



FREMONTIA

A JOURNAL OF THE CALIFORNIA NATIVE PLANT SOCIETY



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40TH ANNIVERSARY OF CNPS



FREMONTIA

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California Native Plant Society

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CALIFORNIA NATIVE PLANT SOCIETY

Dedicated to the Preservation of the California Native Flora

The California Native Plant Society (CNPS) is a statewide nonprofit organization dedicated to increasing the understanding and appreciation of California's native plants, and to preserving them and their natural habitats for future generations.

CNPS carries out its mission through science, conservation advocacy, education, and horticulture at the local, state, and federal levels. It monitors rare and endangered plants and habitats; acts to save endangered areas through publicity, persuasion, and on occasion, legal action; provides expert testimony to government bodies; supports the establishment of native plant preserves; sponsors workdays to remove invasive plants; and offers a range of educational activities including speaker programs, field trips, native plant sales, horticultural workshops, and demonstration gardens.

Since its founding in 1965, the traditional strength of CNPS has been its dedicated volunteers. CNPS activities are organized at the local chapter level where members' varied interests influence what is done. Volunteers from the 33 CNPS chapters annually contribute in excess of 87,000 hours (equivalent to 42 full-time employees).

CNPS membership is open to all. Members receive the quarterly journal, *Fremontia*, the quarterly statewide *Bulletin*, and newsletters from their local CNPS chapter.

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CALIFORNIA NATIVE PLANT SOCIETY

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Membership form located on inside back cover;
dues include subscriptions to *Fremontia* and the *Bulletin*

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Benefactor	\$500	Family, Group, International . . .	\$45
Patron	\$250	Individual or Library	\$35
Plant Lover	\$100	Student/Retired/Limited Income .	\$20

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CNPS members and others are welcome to contribute materials for publication in *Fremontia*. See the inside back cover for manuscript submission instructions.

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This first in a series of four articles is a celebration of the members and local chapters which make up our society. Carol Witham, current CNPS president, introduces a series of vignettes for seven southern chapters with a brief history of the organization and its members. Summaries of the remaining CNPS chapters will appear in the next three issues of Fremontia.

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The work of local CNPS chapters is augmented by a number of statewide programs that are organized and carried out by paid and volunteer staff. This article introduces the Rare Plant, Vegetation, Conservation, and Horticulture programs, and summarizes how the statewide Society is structured and governed.

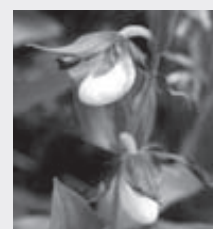


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What happens to rare plant populations when the urban landscape encroaches? Authors Greer and Cheong describe the habitat of the rare willow monardella (Monardella linoides ssp. viminea), a riparian plant of the San Diego area, and assess how changes in water flow affect its populations.

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The California flora includes three species of lady slipper orchid, the very showy Cypripedium californicum and C. montanum, and the clustered lady slipper, C. fasciculatum. In this article the author describes in detail the flower form and pollination of the clustered lady slipper, and discusses the strategy employed by this orchid to reproduce.



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THE COVER: Members of the Riverside/San Bernardino Chapter of the California Native Plant Society learn about desert plants and native fan palm oases at the Dos Palmas Preserve near the Salton Sea. Photograph by R. Muerter.

GUEST EDITORIAL: 40TH ANNIVERSARY OF THE CALIFORNIA NATIVE PLANT SOCIETY

Forty years ago an inspired and dedicated group of native plant enthusiasts, fresh from the battle to save a native plant garden in the East Bay hills, founded the California Native Plant Society (CNPS). Today we have much to be thankful for: that small beginning grew into a respected and influential native plant conservation organization of over 9,700 members. We are enormously grateful to all the dedicated and talented people who have built and sustained CNPS over the years.

To celebrate the 40th anniversary of CNPS, we are planning a series of events spanning the year 2005. These activities will give members and supporters the opportunity to acknowledge and share our experiences in the spirit of friendship that has always characterized our organization. The 40th-year events will include activities hosted by both the statewide organization and local chapters of CNPS. The June and September Chapter Council meetings (to be held in the Sacramento Valley and Southern California areas, respectively) will be enhanced with extra events, such as presentations or field trips provided by exceptional presenters. We are planning workshops at these gatherings in which CNPS volunteer groups—such as chapter treasurers, program chairs, or rare plant coordinators—can exchange experiences and learn from each other. There will also be table-top displays and posters where chapters will present who their members are, their history, their special plants and places, and their work. In addition, we will honor CNPS founders at these meetings and at our annual banquet in December. We strongly encourage all interested members, together with friends and family, to attend these special Chapter Council meeting events. (Look for specific event information and updates in your CNPS *Bulletin*.)

We have a new 40th Anniversary logo (shown on page 17) to be used by chapters for materials or events they produce during 2005, as a way of celebrating and spreading the news of the valuable work of CNPS to the public and local politicians. In addition, two beautiful books will also be available for sales and outreach in 2005: the new book on the desert flora, *The Best Year Ever*, and a new printing of *California's Wild Gardens*, now with the different subtitle of *A Guide to Favorite Botanical Sites*.

In addition, we will celebrate our 40th year in each of the 2005 issues of *Fremontia*. Each issue will begin with an article about several of the CNPS regional chapters, including their history, natural surroundings, and accomplishments—so that we can be inspired by the great work of others and the beauty of our botanically diverse state. The next article or articles will feature statewide programs—so that we can all appreciate the hard work being done by both paid staff and especially by volunteers. This should be a fun-filled and motivating year for all of us. Let's join in celebrating the best of our great organization and the people who make it all happen—us!

—Jim Bishop and Diana Hickson, Co-chairs
CNPS 40th Anniversary Committee

USEFUL WEBSITES AND CONTACT INFORMATION

California Native Plant Society:

www.cnps.org, with links to conservation issues, chapters, publications, policy, etc.

For updates on conservation issues:

Audubon Society www.audubon.org

Center for Biological Diversity
www.sw-center.org

Native Plant Conservation
Campaign www.plantsocieties.org

Natural Resources Defense
Council
www.nrdc.org

Sierra Club
www.sierraclub.org

Wilderness Society
www.wilderness.org

For voting information:

League of Women Voters
www.lwv.org, includes online voter
guide with state-specific nonparti-
san election and candidate
information.

US Senate
www.senate.gov

US House of Representatives
www.house.gov

California State Senate
www.sen.ca.gov

California State Assembly
www.assembly.ca.gov

To write letters:

President George W. Bush
The White House
1600 Pennsylvania Ave. NW
Washington, DC 20500

Senator Barbara Boxer
or Senator Dianne Feinstein
US Senate
Washington, DC 20510

Your CA Representative
US House of Representatives
Washington, DC 20515



Mojave Desert Chapter spring 2004 field trip to the Zzyzx area with about 20 members participating; at least 75 species were in flower at this site. Photograph by T. Thomas.

THE CALIFORNIA NATIVE PLANT SOCIETY: ITS MISSION, HISTORY, AND HEART

by Carol Witham

The mission of the California Native Plant Society (CNPS) is to increase understanding and appreciation of California's native plants and to conserve them in their natural habitats through education, science, advocacy, horticulture, and land stewardship. This mission statement clearly recognizes our dual role of being a native plant appreciation club and being a science-based conservation organization. These very different but overlapping purposes have served CNPS well during the past four decades.

The California Native Plant Society began in 1965 with a specific conservation mission—to save the native plant garden east of San Francisco Bay (now the Regional Parks Botanic Garden). That same year, Sacramento Valley became the first official chapter of the organization due to the efforts and enthusiasm of G. Ledyard Stebbins and his desire to protect rare plants. By the end of our first decade, the Society had 12 chapters and about 900 members. Since then CNPS membership has grown to over 9,700 and is organized into 32 chapters.

From the outset, the founders of CNPS realized that people were more enthusiastic about conserving something they were familiar with; those that had personally experienced the beauty and wonder of the California flora would more vigorously work for its protection. Field trips quickly became a major tool for increasing membership and sharing native plants and their habitats with members of the local community. Every chapter continues to carry on this tradition—sometimes mixing business with pleasure in order to count rare plants, survey



these sales are used to fund chapter activities. They are also a great way to attract new members, share the beauty of native plants, and educate members of the community on more water-conserving alternatives for home landscaping.

The Society's dedication to conservation and other forms of advocacy has also grown over the years. What began as an endeavor to save a native botanical garden has grown into far-reaching efforts throughout the state. CNPS gathers information on rare plants and advocates the protection of their habitat. We are doing the same for rare plant communities. We encourage good land management and we fight bad laws and poorly planned devel-



Top: Members of the South Coast Chapter at a July 2004 assessment of the White Point Nature Preserve. Photograph by J. Iwens. • **Far left:** Members of the Riverside-San Bernardino Chapter at Dos Palmas Preserve near the Salton Sea, looking at Washington fan palm (*Washingtonia filifera*). Photograph by R. Muerter. • **Near left:** A San Gabriel Mountains Chapter field trip to Eaton Canyon. Photograph by G. McLean. • **Bottom left:** At the San Diego Chapter's native plant sale. Photograph by L. Pardy. • **Bottom right:** An Orange County Chapter hike. Photograph by J. Hampton.

plant communities, or monitor conservation easements.

Native plant sales, another of our traditional outreach activities, started out of necessity. The first plant sale was held in 1966 for the very practical reason of needing to pay the office rent. Today most chapters hold well-publicized and highly successful native plant sales. Proceeds from





A Malibu Bluffs plant walk with the Los Angeles/Santa Monica Chapter of CNPS. Photograph by E. Landis.

opment. And because we use scientific information in our advocacy and conservation efforts, we are a well-respected environmental organization.

