWENS, JANNA<sup>1</sup>, KEN MARION<sup>1</sup>, ROBERT ANGUS<sup>1</sup>, MELINDA LALOR<sup>1</sup>, ERIC MEYER<sup>2</sup>, AND STEVE MCKINNEY. <sup>1</sup>University of Alabama at Birmingham and <sup>2</sup>Storm Water Management Authority - Aquatic biota as indicators of urbanization impact.

It can be difficult to identify the effects of urbanization on water quality and stream habitat, particularly in the initial stages. Factors accompanying urban growth that affect receiving waters include: loss of vegetation, land disturbances, riparian alterations and increase in impervious surfaces. Impacts related to these changes on water quality are usually episodic in nature and therefore difficult to profile for water quality evaluation. Our objective was to examine possible correlations between a watershed's urbanization status and the community structures of fish and benthic macroinvertebrates in the upper Cahaba River basin in Birmingham, Alabama. A series of metrics were utilized to evaluate the status of the aquatic communities. These were compared to water chemistry, habitat conditions, accumulated sediment depths and upstream land usages. To calculate upstream urbanization characteristics, geographic information systems (GIS) and selected data layers were used to construct a cartographic model. This information is used to generate a sedimentation potential index (SPI) value for the watershed upstream of each site, as well as to calculate the coverage of vegetation and impervious surfaces. Significant correlations were found between the percentage of impervious surfaces in the upstream watershed and pollution-sensitive macroinvertebrate metrics, such as the EPT and Hilsenhoff biotic indices. Darter, sucker and selected minnow species correlated negatively with the percentage of impervious surfaces, habitat scores and SPI values. Management strategies for aquatic systems that include geographic and aquatic community information in addition to water quality monitoring will be able to characterize, detect and remediate the effects of urbanization more precisely.

P63 FINLEY IV, GENE, DAVID D. MOODY, AND A. LANE RAYBURN. University of Illinois at Champaign-Urbana - Concentration and stability of atrazine in an Illinois watershed.

The Lake Decatur watershed drainage area in Illinois is 925 square miles of which over 80% consists of land used for corn and soybean production. Lake Decatur was formed in 1922 to provide a water supply for the city of Decatur. Over the years as drinking water standards have been implemented, Lake Decatur has been found to be out of compliance with the standards with respect to various contaminants. Some such as pesticides while may be used in urban areas have an easily observed link with the agriculture of the area. One major problem is following the flow of pesticides from the site of application to the potable water supply. In many cases the data is based on models and extrapolation that lack true hard data in the areas they propose to protect. In this study, water samples were collected from various parts of the watershed representing field tile areas, drainage ditches, waterways, creeks, river and ultimately Lake Decatur. Collects were made weekly

in the early spring. The amount of atrazine was determined for each sample. In addition, each source listed above i.e. creek, was tested for the long term stability of atrazine concentration. Specific sites were defined that had high atrazine concentrations but low atrazine stability to sites that had low atrazine concentrations but high atrazine stability. The relationship between atrazine concentration and stability will be presented.

- P64 MOODY, DAVID D., JENNIFER L. FREEMAN, AND A. LANE RAYBURN. University of Illinois at Champaign-Urbana - Comparing the cytotoxicity of field applied atrazine to technical grade atrazine.

In the Midwest, agrochemical contamination of aquatic ecosystems is not uncommon and is in fact the norm. The most well characterized and widely used agrochemical that is known to contaminate surface waters is atrazine. When atrazine was first released for agricultural use it was thought that since its mechanism of action was photosynthesis, animals would be immune to any effects of atrazine. It was soon suspected that atrazine might have non-target action in animals. Atrazine has been implicated as a clastogen (an agent that causes chromosomal damage). Levels of the herbicide atrazine have been reported to be up to 860 ppb in streams below field plots that have been treated with atrazine. Tailwater pits in Kansas have been reported to have a mean atrazine contamination level of 50-100 ppb with concentrations as high as 1 ppm. One aspect that needed more attention was the formulation of atrazine used in scientific studies. Of interest is whether the field grade atrazine that is applied to crops results in the similar damage to animal cells as the technical more pure grade atrazine used in most of the scientific studies to date. In this study, Chinese Hamster Ovary Cells were exposed to the same concentrations of both field and technical grade quality atrazines. The cells were exposed to the concentrations for 3 days and the toxicity assayed using a mammalian cytotoxicity assay. Comparison between the field grades and technical atrazine will be presented.

- P65 SMITH, SHANNON, MENDORA HACKLER, RACHAEL CHILTON, REBECCA AMBERS, AND DAVID ORVOS. Sweet Briar College - Determination of heavy metals concentrations in biosolids applied to agricultural fields in Appomattox County, Virginia.

Biosolids from domestic and industrial wastewater plants are often used as a soil amendment on agricultural fields. These amendments provide nutrients and moisture and often enhance crop yields. However, biosolids may pose human health and ecological risks due to heavy metals present in them. This investigation examined Class B biosolids and biosolid-amended soils in Appomattox County, Virginia, to determine the concentration of selected heavy metals and estimate potential ecological risk. Soils were digested in 1.5:1 nitric:hydrochloric acids at 95 C for 30 to 60 minutes. Following digestion, samples were analyzed using either flame, electrothermal, or cold-vapor atomic absorption spectrometry. Sewage sludge certified reference material was used to determine the efficiency of the extraction and the precision of the analytical method. Zinc, copper, and mercury have been detected in biosolids with analysis of other sample currently in progress. An ecological risk assessment using exposure pathways and paradigms from the U.S. Environmental Protection Agency will be conducted using various combinations of application rates and frequencies.

- P66 FAULKNER, S. P AND H. W. COBB, JR. Delta State University - Water-staining of submerged wetland foliage due to iron-polyphenol reactions?

Leaf submergence in wetlands is associated with a distinctive darkening, called "water-staining". Although the phenomenon is considered a secondary indicator for wetland hydrology, causative mechanisms remain poorly understood. We hypothesize that Fe(II)

diffuses from anaerobic soils into leaves, reacts with polyphenols, and ultimately forms low-chroma pigments in submerged leaves. We exposed leaves of 22 species of bottomland hardwood trees to an Fe(II) gradient, and used a Munsell color chart to monitor color change over time. Shagbark hickory, water hickory and sycamore, water-stained after 6 weeks of exposure to 8 mg/L iron. Cottonwood stained at 2 mg/L iron and above. Some species resisted staining and did not stain, or only partially stained, even after 6 weeks' exposure to iron. In another study, we extended the iron exposure for up to 8 weeks. Water oak stained at 2 mg/L iron and higher, while willow oak, swamp chestnut oak, and tulip poplar stained at 8 mg/L iron, but not at lower levels. Red maple and American elm stained at approximately 6-8 weeks and 3-4 weeks respectively at concentrations of 4 and 8 mg/L iron. While some species resisted water-staining (e.g., sweetgum and sweetbay magnolia), even these darkened to a limited extent with time. Under the conditions of our study, water-staining appears to be a function of Fe(II) concentration and time, species and possibly other factors. Since flood duration is important during hydrologic assessments, this research has implications for use of water-staining as a secondary hydrologic indicator during wetland delineations.

