



CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont, CA 91711

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January, 1989

COOPERATION - THE KEY TO PLANT HABITAT CONSERVATION
ON THE SAN BERNARDINO NATIONAL FOREST

by

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Introduction

The San Bernardino National Forest is taking steps to insure the long term conservation of the unique Pebble Plains habitat in the Big Bear area. This will be accomplished through habitat protection, monitoring, and interpretation. Forest Service personnel are working with The Nature Conservancy and the California Department of Fish and Game to develop monitoring and interpretive plans. The purpose of this article is to describe the habitat protection efforts that involved cooperation between special interest groups with different values and goals.

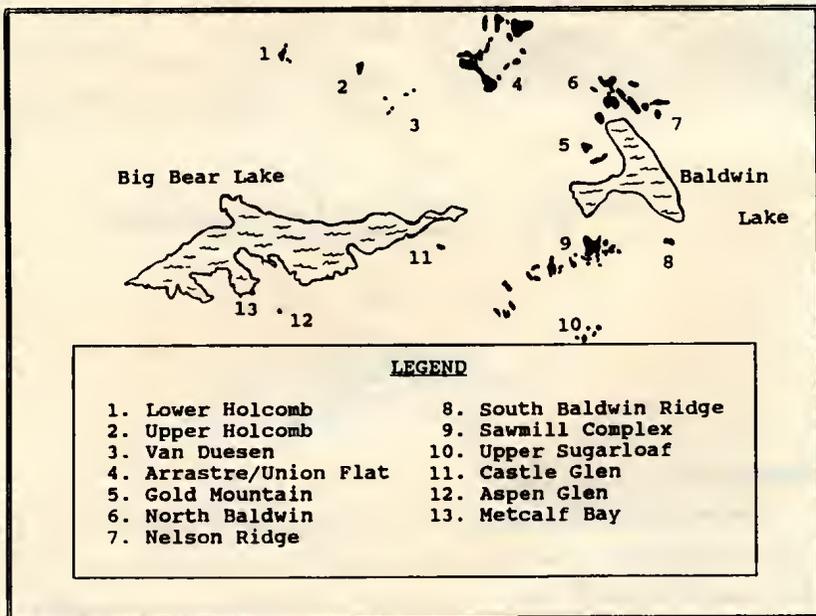
The Big Bear Pebble Plains (previously known as "pavement plains") habitat was first described by Jeanine Derby in 1979. Krantz (1981, 1987) has also documented the significance and limited distribution of this habitat. There was once an estimated 700 acres of this relict alpine community in the Big Bear area. Much of this was lost by inundation when Big Bear Lake was formed in the late 1800's. Acreage continues to be lost to urbanization on private land and impacted by a variety of recreational uses on public land. Approximately 343 acres remain on National Forest Land and 99 remain on private land.

see also p. 5

Protection Projects

By the end of December the Forest Service will have completed three separate Pebble Plains protection projects this year: Gold Mountain (45 acres), Arrastre Flat / Union Flat (150 acres) and Nelson Ridge (27 acres) (Figure 1). Both Forest Service System roads and unauthorized vehicle use have impacted these sites.

Figure 1. Pebble Plain locations.



The Gold Mountain Road passed through 2 large Pebble Plains. The road was relocated away from one plain and access to the other was blocked. This road relocation was completed in June of this year with funding from the California Green Sticker program. Green Sticker money is collected when people register non-street legal vehicles.

Arrastre Flat and Nelson Ridge have been protected by temporary road closures since December, 1987. Projects that will provide long-term habitat protection were recently approved. Funding for these two projects comes from the California Environmental License Plate program which is administered by the

California Department of Fish and Game. When completed, these efforts will protect a total of 222 acres of Pebble Plain habitat. This represents 64% of the total acreage on National Forest Land. An additional 77 acres has already been protected by The Nature Conservancy, the Forest Service and by Pleueas-Stauffer (California), Incorporated (a limestone mining company). Thus, by the close of this year, 87% of the Pebble Plain habitat on National Forest Land will be protected.

Because road closures on public lands in the Big Bear area have been so controversial, Environmental Assessments (EA) were completed for both the Arrastre Flat / Union Flat Project and the Nelson Ridge Project. As an extension of the public scoping and involvement requirements of the National Environmental Policy Act (NEPA), the Forest Service formed ad hoc committees composed of interested agencies, special interest groups and individuals. The following groups and persons were represented on the committees: the Big Bear Trail Riders Motorcycle Club, the California Association of Four Wheel Drive Clubs, the California Department of Fish and Game, the Friends of the Big Bear Valley Preserve, the Sierra Club, and one local resident. These advisory committees reviewed the project goals and alternatives and toured the project sites. The committees gave input on issues and concerns related to alternatives the Forest Service developed. Everyone had the opportunity to comment on each alternative and to suggest alternatives we had not yet thought of. Once input was received from the committees, the Forest Service completed the NEPA process independently.

As a result of the Arrastre Flat ad hoc committee, the two OHV clubs involved supported the closure of 4.9 miles of road through the sensitive areas. The environmental groups, on the other hand, could see the benefit of providing a 1.5 mile alternate route around the closed area. This reroute will provide a legal way for non-atreest legal vehicles to travel between two extremely popular routes: the John Bull Trail and the road to Burnt Flat. This alternative route will reduce the temptation of cutting through the closure to access one route from the other. Another benefit is that the OHV groups are now aware of the significance of the unique flora of the Big Bear area and are willing to help us conserve it. This win-win situation is a far cry from the traditional OHV user vs. Environmentalist confrontations.

Conclusion

Ad hoc committees are often viewed as taking up a great deal of time and effort. Its true, they do! While they may lengthen the environmental analysis procedure initially, in the long run this type of advisory committee may shorten it. Special interest groups are less likely to appeal decisions if they are involved along the way. This can save countless hours of responding to appeals and resolving conflicts. In addition, we can count on personal commitment from at least the members of the groups involved to support the closures once they are in effect. Finally, a certain amount of trust is established as we learn how to take into account and balance the needs and goals of different special interest groups, while conserving unique resources.

The results of this process show that it is possible for people with very different values and interests to work together to conserve sensitive species and their habitat. It is also clear that conservation does not need to exclude all other uses. We are continually striving to encourage forest use in the most appropriate places. In this case, while the Forest Service recognizes vehicular recreation as a legitimate use of National Forest Land, it may not always be appropriate to allow this type of use in all areas. In general, many Forest Service resource management activities are limited or excluded in sensitive habitats.

The type of cooperation developed in ad hoc committees and other similar types of groups will become more and more important as the population of southern California continues to grow and more demands are placed on our natural resources.

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THE VASCULAR PLANTS OF ISLA SAN MARTIN
BAJA CALIFORNIA, MEXICO

Robert F. Thorne and Steven A. Junak

Rancho Santa Ana Botanic Garden, Claremont, CA 91711 and
Santa Barbara Botanic Garden, Santa Barbara, CA 93105

This list of the vascular plants of Isla San Martin is based mostly on collections or observations by Robert F. Thorne, serving as naturalist on the fishing cruiser Qualifier 105, on three whale-watching expeditions to the west coast and islands of Baja California on January 31-February 6, 1985, February 15-22, 1986, and February 3-10, 1987, and on a biological expedition to this island and Islas Guadalupe and Cedros March 27-April 2, 1988, and by Steven A. Junak also on the last expedition and earlier trips to the Mexican islands in April 1980, June 1983, February 1985, and March 1987. A few taxa not observed on these trips are listed fide R. V. Moran, R. N. Philbrick, or M. R. Benedict. The help of these botanists is greatly appreciated. A preceding * denotes species believed to be introduced on the island. Vouchers are mostly filed at RSA, SBBG, BCMEX, MEXU, and SD.

Elevations vary from sea level to ca. 160 m and the coordinates are approximately lat 30 deg 29 min N and 116 deg 07 min W. This volcanic island is nearly circular in shape and about 1.45 km in area. It lies about 2.7 km off the mainland at Playas de San Quintin. The vegetation is primarily maritime desert scrub on the lava and salt-flat succulent, coastal dune sand plant, and surfweed communities on the fringing salinas, dunes, and tidal rocks.

Aizoaceae

**Mesembryanthemum crystallinum* L.

Alliaceae

Dichelostemma pulchellum (Salisb.) Heller

Asteraceae

Amauria rotundifolia Benth.

Amblyopappus pusillus Hook. & Arn.

Ambrosia chamissonis (Less.) Greene

Coreopsis maritima (Kell.) Hall

Encelia californica Nutt.

Gnaphalium bicolor Bioletti

Microseris lindleyi (DC.) A. Gray [*M. linearifolia* (Nutt.) Sch.Bip.]

Perityle emoryi Torr.

Rafinesquia californica Nutt.

Senecio lyonii A. Gray

**Sonchus oleraceus* L.

**Sonchus tenerrimus* L.

Boraginaceae

Amsinckia inepta Macbr.

Cryptantha intermedia (A. Gray) Greene

Heliotropium curassavicum L. ssp. *oculatum* (Heller) Thorne

Brassicaceae

**Cakile maritima* Scop.

Descurainia pinnata (Walt.) Britt. ssp. *halictorum* (Cockl.) Detl.

Lepidium lasiocarpum Nutt. ex t. & G.

Cactaceae

Bergerocactus emoryi (Engelm.) Britt. & Rose

Echinocereus maritimus (M. E. Jones) K. Schum.

Ferocactus fordii (Orcutt) Britt. & Rose ssp. *fordii*

Mammillaria hutchinsoniana (Gates) Boed.

Myrtillocactus cochal (Orcutt) Britt. & Rose

Opuntia prolifera Engelm.

Stenocereus gummosus (Engelm.) Gibson & Horak

Chenopodiaceae

- Aphanisma blitoides Nutt.
- Arthrocnemum subterminale (Parish) Standl.
- Atriplex julacea S. Wats.
- Atriplex leucophylla (Moq.) D. Dietr.
- Atriplex pacifica A. Nels.
- *Atriplex semibaccata R. Br.
- Atriplex watsonii A. Nels.
- Chenopodium flabellifolium Standl.
- *Chenopodium murale L.
- Salicornia virginica L.
- Suaeda californica S. Wats.

Convolvulaceae

- Calystegia macrostegia (Greene) Brummitt ssp. macrostegia
- Cuscuta californica Hook. & Arn.

Crassulaceae

- Crassula connata (R. & P.) Berger in Engler & Prantl (Tillaea erecta Hook. & Arn.)
- Dudleya anthonyi Rose
- Dudleya anthonyi Rose x D. cultrata Rose
- Dudleya cultrata Rose

Cucurbitaceae

- Marah macrocarpus (Greene) Greene

Euphorbiaceae

- Chamaesyce polycarpa (Benth.) Millsp. var. hirtella (Boiss.) Millsp.
- Euphorbia misera Benth.

Fabaceae

- Lotus scoparius (Nutt. in T. & G.) Ottley ssp. watsonii (V. & R.) Greene [L. watsonii (V. & R.) Greene]
- Lupinus sparsiflorus Benth. ssp. pondii (Greene) Dziek. & Dunn

Geraniaceae

- *Erodium cicutarium (L.) L'Her. ex Ait.
- *Erodium moschatum (L.) L'Her.

Hydrophyllaceae

- Phacelia ixodes Kell.
- Phacela parryi Torr.
- Pholistoma racemosum (Nutt.) Const.

Malvaceae

- *Malva parviflora L.

Nyctaginaceae

- Abronia maritima Nutt.
- Mirabilis californica A. Gray var. cedrosensis (Standl.) Macbr.

Onagraceae

- Camissonia californica (Nutt. ex T. & G.) Raven
- Camissonia cheiranthifolia (Hornem. ex Spreng.) Raimann ssp. suffruticosa (S. Wats.) Raven

Papaveraceae

- Eschscholzia ramosa Greene
- Stylomecon heterophylla (Benth.) Tayl.

Poaceae

- *Avena fatua L.
- Bromus arizonicus (Shear) Stebbins
- *Bromus rubens L.
- Bromus trinii Desv. in Gay
- Distichlis spicata (L.) Greene ssp. stolonifera (Beetle) ined.
- *Hordeum leporinum Link
- *Lamarckia aurea (L.) Moench.
- Melica imperfecta Trin.
- Monanthochloe littoralis Engelm.
- Muhlenbergia microsperma (DC.) Kunth
- *Triticum aestivum L.
- Vulpia microstachys (Nutt.) Munro ex Benth. var. pauciflora (Scribn. ex Beal) Lonard & Gould
- Vulpia octoflora (Walt.) Rydb. var. hirtella (Piper) Henr. (Festuca octoflora Walt. ssp. hirtella Piper)

Polygonaceae
 Pterostegia drymarioides F. & M.
 Portulacaceae
 Calandrinia ciliata (R. & P.) DC. var. *menziesii* (Hook.) Macbr.
 Calandrinia maritima Nutt. in T. & G.
 Claytonia perfoliata Donn.
 Rubiaceae
 **Galium aparine* L.
 Scrophulariaceae
 Antirrhinum nuttallianum Benth. in DC. ssp. *subsessile* D. Thomps.
 Solanaceae
 Datura wrightii Regel (D. *inoxia* Mill.)
 Lycium andersonii A. Gray
 Lycium brevipes Benth.
 Lycium californicum Nutt. ex T. & G.
 Nicotiana cleveandii A. Gray
 *Solanum americanum Mill.
 Solanum palmeri Vasey & Rose
 Urticaceae
 Hesperocnide tenella Torr.
 Parietaria hespera Hinton ssp. *hespera* (P. *floridana* auct.)
 Zosteraceae
 Phyllospadix scouleri Hook.
 Phyllospadix torreyi S. Wats.
 Zostera marina L.

Updated 27 May 1988

FIELD TRIPS

February 11 (Saturday) 9:30AM to dusk. Fungus foray, Rancho Mission Viejo. Walt Wright will lead this field trip to look at plants (vascular) and fungi in the oak woodlands found on the Rancho Mission Viejo. Take the San Diego freeway (5) south, to the Ortega Highway (74) and go east about 5 miles. We will meet at the large yellow gates on the south side of Ortega Hwy. (Cristianitos Rd.), which is about 1/4 mi. before (west) the entrance of Caspers Park. For additional information call the LA Mycological Society at (213) 292-1900.

February 12 (Sunday) 10:00 AM to 5:00 PM. Mycological Faire.
 The LA Mycological society will hold a series of demonstrations, displays and lectures on common fungi of southern California at the Orange County Natural History Museum. To reach the Museum take the San Diego Freeway (405) to Jamboree and turn right (south). Continue south to Eastbluff Dr. Turn left on Eastbluff, go past Corona del Mar high school to Vista del Oro. Turn right and look for the Museum on the left (2627 Vista del Oro). For additional information call the LA Mycological Society at (213) 292-1900.

February 18 (Saturday) Tentative Desert Field Trip *

Dave Charlton may lead a field trip in the Mojave desert for the Riverside Chapter of CNPS. For additional information send an SASE to Dave Charlton 427 Canoe Cove Dr., Diamond Bar CA 91765.

February 25, 26 (Saturday and Sunday) Fungus forays and Faire.

The LA Mycological Society will hold a number of forays in Los Angeles and potentially Orange Counties to look for mushrooms and other fungi. A faire to display these fungi with lectures and demonstrations will be held on Sunday at the LA Arboretum. For details contact the LA Mycological Society at (213) 292-1900.

March 5 (Sunday) 9:30AM to 3:00PM. Moro Canyon, Crystal Cove State

Park. Fred Roberts will lead this trip to examine coastal sage scrub, oak woodland and riparian vegetation in the Sycamore Mills. To reach the park take the San Diego Freeway (405) to McArthur and go right (south). Continue on McArthur to the Pacific Coast Highway (PCH) and turn left (southeast). Continue south on PCH to the sign for the Moro Cyn parking lot and visitors center. Turn left and drive to the visitors center where we will meet. Bring water and a sack lunch.

March 12 (Sunday) 9:00AM to 3:00PM Santa Ana River

Walt Wright will lead this trip to examine the alluvial sage scrub, Juniper woodland, and riparian plant communities associated with the upper Santa Ana River. We will also examine populations of the federally endangered Santa Ana woolly star and the slender-horned spine flower. Take the San Bernardino freeway east to Redlands. Go north on Tennessee (new Hwy 30) and go east on Fifth St. Continue east onto Greenspot Rd for about six miles. We will meet on Greenspot just before the bridge that crosses the Santa Ana River. For additional information call D. Brawlet (714) 549-0647.

April 1 and 2 (Saturday and Sunday). Anza-Borrego Desert Weekend.

Erik Jonsson will lead this trip to look for desert wildflowers in the park. It is too early to determine the exact areas we will visit but we will dry camp somewhere within the park. Be prepared for hot weather and bring along plenty of water. Must have containers for two quarts of water on Sat. afternoon, boots and camping gear. We will meet at 10:00 AM on Sat. at Scissors Crossing- junction of SR-78 and S-2 (San Diego County). Trip will end about noon on Sunday. If you plan to attend, call or write: Dave Bramlet, 1691 Mesa Dr. No. A-2, Santa Ana CA 92707, (714) 549-0647.

April 14-16 (Friday-Sunday) Death Valley-Ash Meadows Field Trip

This is a Nature Conservancy and CNPS field trip to examine some of the unique plants in Ash meadows and Death Valley. Ash meadows is a large desert oasis, now a National Wildlife refuge, which contains some B plant species listed as endangered or threatened. We will also examine Devil's hole, and view several species of pupfish in this unique environment. If you are interested in the trip please send a SASE to : Bob Love, P.O. Box 1006 Yorba Linda CA 92686.

April 23 (Sunday) Tentative Trip Santa Ana Mtns.

This trip may examine some burn areas in the Santa Ana Mtns. (possibly Chiquito Basin or along the Ortega Highway) or will go to the Santa Rosa Plateau to examine vernal pool flora. Please send an SASE to D. Bramlet, 1691 Mesa Dr. A-2, Santa Ana CA 92707 to see if the trip is still planned.

April 30 (Sunday) 9:00 AM Marford Springs Park, Riverside Co.

Steve Boyd of the Rancho Santa Ana Botanical will lead this trip to see the unique flora found in the Gavilan Mills. We will examine the Juniper woodlands found in this area and look for Munz's onion, Paysen's calanthus and other rare species. Take the 91 freeway east to the 15 and go south. Turnoff at Cajalco Rd. and go east to Gailan Rd. Go south on Gavilan Rd. to Ida Leona Rd (1st left past the trailer park) and meet at the top of the rise on Ida Leona. Bring water and a sack lunch. Please call D. Bramlet (714) 549-0647 for further details.

May 6-7 (Sat-Sun) Cacti Field Trip Dana Pt. to Hemet

This trip will examine various cacti along the coastal and inland areas. We shall encounter most of the taxonomic segregates of the highly complex populations of native prickly pear cactus (Opuntia), and note the possible influence that the introduced mission cactus may have played on present Opuntia populations. Route is from Dana Harbor to Hemet, over Ortega Highway to the Temecula region of southern Riverside County. We will camp on Sat. night at the Casper's Regional Park. We will meet at 8:30 at Dana Pt. Harbor, at the corner of Del Obispo St and Ensenada Place. Bring camping gear, food and water. Be prepared to pay a camping fee at the park.

May 14 9:00 AM to 4 PM Santiago Peak, Santa Ana Mountains

This trip will be to examine the flora in the upper elevations of the Santa Ana Mountains. We will be examining chaparral, Coulter pine forests and mixed evergreen woodlands. We will be taking the main divide truck trail, which, depending when road work is scheduled may not always be suitable for passenger cars. From the Newport freeway (55) take Chapman Ave, and exit east. Follow Chapman to Santiago Canyon Rd. (S1B) and go right on S18. Continue on S18 and go east onto Silverado Canyon Rd. Go to the end of Silverado Cyn. Rd, where it is blocked by a gate. Bring lunch and water. Since road conditions may change due to late rains, please send a SASE to D. Bramlet, 1691 Mesa Dr. A-2 Santa Ana CA 92707 for details.

May 19-21 (Fri-Sun) Desert Studies Center at Soda Springs (Zzyzx)

This trip will probably examine some of the unique desert, black brush scrub and juniper woodland flora in the Clark Mtns., since most the lower elevations will have completed flowering. If time permits we may go further onto the mountain to look for limestone endemics. Space is limited and Al Romspert must receive reservations for the facility by May 1. A cost of approximately \$15 per person will be charged for use of the center. To make reservations call Al at (714) 773-2428.