While CNPS has grown in many ways, members always have been and always will be the heart of the organization. Members share their personal appreciation of California's native plants with friends and neighbors through gardening, photography, wildflower hikes, and the books that decorate their coffee tables. They also contribute one-half million dollars annually through dues and in response to fund appeals. These funds are critical to our ongoing efforts in the areas of conservation, legislation, rare plants, and vegetation.

Members are special in another way as well—they volunteer. From the very beginning, CNPS has been a volunteer-based organization. When something needs to get done—from organizing a chapter speaker program to writing a comment letter on a development project—chances are it will be done by a volunteer. And CNPS members are enthusiastic about their volunteerism. Last year volunteers contributed over 87,000 hours to further the mission of CNPS. That's the equivalent of 42 full-time employees!

Volunteers have found hundreds of ways to contribute their time to CNPS. Our volunteers know that you don't have to be an expert about plants, conservation, or anything



Map of the local chapters of the California Native Plant Society (for greater clarity, see map in color at www.cnps.org under "Chapters"). The chapters summarized in the text include the Los Angeles/Santa Monica Mountains Chapter (27), the San Gabriel Mountains Chapter (28), the Riverside-San Bernardino Chapter (29), the South Coast Chapter (30), the Orange County Chapter (31), the San Diego Chapter (32), and the Mojave Desert Chapter (33).

else. For example, at the last plant sale I attended, volunteers did everything from growing the plants to running the cash register. Volunteer jobs included unloading the plants, making attractive displays, pricing the plants, providing information to shoppers, making and selling refreshments, making lunch for the volunteers, lugging plants to cars, and giving talks on native gardening. And this was just *one* of many events being held by the local chapter.

The next time you read your chapter newsletter, take a close look at the number of people listed as board members or committee chairs. These are all dedicated volunteers. Or look over the activities and events and consider that they are all being accomplished through the efforts of volunteers. Perhaps you, too, can find a small but personally rewarding task that contributes to the culture and the mission

of CNPS. Every volunteer activity I have ever undertaken in this organization has resulted in new friends, a feeling of accomplishment, and a renewed dedication to both our mission and to the people that make CNPS what it is. I am proud of who we are and personally look forward to many more years of volunteering for this great organization.

As CNPS enters into its fifth decade, we should all celebrate our grassroots origins and our dedication to both the native flora and to the spirit of volunteerism. We dedicate the following section in this issue of *Fremontia* to all those who have contributed their own unique talents to the past accomplishments of CNPS, and in numerous ways both large and small, helped to preserve our precious native plants for future generations.

Carol W. Witham, 1141 37th Street, Sacramento, CA 95816. cwitham@ncal.net

SEVEN SOUTHERN CHAPTERS OF THE CALIFORNIA NATIVE PLANT SOCIETY

Each issue of Fremontia Volume 33 will include summaries of local chapters, beginning with chapters in the south, and proceeding northward. As editor, it is my hope that readers will be inspired to read the newsletter or attend a meeting or field trip of one of the other chapters, or if you are not already a member of CNPS, that you will join us! (Membership form appears on the inside back cover.)



The Los Angeles/Santa Monica Chapter plant sale. Photograph by S. Hartman.

LOS ANGELES/ SANTA MONICA MOUNTAINS CHAPTER

Size of chapter: Approximately 500 members

Website address: www.lacnps.org

In 1967 the Sierra Santa Monica Chapter formed, with Helen Funkhouser serving as first president. Over the years, public confusion about our area of influence led to changing the chapter name to Santa Monica Mountains Chapter and, more recently, to Los Angeles/Santa Monica Mountains Chapter.

Due to the chapter's geographical boundaries, we are faced with a multitude of urban-wildland interface challenges. The chapter includes Los Angeles, a densely urban area containing primarily isolated patches of native habitat. How-

ever it also encompasses the nearby Santa Monica Mountains and other adjacent areas that include a diverse palette of habitat types, including desert, mountains, marshland, and seashore areas.

Most of our chapter board members also serve on committees or task forces of public agencies and governmental entities or of other nonprofit organizations interested in the environment. We offer a full array of activities for people interested in conserving and enjoying our native flora. These include chapter hikes and walks, fungus forays, desert field trips, rare plant searches, weed wars, revegetation projects, native plant gardening, our outdoor Spring Wildflower Show and Fall Plant Sale, a new members picnic, and a Garden Party. To accomplish our varied goals we make use of a host of conservation tools: local botanical knowledge, weed-

ing, revegetation, horticulture, education, communication, and partnerships.

Augmenting everything else we do each year are activities specifically geared toward public outreach, including 11 monthly educational programs, tabling at public events, our bimonthly *Toyon* newsletter, and our informational website (www.lacnps.org). Our chapter has also published three books: *Flowering Plants of the Santa Monica Mountains: Coastal and Chaparral Regions in Southern California* by Nancy Dale, *Southern California Native Plants for School Gardens* by Betsey Landis, and a children's book, *Grandmother Oak* by Rosi Dagit. We have also developed a recommended list of native plants available to homeowners, landscapers, and developers in the Santa Monica Mountains.

SAN GABRIEL MOUNTAINS CHAPTER

Size of chapter: Approximately 180 members

Website address: www.cnps-sgm.org

What began in 1985 as an offshoot of the Los Angeles/Santa Monica Mountains Chapter has now blossomed into the vibrant San Gabriel Mountains Chapter. Over the years there were periods when the chapter was "drought deciduous," but we always have grown new leaves and branches, and today we're quite vigorous.

Our well-attended evening pro-



San Gabriel Mountain Chapter members at Mt. Hillyer. Photograph by G. McLean.

grams reflect the diligence and professionalism of our Program Chairs. Many of the presenters are affiliated with Rancho Santa Ana Botanic Garden on the Chapter's eastern edge, so we hear regularly from both professors and graduate students, all with fascinating research to relate. At least one program each year has a horticultural theme.

Under the Oaks: Native Plants for Foothill Gardens is the chapter's annual fundraiser. Late fall is prime planting time, and we are usually the last (for the calendar year) CNPS plant sale in southern California. The sale features native plants and wildflower seeds appropriate for gardens in the San Gabriel, San Fernando, and Pomona valleys. Each sale also features a special event such as a book signing, a CD-ROM debut, or a lecture.

The chapter sponsors two kinds of field trips, both of which are outstanding in quality. The first is a regular monthly walk about the Eaton Canyon Natural Area in the foothills of the San Gabriel Mountains near Pasadena. These trips to the canyon are an excellent way to learn the local flora and to begin understanding basic botany. Each month the leaders are different, and bring a new outlook and their own special expertise to the familiar walk.

The second type of walk explores the San Gabriel Mountains, and affords participants numerous opportunities to study their infinite

variations. We look at willows in winter, ferns in early spring, and seeds and fruits in early fall. There are wildflowers in the burn areas (the fire-followers) and denizens of dripping springs, subalpine plants in the sackungen (ridgetop depressions), endangered species in the carbonates, and lovely lilies in the snowmelt gullies.

All of our activities are highlighted in our well-illustrated quarterly newsletter, *The Paintbrush*. The newsletter also contains member-authored accounts of hikes or gardening adventures, field guides for field trips, local plant profiles, Gabrielino plant articles by Tongva elder, Mark Acuna, and book and website reviews.

RIVERSIDE– SAN BERNARDINO CHAPTER

Size of Chapter: Approximately 180 members

Chapter Website: www.encyliacnps.org

From desert slopes of ocotillo and brittlebush to vernal pools and oaks of the inland valleys, the territory for the Riverside-San Bernardino chapter is large and diverse in flora and vegetation. Our chapter includes all of Riverside County and southwestern San Bernardino County. As is true throughout CNPS, our volunteers make it happen.

For some years the chapter was somewhat inactive. In 2001, through the efforts of CNPS Southern California Botanist Ileene Anderson and then state board member Lorrae Fuentes, our chapter was revitalized. In the process, a whole new CNPS chapter was born, the Mojave Desert Chapter. Since 2001 we have had ongoing activities as we try to reach out to members across a large part of inland southern California.

This fast growing region pre-

sents ongoing challenges for rare plant issues and conservation. Conservation chair Alison Shilling and Rare Plant Chair Fred Roberts are tireless in their efforts to support native plant conservation. With great support from Ileene Anderson, CNPS has a strong presence in conservation issues including large regional conservation plans.

Our first plant sale was held in October 2003 in cooperation with the Riverside/Corona Resource Conservation District. We have co-sponsored with state CNPS staff a Vegetation Sampling Workshop with another one planned for Spring 2005. Propagation workshops in the spring find our dedicated board horticulturists Susan Jett, Michael Duval, and Alison Shilling teaching beginning native plant gardeners and helping to provide materials for future plant sales.

Top: Lorrae Fuentes at the outreach table at the Green Faire with the Riverside-San Bernardino Chapter. • **Bottom:** Members of the Riverside-San Bernardino Chapter in a patch of fireweed (*Epilobium angustifolium*). Photographs by N. Rutherford.



We strive to get the word out about growing natives and native plant conservation issues. Lorrae Fuentes, our education and community outreach chair, makes sure we are often out in the community spreading the word about CNPS. We are helped tremendously by Rancho Santa Ana Botanic Garden which provides space for CNPS at their plant sales and other events.

With lots of requests for help with inland area school gardens, we prepared an extensive supplemental list for inland/desert regions to accompany Betsey Landis's wonderful school gardens book.