P67 MCCARY, LAURA<sup>1</sup> AND DENNIS HANEY<sup>2</sup>. <sup>1</sup>University of Dallas and <sup>2</sup>Furman University - Detection of estrogen associated with wastewater treatment plants in the Broad River basin of South Carolina.

Studies in parts of Europe and the United States have suggested that wastewater treatment plants (WWTPs) fail to completely remove estrogen and estrogen like compounds (xenoestrogens) from wastewater effluent, thereby releasing them into rivers. We were interested in determining whether measurable amounts of estrogenic compounds could be found in river water downstream of WWTPs in the Broad River basin of South Carolina. As well, we wanted to assess if estrogen levels compounded downstream when WWTPs flow into the same river in close proximity to one another. The Broad River basin differs from previous estrogen detection studies because the city sizes whose treated wastewater flows into the Broad River basin are all smaller than cities previously examined. In addition, several of the WWTPs in the Broad River basin are in very close proximity, with three of the smallest plants being found within one river mile of each other. We tested for estrogen using a recombinant yeast that had the human estrogen receptor inserted into its genome. In the presence of estrogen the yeast secretes  $\beta$ -galactosidase in proportion to the estrogen concentration, causing a graded colorimetric change that can be detected with a spectrophotometer. We tested river water upstream and downstream of five WWTPs in addition to testing their effluent. Results indicate that detectable levels of estrogen are associated with WWTP effluent in the Broad River basin. However, estrogen levels decline once effluent is discharged into the river, suggesting that estrogen levels do not compound downstream of WWTPs in this system.

P68 O'CONNELL, ANN<sup>1</sup> AND JOSEPH KING<sup>2</sup>. <sup>1</sup>University of New Orleans, PIES and <sup>2</sup>University of New Orleans, College of Sciences - Evaluation of algal bloom potential near the Davis Pond Freshwater Diversion Project.

The Davis Pond Freshwater Diversion structure can re-introduce up to 10,650 cfs of freshwater into Barataria Bay estuary. Its purposes are to enhance vegetation growth, reduce rate of marsh loss, and increase fishery and wildlife productivity. The structure channels water from the Mississippi River into a 9300 acre ponding area, which then spills into Lake Cataouatche. Because this area receives runoff and sewage effluent from numerous sources, it is eutrophic at times, and algal blooms have occurred in the past. Because the river water arriving in Lake Cataouatche is potentially high in nutrients, even after some uptake in the ponding area, there is concern for algal bloom reoccurrence. We analyzed pre- and post-diversion water quality data (collected at Army Corps stations from January 2001 through June 2003) from the study area. Exceptional blooms were not

common during the time period covered. Hypereutrophic chlorophyll levels occurred in the study area but were mostly outside of the diversion pathway. No incidents occurred in Lake Cataouatche at all or in the diversion pathway since its opening. Although some water quality parameters changed with the diversion, it has not had detrimental effects in terms of nutrients and chlorophyll levels. Canonical Correspondence Analysis indicated that chlorophyll, along with other parameters, significantly separated stations in ordinate space. Stations with higher chlorophyll tended to be coastal, and their high values tended to occur during the prediversion. The highest values for more inland stations also tended to occur at these times.

- P69 RICHIE, JERRY C<sup>1</sup>, VERNON L. FINNEY<sup>2</sup>, KENNETH J. OSTER<sup>3</sup>, AND CAROLE A. RITCHIE<sup>4</sup>. <sup>1</sup>USDA ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD 20705, <sup>2</sup>USDA NRCS California State Office, Davis, CA 95616, <sup>3</sup>USDA NRCS Templeton Service Center, Templeton, CA 93465, and <sup>4</sup>Botanical Consultant, Laurel, MD 20708 - Sediment deposition in the floodplain of Stemple Creek Watershed.

Over the past 150 years major land use changes have occurred in the Stemple Creek Watershed in northern California that have caused erosion to move soils from the upland to the floodplain, stream channels, and the bay. The purpose of this study is to document the recent sediment deposition (1954 to present) patterns in the floodplain area adjacent to Stemple Creek using the <sup>137</sup>Cesium technique. Sediment deposition ranged from 0.26 to 1.84 cm yr<sup>-1</sup> for the period from 1964 to 2002 with an average of 0.85  $\pm$  0.41 cm yr<sup>-1</sup>. Sediment deposition rates were higher for the 1954 to 1964 period with a range of 0.31 to 3.50 cm yr<sup>-1</sup> and an average of 1.29  $\pm$  1.04 cm yr<sup>-1</sup>. These data indicate that sediment deposition in the floodplain has decreased since the middle 1950's probably related to reduction in row crop agriculture and an increase in pasture land in the uplands. This study shows that the floodplains in the Stemple Creek Watershed are a significant sink for the soils being eroded from the upland area. Given the significance of the floodplain for trapping eroded materials before they reach the stream channels or bay, efforts need to be made to manage these floodplain areas to insure that they do not change and become a source rather than a sink for eroded materials as improved management practices on the upland areas reduce sediment input to the floodplain.

- P70 WILLIAMS, JASON<sup>1</sup> AND CHARLES PEDERSON<sup>2</sup>. <sup>1</sup>Augustana College, Rock Island, Illinois and <sup>2</sup>Eastern Illinois University, Charleston, IL - Diel vertical migration in *Daphnia lumholtzi* (Sars).

*Daphnia lumholtzi* (Sars), a native to Africa, Australia and Asia, was documented in Fairfield Reservoir, Texas in 1991. Now present throughout the southeastern United States, this cladoceran is distinguished by exceptionally long head and tail spines. Despite its defensive morphology, *D. lumholtzi* cannot always escape consumption by planktivorous fish, which may rely on it when native zooplankton are rare. Diel vertical migration (DVM) is an alternative adaptive response to visually oriented planktivores. To our knowledge, only two previous studies have reported DVM by *D. lumholtzi*. We collected zooplankton from discrete depths every 4 hours for 48 hours at the same location within Newton Lake, a cooling reservoir for a coal-fired power plant in Jasper County, IL with a known population of *D. lumholtzi*. Single factor ANOVA revealed that *D. lumholtzi* and *Chaoborus sp.* were migrating vertically, as were other members of the zooplankton community. Maximum abundances of *D. lumholtzi* and *Chaoborus* were observed at similar times and depths, suggesting that *D. lumholtzi* is migrating to avoid the photic zone and not to avoid *Chaoborus*, the only invertebrate in Newton Lake potentially capable of consuming *D. lumholtzi*. We conclude that *D. lumholtzi* undergoes diurnal migration out of the photic zone to reduce likelihood of observation and consumption by visually-oriented predators. Our observation of DVM in *D. lumholtzi* indicates that even its

extreme morphology is incapable of deterring fish predators effectively enough to decrease the amount of food available to juvenile planktivores or increase predation pressures on native zooplankton.