1989 ELECTION RESULTS
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The board would like to thank all SCB members who took the time to vote. The process of voting is very important in the continuance of the Southern California Botanists as a functioning organization.

ANNOUNCEMENTS

Field Trip Leaders. Southern California Botanists are always looking for new field trip ideas. If you have an idea for a field trip, please call Dave Bramlet at (714) 549-0647. Call with your idea, even if you don't want to be the leader.

San Diego County Floras. A few copies of the San Diego County Flora by Mitch Beachamp are still available. The price, including tax and shipping is \$23.20. Send your check to:

Alan Romsper
Dept. of Biological Science
California State University, Fullerton
Fullerton, CA 92634

Operation Phoenix is a partnership of individuals and organizations that have been formed to work together toward resource recovery on fire damaged land. The opportunities are basically two-fold; man power to complete the tasks, and financial support to provide materials and supplies.

Volunteer work will involve tree planting, tree plantation maintenance, stream rehabilitation and other projects. Of 700,000 acres burned during the summer fire siege of 1987, approximately 250,000 acres of devastated forest will need helping hands to heal the land. The local work to be done includes one area in Trabuco and the Cleveland National Forest.

The U.S. Forest Service, the California Department of Forestry and Fire Protection, and the BLM are agencies involved in this project. If you are interested in helping in any way, call Gus and Frieda Kinoshita, at 974-1639, and they will forward additional information to you.

Trailbuilding in southern California. Each weekend the Sierra Club (and associated environmental groups) sponsors volunteer trail building. You can take part by helping for a day, a weekend or becoming a regular. Call the Sierra Club Trails Coordinator for the Mountain Range in which you want to work. Sierra Club membership is not required. Santa Monica Mountains, call Ron Webster, (213) 451-1231; San Gabriel Mountains (Angeles N.F.), call Charles Jones, (818) 352-9611; Santa Ana Mountains, call Ken Croker, (714) 546-7016.

Amateur and Professional Botanists. The journal of the Southern California Botanists, CROSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript to:

Dr. Allan Schoenherr
Division of Biological Sciences, Fullerton College
321 E. Chapman Avenue
Fullerton, CA 92634

Sierra Club Outings

The Sierra Club is sponsoring several desert outings to Wilderness Study Areas (WSA). For information about the trips, call (619) 942-8692. The following trips are scheduled:

March 11	Jacumba Mtns WSA
April 15	Sawtooth Mtns WSA

UPPER NEWPORT BAY NEEDS YOUR HELP

Upper Newport Bay has survived threats from development and from siltation. Now the reserve faces another threat - the destruction of native plant communities by the invasion of several species of weedy exotic plants which have escaped from cultivation. The most important and potentially damaging species are pampas grass, castor bean and ice plant. These aggressive weeds are rapidly displacing native species along the shores of the bay itself, as well as in the surrounding riparian and coastal sage scrub communities.

We must act soon to protect the fragile plant communities which are becoming increasingly rare in Southern California, and which provide food and shelter for the bay's wildlife. The Department of Fish and Game can use the help of teams of volunteers in a program of weed control.

Volunteers are needed for the physical work of removing weeds and for mapping and photographic documentation of progress of the work. Donations and the loan of equipment will also be appreciated.

If you can join a team to start this important work, please notify:

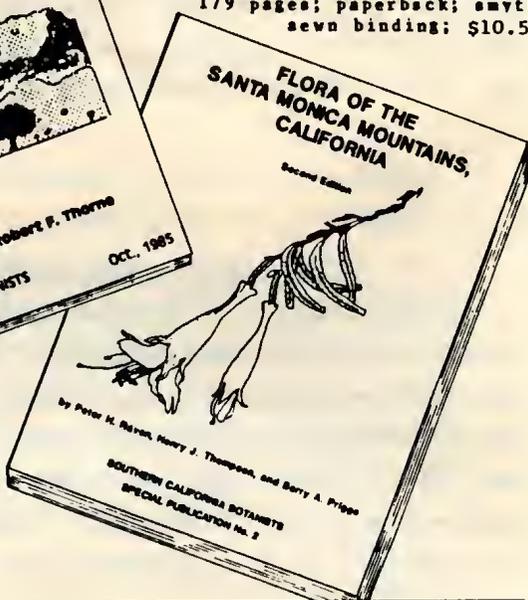
Greg Gerstenberg
615 S. Grand Avenue
Orange, CA 92666

Two revised floras from the Southern California Botanists



A FLORA OF THE SANTA ROSA PLATEAU, SOUTHERN CALIFORNIA. By Earl W. Lathrop and Robert F. Thorne. 39 pages; paperback; comb binding; \$7.00

FLORA OF THE SANTA MONICA MOUNTAINS, CALIFORNIA. By Peter H. Raven, Henry J. Thompson, and Barry A. Priggs. 179 pages; paperback; Smyth sewn binding; \$10.50



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SOUTHERN CALIFORNIA BOTANISTS

Rancho Santa Ana Botanic Garden
1500 North College Avenue
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The purpose of the SOUTHERN CALIFORNIA BOTANISTS is the study, preservation and conservation of the native plants of California; and the education of the public to the value of the native flora and its habitats. It is a non-profit association formed in 1927.

Membership benefits include:

Various field trips throughout the state led by competent field botanists and biologists.

A yearly plant sale featuring native California species.

An annual symposium on various aspects of the California vegetation.

The SCB Journal, CROSSOSOMA.

Discounts on botanical and natural history books.

Membership categories are:

<input type="checkbox"/>	Individual*	\$ 8.00	<input type="checkbox"/>	New Member
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*Includes membership for entire family.

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In addition, I want to give \$ _____ to help support SCB.

Make check payable to: SOUTHERN CALIFORNIA BOTANISTS.
Mail check and form to:

Alan P. Romsper
Southern California Botanists
Department of Biological Science
California State University, Fullerton
Fullerton, CA 92634

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February 11	Fungus Foray, R. Mission Viejo
February 12	Fungus Faire, Nat. Hist. Mus.
February 25	Fungus Foray and Faire
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April 1&2	Ana-Borrogo State Park
April 14-16	Ash Meadows, Nevada
April 22	Santa Ana Mtns. (Tentative)
April 30	Harford Springs Park
May 6-7	Dana Pt. to Hemet, Cactus Trip
May 14	Santiago Peak
May 19-21	Soda Springs (Zzyzx)

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LAST ISSUE

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SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont, CA 91711

CROSSOSOMA Vol. 15, No. 2
Managing Editor: Allan Schoenherr

April 1989

ANOTHER NEW LOCALITY FOR THE DESERT FAN PALM IN CALIFORNIA

James W. Cornett
Natural Science Department
Palm Springs Desert Museum

Native groves of desert fan palms (*Washingtonia filifera*) are isolated and widely scattered throughout the Sonoran Desert of southeastern California, Baja California Norte, and western Arizona. The location of most of these are known (Brown et al., 1976; Cornett, 1987, 1988a, 1988b, 1989a, 1989b; Henderson, 1951, 1971).

On 12 December 1986, the author found 4 mature (fruit-producing) and 4 immature desert fan palms growing at Sacramento Spring, near Needles, San Bernardino County, California (Lat. 34° 54' 02"; Long. 114° 46' 09"; Figure 1). Four of the palms had a trunk height between 2 and 4 m and four exceeded 4 m in height. All of the palms appeared in good condition having successfully emerged from the dense surrounding vegetation with full crowns and brilliant green fronds. Associated perennial species (in descending order of coverage) were cattle spinach (*Atriplex polycarpa*), mesquite (*Prosopis glandulosa*), arrowweed (*Pluchea sericea*), salt grass (*Distichlis spicata*), tamarisk (*Tamarix ramosissima*), alkali goldenbush (*Haplopappus acradeni*), common reed (*Phragmites australis*), mistletoe (*Phoradendron californicum*) and catclaw (*Acacia greggii*).

see also p. 5

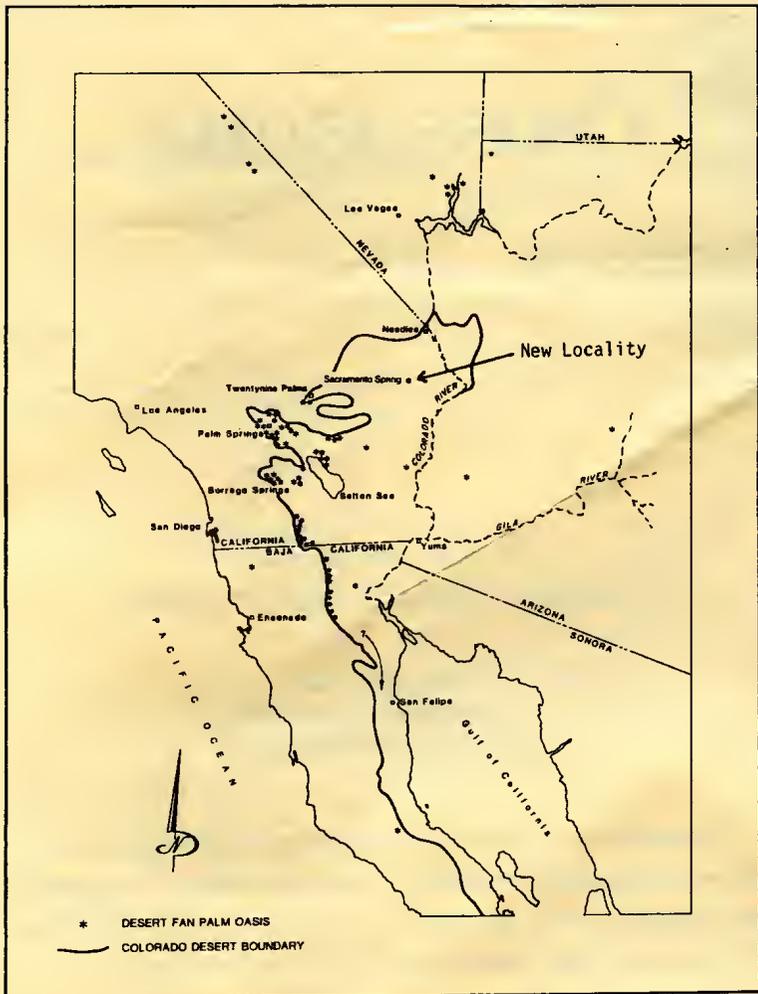


Figure 1. Distribution of Desert Fan Palms

The author was unable to locate any literature reference to wild palms being present at or near the site. The closest desert fan palm oasis lies 70 km to the south at Mopah Spring in the Turtle Mountains. The lack of dead palms (erect or prone), the absence of any palms approaching the maximum height of the species (about 25 m) and the 1:1 ratio of young to adult palms suggest the palms at Sacramento Spring are of recent origin. Suzie Anderson (pers. comm.) of Needles recalled that the palms were already established when she first visited the spring in 1963. John Farmer (pers. comm.), also of Needles, first visited the spring in 1922 and stated that there were no palms present at that time. He believed the palms were planted by humans sometime in the early 1960s.



Figure 2. California Fan Palm at Sacramento Spring

The palms were located in a gully created by occasional flows from Sacramento Spring and a small, local watershed (Figure 2). The elevation of the site was 384 m and January minimum temperatures are said to occasionally drop below freezing (Suzie Anderson, pers. comm.). The palms were growing in fine moist silt.

Sacramento Spring appears to be the most recent establishment and also one of the most northerly occurrences of *W. filifera* in the California deserts. The presence and apparent reproductive success of this species documents that conditions are suitable for its existence at the present time. This is the fourth discovery of *W. filifera* noted well to the north of its historical range as described by Munz (1959) and Brown et al. (1976). As is the case with Littlefield Palms in Arizona (Cornett, 1989b), the four palm oases in

southern Nevada (Cornett, 1988a) and the four sites in Death Valley National Monument (Cornett, 1988b) each is of recent origin, all having appeared in the past 60 years. The only other known appearance of *W. filifera* during this time period is at Clapp Spring in Riverside County, California, near the latitudinal center of the species' range (Cornett, 1987). If these recent appearances are indicative of a range expansion, then *W. filifera* appears to be expanding its range in a northerly direction, an interesting phenomenon for a species with tropical affinities.

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THE VASCULAR PLANTS OF BAHIA SAN QUINTIN AND ADJACENT AREAS,
BAJA CALIFORNIA, MEXICO

Following is a list of the species of vascular plants collected or observed in and about Bahía San Quintín in the marine meadows, salt marshes, dunes, coastal flats, and lava and pumice of the volcanos. Coordinates for the Playas of San Quintín are 30° 28' N-116° 02' W. Elevations range from just below sea level to ca. 100 m on the slopes of the cinder cones. The list is based primarily on collections made by R. F. Thorne and associates from the Rancho Santa Ana Botanic Garden, Claremont, California on various trips in 1983 to 1987. Additional species are included from collections made by others, especially by Reid V. Moran, deposited at RSA, SD, and DS. The Thorne et al. specimens are mostly deposited at RSA, SD, MEXU, and BCMEX. A preceding * in the list denotes species believed to be introduced in the area.

Adiantaceae

- Pellaea andromediifolia* (Kaulf.) Fee var. *pubescens* D.C. Eat.
- Pityrogramma triangularis* (Kaulf.) Maxon

Aizoaceae

- **Malephora crocea* (Jacq.) Schwant.
- **Mesembryanthemum crystallinum* L.
- **Mesembryanthemum nodiflorum* L.

Alliaceae

- Dichelostemma pulchellum* (Salisb.) Heller

Apiaceae

- Apiastrum angustifolium* Nutt. ex T. & G.

Asteraceae

- Amauria rotundifolia* Benth.
- Amblyopappus pusillus* Hook. & Arn.
- Ambrosia chenopodiifolia* (Benth.) Payne
- Baccharis brachyphylla* A. Gray
- Chaenactis furcata* Stockwell
- Coreopsis maritima* (Nutt.) Hook. f.
- **Cotula coronopifolia* L.
- Encelia farinosa* A. Gray ex Torr.
- Gnaphalium bicolor* Bioletti
- Haplopappus berberidis* A. Gray
- Haplopappus venetus* (H.B.K.) Blake ssp. *furfuraceus* (Greene) Hall
- Haplopappus venetus* (H.B.K.) Blake ssp. *oxyphyllus* (Greene) Hall
- Helianthus niveus* (Benth.) Bdg. ssp. *niveus*
- Hemizonia parryi* Greene
- Jaumea carnosa* (Less.) A. Gray
- Lasthenia californica* DC. ex Lindl.
- Layia platyglossa* (F. & M.) A. Gray ssp. *campestris* Keck
- Malacothrix similis* Davis & Raven
- Microseris lindleyi* (DC.) A. Gray
- Perityle emoryi* Torr. in Emory
- Pluchea odorata* (L.) Cass. var. *odorata*
- Rafinesquia californica* Nutt.
- Senecio aphanactis* Greene
- Senecio californicus* DC. ssp. *ammophilus* (Greene) ined.
- Senecio lyonii* A. Gray
- **Sonchus oleraceus* L.
- Stephanomeria diegensis* Gottlieb
- Stephanomeria pauciflora* (Torr.) A. Nels.
- Stylocline gnaphalioides* Nutt.
- **Tagetes erecta* L.
- Trixis californica* Kell.
- Viguiera deltoidea* A. Gray

Bataceae

- Batis maritima* L.

Boraginaceae

- Amsinckia inepta* Macbr.
- Cryptantha intermedia* (A. Gray) Greene
- Cryptantha maritima* (Greene) Greene
- Heliotropium curassavicum* L. ssp. *oculatum* (Heller) Thorne
- Pectocarya peninsularis* I. M. Jtn.
- Plagiobothrys leptocladus* (Greene) I. M. Jtn.

Brassicaceae

- **Cakile maritima* Scop.
- **Capsella bursa-pastoris* (L.) Medic.
- Caulanthus lasiophyllus* (H. & A.) Payson
- Descurainia pinnata* (Walt.) Britt. ssp. *halictorum* (Cockl.) Detl.
- Lepidium lasiocarpum* Nutt. ex. T. & G. var. *lasiocarpum*
- Lepidium nitidum* Nutt. var. *nitidum*
- Sibara brandegeana* (Rose) Greene
- **Sisymbrium irio* L.
- Tropidocarpum gracile* Hook.

Cactaceae

- Echinocactus polycephalus* Engelm & Bigel. var. *polycephalus*
- Echinocereus maritimus* (M. E. Jones) K. Schum.
- Ferocactus fordii* (Orcutt) Britt. & Rose ssp. *fordii*
- Lophocereus schottii* (Engelm.) Britt. & Rose
- Mammillaria dioica* K. Brandegee
- Mammillaria hutchinsoniana* (Gates) Boed.
- Myrtillocactus cochal* (Orcutt) Britt. & Rose
- Opuntia prolifera* Engelm.
- Opuntia rosarica* Lindsay
- Stenocereus gummosus* (Engelm.) Gibson & Horak

Capparaceae

- Cleome isomeris* Greene

Caryophyllaceae

- Acronychia cooperi* T. & G.
- Cardionema ramosissima* (Weinm.) Nels & Macbr.
- Drymaria viscosa* S. Wats.
- Spergularia macrotheca* (Hornem.) Heynh. var. *macrotheca*
- Spergularia marina* (L.) Griseb.

Chenopodiaceae

- Allenrolfia occidentalis* (S. Wats.) Kuntze
- Aphanisma blitoides* Nutt.
- Arthrocnemum subterminale* (Parish) Standl.
- Atriplex julacea* S. Wats.
- Atriplex leucophylla* (Moq.) D. Dietr.
- Atriplex pacifica* A. Nels.
- **Atriplex semibaccata* R. Br.
- Atriplex watsonii* A. Nels. in Abrams
- **Chenopodium ambrosioides* L.
- **Chenopodium murale* L.
- Salicornia bigelovii* Torr.
- Salicornia virginica* L.
- Suaeda calceoliformis* (Hook.) Moq.
- Suaeda esteroa* Ferren & Whitmore
- Suaeda pubescens* Jeps. (S. *californica* of BC authors)

Convolvulaceae

- Calystegia macrostegia* (Greene) Brummitt ssp. *macrostegia*
- Cressa truxillensis* H.B.K. var. *vallicola* (Heller) Munz
- Cuscuta californica* Hook. & Arn.
- Cuscuta salina* Engelm. var. *salina*

Crassulaceae

- Crassula connata* (R. & P.) Berger in Engler & Prantl
- Dudleya anthonyi* Rose
- Dudleya anthonyi* Rose x *D. cultrata* Rose
- Dudleya cultrata* Rose

Cucurbitaceae

- Marah macrocarpus* (Greene) Greene

Ephedraceae

- Ephedra californica* S. Wats.

Euphorbiaceae

- Chamaesyce micromera* (Boiss.) Woot. & Standl.
- Euphorbia misera* Benth.
- **Ricinus communis* L.
- Stillingia linearifolia* S. Wats.