Invasive plants are another chapter target. Renowned invasives foe Bill Neill spreads his efforts between Orange County and our chapter in the battle against tamarisk and other exotics. Co-chair Rolf Muerter keeps us in touch with the next invasive removal project and provides great information to our members via our chapter website, www.encyliacnps.org.

Our wonderful quarterly newsletter, *The Encelia*, is under the able stewardship of Nancy Rutherford who also keeps track of our membership. With help from our chapter outreach coordinator, Sheila McMahon, our members are kept well informed and in touch.

SOUTH COAST CHAPTER

Size of chapter: Approximately 100 members

Website address: www.sccnps.org

One of the smallest CNPS chapters, the South Coast Chapter was founded in 1982. One of the unique characteristics of the area is its geological link to the Channel Islands. Some of the rare plants of the Palos Verdes Peninsula, located within the chapter's assigned area, only occur in one other spot—the Channel Islands. We are very much a coastal



South Coast Chapter's Annual Picnic on July 11, 2004 at White Point Nature Preserve. Pictured from left to right: Angelika Brinkmann-Busi, Fabrizio Busi, Corinne Johnson, Barbara Sattler, Ric Dykzeul, and Ralph Iwens. Photograph by J. Iwens.

chapter, and our coastal area has been subject to intense development pressures for many years. However, in recent years we have been pleased to see a number of coastal restoration projects beginning to occur. Although much of the area encompassed by our chapter boundaries has been urbanized, our area also includes the only remaining segment of coastal sage scrub between the Santa Monica Mountains and Orange County. The protection and preservation of this remnant of native habitat has been a primary focus of our chapter in recent years. Currently a Natural Communities Conservation Plan (NCCP) is being finalized by the city of Rancho Palos Verdes, with the hopes that some of the key areas may be purchased for preservation.

Our chapter has been diligent about commenting on proposed development projects and their impacts to our native plants and habitat areas. Several of our members work on committees and with cities and other entities to further our conservation goals.

The South Coast Chapter has always had a strong horticultural base. We hold a plant sale every

year, a number of public programs about gardening with native plants, and an annual Spring Garden Tour. For many years we maintained a native plant garden at Point Vicente in Rancho Palos Verdes. The garden was shut down several years ago to remodel the visitor facility, and reopening was delayed when lead contamination from previous military use was discovered in the soil. We are anticipating that construction of the visitor center will be back on track soon, and that by late 2005 we will be able to begin restoring and expanding the native plant garden.

ORANGE COUNTY CHAPTER

Size of chapter: Approximately 370 members

Website address: www.occnps.org

Orange County is one of California's smallest, yet it enjoys great botanical diversity. Habitats range from coastal sage scrub to foothill chaparral, dune environments to upland mixed conifer forest. Several highly localized endemics are found

in the county. Unfortunately, the pleasant climate and proximity to the ocean has made it a magnet for people, and the resulting development, which has obliterated irreplaceable habitat throughout the county, continues as a major threat. On the positive side, much of the land has been set aside in county and state parks, and in preserves dedicated under NCCP Programs.

Our chapter was founded in 1980. Initially, our activities focused on botany, field trips, and horticulture. In recent years, with pressure from development, we have increasingly directed our energy toward conservation in response to pressure from development of the county's remaining natural edges. At present, our key regional issue is the proposed Ranch Mission Viejo development plan and the officially separate but functionally intertwined toll road extension. At risk is the integrity of the San Mateo Creek watershed habitat—the last wild river south of Ventura—and

for the past three years enthusiastic gardeners have opened their native gardens for a Spring Garden Tour. Nevertheless, we still have time for fun with a vigorous schedule of field trips in and outside the county.

Our bimonthly newsletter is posted to our website where there are also conservation updates, links to our field trip plant lists, field trip information with pictures, some horticultural tips, and even a quiz. Visit us there!

SAN DIEGO CHAPTER

Size of chapter: Approximately 850 members

Website address: www.cnpsd.org

The San Diego Chapter of CNPS is the southernmost chapter in the state, and is home to native plant communities as varied as the beach dunes along the Pacific strand, to alpine meadows and desert dunes near the Arizona border. More sensitive plant species (over 200) are found here than in any other county in the continental United States. Reasons for this plant diversity include the variations in topography, altitude (from sea level to 4,000 feet), the moisture gradient between the coast and the desert, differences in soil, and a number of Baja California species whose range just enters the southern part of the county.

The San Diego region supports several rare habitats such as maritime succulent scrub and southern maritime chaparral. CNPS members and the general public are invited to learn about these unique plants at our monthly program in Balboa Park, which features a presentation and book sales.

The conflict between a growing population and the need to protect endangered species has made San Diego a pioneer in the development of large-scale, long-term, multispecies Habitat Conservation Plans that seek to achieve a balance

between growth and conservation. From the perspective of the San Diego chapter, the local plan has suffered a few failures, including the filling of “preserved” vernal pools, and the destruction of a major population of a protected species. Monitoring this plan is one of the tasks of the chapter's conservation committee. CNPS-San Diego also actively works to conserve our floristic heritage by writing comment letters on development proposals, serving as a local expert on plants to local agencies, and filing lawsuits if necessary. The chapter is currently organizing work parties to support the survival of Nuttall's lotus (*Lotus nuttallianus*) in Mission Bay, and willow monkey orchid (*Monardella viminea*) in Lopez Canyon.

We recognize that invasive non-native plants are a major threat to native plant habitats, and have developed a number of educational programs. The chapter has become a leader in fighting invasive species in projects as varied as proposing legislation to control the sale of pampas grass, holding work parties to hand-weed sensitive habitats, lobbying agencies such as CalTrans to use more native plants, and working with the local chapter of the American Society of Landscape Architects to develop a “Do Not

At the San Diego Chapter's native plant sale. Photograph by L. Pardy.



Orange County Chapter field trip to Laguna Canyon (top). Photograph by J. Hampton.

the rare plants, animals, and habitats found there.

We keep busy supporting education through our grants program and development of curriculum. We help with planting and weeding the California Native Collection at the University of California, Irvine, Arboretum. Fall and spring plant sales provide funds for the chapter, and

Plant” brochure for Southern California, to guide designers away from problem plants.

For many of our members, gardening with natives is their primary interest, and meetings that spotlight native gardening techniques are always popular. Every October in Balboa Park the chapter holds a native plant sale, a major source of funds for the chapter. The plant sale succeeds due to the efforts of dozens of volunteers. The thousands of dollars raised on this day allow us to pursue our goals in conservation, restoration, and education throughout the year. For example, the chapter has launched a program to award grants and free consultations to teachers who are establishing native plant gardens at local schools. To date, 13 San Diego County schools have received funds to develop native gardens. Our members also staff CNPS booths at fairs and exhibitions around the county.

MOJAVE CHAPTER

Size of chapter: Approximately 50 members

Website address: none

The Mojave Desert Chapter of CNPS was started in 2000 as a splinter group of the Riverside/San Bernardino Chapter. Our membership is primarily in the Victorville area, but there are a few members that are scattered two to four hours distant—out here we usually measure distance in time instead of miles. The Mojave Desert Chapter covers the region north of the transverse ranges in the northern portion of San Bernardino County, an area roughly the size of Costa Rica. The landscape is predominantly public and is managed by the Department of Defense, the National Park Service, and the Bureau of Land Management. These agencies offer consistent opportunities and challenges to the environ-



Mojave Desert Chapter field trip in 2003 to find *Prunus eremophila*, newly described by Barry Prigge (in *Madroño* 14(4) 2002). Twenty-five members went along on this trip to the Eastern Mojave National Preserve in the Vontiger Hills, and were rewarded with finding the plant. Photograph by T. Thomas.

mental community to monitor and comment upon actions that have the potential to adversely affect the natural resources of the desert.

Several rare and endemic desert plants occur on these lands, so there is plenty of work for each of our members just looking after them. Edwards Air Force Base is home to the world's largest stands of *Calochortus striatus* and *Cymopterus deserticola*. China Lake Naval Weapons Center contains virtually the entire distribution of *Cryptantha clokeyi*. Fort Irwin, the US Army's tank training center, has significant populations of *Astragalus jaegerianus* and *Cymopterus deserticola*. Twenty-nine Palms Marine Corps Training Center has 80 percent of the distribution of *Escobaria vivipara* var. *alversonii*. The Mojave National Preserve manages the only known locations of *Eriogonum ericifolium* var. *thornei* and *Astragalus cimae* var. *cimae*. Joshua Tree National Park manages *Monardella robisonii* and portions of the distribution of *Linanthus maculatus*. The Bureau of Land Management has the majority of the occurrences of *Mimulus mohavensis* and *Eriophyllum mohavensis*. The only extant location for *Plagiobothrys parishii* is on a single private parcel under the county of San Bernardino's planning respon-

sibility. Other significant plant occurrences that are found within the chapter boundaries include the oldest known living plant, the 'King-Clone' creosote bush (*Larrea tridentata*), immediately adjacent to a designated BLM off-highway vehicle unrestricted play area, and the saguaro cactus (*Carnegiea gigantea*) in the Whipple Mountains.

The chapter holds meetings at the Victor Valley College where there is a small registered herbarium. Pam MacKay, a biology/botany instructor at the college and founding member of the chapter, recently authored a color photographic guide, *Mojave Desert Wildflowers*, that uniquely contains some of the rarest species to help educate the public about the rare and endemic plants of the region. Our activities consist mainly of winter and spring field trips and bimonthly meetings, and we attempt to produce a quarterly newsletter. We have an active conservation chair, specifically knowledgeable about the BLM. And last but not least, one of our members, Tom Elder, is working with other CNPS members to organize the photographic taxonomy project at the state level.