- P71 MORTON, STEVE L.<sup>1</sup>, STACIE DOVER<sup>1</sup>, WES JACKSON<sup>1</sup>, LUCIE MARANDA<sup>2</sup>, SUSANNAH CORWIN<sup>2</sup>, LAURIE L BEAN<sup>3</sup>, AND STEVEN EAKER<sup>1</sup>.  
<sup>1</sup>NOAA/National Ocean Services, Marine Biotoxins Program, 331 Fort Johnson Rd., Charleston, SC 29412, <sup>2</sup>Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882, and <sup>3</sup>Department of Marine Resources, West Boothbay Harbor, ME 04575 - Toxicity and ecology of *Prorocentrum lima* and the potential for diarrhetic shellfish poisoning along the New England coast on the United States.

Following the occurrence of several unexplained incidents of shellfish-related gastroenteritis, field studies were conducted to determine if diarrhetic shellfish poisoning (DSP) toxins were present in the coastal waters of New England states. Previous studies have found the toxic dinoflagellate, *Prorocentrum lima*, is widespread in New England coastal waters. The abundance and seasonality of this toxin producer was followed within the planktonic and epibiotic community. Samples were collected bimonthly at eight sites from Rhode Island, New Hampshire, and Maine. In an effort to evaluate the potential for diarrhetic toxins to contaminate shellfish resources, the digestive glands of wild and cultured shellfish were collected. The epiphytic samples and digestive glands were analyzed for the potential of okadaic-acid activity using the fluorometric protein phosphatase inhibition assay. Samples positive for protein phosphatase activity were analyzed for okadaic acid and related congeners using the ADAM-HPLC method. Epiphytic samples showed a seasonal trend in both the population of *P. lima* and total toxicity, with increase cell number and toxin content during summer months. Analysis of these samples showed the production of both dinophysin toxin-1 and dinophysin toxin-2. Like previous studies, no okadaic acid was detected. Cultures of *P. lima* isolated from the sample area showed a similar toxin profile with a predominate production of dinophysin toxin-1 and little okadaic acid production. The digestive glands did display very low protein phosphatase activity. Although the presence of DSP-type toxins in shellfish digestive glands indicate uptake, the levels are well below the maximum accepted concentration.

- P72 SMITH, LAURINDA L. AND STEVE L. MORTON. NOAA/NOS/Marine Biotoxins Program - Morphology of *Prorocentrum reniformis* sp. nov., (Dinophyceae) a benthic dinoflagellate from the Gulf of Mexico.

A new marine, benthic dinoflagellate species, *Prorocentrum reniformis* isolated from the Gulf of Mexico, is described using scanning electron microscopy and light microscopy. This species was collected as an epiphyte on oil platforms off the Texas coast. Cells are slightly ovate and range in length from 37-40  $\mu\text{m}$  and in width from 32-35  $\mu\text{m}$ . The thecal surface is smooth with 49-63 randomly distributed, kidney shaped, trichocyst pores. The valve centers are devoid of pores. The valve margins have 62-70 kidney shaped, trichocyst pores per valve. The intercalary band appears striated. The periflagellar region is a triangular area at the anterior end of the right valve. The flagellar and auxiliary pores are unequal in size. This new species will be compared to other benthic Prorocentroid dinoflagellates.

- P73 HAMISSOU, MIJITABA, MARK PATTON, AND CONTESSA PATTON. Jacksonville State University - Induction of callose biosynthesis in *Arabidopsis* and tobacco plants: an activation of plant defense mechanisms.

Throughout their life cycle, plants must face several challenges from their environment. They are constantly attacked by a wide variety of predators including insects, bacteria,

fungi, and viruses. When plant cells are mechanically wounded, they block the damaged sites and their plasmodesmata with a polysaccharide cement known as callose. This helps prevent the loss of cytoplasmic contents from adjacent cells and serves as a barrier against fungal infection. Callose is a beta – 1, 3-glucan polymer of glucose, a major component of inducible plant cell wall apposition. Callose biosynthesis can be monitored *in vivo* as well as *in vitro*. The objective of this paper is to use biochemical and microscopic methods to investigate callose biosynthesis by arabidopsis and tobacco plants in response to mechanical injury and to cell wall degrading enzymes. Adult arabidopsis and tobacco plants grown in pots containing a mixture of sand and vermiculite were mechanically wounded by crushing their leaves with a hemostat or by puncturing them with sterile needle. Some wounded plants were treated with solutions of maceroenzyme pectinase or cell wall dissolving enzyme cellulase at the wound sites. 12, 24, and 48 hours following the injury, 0.2 grams of leaves per treatment, including the injured leaves, were harvested, and cleared in organic solvent and the callose extracted by differential centrifugation. Preliminary results of biochemically analyses indicated that callose production in arabidopsis plants increased linearly with time of injury and the nature of damage.

P74 FARMER, SUSAN B. AND EDWARD E. SCHILLING University of Tennessee, Knoxville, TN 37996-1100 - Additional insights into Trilliaceae phylogeny: the *Delostylis* group. Preliminary results.

An analysis was made of the evolutionary relationships of the “*Delostylis* Group” of *Trillium*. Although this Rafinesquian genus was never accepted, the name *Delostylis* can be used to define a group consisting of *Trillium catesbaei*, *T. nivale*, *T. persistens*, and *T. pusillum*; the defining feature of this group is the style which is basally fused. Recent phylogenetic analyses of Trilliaceae have suggested that, based on morphology, it may represent a distinct group, either within *Trillium* or as a sister group to it. The status and relationships of the “*Delostylis* Group” of *Trillium* were evaluated based on comparisons of morphological and molecular phylogenetic data (ITS and *matK*) for the varieties of *T. pusillum* as well as for the other species in this group. In addition, their relationships to the other non-Erectum pedicellate trilliums (e.g., *T. ovatum* and *T. grandiflorum*) were examined. Preliminary results suggest that *T. pusillum* var. *texanum* is distinct from *T. pusillum*; *T. nivale* is more closely related to *T. grandiflorum* than to the rest of the *Delostylis* Group; and *Trillium ovatum* var. *hibbersonii* is distinct from *T. ovatum*. Based on preliminary evidence, *Delostylis* is not monophyletic.

P75 GAITHER, THOMAS W.<sup>1</sup> AND HOWARD W. KELLER<sup>2</sup>. <sup>1</sup>Slippery Rock University and <sup>2</sup>Central Missouri State University - The genus *Schenella*, myxomycete or gastroid fungus, a 100 year-old mystery.