Fabaceae

- Astragalus anemophilus* Greene
- Astragalus hornii* A. Gray var. *minutiflorus* M. E. Jones
- Astragalus insularis* Kell. (vars. *insularis* and *quintinensis* M. E. Jones)
- Astragalus nuttallianus* DC. var. *cedrosensis* M. E. Jones
- Astragalus trichopodus* (Nutt.) A. Gray ssp. *leucopsis* (T. & G.) Thorne

Lathyrus laetiflorus Greene ssp. glaber Hitchc.
 Lotus cedrosensis Greene
 Lotus distichus (Greene) Greene
 Lotus hamatus Greene
 Lotus nuttallianus Greene
 Lotus salsuginosus Greene ssp. salsuginosus
 Lotus scoparius (Nutt. in T. & G.) Ottley
 ssp. watsonii (V. & R.) Greene
 Lupinus sparsiflorus Benth. ssp. pondii (Greene) Dziel. & Dunn
 Lupinus succulentus Dougl. ex Koch.
 *Phaseolus vulgaris L.
 Trifolium amplexens T. & G.
 Frankeniaceae
 Frankenia palmeri S. Wats.
 Frankenia salina (Mol.) Jtn.
 Geraniaceae
 *Erodium cicutarium (L.) L'Her. ex Ait.
 Grossulariaceae
 Ribes tortuosum Benth.
 Hippocastanaceae
 Aesculus parryi A. Gray
 Hydrophyllaceae
 Nama hispidum A. Gray var. spathulatum (Torr.) A. Hitchc.
 Phacelia distans Benth.
 Phacelia hirtuosa A. Gray
 Phacelia ixodes Kell.
 Phacelia parryi Torr.
 Phacelia stellaris Brand
 Pholistoma membranaceum (Benth.) Const.
 Pholistoma racemosum (Nutt.) Const.
 Juncaginaceae
 Triglochin concinna Davy var. concinna
 Triglochin maritima L.
 Lamiaceae
 Salvia carduacea Benth.
 Lennoaceae
 Pholisma arenarium Nutt. ex Hook.
 Malvaceae
 *Malva parviflora L.
 Sphaeralcea fulva Greene
 Nyctaginaceae
 Abronia gracilis Benth. ssp. gracilis
 Abronia maritima Nutt. ex S. Wats.
 Abronia umbellata Lam.
 Abronia villosa S. Wats.
 Mirabilis californica A. Gray var. cedrosensis (Standl.) Macbr.
 Onagraceae
 Camissonia californica (Nutt. ex T. & G.) Raven
 Camissonia cheiranthifolia (Hornem. ex Spreng.) Raiman
 ssp. suffruticosa (S. Wats.) Raven
 Camissonia crassifolia (Greene) Raven
 Camissonia intermedia Raven
 Camissonia lewisii Raven
 Oenothera wigginsii W. Klein
 Papaveraceae
 Eschscholzia australis Greene
 Eschscholzia californica Cham. ssp. peninsularis (Greene) ined.
 Stylomecon heterophylla (Benth.) Tayl.
 Plantaginaceae
 Plantago bigelovii A. Gray
 Plantago ovata Forsk.
 Plumbaginaceae
 Limonium californicum (Boiss.) Heller ssp. mexicanum (Blake) ined.
 *Limonium sinuatum (L.) Miller
 Poaceae
 Alopecurus howellii Vasey
 Aristida californica Thurb.
 Aristida glauca (Nees) Walp.
 *Avena fatua L.
 *Bromus rubens L.

- Diplachne uninervia* (Presl) Parodi
Distichlis spicata (L.) Greene ssp. *stolonifera* (Beetle) ined.
Hordeum intercedens Nevski (H. *pusillum* of BC authors)
 **Hordeum murinum* L. ssp. *leporinum* (Link) Arcang.
 **Lamarckia aurea* (L.) Moench.
Melica imperfecta Trin.
Monanthochloe littoralis Engelm.
 **Monerma cylindrica* (Willd.) Coss. & Dur.
Muhlenbergia microsperma (DC.) Kunth
Panicum capillare L. var. *occidentalis* Rydb.
 **Parapholis incurva* (L.) C. E. Hubb.
Phalaris caroliniana Walt.
Poa secunda Presl [incl. *P. scabrella* (Thurb.) Benth. ex Vasey]
 **Schismus barbatus* (L.) Thell.
Spartina foliosa Trin.
Vulpia ocotoflora (Walt.) Rydb.
- Polemoniaceae**
Linanthus laxus (Vasey & Rose) Wherry
- Polygonaceae**
Chorizanthe chaetophora Goodm.
Chorizanthe interposita Goodm.
Chorizanthe procumbens Nutt. ssp. *procumbens*
Chorizanthe turbinata Wigg.
Eriogonum fasciculatum Benth. ssp. *fasciculatum*
Harfordia macroptera (Benth.) Greene & Parry in Parry
 var. *galioides* (Greene) Reveal
Lastarriaea coriacea (Goodm.) Hoov. (*Chorizanthe coriacea* Goodm.)
Nemacaulis denudata Nutt. (vars. *denudata* and *gracilis*
 Goodm. & L. Benson in Munz)
Polygonum ramosissimum Michx.
Pterostegia drymarioides F. & M.
- Portulacaceae**
Calandrinia ciliata (R. & P.) DC. var. *menziesii* (Hook.) Macbr.
Calandrinia maritima Nutt. in T. & G.
Calyptridium monandrum Nutt. in T. & G.
Claytonia perfoliata Donn.
- Ranunculaceae**
Delphinium parryi A. Gray ssp. *parryi*
- Resedaceae**
Oligomeris linifolia (Vahl) Macbr.
- Rhamnaceae**
Condalia globosa I. M. Jtn. var. *pubescens* I. M. Jtn.
- Rubiaceae**
 **Galium aparine* L.
- Scrophulariaceae**
Antirrhinum kingii S. Wats.
Antirrhinum nuttallianum Benth. in DC. ssp. *subsessile*
 (A. Gray) D. Thomp.
Castilleja jepsonii Bacig. & Heck.
Cordylanthus maritimus Nutt. ex Benth. in DC. ssp. *maritimus*
Galvezia juncea (Benth.) Ball
Orthocarpus densiflorus Benth. var. *densiflorus*
- Simmondsiaceae**
Simmondsia chinensis (Link) C. K. Schneid.
- Solanaceae**
Datura wrightii Regel
Lycium andersonii A. Gray
Lycium brevipes Benth.
Lycium californicum Nutt. ex T. & G.
Lycium fremontii A. Gray var. *congestum* C. L. Hitch.
 **Nicandra physalodes* (L.) Gaertn.
Nicotiana clevelandii A. Gray
 **Nicotiana glauca* Grah.
Physalis crassifolia Benth. var. *crassifolia*
Solanum palmeri Vasey & Rose
- Urticaceae**
Parietaria hespera Hinton ssp. *hespera* (P. *californica*
 of BC authors)
- Zosteraceae**
Phyllospadix scouleri Hook.
Phyllospadix torreyi S. Wats.
Zostera marina L.

Robert F. Thorne
 Rancho Santa Ana Botanic Garden
 Claremont, CA 91711
 Updated 13 March 1989

SOUTHERN CALIFORNIA BOTANISTS



GRANTS AVAILABLE

SCB announces its annual program of grants to support student research in field botany. e.g., floristics, taxonomy, ecology. Both graduates and undergraduates are encouraged to apply. The amount of an award varies but cannot exceed \$200.00. A limited number of proposals can be funded. Grants may cover expendable items (gasoline, film, etc.) not otherwise available to the student.

Proposals containing the following information will be considered:

1. Title page
2. Description of proposed research, primary objectives, and relationship of the research to the student's goals (two page limit).
3. Timetable for research: anticipated commencement and completion dates.
4. Budget, with justifications, and statement regarding availability of funds from other sources.
5. Brief resume stating current position, education, affiliations, qualifications and anticipated position and address at completion of research.
6. A letter of recommendation from a faculty member (may be sent separately to the Student Research Grants Committee).

Three copies of the proposal should be submitted before May 1, 1989



to: Student Research Grants Committee
Southern California Botanists
Department of Biological Science
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SCB will publish the results of the research in its journal, *Crossosoma*. Awardees will provide SCB a formal report of the research completed, in a format suitable for publication, by not later than one year following receipt of the grant.

FIELD TRIPS

April 1 and 2 (Saturday and Sunday): Anza-Borrego Desert Weekend.

Erik Jonsson will lead this trip to look for desert wildflowers in the park. It is too early to determine the exact areas we will visit but we will dry camp somewhere within the park. Be prepared for hot weather and bring along plenty of water. Must have containers for two quarts of water on Sat. afternoon, boots and camping gear. We will meet at 10:00 AM on Sat. at Scissors Crossing- junction of SR-78 and S-2 (San Diego County). Trip will end about noon on Sunday. If you plan to attend, call or write: Dave Bramlet, 1691 Mesa Dr. No. A-2, Santa Ana CA 92707, (714) 549-0647.

April 14-16 (Friday-Sunday) Death Valley-Ash Meadows Field Trip

This is a Nature Conservancy and CNPS field trip to examine some of the unique plants in Ash meadows and Death Valley. Ash meadows is a large desert oasis, now a National Wildlife refuge, which contains some 8 plant species listed as endangered or threatened. We will also examine Devil's hole, and view several species of pupfish in this unique environment. If you are interested in the trip please send a SASE to : Bob Love, P.O. Box 1006 Yorba Linda CA 92686.

April 23 (Sunday) Tentative Trip Santa Ana Mtns

This trip may examine some burn areas in the Santa Ana Mtns. (possibly Chiquito Basin or along the Ortega Highway) or will go to the Santa Rosa Plateau to examine vernal pool flora. Please send an SASE to D. Bramlet, 1691 Mesa Dr. A-2, Santa Ana CA 92707 to see if the trip is still planned.

April 30 (Sunday) 9:00 AM Harford Springs Park, Riverside Co.

Steve Boyd of the Rancho Santa Ana Botanical will lead this trip to see the unique flora found in the Gavilan Hills. We will examine the Juniper woodlands found in this area and look for Munz's onion, Paysen's calanthus and other rare species. Take the 91 freeway east to the 15 and go south. Turnoff at Cajalco Rd. and go east to Gailan Rd. Go south on Gavilan Rd. to Ida Leona Rd (1st left past the trailer park) and meet at the top of the rise on Ida Leona. Bring water and a sack lunch. Please call D. Bramlet (714) 549-0647 for further details.

May 6-7 (Sat-Sun) Cacti Field Trip Dana Pt. to Hemet

On this trip we will examine various native cacti that occur along coastal and inland habitats of southern California. We shall encounter most of the taxonomic segregates of the highly complex populations of native prickly pear cactus (*Opuntia*), and note the possible influence that the introduced mission cactus may have played on present *Opuntia* populations. The route begins at Dana Harbor, then through coastal foothill environs, over Ortega Highway to the inland valley, Temecula region. We will camp Sat. night at the Culp Valley camp site on Highway S22 in Anza Borrego Desert State park. Meet at 8:00 A.M. at Dana Pt. Harbor, at the entrance to the Dana Point Marine Institute. Bring camping gear, food and water. For more information contact Geoff Smith at (714) 925-7129, 526-6963, or 992-7380.

May 14 9:00 AM to 4 PM Santiago Peak, Santa Ana Mountains

This trip will be to examine the flora in the upper elevations of the Santa Ana Mountains. We will be examining chaparral, Coulter pine forests and mixed evergreen woodlands. We will be taking the main divide truck trail, which, depending when road work is scheduled may not always be suitable for passenger cars. From the Newport freeway (55) take Chapman Ave, and exit east. Follow Chapman to Santiago Canyon Rd. (S18) and go right on S18. Continue on S18 and go east onto Silverado Canyon Rd. Go to the end of Silverado Cyn. Rd, where it is blocked by a gate. Bring lunch and water. Since road conditions may change due to late rains, please send a SASE to Alan Romspert Dept. Biology, CSUF, Fullerton, CA. 92634.

May 19-21 (Fri-Sun) Clark Mt. and ZZYX, San Bernardino Co., CA.

Participants in this field trip will stay at the Desert Studies Center at Soda Springs (ZZYX) administered by the California State University. Lodging and meals will be provided free from Friday evening to Sunday afternoon. This will be a working field trip to earn money for the SCB by surveying for nineteen (19) sensitive plant species that occur in the Clark Mountains. The Bureau of Land Management has requested this survey and has arranged for the free lodging and meals. Participants do not need to be professional botanists as drawings and photos will be provided of the plants to allow recognition. Space is limited to twenty-five (25) so contact Alan Romspert for reservations and additional information as soon as possible at (714)449-7034 or Dept. Biology, CSUF, Fullerton, CA. 92634. This should be a fun outing with the opportunity to earn some money for our organization.

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Amateur and Professional Botanists. The journal of the Southern California Botanists, CROSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript

to: Dr. Allan Schoenherr
Division of Biological Sciences, Fullerton College
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Fullerton, CA 92634

ANNOUNCEMENTS

Endangered Plant Communities of Southern California

On October 28, 1989, Southern California Botanists will hold their 15th. annual symposium. This year's talks will describe the characteristics and threats associated with some of our most endangered plant communities. Topics include the following communities: Coastal Strand, Coastal Sage Scrub, Walnut and Oak Woodlands, Valley Grasslands, and Wetlands, including Vernal Pools. Last year's symposium was so successful that we are all enthusiastic about this new topic and the speakers who have agreed to talk. It worked so well at CSUF that once again we are holding the symposium in Room 121, McCarthy Hall at California State University, Fullerton. Watch for more details in future issues of CROSSOSOMA.

Wilderness Conference. October 19-22, 1989. 1989 is the twentieth anniversary of the signing of the Wilderness Act. In celebration of this event, The California Wilderness Coalition is sponsoring a Wilderness Conference in Visalia. For more information contact the Coalition at 2655 Portage Bay East #3, Davis, CA 95616 or call (916) 758-0380.

Dr. Daniel Janzen at CSUF. April 10, 1989 (Monday), 7:30 PM. Dr. Daniel H. Janzen, world-renowned tropical ecologist, will speak on "Conservation Science Policy in Costa Rica: The Future of Biodiversity" in the University Center Theatre at California State University, Fullerton,

Dr. Janzen, Professor of Biology at the University of Pennsylvania, is the leading spokesperson for efforts to establish Guanacaste National Park, a reserve designed to restore and maintain existing fragments of tropical dry forest in Costa Rica. The Guanacaste Project provides the unique opportunity to restore topographically diverse lands to dry forest, to maintain a tropical wildland for material goods and to reinstate the natural world as a source of local cultural and intellectual enrichment.

Professor Janzen will describe these efforts in his presentation as well as speak about current and developing conservation policy in Costa Rica, a policy increasingly recognized as the flagship for preservation of biodiversity in the tropics.

Dr. Janzen's lecture will be followed immediately by a reception in the Garden Cafe, also located in the University Center. Notices with a map and parking information will be distributed in March. Both events are free of charge and open to the public. Those interested in actively supporting tropical conservation efforts are especially encouraged to attend.

Desert Adventure Weekend. April 14-16, 1989. The California and Great Basin Chapters of CNPS, in cooperation with The Nature Conservancy is sponsoring this trip to Death Valley, Ash Meadows, and the Amargosa Canyon. For a reservation please call Sheila Johnson at (805) 682-4618.

Southern California Academy of Sciences Annual Meeting.

May 12-13, 1989. California Lutheran University in Thousand Oaks is hosting this year's annual meeting. College students are eligible for Best-Paper Awards of \$100 each in Environmental Science, Vertebrate Zoology, Botany, and four SCAS open categories. For more information contact Dr. Camm Swift, Natural History Museum, 900 Exposition Blvd., LA 90007 or call (213) 744-3375.

Two revised floras from the Southern California Botanists

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CROSSOSOMA

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Managing Editor: Allan Schoenherr

June, 1989

THE NATURAL HISTORY OF THE NIPOMO MESA LUPINE
(Lupinus nipomensis Eastwood)
PART ONE

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INTRODUCTION

Lupinus nipomensis (Nipomo Mesa lupine) is an extremely restricted annual lupine found in the stabilized coastal sand dunes of the Nipomo Mesa near Nipomo, California (Fig. 1). Today it is restricted to approximately three square miles centered on the Santa Maria Refinery of Union Oil of California (UNOCAL). Individuals of Lupinus nipomensis have been found in only 6 more or less isolated localities within the areas shown. For convenience, groups of populations are clustered into 6 named groups: Callender Switching Station, Jack Lake, Jones, Sacks-Nixon, Union East, and Union North. Within the named groups, the individual populations are generally quite small and found either along old roads or pipeline disturbances or on the bottom one-quarter of north or east facing slopes of the long east-west tending dunes found in this area.

Note: Due to the length of this article it is being printed in two parts. Part two will include pests, comments on population size, and a list of selected references.

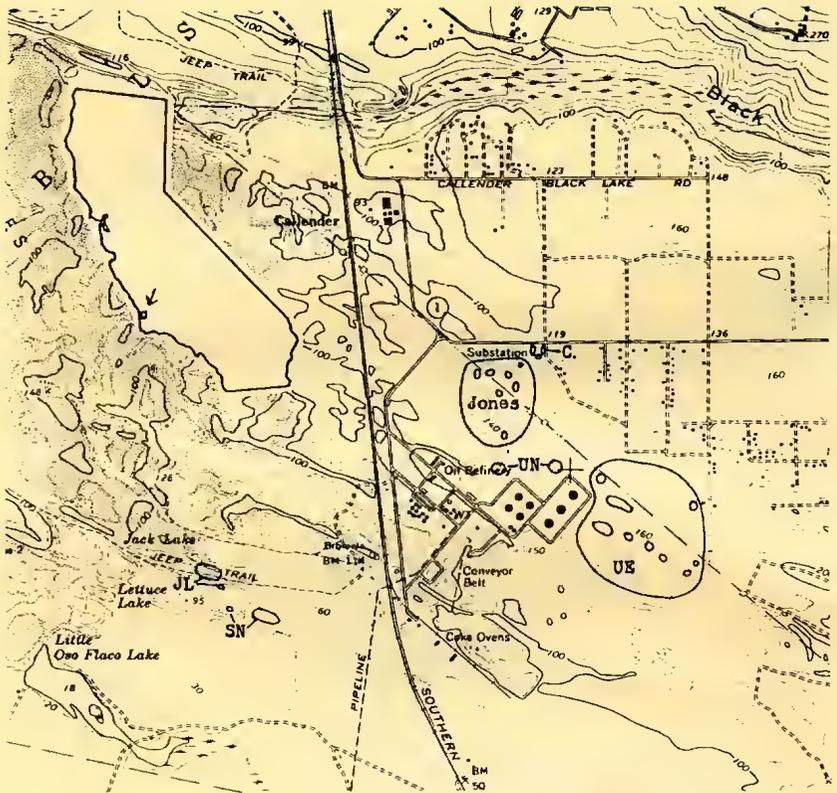


Fig. 1. Outline map of California (inset) showing the location of the area from the U.S. Geological Survey 7.5' map of the Oceano Quadrangle, California. C = Callender East, West and South sub-populations; Jones = Jones Populations; UE = Populations east of Unocal Refinery in sheep pasture; SN = Sacks-Nixon Populations; JL = Jack Lake Populations; and UN = Union North Populations.

Lupinus nipomensis is one of eighty-two species of lupines in California (Munz and Keck, 1968). Nipomo Mesa lupine can be separated from other lupine species by its succulent leaves, prostrate habit, and horizontal peduncles that bend at a right angle at the base of a succulent rachis (Fig. 2). It is a member of a small group of lupines known as the section concinni (Abrams, 1944; Jepson, 1936). Members of this section are annuals, bearing flowers in tight spirals along the rachis, and bearing no cilia or hairs on the lower two petals (keel). Historically, there have been several opinions as to the amount of variation necessary for species recognition in this group.



Fig. 2. Habit of specimen of *Lupinus nipomensis*, showing terminal flowers, green and open fruits and primary branch inflorescences.

Lupinus nipomensis was first described as a species by Alice Eastwood in 1939 and since then has been variously ignored (Dunn, 1966), reduced to synonymy (Munz and Keck, 1968), or recognized as a distinct species (Hoover, 1970, Smith, 1976). This problem probably arises from there being only ten preserved herbarium specimens of *L. nipomensis* in major western herbaria. Our guess is that many of these specimens are, in fact, parts of the same large individual. We know that the two original herbarium sheets at Cal Poly, San Luis Obispo, were collected from the same individual plant. This lupine's relationships were little understood because experts had not had access to enough specimens for study. Those that have seen the plant growing (Hoover, 1970, Smith, 1976, Mcleod, 1988) agree that it is very distinct, and that it is more different from other species within the section than those are among themselves.

At the beginning of our study, all that was known about the Nipomo Mesa lupine was that there were about 200-300 plants at two disturbed locations -- Callender switching station and Jack Lake. Nothing was known about the natural habitat of the species. It was assumed that the species was a winter annual that germinated sometime in the fall after the rains began, bloomed, and produced fruit in the spring before dying in time to avoid the summer drought. No one knew what the seeds, seedlings

and early growth forms of the plant looked like. Although the plant had been sought informally ever since its rediscovery in 1956 by Dr. Robert Hoover, no thorough search had been undertaken. We hoped to find the species growing away from the disturbing influence of human activities.