Each chapter summary was authored by one or more representatives from that chapter.

THE CALIFORNIA NATIVE PLANT SOCIETY AT THE STATE LEVEL: WHO WE ARE AND WHAT WE DO

by Michael Tomlinson

When the founding members got together in Berkeley in 1965 for the first meeting of CNPS, I doubt they could have conceived of what the Society would become 40 years later. How do you really picture 32 chapters, more than 9,700 members, 87,000 volunteer hours, and 15 staff people? How could they ever have predicted that CNPS

would become the largest native plant society in the United States?

Today CNPS has an office in Sacramento that serves as its state headquarters, three staffed programs, and several employees across the state. CNPS also continues to rely on its traditional strength: its extraordinarily dedicated volunteer corps. In fact, many CNPS programs are “staffed” entirely by vol-

unteers, making CNPS fairly unusual in the nonprofit world. In 2003 volunteers gave 87,000 hours of their time (equivalent to 42 full-time employees!) to activities ranging from organizing native plant sales and commenting on land use and management plans, to taking school kids on field trips to vernal pools.

CNPS STAFFED PROGRAMS

A pivotal question in most conservation issues involving plants in California is, “How rare is this plant or plant community, and where is it located?” Good answers to such questions—or, in other words, good science—becomes the basis for creating viable habitat protection and management plans. CNPS plant science and conservation staff work in a continuum; the Rare Plant and Vegetation programs help define the rarity of plants and vegetation types, and the Conservation programs work to make sure that this good science guides planning and management decisions. For instance, data from CNPS vegetation surveys in the San Dieguito River watershed have provided critical information for prioritizing land purchases for the San Dieguito River Valley Park.

THE FIRST CNPS PROGRAM: RARE PLANTS

Founded in the early 1970s, the CNPS Rare Plant Program develops current, accurate information



Joe Molter, a Bureau of Land Management Botanist, pictured here with his discovery of the first California occurrence of Gentner's fritillary (*Fritillaria gentneri*) in Siskiyou County, 2003. All photographs by the author except as noted.

Gentner's fritillary (left) is listed as Endangered by the federal government and was recently added to the CNPS Rare Plant Program's *Inventory of Rare and Endangered Plants*. Before Joe's discovery, the plant was thought to occur only in Oregon. Recently, more plants were found about a mile east of the first locality. This perennial herbaceous member of the lily family grows in oak woodland and open chaparral at 1,080–1,120 meters elevation. The species is particularly vulnerable to a number of existing and potential threats because its populations are very small.

THE GOVERNANCE STRUCTURE OF CNPS

All members of the California Native Plant Society belong to one of its 32 chapters. The statewide Society is run by chapter delegates who form the Chapter Council; the Board; the paid staff (both contractual and salaried) overseen by the Executive Director; and the programs that are run by volunteers. The membership, through its Chapter Council delegates, works to determine the policy objectives of our society, and the Board and Executive Director work to implement these objectives in a fiscally and legally responsible manner. (For current listings of Chapter Council, Board, Staff, and Program Directors, see roster on the inside front cover of this issue.)

CNPS CHAPTER COUNCIL

This body is composed of a single representative from each chapter. The Chapter Council delegates elect a Chair, Vice Chair, and Secretary. The Council meets on a quarterly basis. At Chapter Council meetings delegates debate policy issues and give policy direction to the CNPS Board of Directors. The Chapter Council also elects the CNPS Board of Directors and Board officers. Standing Chapter Council committees include: Bylaws, Chapter Support, Governance/Elections, Meeting Organization, and Program Policy.

CNPS BOARD OF DIRECTORS

Board members (up to 11) and Board officers (President, Vice President, Secretary, and Treasurer)

are elected to two year terms. There are no term limits. The Chapter Council Chair and Vice Chair also serve on the Board. The Board has ultimate fiscal and legal responsibility for CNPS. It works with the CNPS Executive Director to approve the annual budget and program work plans, and to ensure that these plans follow the policy directions of the Chapter Council. The Board has ultimate responsibility for hiring the CNPS Executive Director. The



Pam Muick, Executive Director of CNPS.

Chapter council meeting of the California Native Plant Society.



on the distribution, ecology, and conservation status of California's rare and endangered plants, and uses this information to promote science-based plant conservation in California. During its considerable history, the Rare Plant Program has developed a reputation among policymakers and stakeholder groups throughout the state for scientific accuracy and integrity. The Program's data are widely accepted as the standard for information on

the rarity and endangerment status of the California flora.

The primary means of distributing this information is through the continually updated *Inventory of Rare and Endangered Plants of California*, a database of more than 2,000 rare and uncommon plant taxa. It is available in print, on CD, and can be viewed at the CNPS website, www.cnps.org. The information in the *Inventory* has played a significant role in gaining

federal listings for nearly 200 plants, and state listings for 29 plants. These listings provide increased protection for these plants and their habitats.

The CNPS Rare Plant Botanist, Misa Ward, coordinates, facilitates, and augments the work of scores of CNPS volunteer botanists at both the state and local levels. She also works closely with botanists from state and federal agencies by sharing data on rare plants.

CNPS Board meets at least six times a year, usually on the same weekend as the Chapter Council. Standing Board committees include: Bylaws, Chapter Support, Executive, Finance, Fundraising, Leadership and Evaluation, and Planning and Evaluation.

THE STATE OFFICE

The 32 chapters across the state are the heart of the society and, naturally, many CNPS members' most immediate connection to the organization. However, the combined efforts of the chapters and state office create an organization that does more than the sum of its parts. The CNPS state office supports all program and chapter activities with expert guidance on statewide and federal issues. This includes running and staffing the Plant Science, Conservation, and Legislation programs. In addition, the staff of the CNPS state office maintains the book and poster sales program. Of great importance, the office staff provides the essentials of bookkeeping, payroll, and audit services; insurance for all CNPS activities; payment of taxes and upkeep of nonprofit status; management of membership and fundraising; website and Internet services; general public relations and fielding of questions; and coordination of statewide meetings.

CNPS STAFF AND VOLUNTEER PROGRAMS

Who are CNPS members and how do we protect plants? Images of Dr. Seuss's brave Lorax leap to mind: "*I am the Lorax I speak for the trees.*" Similarly, CNPS members—volunteers and staff—are people who speak for California's plants and habitats.



CNPS Vice President, Sandy McCoy, honoring Sue Britting at the end of her tenure as CNPS President in 2003.

CNPS members speak for the plants using facts and science as advocacy tools. Through the CNPS programs, volunteers and staff gather facts and continuously add to the knowledge about common, rare, and endangered native plants. Many of our chapter and state activities are vehicles for sharing information: talks, hikes, school gardens, plant sales, popular articles, books, and posters. We also share this information when we testify at public hearings and to the legislature, participate in letter writing campaigns, and occasionally use legal action to insure that plants are being protected. Through the structure of the state programs, and with the assistance of paid staff, CNPS members can more effectively speak for California's plants, thus sharing our unabashed love and appreciation of California's native plants and their habitats.

VEGETATION: SAMPLING THE BIG PICTURE

The Vegetation Program had its origins in 1990 when a small ad hoc subcommittee of the CNPS Rare Plant Program proposed a parallel program to develop comparable information about California's plant communities. In 1995 CNPS published *A Manual of California Vegetation*, which quickly became

the authoritative publication on the subject. Recognizing the paucity of quantitative field data to support the definitions of vegetation types throughout much of the state, the CNPS program has developed vegetation sampling protocols and trained numerous volunteers and agency staff in their use.

CNPS vegetation staff travel around the state teaching volunteers and agency professionals uniform, scientific methods to describe

and map plant communities such as coastal prairie, redwood forest, and high mountain meadows. This is vital data collection—fundamental both to science and to creating sound, sustainable ecosystem management by state, federal, and county agencies.

The Vegetation Program also serves as a nexus for the accumulation and dissemination of information about California vegetation. It coordinates a range of volunteer and



CNPS members looking at Peirson's milkvetch (*Astragalus magdalenae* var. *peirsonii*) at Algodones Dunes in Imperial County.

For the past decade the CNPS Conservation Program has made extensive efforts to protect Algodones Dunes habitat and the suite of endemic plant species that live there from off-road vehicles. In 2004 CNPS helped the US Fish and Wildlife Service (FWS) reach a decision based on good science when it turned back efforts by off-road groups trying to remove federal protections for the



Peirson's milkvetch, and determined that off-road vehicle use in the area continues to threaten the existence of this species. However, later that year FWS issued a Final Critical Habitat Rule for the Peirson's milkvetch that reduced the area of land on which the plant will be protected by more than 60%. The Conservation Program is currently exploring all remaining avenues to protect these amazing dune dwellers.

agency involvement in vegetation conservation, from grassroots field sampling by local CNPS chapters, to focused work on individual vegetation types requiring definition, to multi-agency coordinated projects for broad-scale mapping and classification of vegetation. The program's principle responsibility is the maintenance and development of the CNPS vegetation classification. It is also responsible for coordinating and integrating ecological sampling information on vegetation throughout the state.

The Vegetation Program has developed digital databases known as the California Vegetation Information System (CVIS) and the Rapid Assessment database to accomplish these goals. CVIS consists of two parts: a Sampling Database, which archives the vegetation samples collected by CNPS and other agencies and organizations, and the Classification Database, which houses the information on the descriptions of each of the vegetation types identified in *A Manual of California Vegetation*. The Rapid Assessment method also has its own database to archive vegeta-

tion samples, which provides additional species, environmental, and site-quality information to characterize vegetation and habitats.