*Schenella simplex* was described and illustrated as a new myxomycete genus and species by Thomas H. Macbride in 1911. A single collection gathered in August of 1903 on a decaying pine log in the Yosemite Valley, California was designated as the holotype. In 1961, George W. Martin described a second species *S. microspora* based on a single collection from Big Basin State Park, San Mateo County, California, 26 August 1957. Martin concluded that *Schenella*, was a valid myxomycete genus in the Stemonitaceae, closely allied to the genus *Amaurochaete*. Martin reinterpreted the morphology of this taxon as a pseudoaethalium with the sporangia arranged vertically similar to *Dictydiaethalium*. Holotypes of both *Schenella* species were examined with light and scanning electron microscopy. These observations confirmed the presence of simple capillitial threads twisted together to form vertical columns attached to the outer peridium and base of the fructification. These threads appeared similar to the capillitium seen in fungi such as puffballs and unlike any myxomycete species. Spores were small, 3.0 to 6.0 µm in diameter, elliptical in shape, the surface roughened with flattened, disc-like areas



unlike any myxomycete spore. At one end of the spore was a circular, recessed scar representing the point of attachment to the basidium identical to the basidiospores of the gasteromycete puffball, *Pyrenogaster atrogleba*. Morphological comparisons of collections authentically identified as *Pyrenogaster atrogleba* indicate it is synonymous with *Schenella simplex*. This research was funded in part by a faculty sabbatical leave to TWG.

P76 DELONG, MICHAEL<sup>1</sup>, SUNEETI JOG<sup>1</sup>, J EFF JOHANSEN<sup>2</sup>, AND GEORGE WILDER<sup>3</sup>. <sup>1</sup>Southern Illinois University, Carbondale, <sup>2</sup>John Carroll University AND <sup>3</sup>Florida Gulf Coast University - Floristic survey of a highly disturbed wetland within Shaker Median Park, Beachwood (Cuyahoga Co.), Ohio.

A 1.5 year-long investigation of a highly disturbed suburban wetland revealed 298 species of vascular plants, including several taxa uncommon elsewhere in Cuyahoga County. The site exhibited five vegetation subtypes which we compared according to several measures including Floristic Quality Assessment Index and Shannon Diversity Index. Data indicated that the site had recovered partially from disturbance, but was threatened by invasive species. Management practices recommended herein may protect the site from natural and anthropogenic disturbances, and may induce balance between conservation, environmental education, and recreation.

P77 CONNER, WILLIAM H., GEORGE R. ASKEW, AND JEFFERY T. VERNON. Baruch Institute of Coastal Ecology and Forest Science - Community structure and aboveground productivity in a coastal pine-swamp blackgum forest, South Carolina, USA.

Aboveground net primary production (ANPP) was monitored from 2000-2002 in a longleaf pine-swamp blackgum forest in Georgetown County, SC. Permanent study plots (20-m x 25-m) were established in the hydric, mesic, and xeric portions of the drainage, and water levels were continuously monitored. Tree growth was monitored on a monthly and annual basis. Litterfall was measured monthly. Severe drought conditions began in July 2001 and lasted to late summer 2002. Diameter growth was affected in all three sites, but more so in the Xeric and Mesic sites where diameter growth was reduced by 50%. Litterfall values in the hydric site increased from 295 g/m<sup>2</sup> in 2000 to 361 g/m<sup>2</sup> in 2001 and 2002. In the mesic site, litterfall decreased from 448 g/m<sup>2</sup> in 2000 to 391 g/m<sup>2</sup> in 2001, but increased to 654 g/m<sup>2</sup> in 2002. Litterfall in the xeric site increased each year of the drought, peaking at 520 g/m<sup>2</sup> in 2002. Highest ANPP values occurred in the mesic site during 2000 and 2002 with 823 g/m<sup>2</sup> and 862 g/m<sup>2</sup>, respectively. In the xeric site, ANPP values varied from 624-696 g/m<sup>2</sup>, but were significantly greater than the hydric site. ANPP values for the hydric site increased from 471 g/m<sup>2</sup> in 2000 to 508 g/m<sup>2</sup> in 2001 before declining to 430 g/m<sup>2</sup> in 2003. With a return to normal water levels, continued monitoring of the sites will allow for more detailed analyses of the response of the tree species to changing environmental conditions.

P78 WACHHOLDER, BRENT, MATT BURMEISTER, CHARLES PEDERSON, AND ANDREW METHVEN. Eastern Illinois University - Baseline description of corticolous lichen communities for evaluation of restoration of coastal floodplain forests.

Weeks Bay, a microtidal estuary located on the eastern shore of Mobile Bay in Alabama, is part of the National Estuarine Research Reserve System administered by the National Oceanic and Atmospheric Administration. A variety of terrestrial habitats, including coastal floodplain forests occur within the reserve. Forested areas immediately adjacent to Weeks Bay are dominated by hardwood species (tupelo, water oak, live oak, sweet bay) but include gymnosperms such as bald cypress, slash pine and longleaf pine. Although many of the forested areas are relatively undisturbed, some have been impacted by agriculture,

timber cutting, and scarring of pines for production of turpentine. Effects of these disturbances on composition of biotic communities within the reserve are largely unknown. We conducted a survey of corticolous lichens along three permanent transects through areas at different levels of disturbance to ascertain whether restoration activities alter lichen community structure. One transect was located in an area of former row crop agriculture with considerable hydrological alteration, introduced invasive species, and excessive fuel load. A second transect was sited within a pine plantation used in turpentine production. Management plans for these areas include restoration of normal hydrology as well as controlled burns to reduce fuel load and exotic species. The third transect was placed within a relatively undisturbed interpretative nature walk. Lichens were identified between 50 and 150 centimeters from the base on two permanently tagged hardwood trees at points every ten meters along the transects. Multivariate analyses reveal considerable variation in corticolous lichen community structure between transects.

P79 KELLER, HAROLD W. Central Missouri State University - Tree canopy biota in the Great Smoky Mountains National Park.

The Great Smoky Mountains National Park (GSMNP) has over 40,000 hectares of old-growth forest in eastern United States. The All Taxa Biodiversity Inventory program aims to inventory all life forms in the Park. This tree canopy biodiversity study represents the first comprehensive inventory of cryptogams (Myxomycetes, macrofungi, mosses, liverworts, lichens, and ferns) in the Park. Students climbed a total of 240 trees representing 35 tree species during two three-week periods the summers of 2000 and 2001. The double rope climbing technique was used to reach the tree canopy. Preliminary results suggest that the Myxomycetes are the only group of tree canopy cryptogams with some species found only on bark and epiphytes of living trees. Ninety five myxomycete species were harvested mostly from moist chamber cultures derived from bark samples taken from the tree canopy, and included 52 new records for the Park. A new species of *Diachea* was restricted to heights above 6 meters; the first upper tree canopy species documented for the Myxomycetes. A total of 2007 samples from 141 trees yielded 194 lichen taxa from the canopy with 83 new records for the park accessions list. *Gomphillus americanus*, a new lichen record for the Park and Tennessee, had conspicuous, stalked hyphophores with stellate tips. This crustose lichen was abundant at about 15 meters on the trunk of a living *Fraxinus americana* tree. This project was funded by the National Science Foundation, Biotic Surveys and Inventories Program, Award DEB-0079058 and Discover Life in America Awards 2001-26 and 2002-17.