MATERIALS AND METHODS

Because so few L. nipomensis were believed to exist, we started our study in 1983-4 by marking every plant we found in the best known population around the Callender switching station with a numbered plastic tag. These plants were censused every 2 weeks to a month throughout the growing season, and new ones marked as they appeared. Recorded information about each individual included growth stages of the plants: i.e. cotyledons, juvenile leaves, adult leaves, terminal inflorescence present or not, degree of branching, and reproductive condition (terminal and branch inflorescence, flowers, green fruits, open fruits). Diameter and height, in centimeters, were recorded in the 1984-5 season and the width of largest leaf was recorded in the 1986-7 season. We also recorded notes on general health and pests. A grid was set up at the Callender site and the position of each plant was recorded to within 0.1 m (meter). In 1985-6, we restricted our censusing to 50 random 1 m² quadrats on the west side of the Callender switching station. From 1986-7 on, we changed to 60 stratified random 1 m² quadrats in the same area. Ten quadrats were randomly placed into each of six 4 m wide transects. In areas outside the quadrats, plants were marked as they produced open fruits and numbers of fruits were estimated. At the end of the season, plants and open fruits were counted.

In the area of frequent census around the Callender switching station, when green and open fruits appeared, they were counted. Because open fruits form an interlocking tangle, they are difficult to count, so their numbers were estimated while the plant was still living by allowing 5 open fruits per centimeter of rachis. If pocket gophers did not remove the plant, exact counts were made after the plants died by pulling each open fruit off individually. In the spring of 1988, Sacks-Nixon and Union East Populations produced hundreds of plants with thousands of

fruits. In this instance, the number of fruits was estimated by counting the number of fruits on 1/8 to 1/4 of the plant and multiplying by the proper factor.

Efforts were made to find new populations of L. nipomensis and to describe their habitats. As new populations were found, the number of individuals and the total number of fruits set were estimated by marking as many plants as could be found in a general census in March and then recensusing in June to August after the plants had died. Since most of these new populations were in native vegetation, on very fragile dune slopes, and the individual Nipomo Mesa lupine plants were so difficult to see, no attempt was made to study these as intensely as the Callender switching station populations.

ECOLOGY OF THE PHYSICAL ENVIRONMENT

This portion of California has a Mediterranean climate with warm, dry summers and cool, wet winters. The temperature extremes are damped by the ocean. We do not have our own data on temperature and humidity. The literature gives values indicating an average yearly temperature of 58° F and an average frost-free season of 235-365 days (Ernststrom, 1984). The yearly average temperature masks the fact that the range of daily values is often 30°-40° F and there is only a 6° F average temperature difference between the lowest monthly average (January) and the highest (July). The area is regularly bathed by morning and evening coastal fogs which tend to keep humidity fairly high. The coastal fogs and the prevailing winds off the ocean regularly supply dissolved salts to the plant and soil surfaces (Barbour, Burk, & Pitts, 1987).

Three closely related soil types cover the entire distribution of Lupinus nipomensis (Ernststrom, 1984). These are Oceano Sand with 0 to 9 percent slopes, Oceano Sand with 9 to 30 percent slopes, and dune land soils. All three soil types are basically sandy soils with very little water and nutrient-exchange capacity. These soils are easily penetrated by rain and therefore are not subject to runoff and water erosion. When devoid of vegetation, they are subject to wind erosion. Since

water-holding capacity is low in these soils, soil moisture is depleted rather quickly. This means that annuals, such as the Nipomo Mesa lupine, which grow from seed, are dependent on adequate rainfall spread out over the total growing season. Fig. 3 shows the rainfall amounts accumulated for two week periods for the five years of our study.

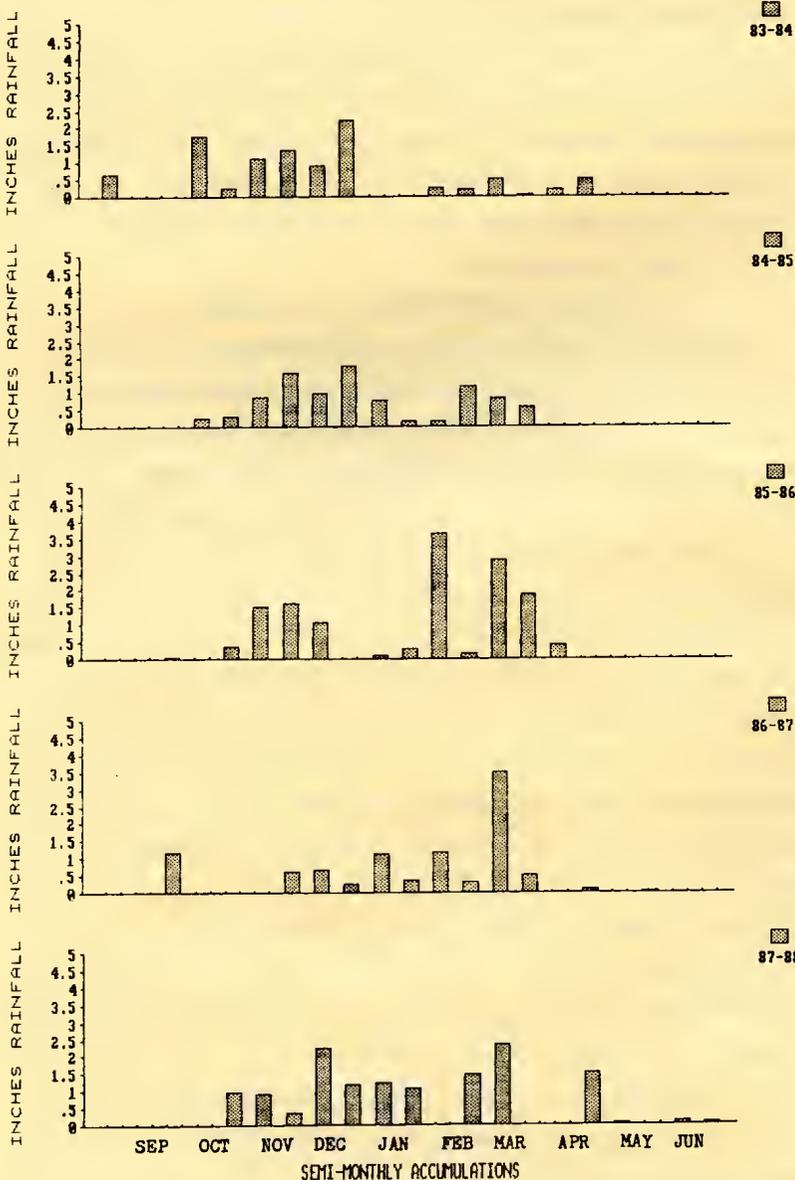


Fig. 3. Distribution of rainfall at the Santa Maria refinery of Union Oil of California on the Nipomo Mesa. Original data courtesy of UNOCAL.

PLANT SOCIOLOGY

The habitats for the Nipomo Mesa lupine are of two generally distinct types. We have called the habitat around the Callender switching station, **type 1 habitat**, since it was the first locality where we studied the lupines. This habitat is dominated by human activity and is therefore a disturbed, open, and relatively flat area. Where the lupines grow, there is a considerable amount of bare sand and relatively sparse growth of a few species of annual grasses and forbs. Shrubs are essentially non-existent in this habitat. Table 1 is a list of the common species found in type 1 habitat. Lupinus nipomensis is found in greatest densities here. Plants are easier to find and study in type 1 habitat since the vegetation is so sparse. The populations on the three sides of the Callender switching station, most of the original Jack Lake population, and the populations on the east edge of the Union East area are classed as type 1 habitat. This habitat is the one most heavily infested with the perennial veld grass, Erharta calycina, introduced as a pasture grass approximately 30 years ago (Moore, 1984) and which has become very weedy. Where veld grass has become established, few other plant species are able to grow and one usually finds only a few aging shrubs widely scattered in an otherwise monospecies stand.

Table 1. Species commonly found in the type 1 habitat. This list is a composite from all type 1 areas. Any one area will have relatively few of the species from this list.

Asteraceae		Labiaceae	
Ericameria ericoides	shrub	Monardella undulata	shrub
Heterotheca grandiflora	biennial herb	Nyctaginaceae	
Senecio blochmannii	half shrub	Abronia umbellata	perennial vine
Boraginaceae		Plantaginaceae	
Cryptantha sp.	annual herb	Plantago erecta	annual herb
Caryophyllaceae		Poaceae	
Cardionema ramosissimum	annual herb	Bromus mollis	annual grass
Euphorbiaceae		Bromus diandrus	annual grass
Croton californicus	half shrub	Bromus rubens	annual grass
Fabaceae		Erharta calycina	perennial grass
Lotus subpinnatus	annual herb	Rosaceae	
Lupinus chamissonis	shrub	Horkelia kelloggii	perennial herb
Lupinus nipomensis	annual herb	Scrophulariaceae	
Medicago hispidula	annual herb	Linaria pinifolia	annual herb
Geraniaceae			
Erodium botrys	annual herb		
Erodium cicutarium	annual herb		

The remaining areas are **type 2 habitat**, usually characterized by gentle topography near the bottom of north-facing and east-facing dune slopes. The vegetation here is very short and dense, consisting of a large diversity of annual forbs with very little open sand between them. These are the 'wildflower areas' that local flower enthusiasts seek. Table 2 lists the common species found in type 2 habitat. Perennial grasses and forbs are present but tend to be widely scattered. Veld grass is often absent or, if present, consists of very few, widely scattered, small individuals. Other perennial herbs are often found growing under the shrubs. Shrubs are few in number

Table 2. Species commonly found in the type 2 habitat. This list is a composite from all type 2 areas. Any one area will have most of the species on this list.

Aizoaceae			Lamiaceae	
<i>Conocosia elongata</i>	annual herb		<i>Monardella undulata</i>	shrub
Amaryllidaceae			Nyctaginaceae	
<i>Dichleostema pulchra</i>	perennial herb		<i>Abronia umbellata</i>	perennial vine
Asteraceae			Onagraceae	
<i>Artemisia californica</i>	shrub		<i>Oenothera graciflora</i>	annual herb
<i>Chaenactis</i> sp.	annual herb		<i>Oenothera contorta</i>	annual herb
<i>Ericameria ericoides</i>	shrub		Plantaginaceae	
<i>Erigeron blochmaniae</i>	sub shrub		<i>Plantago erecta</i>	annual herb
<i>Eriophyllum aulticaule</i>	annual herb		Poaceae	
<i>Snaphalium</i> sp.	perennial herb		<i>Bromis mollis</i>	annual grass
<i>Heterotheca grandiflora</i>	biennial herb		<i>Bromus diandrus</i>	annual grass
<i>Hypochaeris glabra</i>	annual herb		<i>Bromus rubens</i>	annual grass
<i>Layia glandulosa</i>	annual herb		<i>Eriharta calycina</i>	perennial grass
<i>Lessingia germanorum</i>	annual herb		<i>Mellica</i> sp.	perennial grass
<i>Senecio blochmaniae</i>	shrub		Polemoniaceae	
Boraginaceae			<i>Eriastrum densifolium</i>	annual herb
<i>Amsinckia spectabilis</i>	annual herb		Polygonaceae	
<i>Cryptantha</i> sp.	annual herb		<i>Chorizanthe</i> sp.	annual herb
Brassicaceae			<i>Eriogonum parvifolia</i>	shrub
<i>Descuriana pinnata</i>	annual herb		<i>Mucronea californica</i>	annual herb
<i>Erysimum suffrutescens</i>	subshrub		Rhamnaceae	
<i>Lepidium</i> sp.	annual herb		<i>Rhamnus californicus</i>	shrub
Caryophyllaceae			Rosaceae	
<i>Cardionema ramosissimum</i>	annual herb		<i>Horkelia kelloggii</i>	perennial herb
Crassulaceae			<i>Prunus fasciculatus</i>	shrub
<i>Dudlea lanceolata</i>	succulent herb		Scrophulariaceae	
<i>Tillaea erecta</i>	annual herb		<i>Collinsia bartisiaefolia</i>	annual herb
Euphorbiaceae			<i>Linaria piniifolia</i>	annual herb
<i>Croton californicus</i>	half shrub		<i>Orthocarpus purpureosens</i>	annual herb
Fabaceae			<i>Penstemon cheiranthifolia</i>	half shrub
<i>Lotus scoparius</i>	shrub			
<i>Lotus subpinnatus</i>	annual herb			
<i>Lupinus bicolor</i>	annual herb			
<i>Lupinus chamissonis</i>	shrub			
<i>Lupinus nipomensis</i>	annual herb			
<i>Medicago hispidula</i>	annual herb			
Geraniaceae				
<i>Erodium botrys</i>	annual herb			
<i>Erodium cicutarium</i>	annual herb			
Hydrophyllaceae				
<i>Phacelia douglasii</i>	annual herb			
<i>Phacelia distans</i>	annual herb			

and represent relatively few species. The principal species is mock heather, Ericameria ericoides. These shrubs are, on the average, 5 m apart and are rarely more than 75 cm in diameter. The plants are so short that in the spring and from a distance, this habitat looks as if it has been landscaped and mowed. There are usually small patches (20-30 cm across) of bare open sand caused primarily by the activity of pocket gophers, Thomomys bottae (Roest, 1984). Lupinus nipomensis seedlings can often, but not always, be found in these open patches which would seem to indicate that these are the preferred sites for seed germination. Although we have repeatedly and systematically searched areas of heavy grass and shrub cover for the lupine, we have seldom found them there. Occasionally, we have found them next to veld grass clumps or inside older shrubs with thin or broken canopies. In these cases, the growth form of the plant is relatively tall and narrow.

The greater the area of bare sand in a habitat, the greater can be the concentration of lupine plants. In type 1 habitat, lupine plants sometimes grow so close together that they form solid mats of interlocking roots and branches. This means that if one plant is discovered by a pest, then all in that mat are also found.

In type 2 habitat, Nipomo Mesa lupine is found not only in the small bare areas, but also crowded in among the other small annuals. Because of this, the lupines do not form large concentrations in habitat 2. This makes each individual more difficult for a pest to locate and thus more likely to avoid destruction.

We assume that interference among the various species of annuals must occur. Data on these interactions are difficult to obtain and probably vary from year to year, depending on the vagaries of rain, fog, and heat. We would expect under some regimes, that lupines would be favored, whereas under other conditions different species would have the advantage. However, we can report that some very successful plants have been found growing out of patches of annual forbs.

LIFE HISTORY

The stimulus for germination of Lupinus nipomensis seems simply to be water. Although we haven't specifically studied the role of temperature in germination, that doesn't seem to be an important factor, and the correlation with rainfall is striking. L. nipomensis seeds germinate after the first soaking rain of autumn. Large numbers of seedlings appear in early November in "normal" rain years when the first soaking rains fall in October. In the autumn of 1986, when the first soaking rain occurred in September, the first cohort of seedlings appeared in early October.

Upon germination, the first obvious sign of Lupinus nipomensis plants is a pair of dark purplish-green wrinkled, but slightly succulent, cotyledons, each 4 to 7 mm long. If one is marking plants and trying to detect them as early as possible, one can often detect a telltale bump in the sand where a seedling is pushing up from below. Next, the typical "hand-shaped" lupine leaves appear, with the plant adding 1 to 3 leaves per week until it has 10 to 12 leaves. In a cold year, growth is much slower. At the addition of the fifth or sixth leaf, the form of the leaves goes from thin, reddish, juvenile leaves to the fat, fuzzy, grayish-green, adult leaves. These adult leaves are the ones considered typical of most L. nipomensis.

When the Lupinus nipomensis plant reaches 10 to 12 leaves, branching begins. In a typical year, branching for the earliest plants begins toward the end of December. The first branches appear as a tight cluster of many leaves, making the plant look like a gray-green ball. The primary branches, up to 10 of them, quickly lengthen and become distinct. Three primary branches, the ones closest to the base of the plant and equidistant from each other, lengthen more quickly than the others (Fig. 2). These hug the ground as they lengthen, giving the plant a flattened, triangular appearance.

Soon after branching begins, a terminal inflorescence appears at the apex of the plant. As the peduncle lengthens, it bends

over toward the ground, whereas the inflorescence itself remains upright. Toward the end of January, by the time the terminal inflorescence flowers, the peduncle is lying on the ground, whereas a right angle turn in the rachis makes the flower stalk perpendicular to the ground. In a warm year, with early rains, flowers can appear by the end of December, but in a cold year, such as during the winter of 1988-9, they can be delayed until March.

By the time the terminal inflorescence is flowering, the three largest primary branches also have small inflorescences at their tips and secondary branches sprouting from the their leaf axils. At this time an interesting thing happens that also appears to be dependent on rainfall (assuming proper growth temperatures). If the plants have near-ideal conditions, the terminal flowers will abort and fall off as the branches rapidly elongate. The same thing can happen to the primary branch flowers. If the weather is right, the flowers open and immediately fall off before setting fruits. Again rapid vegetative growth is seen, this time in the secondary branches, especially in those closest to the primary branch flowers.

When this phenomenon was first observed, there was fear that the dropping flowers indicated some pathological condition. But it soon became clear that the plants aborting flowers in this pattern were the healthiest, fastest growing plants. The strategy appears to be that the Lupinus nipomensis plants trade the "certainty" of setting relatively few seeds in the short term for the chance of getting much greater seed-set in the longer term. The weather conditions that produce this phenomenon are soaking rains alternated with periods of sunny weather that dries out the sand surface. The plants grow by branching and spreading along the ground (Fig. 4). Small branches, growing vertically, fill in the spaces with leaves and also produce inflorescences. In the healthiest specimens, L. nipomensis may get to be 50 to 60 cm across and 15 to 20 cm high.

At some point, the soaking rain stops, and the sand dries out and stays that way. This is the trigger for Lupinus nipomensis plants to set seed, as shown by green, succulent

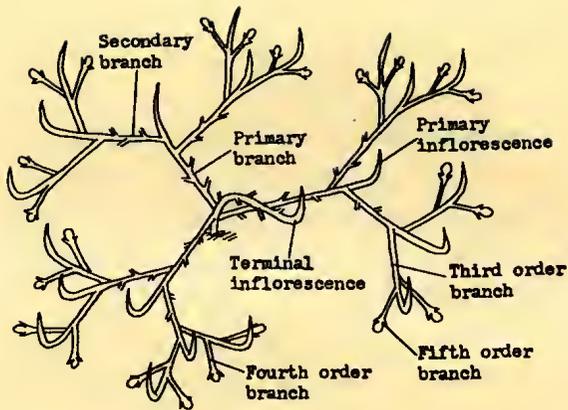


Fig. 4. The typical branching pattern shown by a healthy plant of L. nipomensis. The drawing shows only the major branches and bases of the minor ones. Leaves and flowers are not shown.

fruits. By growing rapidly and storing moisture in their succulent stems and floral axes, large L. nipomensis have the capacity to ripen hundreds of fruits, even though conditions may have turned dry. The succulence of the plants allows fruits to ripen even if a plant gets broken off or pulled out of the ground.

Once Lupinus nipomensis begins to set fruits, it doesn't stop until it dies. Plants can produce as many as 30 fruits per inflorescence, with 3 to 5 seeds per fruit, and as many as 900 fruits per plant. Most plants, of course, produce far fewer than that. The fruits grow over the space of several days until they reach their maximum size. Then, depending on the weather, they dry to a brown pod in the space of a few hours to a day. This pod opens explosively in low humidity, throwing the seeds out. Fruits opening on the edge of the plant can throw seeds up to 2 meters. In April and May, during maximum seed dispersal of a good year, seeds easily can be seen on the sand surface. Because flowering and fruiting stalks of L. nipomensis bend down to the ground and are often located under its leaves, many seeds fall close to the plant. It is almost like an antidispersal mechanism. This mechanism, however, insures that seeds are dispersed both near and far from the parent plant to suitable sandy soils.

Unfortunately, the above ideal growth scenario is rare. Not only are weather conditions seldom ideal, but also a variety of plant predators take their toll. Many people joked that the tags with which we marked individual Lupinus nipomensis plants looked like little tomb stones, and, indeed, that was what turned out to be the case in 70% or more of the plants (Fig. 5). The cause of early mortality was often hard to pinpoint. Vast numbers of seedlings appeared within the area one meter from the fence of the switching station, essentially on the path that people use to walk around the station. 100% of these individuals died during the seedling stage, although we knew they hadn't (all) been stepped on. A possible reason for this mortality was herbicide run-off from the spraying inside the switching station.