CNPS staff recently completed

sampling and classification field work on 1.3 million acres in San Diego and Western Riverside counties. Having now defined the types and distributions of plant communities in this growing region of the state, it will be easier to focus CNPS conservation and restoration efforts. Current CNPS staff in the Vegetation Program include Vegetation Ecologists Julie Evens and Anne Klein, and Vegetation Assistants Sau San and Jeanne Taylor.

CONSERVATION

The Conservation Program staff and volunteers serve as advocates for science-based land management practices. Their charge is to conserve native plant species and their habitats on public and private lands in California. There are laws, regulations, and ordinances at all levels of government that are intended to protect plants. Some accomplish

CNPS members surveying serpentine vegetation on Coyote Ridge in southern Santa Clara County. In 2004 the CNPS Vegetation Program and the Santa Clara Valley Chapter completed a multi-year vegetation survey of the remarkable serpentine plant communities on Coyote Ridge in southern Santa Clara County. The survey more than doubled the list of known plants in the area and generated data that will be vital to a new multispecies habitat conservation plan begun by the US Fish and Wildlife Service. The plan is required because the area has been declared Critical Habitat for the threatened bay checkerspot butterfly. CNPS surveyed more than 30 different plant associations, including at least 10 new associations for California, such as those involving the Mt. Hamilton thistle (*Cirsium fontinale* var. *campylon*), serpentine grasslands, and shrublands. Surveyors discovered a rare plant not previously known from the Hamilton Range, the Loma Prieta hoita (*Hoita strobilina*) and a new population of the state and federally listed Tiburon Indian paintbrush (*Castilleja affinis* ssp. *neglecta*).





Southern California Regional Conservation Committee, at the Eaton Canyon Nature Center (home of the San Gabriel Mountains Chapter) in November 2003. Back row (left to right): David Chipping (San Luis Obispo Chapter and state Conservation Program Chair), Dave Magney (Channel Islands Chapter), Dave Fleitner (San Diego Chapter), Rick Fisher (San Gabriel Chapter), Pam Muick (CNPS Executive Director). Middle row: Barbara Sattler (South Coast Chapter), Cindy Burrascano (San Diego Chapter), Alison Shilling (Riverside/San Bernardino Chapter), Betsey Landis (Los Angeles/Santa Monica Mountains Chapter), Daniel Pritchett (Bristlecone Chapter), Tim Thomas (Mojave Chapter). Front Row: Steve Hartman (Los Angeles/Santa Monica Mountains Chapter), Celia Kutcher (Orange County Chapter), Ileene Anderson (CNPS Senior Conservation Botanist), David Sundstrom (South Coast Chapter). Photograph by S. Hartman.

this goal, and the program works to ensure they are used as intended. Other laws are less useful and so program staff work with the appropriate jurisdiction or agency to re-examine and modify sections pertaining to plant issues.

Conservation staff use science-based information provided by the CNPS Plant Science Program and promote the use of this information by public agencies, local jurisdictions, and others involved in land-use decisions. CNPS chapter volunteers monitor, observe, and follow what is actually happening in the field—what is done or proposed within their areas. They testify, offer comments, and help interpret the best available scientific information to decision-makers. Because the state and federal En-

dangered Species Acts provide the most fundamental protection for plants in most instances, much of the work of CNPS relies on and invokes these laws. Challenging or changing them has been an important topic in recent years.

For instance, in the past decade, CNPS has played a leading role in the nation's first Habitat Conservation Plans (HCPs) in southern California. Through our participation we have learned about the opportunities and limitations of the collaborative and consensus-driven regional plans. Our experience is that it is critical to be involved in these plans from their inception and work with all parties. For instance, in the West Riverside HCP, without the consistent presence of the CNPS Southern California Botanist Ileene

Anderson, native plants would not have been included in the planning process.

Within the Conservation Programs there are several areas of focus, including Legislation, Timber/Forestry, Southern California, and the Native Plant Conservation Campaign (NPCC) (see page 16). The East Bay Chapter also recently added a new staff member, conservation analyst Jessica Jean Olson. David Chipping is the Conservation Program director.

LEGISLATION

The Legislative Program's mission is to ensure that persons formulating laws and regulations at all levels—local, state, and federal, and



Emily Roberson, who served as CNPS Senior Policy Analyst for many years, is now at the Center for Biological Diversity, heading up the Native Plant Protection Campaign.

within the legislative and administrative spheres—understand the importance of California's native flora and the serious threats facing the long-term survival of many species. The CNPS mission statement clearly directs all of its programs to protect and preserve California's native flora, and sometimes this necessitates influencing legislative actions. The program accomplishes this by monitoring how government

Peigi Duvall (right), chair of the CNPS Horticulture Program, discussing plant sales with Joan Stewart (left) at the December 2004 Chapter Council meeting. Photograph by L. Vorobik.



actions may affect plants, whether through the county permit process or by compliance of individual projects with federal law. Vern Goehring, a part-time staff legislative advocate, helps coordinate state legal issues and works with local chapter volunteers and Conservation Program staff.

TIMBER/FORESTRY

The CNPS Forestry Program is dedicated to protecting California's forests and woodlands through science, advocacy, and chapter participation. A recent major victory for the program was the upholding of a ruling that gives plants equal status to animals in the review of timber harvest plans. This means that rare plants remain protected on private timberlands, thanks to the vigilance of the CNPS Forestry Program and botanists at the California Department of Fish and Game. The ruling resulted from a case monitored by the Forestry Program since 2001, in which the California Department of Forestry and Fire Protection (CDF) rejected a timber harvesting plan that did not adequately address threats to rare plants.

SOUTHERN CALIFORNIA

CNPS has a part-time staff person working on behalf of the organization in southern California. Ileene Anderson, formerly Southern California Regional Botanist and now Senior Conservation Botanist, advocates on a variety of plant conservation issues concerning private lands such as Newhall Ranch and Tejon Ranch, or concerning public lands such as those managed by the BLM or USFS. She also works on Habitat Conservation Plans and Natural Communities Conservation Plans. Ileene has also been a lead player in an innovative, cooperative

stakeholder- and science-based plan to protect endangered carbonate plants in the San Bernardino Mountains. If current trends continue, the Carbonate Habitat Management Strategy (CHMS) will be a model of what can be achieved when conservationists, businesses, and government agencies sit at the table and work in good faith to solve difficult problems.

THE NATIVE PLANT CONSERVATION CAMPAIGN

The Native Plant Conservation Campaign (NPCC) is a joint project of the California Native Plant Society and the Center for Biological Diversity (CBD). Emily Roberson, former CNPS Senior Policy Analyst, now with CBD, helped form the coalition in 2001 and continues to staff it. The NPCC is a national grass-roots network of state native plant societies, botanic gardens, and other local and regional native plant science and conservation organizations, representing nearly 60,000 individual members in 29 states. The NPCC is the first and only organization dedicated to federal advocacy on behalf of native plant species and communities.

A key part of the project's mission is to provide low- or no-cost tools to help local native plant organizations educate the public, policymakers, agencies, and the media about the values of and threats to our nation's native plants. An initial NPCC success was helping convince the US Forest Service to increase its staff of full-time botanists by 40 positions—a 30 percent increase!

Another success story concerns the federal native plants development program, which funds efforts by the Bureau of Land Management and the Forest Service to collect and propagate local native plants for revegetation of roads and

other projects. Congress has put more than \$10 million into this program in the past few years. Here in California, these funds have brought us many new projects, including Forest Service greenhouses, scientific studies to determine which local natives are appropriate for revegetation projects, and propagation contracts with private native seed producers.

EDUCATION & HORTICULTURE

One of the six programs of CNPS, the state-level Horticulture Program, has been rejuvenated in the past year by new volunteer program chair Peigi Duvall. The Program has no paid staff. Peigi has led a fact-finding and planning process that will allow CNPS to increase outreach and education efforts about the horticultural uses of native plants in our populous state. The Program has identified several areas it will focus on as it moves forward, including:

- *Outreach and education to the gardening public:* CNPS's 32 local chapters are vibrant in their horticultural activities, and the state Horticulture Program provides support to further strengthen the effectiveness of these efforts. In 2003 CNPS chapters held more than 40 plants sales, utilizing at least 14,000 volunteer hours.
- *Outreach and education to nurseries, the landscape industry, and municipalities:* These groups are key decision makers on the broad-scale usage of natives in horticulture. CNPS is currently working to develop plans to conduct targeted outreach to these groups.
- *Creation of a web-based database of horticultural information*

on specific native plants: Although still in the conceptual stages of development, once developed, this database can be used by the general public to search for horticultural information on specific plants.

- *Restoration:* Over the long-term, the program will look to provide expertise on this intersection of the horticulture and conservation science fields.

IN CONCLUSION

CNPS statewide programs in plant science, conservation, advocacy, education, and horticulture play a key role in helping to increase public appreciation of California's native plants and preserving them for future generations.

Most importantly, these programs increase the effectiveness of local chapters' efforts by providing technical and administrative support and guidance. This support can take many forms, including maintaining the most up-to-date information on rare plants and habitat types, strategizing on Habitat Conservation Plans, helping to locate the best scientific data to influence policy decisions, training chapter volunteers to take plant surveys, assisting chapters in their work to educate the public on the best uses of native plants, and disseminating science-based information through the Society's two publications, *Fremontia* and *The Bulletin*, as well as its own books and floras.