P80 YEAGLE, JESSICA AND JOHN GRONINGER. Southern Illinois University, Carbondale - Thirty-year post harvest survey of a relict chestnut oak stand in southern Illinois.

Chestnut oak (*Quercus prinus*) is common from Maine to Georgia and reaches its northwestern distribution limits in southern Illinois. In 1973 a silvicultural clearcut and post-harvest herbicide treatment was performed on one of the few Chestnut oak stands located in southern Illinois. Prior to the harvest, a survey was taken of the stand identifying stand structure and composition. Fifty-two permanent plots were established using the posi-plot method. Post harvest surveys of the stand were performed using the same plots at 1, 3, and 18 years after the clearcut. In the summer of 2003, the 30-year post harvest survey was conducted. Using the existing plots, trees  $\geq 6.60$  cm dbh were measured and identified by species within a radius of 11.35 m (0.04 ha) of plot center. Saplings ( $2.54 \text{ cm} \leq X < 6.60$  dbh) within 11.35 m of plot center and seedlings ( $< 2.54$  cm dbh) within a radius of 3.6 m (0.004 ha) of plot center were tallied by species. Calculating density and basal area will summarize tree data from each plot. As a result of permanent plots, pre- and 30-year post-harvest stand composition can be related on an individual plot basis. Since little research has been done documenting the long-term effects of clearcutting from

preharvested conditions this study is important for recording the successional patterns after a major disturbance. It is also valuable in showing the reproduction response of chestnut oak at the edge of its range and the regeneration success of other valuable timber species after harvest.

- P81 ROSENFELD, KRISTEN AND THOMAS WENTWORTH. North Carolina State University - Ecological characterization of a North Carolina barrier island.

Barrier islands include some of the most endangered and fragmented ecosystems on the Atlantic coast, providing critical habitat for a variety of plant and animal species, some of which are threatened and endangered. Because the vast majority of these islands have been developed for human use, study and protection of the few remaining undeveloped and undisturbed islands is critical. Knowledge of representative undisturbed habitats is necessary in order to properly protect and manage these systems. A survey of the vegetation and environments of Bird Island, an uninhabited, undeveloped barrier island in Brunswick County, North Carolina was completed during 2003 and 2004, with the dual goals of thorough floristic inventory and quantitative community characterization. The survey utilized stratified-randomly located plots in the principal habitats and plant communities found on the island and in its associated marshes. Plot inventory methods followed procedures developed by the Carolina Vegetation Survey. Plant communities were identified according to The National Vegetation Classification and the Classification of the Natural Communities of North Carolina, and interpretation of vegetation patterns was based on multivariate analysis of vegetation and environmental data. Approximately 80 species were found in 94 permanent 100 m<sup>2</sup> plots distributed across dune, interior grassland, shrub thicket, and marsh communities. Data from this study provide deliverables to the North Carolina Coastal Reserve Program to aid in management, conservation and, where appropriate, restoration efforts on Bird Island. On a larger scale, the knowledge gained from this work informs study of barrier island communities of North Carolina and elsewhere.

- P82 HOWARD, CLINT, EMILY COHEN, SHARLA SETZER, AND ROBERT CARTER. Jacksonville State University - Dendrochronological analysis of montane longleaf pine stands on Weisner Mountain, AL.

Historic responses of montane longleaf pine, *Pinus palustris*, forest to changes in the environment was examined using radial increments of stands from Weisner Mountain, AL. The variation in growth rate was found to be related to historic weather and disturbance patterns.

- P83 JENNE, KEVIN AND ROBERT CARTER. Jacksonville State University - A dendrochronological study of an old-growth stand of longleaf pine, *Pinus palustris*, in Talledega National Forest of northeastern Alabama.

Dendrochronological analysis was performed on an old-growth stand of longleaf pine, *Pinus palustris*, in Talledega National Forest of northeastern Alabama. Standard coring techniques were performed consisting of strategic coring, drying, mounting and sanding of each core. Through comparative ring analysis, distinct disturbance patterns, such as clearing, were detected. Climatic patterns were also detected and compared to historical weather data. This information was used to yield a timeline of climate and disturbances spanning the last two centuries for this stand of pines.

- P84 WOMACK, BRENT AND ROBERT CARTER. Jacksonville State University - An historical perspective on the montane longleaf pine forest of Alabama and Georgia.

A synthesis of research documenting the distribution and structure of montane longleaf pine forests in north Alabama and Georgia is presented. Placing the forest in an historical perspective is important in determining desired future conditions. Records from the 19<sup>th</sup> and early 20<sup>th</sup> centuries indicate that fire was a part of the landscape and perpetuated pine species, especially longleaf, as a component of the forest. Longleaf pine forest dominated ridgetops which burned frequently and was less common on lower slopes and bottomland forest.

P85 ERVIN, GARY. Mississippi State University - Pattern and process during succession of a former beaver pond.

Observational and experimental studies were conducted over a seven-year period of succession in a drained Coastal Plain (W. Alabama) beaver pond. These studies indicate a directional trajectory toward taller stature perennial vegetation, with incipient development of a woody overstory at seven years post-drainage. Experimental investigations during years three and four following drainage demonstrated that shading by the then dominant vascular plant, *Juncus effusus*, influenced strongly the composition of the herbaceous flora within the wetland. Investigations in other Coastal Plain beaver wetlands have suggested a potential facilitative role for *J. effusus* in the establishment of woody and shade tolerant vascular species, further implicating *J. effusus* as a major driver of vegetational succession in this type of freshwater wetland. Data from this successional sere are compared with those from an adjacent, but substantially older, *J. effusus* stand, as an indication of the potential long-term dynamics in *Juncus effusus*-dominated wetlands.

P86 GREIPSSON, SIGURDU. Troy State University - Role of arbuscular mycorrhizal fungi in mediating invasion of native ecosystems in Alabama by non-native plants (privet and kudzu).

Two sites were selected in the Arboretum at Troy State University, AL, where privet (*Ligustrum japonicum*) and kudzu (*Pueraria montana*) are invading the forest. At each site soil and root samples (n=3) were collected across an invading front: (1) resident soil of invading plants, (2) intermediate sites and (3) native ecosystem. Soil (300 ml) was diluted 1:5 with quartz sand before corn was transplanted in pots and grown for four weeks in a greenhouse in order to estimate the mycorrhizal infection potential (MIP) of the soil. The arbuscular mycorrhizal fungi (AMF) root colonization was estimated using the root piece method where 25 root pieces (1 cm) were scored for each plant. AMF root colonization was estimated by staining roots with trypan blue (0.05%). High root colonization was found in the privet and kudzu. In the privet site, the resident soil had significantly the highest MIP followed by soil of the native ecosystem dominated by the Chain fern (*Woodwardia afeolata*) but, no MIP was found in soil in the intermediate site. In the kudzu site, the soil of the intermediate site dominated by grasses had significantly the highest MIP followed by the resident soil of kudzu but, no MIP was found in the native soil of oak dominated forest. These results suggest that invasion of non-native plants into native ecosystems increases the activity of AMF in resident soil. The long term effects of this increased AMF activity needs to be studied further.