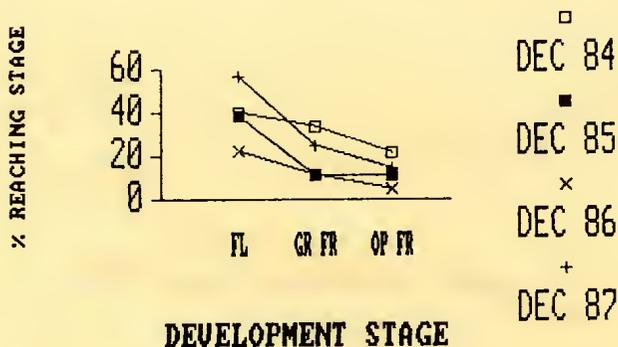


Fig. 5. The probability of plants from the Callender West Population that are vegetative in December surviving to successfully flower and set green and open fruits. Note that on the best year (1984-5) there was little drop in the probability from flowering to green fruits, but there was a large drop in average to poor years.

Early mortality can be weather related. A soaking rain could get a Lupinus nipomensis plant to the juvenile leaf stage, after which more rain would be needed. If a plant is really small and rain doesn't come quickly, it dies. But a seedling L. nipomensis, well-established with 3 to 5 juvenile leaves, could sit for weeks without rain. In many cases, we would go to do a census, expecting high mortality because it had been dry, and plants had not died. The small plants would lie there without growing. In the 1983-4 season seedlings existed for 8 weeks

before significant rains appeared (Fig. 3). If there was no rain, they would die; if it did rain, they'd begin growing immediately. This time, however, growth would be in the terminal inflorescence only.

The terminal inflorescence of Lupinus nipomensis appears to have an important function. In favorable conditions, abortion of the flowers of the terminal inflorescence triggers rapid vegetative growth. In unfavorable conditions, L. nipomensis concentrates its energy on just the terminal inflorescence until it has begun to set fruits. Thus the loss of the terminal inflorescence to predators or boring insect larvae could be expected to have some effect. In fact, the effect it has again depends on the weather. In near ideal weather conditions, when it would abort the flowers anyway, loss of the terminal inflorescence seems to make no difference. But if the rainfall is marginal, this loss can be fatal. Loss of the terminal inflorescence removes the inhibitory force (apical dominance) controlling branching, and the plant begins to grow and branch profusely regardless of the weather. Some of these plants may get 20 or 30 cm across, but if weather remains dry, most die with little or no seed-set. This appears to be because they have started too many inflorescences without sufficient energy reserve to finish out any of them. The terminal inflorescence of L. nipomensis seems to give the plant the ability to utilize the most suitable strategy for whatever weather conditions it faces.

Note: Part two of this article on the natural history of the Nipomo Mesa Lupine will be published in the August, 1989, issue of CROSSOSOMA.

Amateur and Professional Botanists. The journal of the Southern California Botanists, CROSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript

to: Or. Allan Schoenherr
Division of Biological Sciences, Fullerton College
321 E. Chapman Avenue
Fullerton, CA 92634

FIELD TRIPS

June 3, Sat. MT. GLEASON PAINTBRUSH INVENTORY: CNPS FIELD TRIP

Come along on the San Gabriel chapter's annual pilgrimage to the top of Mt. Gleason to visit and survey the population of the rare and endangered Mt. Gleason paintbrush. We expect to see many wildflowers of the yellow pine and cismontane forests along the way. Meet at 9 am at the parking lot of Mill Creek Summit on Angeles Forest Highway, about 30 minutes north of La Cañada. We will carpool from there. After lunch, an optional trip by dirt road to Horse Flats is planned.

June 10 Sat. Circle X Ranch 9:00 AM CNPS FIELD TRIP

The Channel Islands Chapter of CNPS will examine the flora of this former Boy Scout Camp, which is now part of the Santa Monica National Recreation Area. Rick Burgess who is working on a flora of the area will lead the trip. Meet at the Circle X Ranch headquarters 5 miles north of Hwy. 1 on Yerba Buena Rd. Call Tricia Burgess (805-983-1312) for additional information.

June 16-18, Fri.-Sun. CHILAO CAMPOUT WITH EATON CANYON: CNPS FIELD TRIP

Sponsored by the San Gabriel Mountains chapter. Come join the fun at the second semi-occasional joint campout with the Eaton Canyon Nature Center Associates at the Coulter group camp at Chilao. Hikes are planned both Sat. and Sun. (with wildflowers and waterfalls included), with pot-luck dinner on Sat. night. Come prepared for nocturnal activities as well. Take Angeles Crest Highway about 30 minutes north of La Cañada to Chilao campground and follow the signs to Coulter group camp.

June 17-18 Nipomo Dunes CNPS FIELD TRIP

The Santa Monica Mtns. Chapter of CNPS will examine the unique flora in the large dune area in San Luis Obispo County. Send an SASE and \$5 to: George Stevenson, 206 Saltair Ave., LA 90049 for trip information and reservations.

July 8-9, Sat.-Sun. KERN PLATEAU: CNPS FIELD TRIP

Joint trip with Kern County and Santa Monica chapters. Trip led by Jack Zaninovich of the Kern Co. chapter. Must make reservation by July 1, by sending \$5 to G. W. Stevenson, 206 S. Saltair Ave., Los Angeles, CA 90049, 213/472-5464.

Meet at Horse Meadows Forest Service Campground at 10 am on July 8. Will carpool to various meadows and water seeps. On Sunday, other trips may include climbing Sirretta Peak, which has 8 different conifers. Horse Meadows campground is 38 miles beyond Kernville. Take the Kern River road beyond Roads End. Take the road to the right toward Sherman Pass. Stay east of the river. About 6 miles from the river take road to the right to Horse Meadow Campground.

July 15-16 Sat-Sun. Mt Pinos 10:30 AM CNPS FIELD TRIP

The Channel Islands Chapter of CNPS will have Jerry Baird lead this trip to examine the interesting flora of this area. On Sunday the group will examine Iris meadows and subalpine vegetation. The hike will begin at the McGill campground at 10:30 AM. Bring camping gear and water. Call Tricia Burgess (805-983-1312) for further information.

July 22, Sat. BUTTERFLY COUNT

Skilled birders abound, but butterfly experts are rare, so the third annual butterfly count, like the first two, will offer guidance for the beginner.

The census will take place from 9 am to 3 pm. Experts will identify butterflies you locate and will give everyone a chance to look at netted butterflies before they are released.

The census supplies important information, first about butterflies, and beyond that, about other animals and plants, and about the human environment. Because most butterflies are tied to specific, relatively small habitats, they are excellent early indicators of ecosystems in trouble.

If you would like to take part in the Upper Newport Bay count, please call Peter Bryant at 714/856-5957. To participate at one of the other Orange County locations, call Larry Shaw at 714/971-2421.

Please bring drinking water, a bag lunch and, if you have one, a net. Also don't forget sun block and a hat.

(From Friends of Newport Bay Spring 1989 Newsletter).

ANNOUNCEMENTS

The CALIFORNIA DESERT PROTECTION ACT urgently needs your support.

Representative Mel Levine and Senator Alan Cranston have proposed legislation that would establish clear protective mandates for portions of the California Desert identified as having sensitive resource values in need of special protection. Please write your representatives today asking their support of H. R. 780 and A. 11.

A recreation guide and map to the EAST MOJAVE NATIONAL SCENIC AREA is available from the Angeles Chapter Office of the Sierra Club for \$3 plus postage and handling. Call 213/387-4287.

OUTDOOR SCIENCE EDUCATION IN ORANGE COUNTY covers each outdoor science education opportunity in Orange County. It contains map, directions, program descriptions, telephone numbers, fee schedules, and more. Updated continuously so that each printing contains the most recent information available. Available for \$6 from Orange County Department of Education, P.O. Box 9050. Costa Mesa, CA 92628-9050, Attn: Environmental Field Study Program.

NATURAL HISTORY ACTIVITIES IN ORANGE COUNTY is a quarterly calendar listing coming activities in chronological order, with brief descriptions of activity, times, fees, and contact phone numbers. Available for \$5 per year from Orange County Department of Education. P.O. Box 9050, Costa Mesa, CA 92628-9050. Attn: Environmental Field Study Program.

NATURAL COMMUNITY PROJECT

(Abstract of an April 4 memo from
the CNPS to its Chapter Presidents)

"This spring and summer field season we would like to ask the help of California Native Plant Society Chapters in a joint effort with the Nature Conservancy and the Natural Diversity Data Base to collect information on California's rare natural communities. As we've learned from rare plant surveys, location and condition information for endangered resources is the first step toward their protection. This effort will help us document the need for natural community protection, as well as determine the best areas to proceed with protection efforts...Our hope is to develop this into an

on-going project to increase our knowledge of California's rare communities." Attached to this memo is also a list of rare communities that we have targeted by county. This list is broken down by chapter, to include communities that may occur within each chapter's area. We are hoping that each chapter will look over this list and choose one of these communities, or if there is enough interest, maybe adopt more than one community."

The rare communities listed for Orange County are: Southern Coastal Bluff Scrub, Diegan Coastal Sage Scrub, Cismontane Alkali Marsh, Englemann Oak Woodland, and Walnut Forest. For further information call Dave Bramlet, at 714/549-0647.

Note that these communities will be the topic of our next symposium on October 28. (See below)

Endangered Plant Communities of Southern California

On October 28, 1989, Southern California Botanists will hold their 15th. annual symposium. This year's talks will describe the characteristics and threats associated with some of our most endangered plant communities. Topics include the following communities: Coastal Strand, Coastal Sage Scrub, Walnut and Oak Woodlands, Valley Grasslands, and Wetlands, including Vernal Pools. Last year's symposium was so successful that we are all enthusiastic about this new topic and the speakers who have agreed to talk. It worked so well at CSUF that once again we are holding the symposium in Room 121, McCarthy Hall at California State University, Fullerton. Watch for more details in future issues of CROSSOSOMA.

Santa Barbara Botanic Garden Activities. In addition to regularly scheduled hours, 8:00 AM to sunset every day, the Garden is sponsoring the following activities: (For more information call (805) 682-6548.)

June 3 - Family Festival. The Garden will salute the coming of summer with a bouquet of games and hands-on activities among fields of flowers & sunshine.

September 30 - "Give the Earth a Hand" Day. 10:00 AM to 4:00 PM.
Come to the Garden for a day-long celebration and learn about "Bringing Bio-diversity Home."

October 21 - Annual Fall Plant Sale. This sale features hard-to-find drought tolerant native California and Mediterranean Plants.

Save Our Wild Places. The California Department of Fish and Game is sponsoring a series of activities to publicize their Wildlife Areas and to encourage purchase of a Wildlife Pass. For example, Spring Wildlife Walks are being held on Saturdays at the San Jacinto Wildlife Area. For more information call 714/654-0580. For more information on the Save Our Wild Places call 1-800-THE-WILD.



SOUTHERN CALIFORNIA BOTANISTS

Rancho Santa Ana Botanic Garden
1500 North College Avenue
Claremont, CA 91711

SOUTHERN CALIFORNIA BOTANISTS is an organization of individuals devoted to the study, preservation, and conservation of the native plants and plant communities of southern California. The journal, CROSSOSOMA, published bimonthly, carries articles of interest to amateur and professional botanists. It is a non-profit organization formed in 1927.

Membership benefits include:

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SCB COMING EVENTS (DETAILS WITHIN)

June 3
June 10
June 16-18
June 17-18
July 8-9
July 15-16
July 22
October 28

Mt. Gleason, San Gabriel Mts.
Santa Monica Mountains
Chilao, San Gabriel Mts.
Nipomo Dunes
Kern Plateau
Mt. Pinos
Newport Bay, Butterfly Count
Endangered Plant Communities of
Southern California, SCB Symposium

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Managing Editor: Allan Schoenherr

August, 1989

THE NATURAL HISTORY OF THE NIPOMO MESA LUPINE
(Lupinus nipomensis Eastwood)
PART TWO

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PESTS

Lupinus nipomensis has numerous predators. The largest and most dramatic of these is the valley pocket gopher, Thomomys bottae. Pocket gophers kill L. nipomensis plants at all green stages, both by burying them under sand mounds or by eating them. They can reach out of their burrows and eat all or parts of plants. More commonly, they come up under a plant, just eat off the roots, a few branches, or pull the whole plant underground, leaving a tell-tale hole in front of a plant tag. Because L. nipomensis puts off setting fruits as discussed above, the healthiest, fastest growing plants remain vulnerable to pocket gopher predation for a long time. Pocket gophers do get numerous plants, loaded with green fruits, before ripe seed is produced. In the 1984-5 season (especially on the east side of the Callender switching station) near-perfect weather produced large numbers of large plants, intertwined in solid mats of foliage up

Note: Part one of this article was published in the June, 1989 issue of CROSSOSOMA

to 2 or 3 meters across. Once the pocket gophers got into one of these mats, they continued pulling down the plants until they got virtually all of them. A mat could go from having dozens of L. nipomensis plants, with hundreds of green fruits, to bare sand within a day or two, producing one of the severest shocks the researchers received during this study.

This pattern of predation would make one think that pocket gophers are the deadliest enemies of Lupinus nipomensis, but it is more complicated than that. First, in spite of the above predation, in 1985, plants or branches that survived the gophers on the east side still produced more seed than all of the other years we studied (Tables 3 & 4). Second, high concentrations of L. nipomensis and pocket gophers occurred only in the open, type 1 habitat. Type 2 habitat, with more species and more widely-spaced L. nipomensis plants, did not show the same pocket

Table 3. The numbers of successful plants found at each of the known population groups of Lupinus nipomensis during the five years of our study. Missing population data from the non-Callender sites is due to their being not available (NA).

Population	1983-4	1984-5	1985-6	1986-7	1987-8
Callender West	169	478	36	231	225
South	7	119	4	0	0
East	97	201	19	4	146
Jones	NA	5	19	69	27
Jack Lake	NA	28	12*	22	14
Sack-Nixon	NA	54	11*	155	266
Union East	NA	6*	NA	44	1070
Union North	NA	NA	NA	NA	12
TOTAL	273	891	101	525	1760

* Minimum number, no complete census done.

Table 4. The numbers of open fruit produced by each of the known population groups of Lupinus nipomensis during the 5 year span of the study. Missing population data from the non-Callender sites is due to their being not available (NA).

Population	1983-4	1984-5	1985-6	1986-7	1987-8
Callender West	1979	14402	331	3284	3729
South	13	1426	8	0	0
East	1486	3217	75	92	1082
Jones	NA	97	1181	1437	1244
Jack Lake	NA	599	12	303	569
Sack-Nixon	NA	1943	NA	4225	17120
Union East	NA	NA	NA	583	84869
Union North	NA	NA	NA	NA	235
TOTAL	3478	21684	1607	9924	108848

gopher devastation. Third, the mounds of sand that the pocket gophers produced in their excavations, provided an excellent seed bed for L. nipomensis plants. In type 2 habitat, by the time the L. nipomensis germinated in the flattened sand mound, the pocket gopher itself was often long gone and no longer a threat. So, pocket gophers can be beneficial and/or harmful to L. nipomensis, depending on circumstances.

It seems possible that Lupinus nipomensis and pocket gophers have a shaky relationship that breaks down in the gopher's favor when plants get too dense. The pocket gophers make a seed bed for the lupines, but exact a toll if they are still around when the plants mature. Although the heaviest pocket gopher damage has been observed in type 1 habitat around the Callender switching station, type 2 habitat can also have a problem if the lupines get too dense. One small type 2 sub-population of the Jones population had been little touched for two years when numbers remained small and plants scattered. In 1986-7, it lost significant numbers of its largest, healthiest plants to pocket gophers when the numbers of plants reached about 60 and became more closely spaced.

The other important Lupinus nipomensis pests are smaller and do not seem to have any qualifying redeeming value. A significant pest seen for the first time in the 1986-7 season, is a anthomyid fly Hylemya (=Della) lupini (Coquillett) which was identified by Dr. E. M. Fisher of California Dept. of Food and Agriculture. This unusual fly damages the L. nipomensis plants by burrowing into the stem tissue and eating it out. It was first noticed because the terminal inflorescence would start to develop on a plant and then seem to dry up and die. A little digging into these plants would reveal a maggot eating out the stem, killing the terminal inflorescence. Sometimes the entire plant was killed, directly or indirectly. Direct death occurred if the maggot, as it started to feed, also killed the branches leaving no meristems to grow. Indirectly, death occurred if the killing

of the terminal inflorescence precipitated the excessive vegetative growth described earlier. In poor weather this excessive growth could lead to death without seed-set. If the weather was good, death of the terminal inflorescence shunted growth into the branches, but further fly damage in these meristems, too, could make the plant grow into assymetrical or otherwise odd shapes. Continual killing of meristems, of course, reduced the seed set of the plant no matter how much it grew. The damage of this fly was very wide-spread during the 1986-7 season, but had not been observed the 3 previous years. The 1986-7 season was different from the other years because of an early soaking rain (September) that started the L. nipomensis growing earlier (early October) than it had in the other years. The fly may have been a serious pest for the first time in 1986-7 because of the unusual early rains. It was present but not serious in 1987-8 and 1988-9 and probably was present at low level but overlooked in 1983-4 and 1984-5. None of the other years had soaking rains in September.

A spider mite, Petrobia lupini (Tetranychidae) was also in evidence every year of our study. It was identified by T. Kono of the California Department of Agriculture in Sacramento. This mite is known only from lupines on the coast of California (Pritchard and Baker, 1955). Damage from this pest was widespread and ranged from light spots on the leaves to the death of whole plants. However, it appeared that mites were simply the coup de grace for already-stressed plants, the major stress being, again, dry conditions. We seldom saw a fast-growing L. nipomensis under good weather conditions killed by mites, although it did sometimes seem to happen.

Leaf-eating insect predators regularly made scallops in leaves, took whole leaves, and sometimes took whole small plants. In some cases, a caterpillar simply would eat out the terminal bud of a L. nipomensis with the same effects as described above when the terminal inflorescence is killed. Sometimes the leaves and/or branches were cut off and dropped on the ground, but not eaten. It was clear from laboratory work with caterpillars that

the same species, when it is small, makes insignificant scallops in the leaves but it can destroy whole small plants when it is bigger.

The largest caterpillar we caught feeding on Lupinus nipomensis was that of a common butterfly, the painted lady, Vanessa cardui. It was 3.5 cm long, multicolored and ringed with spines. Damage to the plant by this larva was extensive and there were piles of droppings evident. Although we had it only three days before it pupated, it clearly showed its voracious appetite during that time.

We captured one type of small green caterpillar several times. The type of damage it did was widespread, namely, leaf predation, and we assume it is a common pest in the area. It was identified by Dr. Dennis Hynes of the Biology Department at Cal Poly San Luis Obispo as a moth in the family Noctuidae. Some larval members of this family are serious pests called cutworms and are known for not only eating leaves, but also for cutting through the stems of small plants. Cut-off lupine plants and lupine leaves left lying on the ground were not rare and could be the work of these nocturnal larvae.

We often found leaves of Lupinus nipomensis tied together with a web and leaves inside partly eaten. We caught one tiny caterpillar inside a tent, and when disturbed it hung by a thread. When it metamorphosed in captivity, it became a small brown moth, a Microlepidopteran, probably of the family Pylalidae, a large, very common family. It was identified by Dr. Kingston Leong of the Biology Department at Cal Poly San Luis Obispo.

One interesting caterpillar ate the succulent, green fruits of Lupinus nipomensis. This was the only fruit eater we caught. The one we caught, in fact, resembled a fruit itself. It was green, the right size, and holding on as if it were a fruit. When this one metamorphosed in captivity it was identified by Kingston Leong of the Biology Department at Cal Poly San Luis Obispo, as a lupine blue butterfly, Plebejus lupini monticola (Clemence). Many fruits were eaten while they were still green

and succulent, but often the caterpillar ate only the outer layers, without damaging the seeds. Sometimes fruits were eaten enough that the pod didn't open properly, even though the seeds were undamaged. On occasion a fruit was eaten in its entirety.

The role of veld grass, Erharta calycina, an introduced African perennial bunch grass, as a competitor to Lupinus nipomensis is still uncertain. It is capable of forming nearly monospecific stands in which nearly all native and other introduced species are excluded. Because of this, it has been assumed to be a major threat to L. nipomensis. Veld grass produces somewhat succulent buds just under the ground surface which appear to be an important food for pocket gophers in the summer months. It is possible that the veld grass is providing a reliable food source for the pocket gophers in summer when there was little before. This could allow larger than historical pocket gopher populations.