Michael Tomlinson, Provost's Office of Advancement, University of California, Davis. mtomlinson@ucdavis.edu



New logo for CNPS's 40th year, selected at the September 2004 Chapter Council Meeting in Marin County. Created by Sacramento Valley Chapter member, "Slowhand."



A-Jacks, erosion control devices in Lopez Canyon, San Diego County, used to check water flow and thus protect the habitat of the rare willowy monardella. All images used courtesy of City of San Diego, 2003.

SAVING A RARE PLANT IN AN URBAN ENVIRONMENT

by Keith Greer and Holly Cheong

For its size, San Diego County is blessed with one of the highest number of endemic species in the nation. Considered a hotspot for endangered species (Dobson et al. 1997), San Diego has also undergone waves of rapid urbanization since the 1950s. While recent conservation efforts have focused on protecting species and their habitats from direct impacts such as urban development, active land management is equally important to protect species on lands already preserved.

This paper describes efforts of the City of San Diego, in conjunction with the nonprofit Friends of Los Peñasquitos Canyon, to protect a population of the federal and state endan-

gered willowy monardella (*Monardella linoidea* Gray ssp. *viminea* (E. Greene) Abrams; see sidebars) from changes in urban hydrology.

Willowy monardella occurs in the alluvial terraces and cobble bed of intermittent streams in Lopez Canyon, a part of the Los Peñasquitos Preserve located within south and central San Diego County. While Lopez Canyon is part of a city park managed for its natural and cultural resources, indirect impacts from watershed urbanization have threatened the existing monardella population. Since the mid-1970s the 4.5 square mile watershed of Lopez Canyon has been developed into the suburban community of Mira Mesa. Currently, 65% of the watershed has

been covered by impervious surfaces such as pavement or structures.

When urbanization spreads into undeveloped watersheds, the percentage of impervious land surface increases, resulting in changes to hydrology that include increased stream discharge and velocity due to urban runoff, as well as changes in the timing of these flows. White and Greer (2002) documented an annual 4% increase in stream discharge since 1972 due to watershed urbanization in nearby Los Peñasquitos Creek. This increased discharge and velocity has resulted in increased scouring of the streambed, undercutting the alluvial terraces in Lopez Canyon that support willowy monardella.

The loss of alluvial terraces and the

enlargement of the intermittent stream channel were predicted by Karen Prestegard (1979) in her masters thesis. Current and pre-urbanization aerial photographs support Prestegard's predictions, and can be seen in Figure 1. Since 1995 the Friends of Peñasquitos Canyon have documented the loss of several large patches of monardella after large storm events. Effective management for willow monardella in Lopez Canyon requires managing the changes in hydrology caused by watershed urbanization.

Recognizing this problem, staff from the City of San Diego and volunteers from the Friends of Peñasquitos determined that there was a need for hydrologic structures to slow the water velocity and reduce scour. In addition, they determined that it would also be necessary to address changes in hydrologic condition in the entire watershed. This resulted in a two-phase approach: a long-term goal to address the hydrologic changes and a short-term goal of protecting the existing patches of willow monardella.

Working with a diverse citizens advisory committee, the Cities of Poway, Del Mar, and San Diego began looking at a comprehensive, long-term approach that would create a watershed management plan for the area. Those involved have just started to identify areas of stream impairment and possible solutions, but what about the short-term?

In 2001, the City of San Diego re-

ceived grant funding from the California Department of Fish and Game and the California Coastal Conservancy to implement an erosion control project to protect willow monardella in Lopez Canyon. The first task was to design the project. Several alternatives were investigated and rejected prior to settling on the final design.

The first alternative came from two California State Parks engineers who volunteered their time to survey the monardella sites in Lopez Canyon, along with a volunteer representing the Friends of Los Peñasquitos Canyon Preserve. They proposed a series of grade control structures including drop structures, weirs, gabions, and bank armoring. Ultimately this proposal was deemed infeasible because its cost exceeded the available funds.

The second alternative came from the Natural Resources Conservation Service (NRCS) of the USDA. Their engineers drafted plans for a simpler design involving cobble berms to protect the two major monardella sites from erosive wintertime flows. These plans were reviewed in a preliminary meeting with the federal and state resource agencies in 2002. The US Army Corps of Engineers (ACOE) argued that the berm for the downstream site would redirect a secondary channel flow, possibly causing a detrimental change in hydrology.

It became apparent that obtaining approvals from the Corps and the Regional Water Quality Control Board

(RWQCB) would be very time-consuming for the berm design. In addition, grant funding would have expired before the permitting process for those agencies could be completed. Also, the berm design could have possibly impacted an already eroded sewer line within the canyon. Instead of risking unforeseen negative impacts to the canyon, the project team decided to look for another solution.

After consulting with staff from many agencies, it was determined that a new form of erosion control, called A-Jacks, would be the best solution for Lopez Canyon. A-Jacks are concrete armor units designed to interlock into a flexible, water-permeable chain. A-Jacks help dissipate water velocity, protecting channel terraces from scouring and erosion, two problems experts knew they had to solve. A-Jacks also collect sediment within the water, minimizing impacts downstream from deposition, a third problem in the Canyon's waterways. Downstream deposition of sediment into Los Peñasquitos Lagoon had already caused significant impairment (California State Coastal Conservancy 1985). Collection of sediment would also help stabilize the terraces, provide additional habitat areas for willow monardella, and hide the A-Jacks from view.

An engineering firm was contracted to draft a set of plans using A-Jacks to protect the population of monardella without significantly altering the hy-

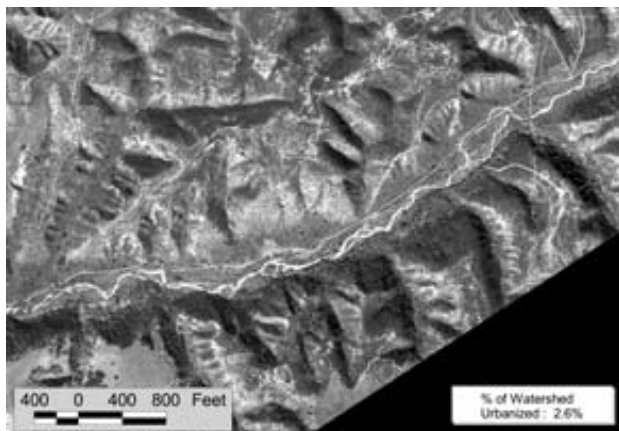


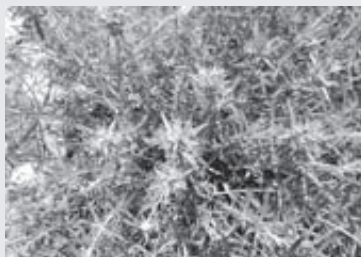
FIGURE 1A. Lopez Canyon, San Diego ca. 1969. Aerial photograph of the canyon prior to the development of the suburban community of Mira Mesa. Note the stream bed of Lopez Creek shown as a meandering white line crossing horizontally in the center of the photograph.



FIGURE 1B. Lopez Canyon, San Diego ca. 2002. Aerial photograph of the canyon after the development of the suburban community of Mira Mesa. Note the enlargement of the stream bed throughout the canyon. 2003 locations of willow monardella are shown as white triangles.

WILLOWY MONARDELLA IN SOUTHERN CALIFORNIA

Willowy monardella (*Monardella linoides* Gary ssp. *viminea* (E. Greene) Abrams) is a state and federally endangered plant species that is found along drainages within central and south San Diego County. It is a



perennial herb that blooms between June and August. This plant species is in the mint family (Lamiaceae) and has a pleasant spearmint aroma.

Habitat for willowy monardella is extremely limited. This rare plant species is only found on terraces along natural drainage courses. As development has increased in San Diego County, willowy monardella has been threatened by

floodplain development, increased urban runoff, and invasion by weeds. Willowy monardella does not compete well with other plants and can be choked out by weeds which invade the streamside terraces. In addition, sparse riparian habitat can turn into thick riparian woodland with increased urban runoff, further decreasing habitat areas for willowy monardella. Urban runoff can also erode the streamside terraces where willowy monardella resides, washing the plant and its habitat downstream. The latter example is what has occurred within Lopez Canyon.

Due to habitat degradation, this plant species is becoming increasingly rare. Only six known locations continue to persist, with the largest population occurring on military land. Many populations in upper Lopez Canyon, Soledad Canyon, and other canyons throughout San Diego have been extirpated. It is extremely important that all remaining populations of willowy monardella be protected and managed. Recent taxonomic work by Andy Sanders and Mark Elvin supports the reclassification of willowy monardella to its own species (*Monardella viminea*), with a new species *Monardella stoneana* (Jennifer's monardella) being described from near the US-Mexican border (see *Novon* 13(4):426 (2003)).



Willowy monardella (*Monardella linoides* ssp. *viminea*), from Lopez Canyon, San Diego County.

drology of the adjacent channels. After consultations and site visits with involved agencies, this third alternative was deemed the most feasible.

Project construction began on August 11, 2003. Urban Corps of San Diego was hired to conduct the installation. This non-profit organization, which focuses on opportunities to conserve our natural resources, provides job training and educational opportunities for young inner-city men and women ages 18 to 25. Representatives from the Friends of Los Peñasquitos Canyon Preserve, Erosion Control Technologies, and a senior ranger for Los Peñasquitos Canyon Preserve, supervised and assisted with the A-Jacks installation.