P87 BIGGERSTAFF, MATTHEW AND CHRISTOPHER BECK. Emory University - Effects of English ivy (*Hedera helix* L.) on regeneration of vegetation in a southeastern Piedmont forest.

Southeastern deciduous forests are threatened by invasive plants, which can have substantial negative impacts on native flora and fauna. However, the mechanisms of these negative impacts and the lasting effects on forest regeneration after removal of invasive plants are largely unknown. To explore mechanisms for the negative effects of

one invasive, English ivy, on native flora, we determined whether ivy influences the size and diversity of the seed bank and seed rain. In addition, we examined whether ivy has allelopathic effects on germination of *Coreopsis lanceolata* seeds. To determine whether ivy has lasting effects on regeneration of native flora, we compared germination rates of *Coreopsis* in soil from sites with ivy and in soil from sites without ivy. English ivy did not affect the size or diversity of the seed bank or seed rain. However, *Coreopsis* that germinated in the presence of ivy plants did have a marginally significant lower germination rate than seeds germinated without ivy. Yet, we found no residual allelopathic effects on seedling germination. Therefore, even though the seed bank and seed rain are not affected by ivy, once ivy invades it will hinder the germination of the seeds, which will reduce the herbaceous understory, slow the regeneration of the forest, and aid in the establishment of ivy in the site. However, once ivy is removed, it appears that the forest will be able to regenerate naturally with the species that are present around the site that contribute to the seed rain and seed bank.

P88 ALLEN, PHILIP B.<sup>1</sup>, JAKE F. WELTZIN<sup>1</sup>, RICHARD J. NORBY<sup>2</sup>, and JAMES E. BUCKNER<sup>1</sup>. <sup>1</sup>University of Tennessee and <sup>2</sup>Oak Ridge National Laboratory - Simulating multifactor climate change in an old-field grass community: Design, setup, and first year monitoring of the Old-Field Community Climate and Atmosphere Manipulation Project (OCCAM).

Current rates of increasing carbon dioxide (CO<sub>2</sub>) concentration, if continued, will result in changes to key climatic variables such as tropospheric temperature and regional precipitation regimes. Changes to any one of these conditions would have a profound effect on the structure and function of ecosystems, but multiple, and often confounded, environmental variables ultimately will dictate the responses of ecosystems. We are studying whole ecosystem response to multifactor environmental change in an old-field (i.e., abandoned agricultural land) system. Its stature is conducive to whole-system analysis and it contains a mixture of plant functional types, which allows us to investigate species-specific responses, competitive interactions, and the role of biological diversity. In the fall of 2002 experimental old-field communities were constructed within open-top chambers used to manipulate the target climatic and atmospheric variables on the Oak Ridge National Environmental Research Park. In the spring of 2003 we began treatments of ambient and elevated CO<sub>2</sub> (ambient + 300 ppm), ambient and elevated air temperature (ambient + 3 °C), and dry and wet soil moisture conditions (varied amounts of overhead irrigation). Average volumetric water content of surface soil (0-15 cm) was approximately 5% lower under elevated CO<sub>2</sub> than ambient and approximately 5% lower under elevated temperatures than ambient.

P89 SAUNDERS, N. ELIZABETH AND SEDONIA D. SIPES. Southern Illinois University, Carbondale - Pollination ecology of the rare Wyoming endemic, *Abronia ammophila* (Nyctaginaceae).

*Abronia ammophila* Greene (Nyctaginaceae) is a Wyoming endemic known from two small populations along the shores of Lake Yellowstone, Yellowstone National Park (YNP), Wyoming, USA. The populations appear to be limited by suitable habitat. The U.S. National Park Service (USNPS) is gathering information about *A. ammophila* to inform conservation efforts. To this end, we conducted breeding-system experiments on and pollinator observations of *A. ammophila*. Pollination treatments included autogamy, geitonogamy, and near and far outcrosses. We marked and covered immature inflorescences to exclude potential pollinators. We then manually pollinated the mature flowers twice to ensure pollination. Insect pollinators were excluded until fruits had matured and were collected. Early data suggest that *Abronia ammophila* is self-compatible, but not obligately so. We also tested timing of stigma receptivity and pollen viability. We marked and covered immature inflorescences, then pollinated on either the

first, second, or third day after flower maturation. Early data suggest that stigma viability is constant across all days the flower is open. We collected pollen from separate inflorescences on the first, second and third day after flower maturation, stained, and counted viable pollen. Pollen viability is greatest on the first day after flower maturation. We documented pollinator visits by noctuid and sphingoid moths, bees, and wasps. Given the flower morphology, moth pollination is suggested, but bees may also pollinate *A. ammophila*. Pollinators should be included in *Abronia ammophila* conservation efforts.

P90 GUSTAFSON, DANNY<sup>1</sup> AND ROGER E. LATHAM<sup>2</sup>. <sup>1</sup>The Citadel and <sup>2</sup>Continental Conservation - Is the serpentine aster, *Symphytotrichum depauperatum* (Fern.) Nesom, a valid species and actually endemic to eastern serpentine barrens?

Serpentine aster, *Symphytotrichum depauperatum* (Fern.) Nesom, is the "flagship" species of the eastern serpentine barrens, inhabiting 20 of the 26 remaining occurrences of significant size of this globally rare community type and long recognized as its only known endemic species. Previous studies have called into question both the validity of the taxon and its status as a true endemic of the serpentine barrens. We used amplified fragment length polymorphism (AFLP) analysis to compare seven serpentine barrens populations, one alleged diabase glade population, and two populations each of the two species with which *S. depauperatum* is lumped by some authors. Our analysis supports the validity of *S. depauperatum* as a distinct species, which grows almost entirely on shallow soils overlying serpentinite bedrock in Pennsylvania and Maryland, but it confirms an earlier hypothesis that *S. depauperatum* also includes small, disjunct populations on diabase glades in North Carolina.

P91 SLAPCINSKY, JODI<sup>1</sup>, DORIA GORDON<sup>1</sup> AND BOB NELSON<sup>2</sup>. <sup>1</sup>The Nature Conservancy, P.O. Box 118526, Gainesville, Florida 32611 and <sup>2</sup>The Nature Conservancy, P.O. Box 630, Babson Park, Florida 33827 - Central Florida climbing fern control.

Two species of climbing fern are invading Florida's natural systems, threatening both pinelands and hydric communities where they overlap. *Lygodium microphyllum*, old world climbing fern, was originally introduced into southern Florida in the late 1950's. This species can form a meter-thick blanket over the ground and vegetation, effectively covering and displacing native plant and animal species. The area infested by old world climbing fern in Florida quadrupled between 1993 and 2002, to over 110,000 acres. *Lygodium japonicum*, Japanese climbing fern, is moving southward in its distribution and has been observed in locations as far south as Dade County, Florida. *L. japonicum* is also invasive from Texas to North Carolina. Both climbing fern species carry fire into forest canopies and increase the threat of wildfire. The Nature Conservancy and partners are proposing a cooperative, comprehensive program of survey, monitoring and control of climbing fern infestation on public and private lands in central Florida to effectively prevent further northward movement of *L. microphyllum* and further southward invasion of *L. japonicum* by 2006.