POPULATION SIZE AND FRUIT-SET

One of the major reasons for this study was to determine the viability of this species. One way to accomplish this is to count the total numbers of individuals and estimate the number of fruits that they produced. Lupinus nipomensis is such a rare plant that it was possible to make these counts for virtually every successful plant in the world.



Fig. 2. Habit of specimen of Lupinus nipomensis, showing terminal flowers, green and open fruits and primary branch inflorescences. (Reprinted from Part One)

Table 3 lists the numbers of plants that produced seed in each of the named groups of populations we censused over the five years of the study. Table 4 gives the total number of fruits produced by each of them. We have complete data for all years only for the Callender switching station populations. Most of the others were either not found until the spring of 1985 or they were not readily available for census.

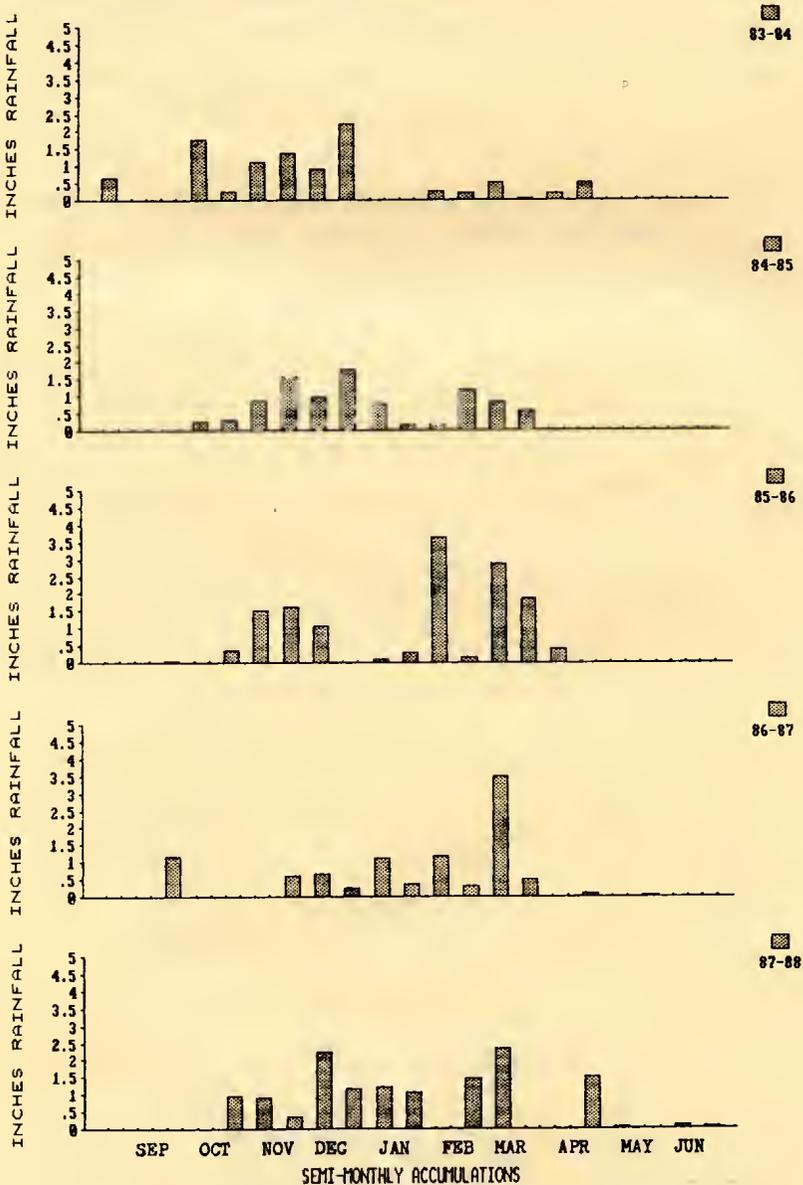


Fig. 3. Distribution of rainfall at the Santa Maria refinery of Union Oil of California on the Nipomo Mesa. Original data courtesy of UNOCAL. (Reprinted from Part One.)

Comparison of precipitation data (Fig. 3) with the tables of numbers of successful plants and their fruit-set will indicate the importance of rainfall distribution as a predictor of success in the Nipomo Mesa lupine. Although the year 1985-6 had nearly average rainfall, it did not rain significantly between late November and late January. The years 1983-4, 1986-7, and 1987-8 on the other hand, had below average rainfall, but had adequate rain between November and January. The year 1984-5 not only had above average rainfall, but, more important, it was distributed throughout the November to March growing season. Study of Tables 3 and 4 will show that based on numbers of successful plants or fruit-set that 1984-5 was the best year and 1985-6 was the poorest at Callender switching station. 1983-4 and 1986-7 were in the middle and approximately equal. Though there was not a lot of run-off in 1987-8, the distribution of rainfall apparently was perfect for the Union East and Sacks-Nixon populations (which tended to be later than Callender populations) because fruit-set that year was quite incredible in those populations (Table 4).

In good years, such as 1984-5, populations are able to succeed in three ways. They can produce a larger number of plants (Table 3) which are bigger and produce more fruits (Table 4) all of which have a greater probability of success (Fig. 5).

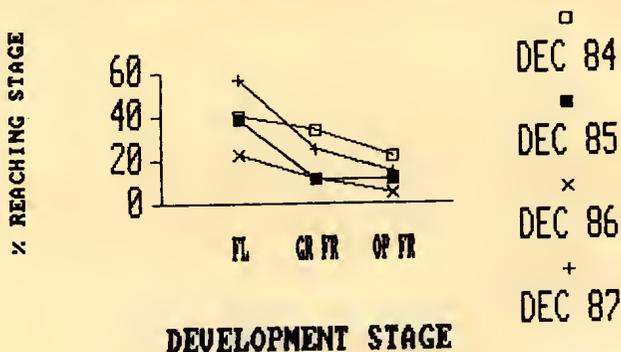


Fig. 5. The probability of plants from the Callender West Population that are vegetative in December surviving to successfully flower and set green and open fruits. Note that on the best year (1984-5) there was little drop in the probability from flowering to green fruits, but there was a large drop in average to poor years. (Reprinted from Part One.)

SUMMARY

Nipomo Mesa lupine, Lupinus nipomensis, is a rare sand dune species that is well-adapted to its harsh environment. It can vary its pattern of growth to accommodate whatever weather conditions it faces each year. This ability allows it to set large numbers of seeds in the most favorable years, and secure at least some seed-set in the poorest years. Endemic pests take a toll and their effects also vary with the weather. The only serious threats to the plants are humans and their activities. Introduced veld grass covers, with thick, solid stands, acres of dunes that might be good L. nipomensis habitat. Development continues to nibble away at all available dune habitat.

The authors of this paper are particularly anxious to see the type 2 habitat protected. It appears to be the natural habitat for the Nipomo Mesa lupine and it is relatively small, scattered and extremely fragile.

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Amateur and Professional Botanists. The journal of the Southern California Botanists, CROSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript

to: Dr. Allan Schoenherr
 Division of Biological Sciences, Fullerton College
 321 E. Chapman Avenue
 Fullerton, CA 92634

FIELD TRIPS

Saturday - Monday September 2-4, New York Mountains

This Labor trip is sponsored by the Channel Islands Chapter of the CNPS. This trip will climb the ridgeline and examine some of the relictual flora found in these mountains. Bring camping gear and water. Call Trisha Burgess (805) 963-1312 for information on the trip.

Saturday October 7 Mt. Baldy 9:00 AM

Orlando Mistretta will lead this trip to examine the montane and subalpine flora for some late blooming species and some stick and twig botany. We may also see some fall colors in the bottom of the canyons. The group will meet at the Mt. Baldy ski lift parking lot. To reach the area take the San Bernardino freeway east to Euclid (83) and go north. Continue on Euclid to San Antonio and go right (north) on Baldy Rd. Continue on Baldy Rd., past Baldy village to the Ski lift parking lot.

ANNOUNCEMENTS

The CALIFORNIA DESERT PROTECTION ACT urgently needs your support.

Representative Mel Levine and Senator Alan Cranston have proposed legislation that would establish clear protective mandates for portions of the California Desert identified as having sensitive resource values in need of special protection. Please write your representatives today asking their support of H. R. 780 and A. 11.

A recreation guide and map to the EAST MOJAVE NATIONAL SCENIC AREA is available from the Angeles Chapter Office of the Sierra Club for \$3 plus postage and handling. Call 213/387-4287.

California Wilderness Conference

The 1989 California Wilderness Conference, celebrating the 25th anniversary of the Wilderness Act will be held October 19-22 in Visalia, CA. The registration fee is only \$15.00. To register, send check to California Wilderness Conference, 2655 Portage Bay East, Davis CA 95696.

ENDANGERED PLANT COMMUNITIES OF SOUTHERN CALIFORNIA

On Saturday, October 28, 1989, Southern California Botanists will hold their 15th annual symposium on the topic of Endangered Plant Communities of Southern California. This year's speakers will describe southern California's most endangered plant communities and the ways in which they are threatened. The program will include the following topics and speakers:

Coastal Sage Scrub - John O'Leary, San Diego State
University

Salt Marsh - Wayne Ferren, U. C. Santa Barbara

Walnut Woodland - Ronald Quinn, Cal Poly Pomona

Coastal Grassland - John Keeley, Occidental College

Riparian Woodland - Peter Bowler, U. C. Irvine and Richard
Zemba, U. S. Fish and Wildlife Service

This program is cosponsored by the Department of Biology at Cal State Fullerton and will be held on the Cal State Fullerton Campus in room 121, McCarthy Hall. Registration begins at 8:00 AM. Coffee and donuts will be served. Registration fee is \$10.00 for non-members of SCB, \$8.00 for students, and \$15.00 for members of Southern California Botanists (including renewal of the \$8.00 annual membership). For more information contact Diana Cosand at (714) 773-3548.

Natural History of the White-Inyo Range

The White Mountain Research Station is sponsoring its third symposium. It will take place at the White Mountain Research Station, 3000 East Line St., Bishop CA on September 21-24, 1989. It will include sessions on plant biology, animal biology, Geomorphology/Paleoclimatology, Geology/Paleobiology, Anthropology/ Archeology, and Physiology. For more information write to the address above or White Mountain Research Station, 6713 Geology Bldg. University of California, Los Angeles CA 90024-3343.

SOUTHERN CALIFORNIA BOTANISTS



GRANTS AVAILABLE

SCB announces its annual program of grants to support student research in field botany, e.g., floristics, taxonomy, ecology. Both graduates and undergraduates are encouraged to apply. The amount of an award varies but cannot exceed \$200.00. A limited number of proposals can be funded. Grants may cover expendable items (gasoline, film, etc.) not otherwise available to the student.

Proposals containing the following information will be considered:

1. Title page.
2. Description of proposed research, primary objectives, and relationship of the research to the student's goals (two page limit).
3. Timetable for research: anticipated commencement and completion dates.
4. Budget, with justifications, and statement regarding availability of funds from other sources.
5. Brief resume stating current position, education, affiliations, qualifications and anticipated position and address at completion of research.
6. A letter of recommendation from a faculty member (may be sent separately to the Student Research Grants Committee).

Three copies of the proposal should be submitted before DECEMBER 1, 1989



to: Student Research Grants Committee
Southern California Botanists
Department of Biological Science
California State University
Fullerton, California 92634



SCB will publish the results of the research in its journal, *Crossosoma*. Awardees will provide SCB a formal report of the research completed, in a format suitable for publication, by not later than one year following receipt of the grant.

Two revised floras from the Southern California Botanists



A FLORA OF THE SANTA ROSA PLATEAU, SOUTHERN CALIFORNIA. By Earl W. Lathrop and Robert F. Thorne. 39 pages; paperback; comb binding; \$7.00



FLORA OF THE SANTA MONICA MOUNTAINS, CALIFORNIA. By Peter H. Raven, Henry J. Thompson, and Barry A. Prigge. 179 pages; paperback; Smyth sewn binding; \$10.50

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Return to: So. Calif Botanists
Dept. of Biology
Calif. State University
Fullerton, CA 92634

Price includes tax, handling,
and postage.

Make check or money order payable to: Southern California Botanists



SOUTHERN CALIFORNIA BOTANISTS

Rancho Santa Ana Botanic Garden
1500 North College Avenue
Claremont, CA 91711

SOUTHERN CALIFORNIA BOTANISTS is an organization of individuals devoted to the study, preservation, and conservation of the native plants and plant communities of southern California. The journal, CROSSOSOMA, published bimonthly, carries articles of interest to amateur and professional botanists. It is a non-profit organization formed in 1927.

Membership benefits include:

Field trips led by competent botanists and biologists.

A yearly plant sale featuring native California and drought-tolerant species.

An annual symposium on various aspects of California vegetation.

The SCB journal, CROSSOSOMA

Discounts on botanical and natural history books.

Membership categories include:

<input type="checkbox"/> Individual (family)	\$ 8.00	<input type="checkbox"/> New Member
<input type="checkbox"/> Group or organization	\$15.00	<input type="checkbox"/> Renewal

APPLICATION

Date _____

Name _____

Address _____

City, State, Zip Code _____

Phone () _____

In addition, I want to give \$ _____ to help support SCB.

Make check payable to: SOUTHERN CALIFORNIA BOTANISTS

Mail to: Alan P. Romsper
Southern California Botanists
Department of Biological Sciences
California State University, Fullerton
Fullerton, CA 92634

CROSSOSOMA (ISSN 0891-9100) is published bimonthly (February, April, June, August, October, and December) by Southern California Botanists, a California non-profit corporation. Back issues of CROSSOSOMA are available for \$2.00 an issue (plus 25¢ postage) or \$8.00 a volume (plus \$1.00 postage). Send a check with your request to Alan P. Romsper, Treasurer, at the above address. Manuscripts submitted for publication should be addressed to Dr. Allan A. Schoenherr, Editor of CROSSOSOMA, Division of Biological Sciences, Fullerton College, Fullerton, CA 92634.

SCB COMING EVENTS (DETAILS WITHIN)

September 2-4

New York Mountains

October 7

Mount Baldy

October 28

SCB Symposium - Endangered Plant
Communities of Southern California

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden
1500 North College Avenue
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CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont, CA 91711

CROSSOSOMA Vol. 15, No. 5 PROGRAM ISSUE ~~Oct~~, 1989
Managing Editor: Allan Schoenherr

In Association with the Biology Department at
Cal State University Fullerton

S C B Presents

The
15th Annual Symposium
on the Topic of

Endangered Plant Communities of Southern California

Date: Time: Place:	Saturday October 28, 1989 8:45 am to 4:00 pm Cal State University Fullerton Room 121 McCarthy Hall
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Admission:	\$7.00 for Current S C B Members \$8.00 for Students \$10.00 for Non-Members \$15.00 for S C B Membership & Admission
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California is a marvelous place, with a greater range of landforms, a greater variety of habitats, and more kinds of plants and animals than anywhere else in North America. There are more endemic plants and animals here than in any area of equivalent size in the United States. When whites first arrived in California, it was a scene of unparalleled, almost unimaginable, natural richness. Unfortunately, this richness coupled with the region's delightful Mediterranean climate soon attracted an unprecedented number of people that encroached upon the landscape to such a degree that California is the state with the greatest number of endangered species.

Nevertheless, California also has the greatest amount of open space in the lower 48 states, and an increasingly devoted proportion of citizens attempting to protect it. These people have won great victories, but many Californians still fail to appreciate the intricate and beautiful natural order of things, and/or that human activities are capable of spoiling it all.

Long-time residents of southern California have watched as the cow, the plow, and the bulldozer have altered the landscape. We have watched as urban sprawl, like some huge ameba, has gobbled up the native terrain; beaches, wetlands, coastal bluffs, valleys, canyons, and hill-tops. Not only have buildings covered the land, but we have watched developers convert native plant communities to athletic fields, golf courses, and parklands landscaped with non-native vegetation; all in the name of "open space."

Humans are merely one of the living organisms in the system, but unlike other organisms, they are capable of thinking and analyzing. Those that choose not to think about California's natural treasures have already altered the face of California forever. This symposium is dedicated to all those thoughtful people who are willing to devote time and energy to promote the concept of preservation and/or restoration of native landscapes. It is also dedicated to the change in attitude that is essential if future generations are to enjoy and appreciate California's natural beauty and diversity.

PROGRAM SCHEDULE

- 8:00 Registration, coffee and donuts
- 9:00 Introduction, Dr. Allan Schoenherr, Editor of CROSSOSOMA
- 9:10 Dr. Jon E. Keeley, Department of Biology, Occidental College, Los Angeles
CALIFORNIA GRASSLAND AND VERNAL POOL COMMUNITIES

Grasslands are widely distributed throughout cismontane California. Most are dominated by non-native annual grasses and forbs, most of which were accidentally introduced during the Spanish Mission era. These annual grasslands have replaced chaparral and coastal sage vegetation on rocky slopes and have replaced native grasslands on gentler slopes with deeper soils. Evidence for these historical changes is presented along with the current distribution pattern of native grasslands dominated by perennial bunchgrasses such as Stipa pulchra. Within the grassland biome is an azonal community known locally as vernal pools. This unique community forms in flat areas underlain by a hardpan that inhibits drainage. Due to the mediterranean climate of winter rains and summer droughts these areas form temporary "vernal" pools with a number of rare and endangered plant species, many of which are threatened due to extirpation of such sites.

- 10:00 Dr. John F. O'Leary, Department of Geography, San Diego State University
CALIFORNIAN COASTAL SAGE SCRUB: GENERAL CHARACTERISTICS AND FUTURE PROSPECTS

Coastal sage scrub is, along with chaparral and northern coastal scrub, one of three major shrubland types occurring in the Mediterranean climate zone of Pacific North America. Extending from the San Francisco Bay region to El Rosario in Baja California, it occurs on coastal and inland sides of the Coast Ranges in California, on the western coastal plain and foothills of the Sierra San Pedro Martin in Baja California, and offshore on the Channel Islands and islands adjacent to northern Baja California. Sometimes termed "soft chaparral," it commonly co-occurs with chaparral, which usually occupies higher, moister sites. Sage scrub is characterized by soft-leaved, drought-deciduous subshrubs having comparatively open canopies and shallow roots; whereas chaparral is characterized by a denser assemblage of sclerophyllous evergreen shrubs having markedly

deeper root systems. The more open nature of coastal sage scrub permits the occurrence of a greater herb component than is usually associated with mature chaparral. Both communities are significantly influenced by periodic fire and have evolved to accommodate its occurrence. It is common for coastal sage species to be mixed with chaparral or xeric sites that have recently burned or that have been subjected to overgrazing. Four floristic associations are recognized within the overall geographic range of coastal sage scrub: Diablan, Venturan, Riversidian, and Diegan. Characteristic species of these associations are California sagebrush (Artemisia californica), several species of sage (Salvia), Encelia californica, California buckwheat (Eriogonum fasciculatum), and Eriogonum cinereum.

Owing to replacement by agriculture and urbanization, coastal sage scrub is an endangered California habitat with as little as 10-25% of its former habitat remaining. Although few California endemics within coastal sage scrub are formally listed as endangered, the accelerating rate of habitat replacement poses a serious threat. In the future, sage scrub may also be impacted by changes in fire frequency, air pollution, and grazing. Preservation of this community type will help insure against loss of rare native plant species, valuable watershed, wildlife habitat, loss of much-needed open space.

10:50 Break

11:10 Dr. Ronald D. Quinn, Department of Biological Sciences,
California State Polytechnic University, Pomona.

THE STATUS OF WALNUT WOODLANDS IN SOUTHERN CALIFORNIA

Juglans californica is one of two endemic species of walnuts occurring in the state. California walnuts grow naturally only in southern California, with the most extensive stands found in the foothills of inland valleys of Ventura, Los Angeles, and northern Orange counties. Since the distribution of these trees was first described early in this century, urbanization has eliminated walnuts from large parts of the Santa Monica Mountains, and current development in the Puente and San Jose Hills is further reducing its

numbers and range. Walnuts probably occurred along riparian corridors and washes on the coastal plains of Ventura, Los Angeles, and Orange counties, where natural stands are now altogether absent.