A small Bobcat or hand tools were used to create the trench for the footing of the A-Jacks. Once the trench was completed, A-Jacks were installed on the site in a long, linked chain. A-Jacks weigh about 80 pounds each and had to be fitted together exactly to ensure proper functioning. The installation, which took about one week, was scheduled to take advantage of the dry summer season when Lopez Creek does not flow. Needless to say, it was a laborious process and the project team, including Urban Corps, maintained a great attitude during the hot summer.

Now that the project has been completed, City of San Diego staff and the Friends of Los Peñasquitos Canyon Preserve hope to preserve and enhance the natural populations of willowy monardella in Lopez Canyon. Annual surveys, started in 2000 (City of San Diego 2000), are documenting the effectiveness of the A-Jacks. These reports will be provided to the federal and state resource agencies and made available to the public.

If our program is successful, in a few years additional habitat for willowy monardella will be created in Lopez Canyon by the natural collection of sediment on the A-Jacks. When that occurs, the Friends of Los Peñasquitos Canyon Preserve expect to plant additional willowy monardella in Lopez Canyon to boost the population.

The City of San Diego staff were able to videotape the installation of the A-Jacks and interview some of the key members of the project team. This video documents the work that went

A BRIEF EXPLANATION OF THE *MONARDELLA LINOIDES* AND *M. ODORATISSIMA* ALLIES IN SOUTHERN CALIFORNIA

The genus *Monardella* consists of approximately 50 taxa of annual and perennial herbs that are found throughout western North America with almost all taxa occurring either partially or wholly in California. *Monardella* species vary mostly in their vegetative characters (as opposed to floral characters), notably pubescence and the size and shape of their leaves and bracts. Speciation in *Monardella* seems to be driven, in part, by a combination of isolation and vegetative and/or physiological adaptation to local conditions (personal observation, M. Elvin and A.C. Sanders).

Many taxonomic problems exist in *Monardella*. The *Monardella* populations in southern California are no exception. They appear to be very similar and it can be difficult to distinguish between the taxa; however, they can be separated into natural groups based on a series of shared characters. The *M. odoratissima* and *M. linoides* species groups are among the most difficult to distinguish in the genus. The taxa in these groups have regularly been confused in the field and herbaria, but can be recognized by small but consistent differences between them.

Plants in the *Monardella linoides* species group generally have narrow leaves (broadly linear) and herbage covered with a short dense pubescence. Their leaves have a winged petiole, an attenuate base, and a consistently narrowish blade that expands gradually to the widest point. The stems and leaves have a short dense pubescence in most cases, with mixed long and short dense hairs in a few populations (e.g., *M. robisonii*). *Monardella linoides* is represented in southern California by a number of taxa including several subspecies of *M. linoides*, *M. robisonii*, and *M. viminea* (a former subspecies of *M. linoides*).

Monardella viminea (willow monardella) is a wispy low growing non-rhizomatous perennial with stems that drape out from the center, which is how it got its common name. It grows on secondary alluvial benches in ephemeral washes (drainages

with running surface water for 24 to 48 hours after a rain) that cut through cismontane marine and alluvial terraces of central San Diego within 20 km of the Pacific Ocean. *Monardella viminea* has a relatively sparse pubescence (especially compared to the closely related *M. linoides* ssp. *linoides*) and is conspicuously and rather densely glandular on the stems and leaves. The leaves are broadly linear to narrowly lanceolate with a length to width ratio of between 7 and 10 to 1. The inflorescence bracts are conspicuously longer than the calyces. *Monardella viminea* has a strong sweet scent of the sort typically associated with *Monardella*.

Plants in the *Monardella odoratissima* species group generally have wide leaves (lance-ovate) and glabrous to sparsely pubescent herbage. Their leaves have a distinct petiole, an acute base, and a relatively broad blade that expands quickly to the widest point. The stems and leaves are generally either glabrous or sparsely pubescent to sparsely short-villous. *Monardella odoratissima* is only represented in southern California by the derivative taxa *M. australis* and the new species, *M. stoneana* (which was recently published in *Novon* 13(4)).

Monardella stoneana (Jennifer's monardella) is a low, compact and non-rhizomatous perennial. It grows in intermittent streams that carry water for several weeks to months during and after the winter rainy season. It most often grows among boulders, stones, and in cracks of the bedrock of these intermittent streams in rocky gorges in the mountains just east of San Diego and into northern Baja California, Mexico. *Monardella stoneana* stems are rather stout compared to the other species in the genus. It is sparsely pubescent to almost glabrous and less glandular than both *M. odoratissima* and *M. viminea*. Its leaves are lanceolate to lance-ovate with a length to width ratio of between 3 and 5:1. The inflorescence bracts are noticeably rather small, of more or less the same length as the calyces. *Monardella stoneana* has a strong and pungent, minty scent.

—Mark Elvin

into this project and provides a valuable guide for anyone considering a similar project. The video, titled the "Lopez Canyon Willow Monardella Protection Project," is available from the City of San Diego.

Although this project underwent a significant number of design changes, it was ultimately successful. One of the main reasons for its success is the incorporation of volunteers into the project. Without their assistance and

vision, this project might still be in the design and permitting stage. The hope is that this project will stop the onslaught of urban runoff on this sensitive plant species and stabilize the eroded terraces for future populations

of willowy monardella. Although the damage to the watershed will not be undone by this project, it will reduce further sediment deposition downstream and minimize erosion within Lopez Canyon.

Future projects included in the Lopez Canyon watershed management plan can build off of this effort to improve the quality of this canyon and its habitats.

ACKNOWLEDGMENTS

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Clockwise from top: Completed installation of the erosion control devices. • The A-Jacks should trap sediment, as well as protect the alluvial terraces, allowing the devices to be partially buried from view in the future. • A-Jacks erosion control device. • Urban Corps of San Diego installing A-Jacks around the alluvial terraces supporting willowy monardella.

POLLINATION BIOLOGY OF THE CLUSTERED LADY SLIPPER

by Charles L. Argue

Orchid flowers and their pollinators provide many examples of highly specialized relationships. The plants are often fertile across species and even generic boundaries, and selection for reproductive isolation has led to the evolution of novel floral morphologies and pollinator behaviors. Biologists have devoted much effort to untangling the interactions between these flowers and their pollen vectors. The most devious orchids are those that produce no nectar or any other floral rewards, employing instead some method of deceit. This group includes the lady slippers, where field and laboratory studies have now disclosed much about the pollination process, the breeding system, and the factors that limit or otherwise influence fruiting success.

A recently studied example is the rare clustered lady slipper (*Cypripedium fasciculatum* Kellogg ex S. Watson). One of only three species of the genus native to western North America, the clustered lady slipper is a small terrestrial orchid of cool,



Clustered lady slipper (*Cypripedium fasciculatum*). Photographs by M.A. Carr.



seasonally dry mountain slopes or moist stream terraces, where it occurs on various substrates, often in partially to fully shaded coniferous forest. Small isolated populations are scattered at elevations of 150–1,900 meters from Washington to northern California and east in the mountains to Idaho, Montana, Wyoming, Utah, and Colorado. In California it is found in the Coast Ranges and Sierra Nevada from Del Norte and Siskiyou counties south to Nevada County with historical

records from San Mateo, Santa Cruz, and Santa Clara counties. I recently (2003) made an extensive search for it in the Santa Cruz Mountains without success.

THE SEMI-TRAP BLOSSOM

The flowers are not showy. A short rhizome produces 2–10 clustered aerial stems, each up to 25 cm tall with 1–8 musky-smelling, small,



drooping, flowers closely spaced in a short arching raceme. Flowering begins in the spring or early summer depending on elevation and aspect. All the flowers of an inflorescence open in less than a week, and individual flowers are usually receptive for over two weeks. The sepals and lateral petals vary in color from purple-brown to yellowish-green and are lined with darker, brownish-purple veins. The lateral sepals are fused nearly to their tips while the dorsal sepal arches over a nearly spherical, dull yellow-green lip (slipper or labellum) mottled with red to purple markings, especially around its mouth (Figure 1).

This lip plays a critical role in pollination. Lady slippers have flowers of a type known as trap or semi-trap blossoms. They temporarily imprison their insect pollinators and force them to follow a prescribed sequence of behaviors in order to obtain their release. I, like others, have observed the pollination mechanism in a number of out-crossing species, and it is the same in each. An insect of the appropriate size enters the lip through the obvious large opening at its top (Figures 1 and 4). The slippery inner surface and the in-folded margins prevent it from leaving by the same route. Even though insects have been reported to sometimes chew through the wall tissue, most find a different way out. A foothold is provided by tightly packed, long hairs (trichomes) on the bottom of the lip. These lead along a pathway (in German, "haarstrassen") toward escape holes at the base or heel of the slipper (Figures 1 and 4).

In its escape the pollinator must pass two points where the passageway is narrowed. At the first of these it is forced to squeeze under and rub its back against the surface of

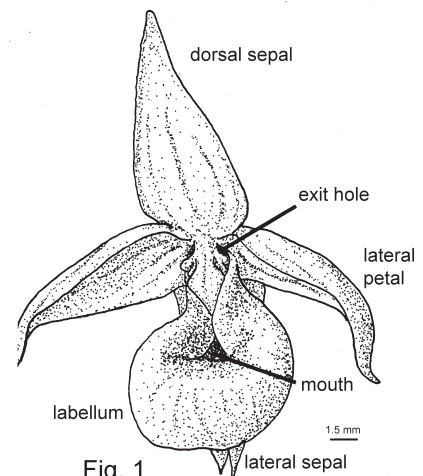


Fig. 1

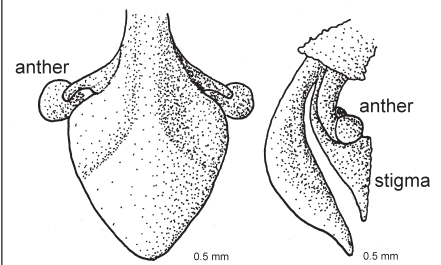


Fig. 2

Fig. 3

Figure 1. Clustered lady slipper flower with erect dorsal sepal • Figure 2. Column, top view. • Figure 3. Column, side view.

the stigma (Figures 3 and 4). The second narrow passage is the exit hole itself. One exit hole is located on either side of the base of the flower (Figures 1-4). An anther is so positioned beside each exit that an insect of the proper size cannot force its way out without contacting the anther and carrying away a mass of sticky pollen on its back.