P92 DAVIS, CHRISTOPHER. Bowling Green State University – The relationship between mycorrhizal fungi and carnivorous plants of the eastern United States.

Segments of root tips were collected from species of *Sarracenia*, *Dionaea*, and *Drosera* from 12 locations in the eastern United States. Examination of the root tips using light microscopy showed that 92 of 134 individual plants were not associated with fungi, 40 were colonized by non-mycorrhizal fungi, and two had established mycorrhizal associations. The mycorrhizal plants were *Sarracenia psittacina* from the Conecuh National Forest in Alabama, and *Sarracenia leucophylla* from Perdido, AL. In both cases

the symbioses was formed with an arbuscular mycorrhizal fungus (AMF). The AMF forming the mycorrhiza with *S. psittacina* was a species of *Glomus* (Glomales: Zygomycota). The AMF in the root tip of *S. leucophylla* was assigned to the family Acaulosporaceae (Glomales: Zygomycota). Due to the small number of mycorrhizal associations identified in this study, no patterns of association based on plant taxon or environmental variables were determined.

P93 FAULKNER, A. A., S. P. FAULKNER, AND D. L. SUDBRINK. Department of Biological Sciences, Delta State University, Cleveland, Mississippi 38733 - Isolation of a graminicolous leaf spot fungus from the invasive grass, *Microstegium vimineum* (Trin.) A. Camus.

Since its discovery in Tennessee in 1919, Japanese stilt grass (*Microstegium vimineum*, Poaceae) has spread throughout the southeastern U.S. and has even migrated into northern and eastern states. A major threat to native wetland plants, this C4 annual grass thrives in moist, shaded riparian habitats, swamps, moist woodlands and roadsides. Identification of potential biological controls such as fungal pathogens may ultimately lead to effective natural control of this weed. During the fall of 2003, a leaf blight-infected population of stilt grass (approximately 0.5 ha area) was discovered in Warren County, Mississippi, USA. Symptoms included whitish or yellowish elliptical spots, leaf margin chlorosis or necrosis, and water-soaked areas. Spots were often surrounded by purple or yellow haloes. Spots developed into necrotic lesions and lamina eventually withered and died. In an attempt to isolate the pathogen or pathogens, we sampled foliage in late October 2003. Leaves were surface-disinfected by treatment in 0.5% hypochlorite solution. Leaf fragments were plated on 10% unclarified V8 agar. Plates were incubated in the dark at 24 C°. We observed septate hyphae arising from the leaf fragments within about 7 days. In 8-12 days, most plates supported dark-brown conidiophores with dark-pigmented conidia. While specific identification of the organism is ongoing, the distinctive conidia suggest the genus *Curvularia*, an anamorph within the *Cochliobolus* complex (Phylum Ascomycota, Class Euascomycetes, Subclass Loculoascomycetes, Order Pleosporales, Family Pleosporaceae).

P94 PARKER, ERICA E. AND HAROLD W. KELLER. Central Missouri State University - Correlation of pH with assemblages of corticolous myxomycetes in Big Oak Tree State Park, Missouri.

The Great Smoky Mountains National Park (GSMNP) has over 40,000 hectares of old-growth forest in eastern United States. The All Taxa Biodiversity Inventory program aims to inventory all life forms in the Park. This tree canopy biodiversity study represents the first comprehensive inventory of cryptogams (Myxomycetes, macrofungi, mosses, liverworts, lichens, and ferns) in the Park. Students climbed a total of 240 trees representing 35 tree species during two three-week periods the summers of 2000 and 2001. The double rope climbing technique was used to reach the tree canopy. Preliminary results suggest that the Myxomycetes are the only group of tree canopy cryptogams with some species found only on bark and epiphytes of living trees. Ninety five myxomycete species were harvested mostly from moist chamber cultures derived from bark samples taken from the tree canopy, and included 52 new records for the Park. A new species of *Diachea* was restricted to heights above 6 meters; the first upper tree canopy species documented for the Myxomycetes. A total of 2007 samples from 141 trees yielded 194 lichen taxa from the canopy with 83 new records for the park accessions list. *Gomphillus americanus*, a new lichen record for the Park and Tennessee, had conspicuous, stalked hyphophores with stellate tips. This crustose lichen was abundant at about 15 meters on the trunk of a living *Fraxinus americana* tree. This project was funded by the National Science Foundation, Biotic Surveys and Inventories Program, Award DEB-0079058 and Discover Life in America Awards 2001-26 and 2002-17.

- P95 JONES, JENNIFER<sup>1</sup>, JASON HUNT<sup>1</sup>, MATT WILSON<sup>2</sup>, and T. WAYNE BARGER<sup>1</sup>. <sup>1</sup>Tennessee Technological University and <sup>2</sup>University of West Georgia - Various *Pteris* species as possible bioremediators of arsenic contamination.

Few plants have been found to hyperaccumulate noxious elements from the environment. The plants that accumulate these elements typically do so at very low levels, or in parts of the plant that makes bioremediation a difficult task. The most notable exception to this was the published report in Nature, February 2001 of *Pteris vittata* (Chinese Ladder Brake Fern) sporophytes by Lena Ma of the University of Florida as a hyperaccumulator of arsenic in the fern's fronds. We have conducted many experiments on both gametophytic and sporophytic *Pteris vittata* plants to identify possible differences in sensitivity or hyperaccumulation abilities that may occur throughout the fern's lifecycle. In addition, the precise cellular location of arsenic sequestration within the cell, root growth experiments, and total carbon assimilation for *Pteris vittata* have also been assessed. Other *Pteris* species were also analyzed for possible hyperaccumulation of arsenic as well.

- P96 HOVSEPYAN, A. AND S. GREIPSSON. Department of Biological and Environmental Sciences, Troy State University, Troy, AL 36082 - Effects of the fungicide benomyl on phytoextraction by corn of lead contaminated soil.

Lead (Pb) contamination in soils can result in a number of environmental problems such as loss of vegetation and toxic effects in animals and humans. Phytoextraction is an emerging technology that uses plants to clean up metal polluted soils. Arbuscular mycorrhizal fungi (AMF) play a key role in the uptake of metals by plant roots. The role of AMF in phytoextraction of Pb contaminated soil can be estimated by suppressing AMF activity using a fungicide (benomyl). For this purpose, corn was grown in soil at four Pb levels: (1) no Pb, (2) low (10 ppm), (3) medium (100 ppm), and (4) high (500 ppm). At each Pb level, corn was grown without (control) and with benomyl. Benomyl affected AMF root colonization; benomyl treated plants had significantly lower AMF root colonization than control plants at high and medium Pb exposures. As expected, AMF increased phosphorus (P) uptake; control plants had significantly higher P concentrations in leaves than benomyl treated ones at low and medium Pb exposures. The AMF played a role in uptake of metals; benomyl treated plants had significantly higher concentrations of Pb than control plants at low Pb exposure. Furthermore, control plants had significantly higher concentrations in leaves of zinc and of copper than benomyl treated plants at low and medium Pb exposures. The results suggest that the role of AMF in heavy metal uptake is metal specific.