The natural distribution of California Walnuts coincided with land suited for agriculture and urbanization, and few of the public lands where preservation of nature is a goal contain this species. De facto walnut reserves exist on private lands that have not yet been developed, but given their proximity to urban centers most of these will disappear in the foreseeable future. The problem of walnut protection is compounded by the lack of attention this species and community type have received, as compared with oaks (Quercus). To my knowledge there are no state or local ordinances to preserve walnut trees, as there are for oaks in Los Angeles County, and the California hardwood task forces and symposia of the 1980's have dealt largely or exclusively with oaks, incidentally with other hardwood species, and scarcely if at all mention walnuts.

A walnut reserve has been established by Mt. San Antonio College, in the City of Walnut, on campus agricultural land. California walnuts are also incidentally protected on the agricultural lands of California State Polytechnic University, Frank G. Bonelli Regional County Park, and the Firestone Boy Scout Reservation.

The California walnut woodland should be regarded as a "custodial community", one which will continue to exist in nature only inside reserves. Human impacts, deliberate and unintentional, will be the most important factor in the future survival and distribution of this community type.

12:00 Lunch

RECENT RESEARCH ON AND NEW MANAGEMENT ISSUES FOR SOUTHERN CALIFORNIA
ESTUARINE WETLANDS.

Wetlands form a rich group of habitats in southern California, many of which (e.g., vernal pools, freshwater marshes, riparian woodlands) have become seriously degraded or endangered as a result of the agricultural development and urbanization of large parts of this region, particularly along the coast. Some of the most impacted types in southern California are estuarine wetlands. These intertidal habitats occur in coastal embayments that are semi-enclosed by land, but are open at least periodically to the ocean and receive at least occasional dilution from freshwater runoff. Various researchers estimate that at least 75% of the historic estuarine wetlands in southern California have been destroyed and that much of the remaining 25% is seriously degraded. Many endangered or regionally rare plants (e.g. Cordylanthus maritimus ssp. maritimus) and animals (e.g., Light-footed Clapper Rail; Belding's Savannah Sparrow; Tidewater Goby) are restricted to this endangered habitat.

Classification of estuaries

Estuaries of southern California can be grouped into at least four categories reflecting their origin, type of watershed, and relationship to the marine environment. They include the following: 1) geologic structural basins (e.g., Carpinteria Salt Marsh and Goleta Slough) that are largely saline or hypersaline and have steep watersheds and significant amounts of sedimentation; 2) mouths of large rivers (e.g., Ventura and Santa Clara rivers) with perennial runoff and lagoons with brackish water conditions; 3) mouths of canyons (e.g., Devereux Slough) that have small estuaries, which may fluctuate seasonally from nearly freshwater to hypersaline conditions depending on runoff, mouth closure by sandbars, and evaporation; and 4) bays and large lagoons (e.g., Anaheim and San Diego bays) that are generally saline and cover extensive areas.

Each of these types are characterized by particular plant species or associations of species that reflect specific salinity or water regimes and latitudinal positions. For example, structural basins and large canyon mouths often have deltas with salt flats and transition zones dominated by winter annual plant species; canyon mouths with brackish lagoons often support a narrowly-restricted western form of Scirpus robustus, whereas most other estuaries support only Scirpus maritimus; bays and lagoons with sufficient tidal amplitude support low marsh vegetation characterized by Spartina foliosa; and, as a whole, estuaries with tidally-flushed salt marsh vegetation generally support species (e.g., Suaeda esteroa, Monanthochloe littoralis, Batis maritima) restricted to southern California estuaries and others south of the state.

Zonation in Mediterranean-climate estuaries

Recent research conducted at the University of California, Santa Barbara, on the vegetation of the structural basin type of estuary has revealed characteristics that may be restricted to estuaries in the Mediterranean type of climate. Field studies along transects at Carpinteria Salt Marsh in Santa Barbara County have included the measurement of elevation, tidal flooding frequency, soil bulk density, slope angle, seasonal changes in soil salinity, and plant species zonation. Four zones were identified: 1) a low elevation zone, dominated by

Salicornia virginica and flooded frequently by tides throughout the year, had soil salinities that were high in both the dry and wet seasons; 2) a nonvegetated salt flat was characterized by low slope angle and dense, consistently hypersaline soils; 3) a transitional zone in the upper marsh, dominated by the perennial Arthrocnemum subterminale and winter annuals (e.g., Lasthenia glabrata ssp. coulteri, Spergularia marina, and Parapholis incurva), was characterized by hypersalinity in the dry season and low soil salinity in the wet season; and 4) a grassland zone, largely above the upper limit of tidal flooding and dominated by introduced annual grasses, was characterized by low soil salinities in both the dry and wet seasons.

Experimental studies of several winter annuals from this zonation revealed that their germination and growth response to different salinities corresponded with their zonation patterns in the field. The survival of scattered perennials in the fluctuating (euhaline) conditions of the upper marsh transition zone is partially dependent on the ability to tolerate summer and fall hypersalinity. Winter annuals, however, survive the dry seasons as seeds, eliminating the need to adapt physiologically to dry season hypersalinity. Winter precipitation, in the absence of tidal flooding of the transition zone during this season, apparently leaches salts from the soils to low levels tolerated by the annual species. Annual plant species have been reported from the upper zones of other Mediterranean-climate salt marshes (e.g., in Europe, Africa, Australia, and elsewhere in southern California). Quantification of the physical conditions under which winter annuals grow at Carpinteria Salt Marsh may have documented a phenomenon that characterizes the transition zone of other Mediterranean-climate estuarine wetlands.

Global warming and sea level rise

Researchers and managers of estuarine wetlands are faced with many opportunities in the future. Increasing interest in wetland functional values and interpretive opportunities, and new state and federal mandates for protection, restoration, and creation of wetland habitats, may result in the gradual reversal of the long-term trend in loss and degradation of wetland habitat.

In spite of this optimism, however, we are faced with a new and potentially catastrophic impact to coastal wetlands. Global warming as a result of the Greenhouse Effect may result in the loss of extensive wetlands worldwide, and possibly most of the estuarine wetlands in southern California. A combination of the thermal expansion of oceans and melting of glaciers could increase sea level as much as one meter during the next century. Such a rise would permanently flood most existing estuarine wetlands. The Environmental Protection Agency estimates that, for those wetlands studied for their model, 30-100% of the coastal wetlands in California would be lost because of the combination of flooding and the lack of areas for a landward migration of wetlands as sea level rises. Should the prediction for sea level rise come to fruition, southern California would be faced with devastating effects to natural resources and coastal economies. Our current zeal to protect, restore, and create new wetlands must now consider their viability if sea level rise is one result of the Greenhouse Effect.

As we proceed with new research and management initiatives for the remaining southern California estuarine wetlands, we undoubtedly will gain insight on the potential for the restoration of degraded habitats and for the creation or expansion of new habitats. We must also be prepared to address the many conflicts that will result between natural resource protection and urban expansion, particularly if a significant rise in sea level suggests the abandonment of coastal real estate to accommodate the relocation of wetland habitats.

2:30

Dr. Peter Bowler, U. C. Irvine and Richard Zembel,
U. S. Fish and Wildlife Service

Riparian Habitat and Woodland

Differences in riparian habitat in headwater, central watershed and coastal/confluence settings are discussed, using the Santa Margarita River as an example. Subhabitat components of riparian vegetation along the Santa Margarita River were analyzed and quantified, and corresponding bird use is presented. Species dominance, total cover and diversity of each subhabitat component are characterized. Itinerant wetlands developing from longterm urban and agricultural runoff are described, and comparisons are made between "natural" riparian formations and those which develop as successional growth in runoff situations. The species richness over time and the ratio of exotic to native species in these settings are discussed. Several itinerant wetland case histories are presented. Riparian woodland sustained by the Prado Dam impoundment is characterized, and differences between the riparian forest above the Dam and those below the Dam along the "free flowing" Santa Ana River are delineated.

3:20

Closing remarks

FIELD TRIPS

Mount Baldy - Oct. 7 (Saturday). Orlando Mistretta will lead this trip to examine the montane and subalpine flora. We will do some stick and twig botany, as well as look for some late blooming species. Fall color is also possible along streams or in the bottom of canyons. Meet at 9:00 AM at the Mount Baldy ski lift parking lot. Exit the San Bernardino Fwy. (I 10) at Euclid or Mountain Ave. Travel north to San Antonio and then north on Baldy Rd. Continue north to the parking lot.

Ash Meadows and Shoshone - Oct. 27-28 (Friday-Saturday). Nature Conservancy volunteers in association with the Riverside-San Bernardino chapter of CNPS will help clear tamarisk from sensitive desert riparian areas. The effort will involve careful application of herbicides. Contact Bill Neal for additional information at (714) 779-2099.

Sisar Canyon - Nov. 4 (Saturday). Join trip leader Rick Burgess of CNPS for a leisurely hike up this beautiful canyon. We may see several late blooming asters and Boykinia rotundifolia, a CNPS listed sensitive species. Meet at the corner of Sisar Rd. and Hwy. 150 in Upper Ojai just east of Summit School. Bring lunch and water.

ANNOUNCEMENTS

Tecate Cypress Hearing - Oct. 6 (Friday). This is the tentative date for an important hearing on whether to list the Tecate Cypress as a threatened species. The hearing is scheduled to meet in the auditorium (B/109) of San Diego's State Bldg., 1350 Front Street. Attendance by environmentalists is important because the California Fish and Game Commission seems to be ambivalent on this issue. Letters to the commission are also requested. Write (before Oct. 4) to Mr. Harold C. Cribbs, Executive Secretary, California Fish and Game Commission, 1416 Ninth Street, Box 944209, Sacramento, CA 94244-2090. For more information call Connie Spenger (714) 879-3471.

Planning and Conservation League Symposium - Oct. 14 (Saturday) This symposium entitled PROTECTING SOUTHERN CALIFORNIA'S ENVIRONMENT: LIVING HERE IN THE 1990s, includes concurrent workshops on topics such as solid waste, recycling, landfills, etc. It will be held at Cal State Los Angeles. The cost is \$20.00 with meals, \$10.00 without. For information call (916) 444-8726.

Ecological Landscaping Symposium - Oct. 14 (Saturday). The Rancho Santa Ana Botanic Garden will host its 5th. annual symposium entitled "Water-wise gardening: California Style." The symposium is designed for homeowners, landscape professionals, contractors, and whomever is interested in new concepts in ecological landscaping and gardening. Pre-registration is required. For information call (714) 625-8767, or write to Rebecca Coleman at Rancho Santa Ana Botanic Garden, 1500 N. College Ave., Claremont, CA 91711.

Fifth Annual Victorian Fair - Oct. 14 (Saturday). The Discovery Museum of Orange County will host its Victorian Fair from 10:00 AM to 4:00 PM at 3101 W. Harvard Street in Santa Ana. Admission is \$2.00 for adults and \$1.00 for children. The fair will feature a recently constructed Victorian Gazebo. On the 3-acre plaza surrounding the Museum's Kellogg House there will be 80 displays, exhibits, and booths featuring turn-of-the-century crafts, antique automobiles, bicycles, clocks, cameras, textiles, herbs, plants, and dried flower arrangements. For information call (714) 540-0404.

California Wilderness Conference - Oct. 21-22 (Saturday-Sunday).

This conference in Visalia is sponsored by the California Wilderness Coalition (Wilderness Soc., Audubon Soc., Sierra Club, et. al.) to celebrate the 25th. anniversary of the Wilderness Act. In-depth workshops will focus on population issues, California deserts, wild rivers, BLM lands, and wilderness management. To register, send \$15.00 to California Wilderness Conference, 2655 Portage Bay East, Davis, CA 95696.

Annual Fall Plant Sale - Oct. 21 (Saturday). The Santa Barbara Botanic Garden has hard-to-find native California and Mediterranean drought-tolerant plants that will be on sale. The garden is located an 1212 Mission Canyon Rd., Santa Barbara, CA 93105. For more information call (805) 682-4762.

Natural History Foundation of Orange County Symposium - Nov. 19 (Sunday). The fourth annual Natural History Symposium entitled "Global Pollution and Local Action" will be held at the Nelson Research Bldg. at U. C. Irvine. It will feature F. Sherwood Rowland of UCI who was the first to demonstrate the connection between chlorofluorocarbons and ozone depletion in the stratosphere. Other subjects include the greenhouse effect and the story of selenium contamination of Kesterson Wildlife Sanctuary. Admission is \$3.00 for students and \$6.00 for others. For information call (714) 640-7120.

El Dorado Nature Center - The Nature Center, located within the city of Long Beach, houses an exhibit prepared by the Los Angeles County Museum of Natural History. This exhibit explains the area's natural history and ecology. There is also a complete nature trail, extending several miles. Admission is free; parking is \$2.00 on weekdays, \$3.00 on weekends, and \$5.00 on holidays. The center is located 7550 East Spring Street in Long Beach, near the intersection of the San Diego and Long Beach Freeways. For information call (213) 421-9431, ext. 3415.

MEETING ANNOUNCEMENT

A meeting of attending members at the 1989 Southern California Botanists Symposium will be held on October 28. The purpose of this meeting is to vote on amendments to the Southern California Botanists Bylaws. The board of directors and officers of the Southern California Botanists in consultation with legal counsel have amended the bylaws since their conception in 1975 to simplify and make them more relevant to our current operation. The amended bylaws can be found following this announcement. Deleted words, phrases, sentences and sections are denoted by bold, underlined lettering. New words, phrases, sentences and sections are denoted by bold letters.

As set by the existing bylaws under which we are now operating you must attend this meeting if you wish to vote on this issue.

Amateur and Professional Botanists. The journal of the Southern California Botanists, CRDSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript to:

Dr. Allan Schoenherr
Division of Biological Sciences, Fullerton College
321 E. Chapman Avenue
Fullerton, CA 92634

SCB is looking for volunteers. The Southern California Botanists are looking for volunteers to become active in the management of the organization. We are seeking new blood. We would like to hear from members that would be able to devote time to serve on the Board of Directors. We are also interested in new ideas for field trips, If someone would like to organize a field trip call Dave Bramlett at (714) 549-D647.

SOUTHERN CALIFORNIA BOTANISTS



GRANTS AVAILABLE

SCB announces its annual program of grants to support student research in field botany, e.g., floristics, taxonomy, ecology. Both graduates and undergraduates are encouraged to apply. The amount of an award varies but cannot exceed \$200.00. A limited number of proposals can be funded. Grants may cover expendable items (gasoline, film, etc.) not otherwise available to the student.

Proposals containing the following information will be considered:

1. Title page.
2. Description of proposed research, primary objectives, and relationship of the research to the student's goals (two page limit).
3. Timetable for research, anticipated commencement and completion dates.
4. Budget, with justifications, and statement regarding availability of funds from other sources.
5. Brief resume stating current position, education, affiliations, qualifications and anticipated position and address at completion of research.
6. A letter of recommendation from a faculty member (may be sent separately to the Student Research Grants Committee).

Three copies of the proposal should be submitted before DECEMBER 1, 1989



to: Student Research Grants Committee
Southern California Botanists
Department of Biological Science
California State University
Fullerton, California 92634



SCB will publish the results of the research in its journal, *Crossosoma*. Awardees will provide SCB a formal report of the research completed, in a format suitable for publication, by not later than one year following receipt of the grant.

Two revised floras from the Southern California Botanists



A FLORA OF THE SANTA ROSA PLATEAU, SOUTHERN CALIFORNIA. By Earl W. Lathrop and Robert F. Thorne. 39 pages; paperback; comb binding; \$7.00

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- October 28 SCB Symposium - Endangered Plant Communities of Southern California
- October 27-28 Ash Meadows and Shoshone
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December 1989

Is Penstemon centranthifolius truly hummingbird pollinated?

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ABSTRACT

Penstemon centranthifolius (Scrophulariaceae) produces red flowers with a long corolla tube. These traits are thought to be adaptations for hummingbird pollination. To test this hypothesis, I excluded hummingbirds from some plants, and measured visitation rates to determine the importance of various visitors. Visitation rates for native bees, introduced honey bees (Apis mellifera), and hummingbirds did not differ significantly in natural populations. Furthermore, exclusion of hummingbirds from some plants did not significantly decrease seed set per fruit, or probability of fruit production relative to naturally pollinated plants. My findings indicate that P. centranthifolius does not depend exclusively on hummingbirds for pollination, and that pollination syndromes may not accurately predict which visitors will be effective or important pollinators.

INTRODUCTION

Many flowering plants in distantly related families have convergent floral characteristics or "pollination syndromes" (Baker and Hurd 1968, Faegri & van der Pijl 1971) that are interpreted as adaptations for pollination by particular animal visitors. For instance, many new-world species have flowers with long reddish tubular corollas, no landing platforms, slender and flexible floral pedicels, high nectar production rates and dilute nectar concentrations. These traits are thought to be adaptations for hummingbird pollination, increasing seed production relative to alternative trait combinations.

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One of the assumptions of the floral syndrome approach is that pollinators have differing, relatively fixed sensory abilities and preferences. For example, insects are commonly thought to be unable to see red (Arms and Camp 1987) and consequently should not visit red flowers. This simplistic view is belied by the facts that insects can indeed see red (Mazokhin-Porshnyakov 1969), and do learn to visit red flowers (e.g. Pleasants and Waser 1985).

Native insects often visit flowers exhibiting a "hummingbird" syndrome (Waser 1979, Pleasants and Waser 1985, Waser 1983, Elam and Linhart 1988), but have probably done so for thousands of generations. Domesticated and feral honey bees (*Apis mellifera*), however, have had a short history on this continent, and are even more promiscuous than most native insects. Honey bees have become the most common floral visitors in many plant communities, and their introduction has reduced the abundance of native pollinators, including birds (Ford & Paton 1986) and bees (Schaffer *et al.* 1983).

If the introduction of honey bees has changed the abundance and identity of pollinators, plant fitness might also be affected. One possible outcome would be a decoupling of what may once have been a close relationship between floral syndrome and pollinator taxon: plants with a hummingbird-pollination syndrome might nonetheless be visited and pollinated largely by honey bees. Because of their recent introduction, any evolutionary response in plant floral traits might not yet be manifest, making it difficult to determine which animals are pollinators simply by observing floral syndromes. In this paper I present some evidence concerning the importance of honey bees and native animals as pollinators of *Penstemon centranthifolius* (Scrophulariaceae).

METHODS

During May and June 1988 I conducted experiments and observations in partially isolated populations of *P. centranthifolius* near Idyllwild, Riverside County, CA. These perennial herbs grow abundantly at my study site in an open disturbed area (1700m elevation). Floral traits are typical of the hummingbird pollination syndrome described above. The scarlet corollas are long and narrow (~24 mm long by 4 mm wide), and flowers are attached to a flexible pedicel. During a 24 hr period, each flower typically secretes about 10 microliters of 24% wt/wt sucrose-equivalent nectar (unpubl. date) from nectaries on the bases of the upper pair of stamens (Straw 1957). The protandrous flowers last about 3 days, spending the first 0.5-1.5 days in male phase, and the remainder in female phase (Straw 1957, pers. obs.).

Behavior and Abundance of Potential Pollinators. I observed visitors to P. centranthifolius flowers in natural populations between 0700 and 2000 h, a period covering most daylight hours. For each visitor, I recorded aspects of behavior, including whether it contacted floral reproductive parts during visits. For most visitors I also recorded handling time (time from arrival to departure) during visits to individual flowers.

I used timed censuses to measure the frequency of visits by different taxa on 8 separate days. For each census, I observed a known number of flowers (39-125) through binoculars from a distance of ~5m for 30 minutes. During each mid-day observation I recorded all floral visits, and noted whether visitors contacted reproductive parts, and whether they foraged for pollen or nectar.

Breeding system and hummingbird exclusion. The breeding system and importance of different pollinators for P. centranthifolius were assessed for plants in natural populations. I matched plants for size, and randomly assigned the members of each matched set to one of the 5 treatments described below. Every second day I marked and treated all receptive female flowers on all plants in each treatment. The treatments were: HAND SELF - Plants were bagged with fine-mesh netting to prevent visitation, and stigmas were pollinated by brushing them with a freshly dehisced anther from flowers on the same plant. HAND OUTCROSS - Plants were bagged, and flowers were pollinated by brushing stigmas with anthers from ≥ 2 other plants. Different pollen donors were used each day. HUMMINGBIRD EXCLUSION - Plants were not bagged, but covered with chicken wire cages (2cm mesh). This treatment prevents visitation by hummingbirds, but allows access to smaller visitors (Waser 1978, Goodman & Clayton-Greene 1988). POLLEN ADDITION - Plants were not bagged or caged, but I supplemented natural pollination of these plants by adding pollen from ≥ 2 donors to flowers of each plant (Bierzychudek 1981). Different pollen donors were used each day. NATURAL POLLINATION - One member of each block was left unmanipulated, as an index of natural pollination success.

In mid-August, just before seed dispersal, I gathered all fruits from each plant, and estimated total flower production by counting floral pedicels remaining on flowering stalks. Four pedicel types occurred: those with developed fruits; those with developed fruits suffering seed predation by Plum Moth (Pterophoridae) larvae or ground squirrels and other vertebrates; those with undeveloped fruits (flowers that did not develop into fruits); and those

with no remaining attached flowers or fruits. Pedicels with no attached flowers or fruits made up a relatively small proportion of the total (5% of 3649), and occurred in all treatments. The fate of these flowers is unknown, so I do not consider them further. I estimated total flower production as the sum of developed and undeveloped fruits, and estimated pollination success for each plant in two ways: as mean seed production per flower in uneaten developed fruits, and as percent of total flowers producing fruit.

RESULTS AND DISCUSSION

Behavior and Abundance of Potential Pollinators. I noted a wide variety of visitors to P. centranthifolius flowers during my censuses and field observations (Table 1). Hummingbirds were present throughout the study, and at all times of day. Birds visited both male and female phase flowers, and

Taxon	Foraging for nectar or pollen?	Potential Pollinator?	Abundance
Hummingbirds			
Anna's (<u>Calypte anna</u>)	nectar	yes	common
Rufous (<u>Selasphorus rufus</u>)	nectar	yes	common
Calliope (<u>Stellula calliope</u>)	nectar	yes	rare
Black Chin (<u>Archilochus alexandri</u>)	nectar	yes	rare
Costa's (<u>Calypte costae</u>)	nectar	yes	rare
Insects			
Hymenoptera			
Apidae (<u>Apis mellifera</u>)	pollen/nectar	yes/no	common/rare
Halictidae	pollen	yes	rare
Megachilidae	pollen	yes	rare
Eumenidae (<u>Pterochelilus</u> sp.)	nectar	no	rare
Lepidoptera			
Pieridae (<u>Colias hartfordi</u>)	nectar	yes	rare

Table 1. Summary of foraging behavior and abundance of visitors and pollinators of Penstemon centranthifolius in natural populations near Idyllwild. Visitors judged likely to transfer pollen from anther to stigma within or between flowers were considered "potential pollinators". Abundance subjectively determined from field notes and observations. For honey bees, information for pollen foragers is given before the slash, and for nectar foragers after.

regularly contacted both anthers and stigma with a limited area of the bill and forehead. As a result, birds appear to be "effective" pollinators, likely to transfer more pollen with each visit than if pollen placement was less precise (see Straw 1957).

Both honey bees (Apis mellifera), and native bees (species identifications pending, but mostly Sweat Bees and Leafcutting Bees: Halictidae and Megachilidae) visited P. centranthifolius flowers. All species were common visitors throughout the daylight hours. Bees foraged almost exclusively for pollen, most likely because their short tongues prevented access to the nectar concealed at the base of the long and narrow corollas. Although most bees contacted stigmas when foraging for pollen, foraging posture and behavior were such that only larger visitors (honey bees and some native bees) seemed likely to deposit much pollen. Pollen-foraging bees appeared to avoid female phase flowers, lessening the chances that pollen would be transferred to receptive stigmas. Bees also packed pollen into scopae and corbiculae ("pollen baskets") between floral visits, a behavior that may limit the amount of pollen available for deposition on stigmas. However, bees took much longer to handle each flower than did hummingbirds ($\bar{x} \pm se$ handling time for honey bees = 8.6 ± 2.0 s/flower, $n = 26$; for native bees = 7.0 ± 1.3 , $n = 16$; for hummingbirds = 0.71 ± 0.05 , $n = 14$), and this could increase pollen transfer.

Potter wasps (Eumenidae; Pterocheillus sp.) were abundant for a brief period early in the flowering season, and removed nectar from slits at the base of the corolla. Some honey bees at this time also robbed nectar. Since robbing by honey bees ended later in the season, when Pterocheillus was no longer present, I infer that wasps cut slits to rob flowers, and honey bees opportunistically used these perforations to gain access to otherwise unavailable nectar. Neither species contacted anthers or stigma while foraging for nectar because of the basal location of the robbing holes. Whether the decrease in nectar resources by robbing influenced hummingbird foraging behavior is unknown.

On rare occasions I observed sulfur butterflies (Colias hartfordi) foraging for nectar. These visitors probed few flowers in succession, and moved slowly between flowers. Further, butterflies seldom contacted anthers or stigmas, so they were unlikely to transfer much pollen. This combination of low visit number and low pollination efficiency indicated that this species is not likely to be an important pollinator.

Results from eight timed census periods showed that visitation rates (number of floral visits/flower observed/30 minutes) for birds and bees did not differ significantly among taxa ($F_{3,21} = 0.68$, $p > 0.5$). Four visitor classes were observed during these censuses: honey bees (\bar{x} visitation rate \pm se = 0.11 ± 0.06), Anna's hummingbirds (0.10 ± 0.08), native bees (0.06 ± 0.02), and Pterocheillus (0.002 ± 0.002). Bees foraged only for pollen during censuses.

Birds foraged more systematically than did bees. Birds visited several flowers on each inflorescence (2.9 ± 0.5 flowers/inflorescence, $n = 18$ inflorescences), and most inflorescences on a plant, whereas bees visited only a few flowers per inflorescence (honey bees 1.5 ± 0.1 , $n = 35$; native bees 1.2 ± 0.1 , $n = 20$), then left the plant. It is unclear how these differences in behavior influence plant mating success. To the extent that bees do transfer pollen, this may mean that bees cause more matings between plants (outcrossing) than birds, but if bees visit fewer flowers before returning to the nest, this effect might be minimal.

Censuses were made at mid-day, and visitor numbers and behavior may alter with time of day as resource abundances change (Montalvo & Ackerman 1986). However, my findings accurately reflect visitation rates and relative abundances for other daylight hours (pers. obs.). Nocturnal visitors such as hawkmoths (Sphingidae), may be important at other times and places (D.C. Hawks & G. Pratt, pers. comm.), but I saw no hawkmoths visiting P. centranthifolius, although they visiting other nearby flowering plants during my observations.

Breeding system and hummingbird exclusion. Fruit and seed set residuals did not meet assumptions for analysis of variance, so I used Kruskal-Wallis nonparametric analysis to detect differences among plant means. Percent fruit set and seed set per developed fruit varied significantly with treatment (Table 2). Significant treatment effects for fruit set apparently resulted from lower values for the two hand pollinated treatments. When hand pollination treatments are deleted, treatment effects were not significant ($\chi^2 = 3.94$, 2 df, $p > 0.1$). Seed set per developed fruit for hand selfing also was low, but seed set for hand outcrossing was near that for natural pollination. In other populations, no fruit or seeds were set when plants were bagged and left unvisited (unpubl. data), indicating that fruits and seeds in the hand pollination treatments resulted from my pollination, not auto-selfing. These results indicate that P. centranthifolius is at least partially self-compatible, and may have been pollen-limited in this year (Bierzychudek 1981). Furthermore, the high fruit

Treatment	Percent fruit set	Seed set per developed fruit
	Mean \pm se (N plants)	Mean \pm se (N plants)
Hand Self	14.4 \pm 9.2 (6)	8.9 \pm 2.4 (4)
Hand Outcross	15.6 \pm 3.0 (6)	15.9 \pm 3.2 (6)
Hummingbird Exclusion	23.7 \pm 6.2 (8)	20.7 \pm 3.4 (7)
Natural Pollination	35.2 \pm 8.9 (8)	13.1 \pm 2.2 (8)
Add Pollen	44.7 \pm 6.7 (8)	19.4 \pm 1.8 (8)

Table 2. Results from breeding system and pollinator exclusion experiment.

Kruskal-Wallis tests for significant treatment effects: for percent fruit set, $\chi^2 = 11.1$, 4 df, $p < 0.03$; for seed set, $\chi^2 = 13.0$, 4 df, $p < 0.02$.

and seed set for caged plants indicates that visitation by hummingbirds is not necessary for reproduction when insect visitors are available. Perhaps the higher aggregate abundance of bee visitors noted in timed observations (0.17 visits/flower/30 min. for bees vs. 0.10 for birds) compensates for the apparently low pollen transfer per visit described above.

CONCLUSIONS

Although floral syndromes and behavioral observations suggest that Penstemon centranthifolius should be pollinated mainly by hummingbirds, it is clear that non-hummingbird pollinators are important for reproduction: bee visits were at least as common as hummingbird visits, and plants from which hummingbirds were excluded did not have significantly lower fruit or seed set than matched controls. Floral syndrome and the identity of major pollinators appear to be uncoupled for this plant species in this area. Perhaps differences in behavior (e.g. number of flowers visited per inflorescence, handling time, or choice of male or female flowers) between hummingbirds and bees have more subtle influences on plant reproductive success (e.g. outcrossing rate), but this possibility has not yet been tested, though further work is in progress. Nonetheless, since honey bees are the major insect visitor to this plant, they are probably important pollinators in the present day, though only recent arrivals in evolutionary time.

The impact of introduced honey bees on the relationship between Penstemon centranthifolius and native pollinators is unclear. If visitation rates and behavior of hummingbirds and native bees in 1988 are indicative of circumstances before honey bees were introduced, hummingbirds would likely have been the most

important pollinators of this plant, given that they are probably more effective pollinators on a per visit basis. However, native bee abundance may be reduced as a result of competition with honey bees (Schaffer et al. 1983). If native bees were more common in the past, bee visitation rates to P. centranthifolius might have been higher, perhaps equalling the sum of present visitation rates by native and honey bees. Even if bees transfer little pollen with each visit, such an increase in abundance could compensate, making native bees as a group important pollinators. If this scenario is accurate, the evolutionary history of the distinctive floral features of this species remain unclear. However, if native bees were not major pollinators before the introduction of honey bees, hummingbirds might indeed have had a disproportionately strong influence on the evolution of the floral characters, perhaps leading to the "hummingbird" pollination syndrome exhibited today.

ACKNOWLEDGEMENTS

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Amateur and Professional Botanists. The journal of the Southern California Botanists, CROSSOSOMA, provides an ideal means by which you can publish things of botanical interest to southern Californians. If you have a favorite field trip, gardening hints, or some preliminary data that you'd like to have in print submit your manuscript to:

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SCB is looking for volunteers. The Southern California Botanists are looking for volunteers to become active in the management of the organization. We are seeking new blood. We would like to hear from members that would be able to devote time to serve on the Board of Directors. We are also interested in new ideas for field trips, If someone would like to organize a field trip call Dave Bramlett at (714) 549-0647.

FIELD TRIPS

December 10 (Sunday). Crystal Cove State Park Tidepool Trip.

Walt Wright will lead this trip to examine the great variety of marine algae and other interesting creatures found in the tide pools at Moro Point. We may also examine some of the interesting plants which comprise the coastal bluff scrub in this area. Meet at 12:00 noon at the Reef Point Parking Lot on the ocean side of Pacific Coast Highway (Hwy 1), about 3.5 miles south of Corona del Mar and just north of Laguna Beach. We will explore until dusk.

December 13 (Wednesday). Docent Tour of the Fullerton Arboretum.

The Environmental Nature Center of Newport Beach is sponsoring this field trip to the Fullerton Arboretum. They plan to start from Newport Beach at 10:30 AM. For more information call: (714) 645-8489.

March 30-April 1 (Saturday-Sunday). Catalina Weekend.

The South Coast Chapter of CNPS is sponsoring this trip to Catalina Island. It will be led by Terry Martin of the Catalina Island Conservancy. For information contact Ellen Frank (213) 534-8844.

Costa Rican Adventure. Mildred Mathias, Emeritus Botany Professor from UCLA, tropical botanist, and friend to many in CNPS and SCB, is leading a trip to Costa Rica in early to mid-February 1990. She will visit Dan Janzen's world-famous project in the dry tropical forest at Santa Rosa on the Pacific Coast, a coastal site near the Panamanian border, and a cloud forest at Monteverde on the continental spine. An extension can be made to see the beautiful rain forest on the Atlantic coast. This is a great opportunity for a botanical adventure in Costa Rica with a world class instructor. For information contact: Yvette Cloutier, 21225 Pacific Coast Hwy. Suite A, Malibu, CA 90265. (213) 452-2130.

Environmental Citizenship - Trail Maintenance and Newport Bay

Weed-pulling. The UCI Cooperative Outdoor Program is sponsoring a series of trips in cooperation with the Sierra Club and the California Department of Fish and Game. The trips are as follows:

1. Saturday, December 2. Joplin Trail Maintenance Trip. It's time to pay you debt to all of those good trails you've hiked and do some reconstruction on this historic trail near the top of the Santa Ana Mountains. No experience is required. Bring gloves, food, and water. The Forest Service is supplying the tools. Carpooling will be arranged. Contact Bill Mautz (856-4760) if you plan to participate.

2. Saturday, January 27. Los Pinos Ridge Trail Maintenance Trip. It's time to refinish our rework of this ridgeline trail in the Santa Ana Mountains and there's no poison oak on this one! No experience is required. Bring gloves, food and water; the Forest Service supplies the tools. Carpooling will be arranged. Contact Bill Mautz (856-4760) if you plan to participate.

3. Saturday-Sunday, February 24-25. Holy Jim Trail Maintenance Trip. We plan to clear and repair this popular trail in the Santa Ana Mountains. No experience is required. Bring gloves, a shovel, a lopper, saw or mattock -- otherwise the Forest Service will have a supply of needed tools. This is an overnight carcamp in the beautiful Holy Jim Canyon. If you can only work Saturday, you are still urged to join us. Carpooling will be arranged. Contact Bill Mautz (856-4760) if you plan to participate.

4. Date to be arranged by the Department of Fish and Game.
Exotic Weedpull and Native Plant-In at the Newport Back Bay. The fragile communities surrounding Upper Newport Bay are being degraded and eliminated by encroachment of introduced plant species, primarily pampas grass, ice plant species, and castor bean. Join the Cooperative Outdoor Program and the California Department of Fish and Game in removing these exotics and in replacing them with appropriate native plant species.

Arrangements regarding equipment will be made by Fish and Game. Call the Upper Newport Bay Ecological Reserve (640-6746) and add your name to the list of eco-volunteers so that you can be notified when the replacement plants are available for transplantation.

ANNOUNCEMENTS

Each One Reach One -- You Can Help Save Laguna Canyon. The Laguna Greenbelt Association is sponsoring a write-in, phone-in campaign to the Orange County Board of Supervisors. A quick guide to the action -- the Irvine Co.'s proposed development would consist of:

- 3204 housing units - private golf course - two shopping centers
- over 36,00 car trips/day

The development would destroy Laguna Canyon's wilderness values and create an urban area in the heart of the Laguna Greenbelt, Orange County's "Central Park." Vital wildlife connections between adjacent open space areas would be lost, and the greenbelt would be fragmented. The only natural lakes in Orange County lie in the center of the proposed development. Neglected and allowed to degrade by the Irvine Co. and the County, they face an uncertain future as part of an ambitious water runoff scheme for the development.

Laguna Canyon is in the Fifth District. Tom Riley, the Fifth District Supervisor, is running for re-election in June and doesn't want the controversy surrounding this project to mess up his campaign. So, the hearings will be rushed through by the end of the year. **Letters and calls to the Supervisors should begin as soon as possible.** The decision to develop Laguna Canyon will be decided by all of the supervisors. **If you have friends or relatives in other parts of Orange County who feel as you do about preserving Laguna Canyon as a public recreation and open space resource for all county residents, now is the time for them to communicate with their County Supervisor.**

Board of Supervisors' address: Hall of Administration
10 Civic Center Plaza
Santa Ana, CA 92701

Telephone numbers:

- District 1: Roger Stanton (834-3110)
- District 2: Harriet Wieder (834-3220)
- District 3: Gaddi Vasquez (834-3330)
- District 4: Don Roth (834-3440)
- District 5: Tom Riley (834-3550)

If you don't know who your Supervisor is, look in the local telephone book in the Orange County Government section.

Thirteenth Graduate Student Meetings. The California Botanical Society will sponsor their thirteenth Graduate Student Meetings on Saturday, 17 March 1990, hosted by the Rancho Santa Ana Botanic Garden. Presentations will take place in the Albrecht Auditorium on the Claremont Graduate School campus.

The presentations of proposed research, research in progress, and finished research will promote exchange of ideas and information among the graduate student community. Awards in each category will be given at a banquet following the talks. All member and non-member graduate students pursuing research in any aspect of plant science are invited to participate. Students not giving a paper, but with prior presentation experience, may participate as awards judges.

Abstracts are due on 20 February 1990. For further registration information contact James D. Morefield, Graduate Student Representative, Rancho Santa Ana Botanic Garden, 1500 N. College Ave., Claremont, CA 91711-3101.

Chino Hills Land Conservancy: A Land Trust for the Chino Hills.

As development in the Chino Hills expands from three counties through the communities of Brea, Diamond Bar and Chino Hills, it has become apparent to all concerned citizens that detailed planning, and exploring all options for development and land preservation is critical. Its numerous canyons, hillsides, woodlands and open spaces, and the wildlife they support, may be a thing of the past. In essence, the existence of a unique suburban area will be lost.

As a service to the community and the environment, the Chino Hills Land Conservancy (CHLC) has been formed in this area. CHLC is a privately administered, nonprofit, charitable corporation. Their primary focus is land acquisition and land management for the public benefit. They are dedicated to the preservation of natural areas and the historic value of the Chino Hills with the intent to administer land for public educational and recreational use. For more information contact David L. Miller at Cal-Poly Pomona (714) 869-2584 or (714) 528-3675.

ENDANGERED PLANT COMMUNITIES OF SOUTHERN CALIFORNIA
(A RETROSPECTIVE)

Our 15th. Annual Symposium was a rousing success. Over 200 people attended and we gained many new members. In fact, the response was so good that we are going to publish the proceedings. It should prove extremely helpful to consultants, public agencies, and environmental activists to have the information on endangered plant communities available in a single authoritative volume. Watch for further information on this publication.

The directors of SCB are considering suggestions for next year's symposium topic. If you have a good idea, please contact one of the directors. In fact if you have comments of any kind, do not hesitate to contact us. My office phone at Fullerton College is (714) 992-7129, and my home phone in Laguna Beach is (714) 494-0675. Both phones have an answering machine.

Allan Schoenherr, Editor of CROSSOSOMA

TREASURER'S REACTION TO THE 15TH. ANNUAL SYMPOSIUM

Financially, this was the most successful symposium to date. After paying expenses, we made more than \$1,000.00. This will help fund future student grants and special publications, including the proceedings from this symposium. We gained 45 new members and had 39 renewals at this symposium.

For the behind-the scenes "gruntwork," such as working registration, getting out publicity, carrying tables, ordering food, preparing beverages, and operating the video camera and audiovisual equipment, we all owe thanks to Terry Daubert, Julie Zwicky, Curtis Clark, Gene Jones, John Wheeler, Diana Cosand, Linda Harris, Collen Cory, Julie Holtzman, and Allan Schoenherr. It was through these people's efforts that the symposium was such a success. Of course, I worked harder than anyone else.

Alan Romspert, Treasurer of SCB



SOUTHERN CALIFORNIA BOTANISTS

Rancho Santa Ana Botanic Garden
1500 North College Avenue
Claremont, CA 91711

SOUTHERN CALIFORNIA BOTANISTS is an organization of individuals devoted to the study, preservation, and conservation of the native plants and plant communities of southern California. The journal, CROSSOSOMA, published bimonthly, carries articles of interest to amateur and professional botanists. It is a non-profit organization formed in 1927.

Membership benefits include:

Field trips led by competent botanists and biologists.

A yearly plant sale featuring native California and drought-tolerant species.

An annual symposium on various aspects of California vegetation.

The SCB journal, CROSSOSOMA

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SCB COMING EVENTS (DETAILS WITHIN)

December 10	Crystal Cove Tidepool Trip
December 13	Fullerton Arboretum
March 30-April 1	Catalina Island
Three weekends	Trail Maintenance and Weed-pulling

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