- P97 HOVSEPYAN, A. AND S. GREIPSSON. Department of Biological and Environmental Sciences, Troy State University, Troy, AL 36082 - Effects of EDTA on phytoextraction by corn of lead contaminated soil.

Heavy metal (HM) contamination of soils is a major environmental problem. In particular, lead (Pb) toxicity has detrimental effects on plants and animals. Phytoextraction is an emerging cost-effective technology that uses plants for HM remediation of soils. Supplementing soil with synthetic chelating agents such as EDTA can increase HM bioavailability in soil. The role of EDTA in Pb uptake by corn grown in soil contaminated with 500 ppm of Pb was examined. Plants were subjected to four EDTA levels: (1) control (0 mmol kg<sup>-1</sup>), (2) low (0.5 mmol kg<sup>-1</sup>) (3) medium (1.0 mmol kg<sup>-1</sup>), and (4) high (2.5 mmol kg<sup>-1</sup>). Lead concentrations in leaves increased with increased EDTA levels; however, Pb concentrations were significantly higher in plant roots than in leaves indicating low translocation of Pb within plants. Iron (Fe) concentrations were significantly higher in roots than in leaves indicating low Fe translocation within plants. Corn subjected to high EDTA



showed high P translocation within plants. Therefore, it was not only the high concentration of Pb in leaves that caused the toxic effects of plants subjected to high levels of EDTA but also the high internal concentrations of P in leaves which can complex Fe and make it unavailable for important chemical reactions within plants.



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# Southeastern Naturalist

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2003

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## NEWS OF BIOLOGY IN THE SOUTHEAST

Leon Jernigan – *News Editor*  
Department of Biology  
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### ABOUT PEOPLE AND PLACES

#### NORTH CAROLINA

The Highlands Biological Station is offering a diverse selection of courses for the summers of 2004 and 2005. Some of the topics for 2004 include salamanders, mammals, spiders, fungi, insect behavior, and quantitative methods. Tentative topics for 2005 include amphibians, mayflies/stoneflies/caddisflies, conservation biology, forest ecosystems, bryology, and vascular plants. A variety of sources of funding or financial support are available. For additional information, contact Dr. Robert Edward Wyatt, Executive Director, Highlands Biological Research Station, P. O. Box 580, Highlands, NC 28741. Telephone: 828-526-2602. E-mail: wyatt@email.wcu.edu.

#### Deadlines for the submission of “news.”

January issue: October 28  
April issue: January 13

September issue: July 13  
December issue will not contain “news”



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## **ASB WELCOMES NEW PATRON MEMBER THOMSON LEARNING-BROOKS/COLE!**

On behalf of the entire ASB membership, the ASB Executive Committee would like to welcome our newest Patron Member Thomson-Learning Brooks/Cole. Thomson Learning-Brooks/Cole joined ASB this past April at the Washington, D.C. meeting while displaying their textbooks as an exhibitor. Since joining, Thomson Learning-Brooks/Cole has become very active and a very important part of ASB. For example, starting at the Memphis meeting in 2004, they will be the sole sponsor of what was once called the "ASB Student Research Award in Aquatic Biology" (some may remember this award by its even older name, "The Wildco Student Research Award in Aquatic Biology"). The award will now be called the "Brooks/Cole Student Research Award in Aquatic Biology" and Thomson Learning-Brooks/Cole will provide the \$200.00 cash prize for the award. And that's not all! Also starting with the 2004 meeting, Thomson Learning-Brooks/Cole will be providing honorable mention book prizes for up to three student papers participating in the ASB Student Research Award sponsored by Martin Microscope Company. Each honorable mention will be for \$200 worth of books at retail value. As the award's sponsor, Patron Member Martin Microscope Company generously agreed to raise the cash value of this award to \$1,000.00 and also make available these honorable mention awards for Thomson Learning-Brooks/Cole.

In addition to awards, Thomson Learning-Brooks/Cole will also sponsor a symposium entitled "Microbiology Practitioners and Educators" at the Memphis meeting. Their intention is to unite information from educators and practitioners in current topic areas like bioterrorism, AIDS, Ebola and other diseases, *etc.* They will be flying in representatives from the CDC, and prominent microbiologists from the University of California Davis, Penn State, and elsewhere.

Finally, starting with the 2005 meeting in Florence, AL., Thomson Learning-Brooks/Cole will be sponsoring a new \$500.00 cash award for outstanding research in the areas of Microbiology/Cell Biology/Genetics/Physiology. ASB is underrepresented in these disciplines and Thomson Learning-Brooks/Cole would like to help us increase our membership representation in these areas by sponsoring this award.

We certainly welcome Thomson Learning-Brooks/Cole to ASB, but we would especially like to thank them for becoming such an active and supportive participant. Without our Patron Members, ASB could never achieve its stated purpose of promoting the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. Thanks Thomson Learning-Brooks/Cole and all of our ASB Patron Members!

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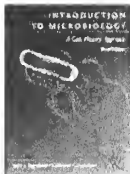
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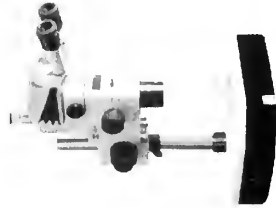


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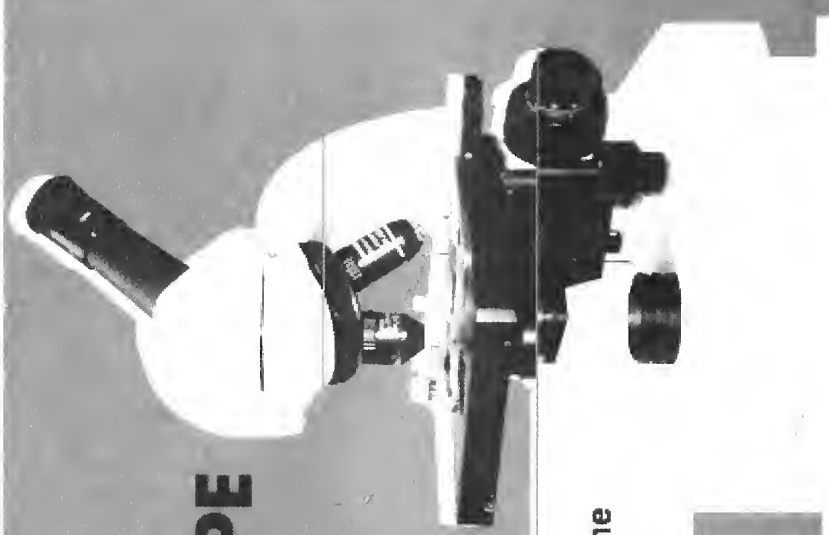
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