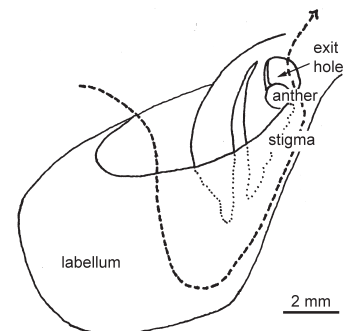


Figure 4. Diagrammatic longitudinal section of clustered lady slipper flower with dotted line showing direction of pollinator movement.

Top left: Mountain lady slipper (*Cypripedium montanum*). • Bottom left: California lady slipper (*C. californicum*). Photographs by J. Game.

Since the vector contacts the stigma before the anther and usually does not reverse directions, it does not ordinarily transfer pollen to the stigma of the same flower. Rather, pollination is accomplished when and if the insect, upon escaping from the first flower, is subsequently trapped again, usually in a different flower, and the escape procedure is repeated.

Biologists are uncertain just why insects enter the flowers in the first place. In some cases the entry is inadvertent. The insects, exploring the outer surface of the lip, tumble into the trap. In other cases entry appears quite deliberate. Some authors contend that insects may collect oil from the hairs on the inside of the lip. This has yet to be confirmed. It has also been conjectured that small amounts of nectar are present or that the insects feed on the hairs in the labellum. But it now appears likely that the flower provides no reward, and the insects are simply deceived by false nectar guides, color, and the odor of the blossoms, which promise nectar or other enticements where none is available (e.g., Nilsson 1981 and references therein).

WHO POLLINATES THE CLUSTERED LADY SLIPPER?

Among species of lady slippers, reproductive isolation or prevention of hybridization is related, in part, to the size of the flower. More specifically, the width of the entrance and especially the diameter of the anther exit holes and the space between the labellar floor and the stigma determine the size of the insect involved in the pollination. The dorsal-ventral thickness of the insect's thorax may be of critical importance. In addition, Nilsson (1981) noted that the depth of the labellum in the European yellow lady slipper (*C. calceolus* L.) must



European lady slipper (*Cypripedium calceolus*). Photograph by D. Lin, courtesy of the University Herbarium and UC Regents.

exceed the length of the pollinating insect by a minimum of 3 to 4 mm or the insect can simply crawl back out through the labellar opening. All of these floral characters are clearly under strong selection pressure in relation to the primary pollen vectors. In the clustered lady slipper the anther exit holes are only 2 mm in diameter, and the opening to the labellum is about 7 mm wide (Knecht 1996). Pollinator size is accordingly restricted.

Recent studies in southwest Oregon identified the pollinator in this area as a tiny parasitic diapiiid wasp in the genus *Cinetus* (Ferguson and Donham 1999). Female specimens of this yet to be identified species were collected carrying pollen smears of the clustered lady slipper on their backs. In one case, the insect was captured emerging from the exit hole at the base of the labellum (Ferguson and Donham 1999, Lipow et al. 2002). Although in-

conspicuous, purplish-brown flowers with a musky odor are also sometimes pollinated by carrion-loving flies, hornets, and beetles, no other insects were seen bearing pollen of this orchid. Moreover, maximum wasp activity matched the peak orchid blooming time in May. Ferguson (pers. comm. 2004) has now monitored additional populations of clustered lady slippers in California, Colorado, and Wyoming, and unidentified diapiiids also show up at all these sites even though none have, as yet, been found carrying orchid pollen.

POLLINATION AND FRUIT SET

Studies of the breeding system in the clustered lady slipper revealed that the experimental transfer of pollen within a single flower (selfing), among flowers in the same

raceme (geitonogamy), or between racemes of nonclonal plants (xenogamy or out-crossing) all produced high levels of fruit set. No fruit was set when insects were prevented from reaching the flowers; no autogamy (i.e., no spontaneous self pollination) occurred in the absence of a pollinator, and no asexual production of seeds occurred (no agamospermy) (Kipping 1971, Knecht 1996, Lipow et al. 2002).

Moreover, there was no reduction in fruit set in self-pollinated as compared to cross-pollinated plants (Knecht 1996, Lipow et al. 2002). Although the pollination mechanism promotes cross-pollination, the clustered lady slipper reproduces vegetatively, and some transfer of pollen among members of a single clone undoubtedly occurs. A flowering period with many simultaneously open flowers on each plant provides ample opportunity for pollen transfer among flowers of the same raceme or among racemes of the same clone. Nonetheless, genetic studies of chemical variation within and between populations imply that the primary mode of reproduction is out-crossing (Aagaard et al. 1999). Either pollination within populations is primarily random or survival of the products of selfing is reduced by some means such as inbreeding depression (Aagaard et al. 1999, Lipow et al. 2002).

The levels of natural fruit set in the clustered lady slipper are highly variable. Greenlee (in Lipow et al. 2002) found that a population of this species in Montana's Bitterroot Mountains averaged 0.72 fruits from 2.55 flowers per flowering plant. Knecht (1996) reported that an average of 32% of flowers produced capsules in nine small populations in Washington's Wenatchee Mountains, and Kipping (1971) found 47% of the flowers produced fruit at a site in Nevada County, California. Lipow et al. (2002) recorded levels of fruit set varying from 18%

in the White River National Forest of Colorado and 29% in the Nez Pierce National Forest of Idaho to 69% in the Siskiyou National Forest of Oregon.

Fruit set was directly related to pollination rates, and at the sites examined by Lipow et al. (2002), pollination rates were negatively related to population size: the level of fruit set at the Oregon site, where the population was small, much exceeded that at the Colorado site, where the population was much larger and denser. A similar inverse relationship is common in other species with non-rewarding pollination systems. Presumably, training of the pollinator to the appearance of non-rewarding flowers is more intense and more rapid in larger, denser orchid populations (Lipow et al. 2002).

At the same time, the diapiids were apparently not influenced by inflorescence size. The probability of a given flower producing fruit was unrelated to the number of flowers present in the inflorescence (Lipow et al. 2002). However the size of the inflorescence was positively correlated with plant size, and larger plants, with a larger number of flowers, had a higher probability of absolute reproductive success and had more resources to devote to fruit production (Lipow et al. 2002).

Fruiting success can be limited either by the quantity of stored food available for allocation to capsule and seed maturation or by pollinator visitation rates. In orchids requiring an external pollinator, low levels of pollinator availability or activity may be indicated by a significant increase in fruit set among flowers that are artificially hand pollinated compared to those that are left to be pollinated naturally (open pollinated). Lipow et al. (2002) demonstrated such a response in experimentally cross-pollinated as compared to open pollinated flowers in their Colorado and

Idaho populations. They conducted no self-pollination experiments in Idaho, but in Colorado self-pollination again produced a significant increase in fruit set when compared to open pollination. Knecht (1996) also observed significantly higher levels of fruit set in hand-pollinated flowers compared to open-pollinated flowers at her study site in east-central Washington. Hand pollinations were not carried out on the Oregon population, but the high level of natural fruit set observed here suggests that fecundity in this population might not be limited by pollinator visitation rates.

WHAT LIMITS FRUIT SET?

Although more than a one-season study is needed to establish whether pollinators or stored nutrient resources or both are limiting (Primack 1996), the pattern noted by Lipow et al. in Colorado and Idaho and Knecht in Washington has been frequently reported in other orchids that rely on deception. Possible adaptation to pollinator limitation in the clustered lady slipper is also consistent with an observed decrease in fruit set associated with a reduction in pollinator numbers due to fire and with the long receptivity of the flowers, which maximizes their opportunity for pollination and may reflect a dependence upon specific, relatively rare pollinators (Neiland and Wilcock 1998).

Many authors consider pollinator limitation to be evolutionarily unstable. According to this view, natural selection should maximize reproduction within limits set by the availability of resources with a trade-off between current reproduction and future reproductive success and growth. Various strategies to increase pollination success to the level where resources are limiting should be favored and should spread through the population.

These might include a shift to asexual seed production or a modification in floral anatomy that would allow spontaneous self-pollination to occur in this already self-compatible species. However, a transition to asexual seed production is uncommon in orchids and according to Neiland and Wilcock (1998 and references therein), may be in-

more often wasted through export to the stigmas of plants from other species. (Neiland and Wilcock 1998). High levels of contamination lead to reduction in viable seed production, probably lowering reproductive success in nectarless orchids even more than estimated on the basis of capsule production.

Although the presence or the

fruit production following hand pollinations. Neiland and Wilcock believe the adoption of nectar production might represent the most effective mechanism for overcoming the reproductive restrictions of pollinator limitation. Why has the predicted increase in individual reproductive success not resulted in the spread or fixation of nectar production in any current lady slipper population?

Data based on hand pollinations suggest that an increase in fruit production can limit the resources available for subsequent growth, reproduction, and survival (e.g., Primack 1996 and references therein). Therefore, even though fruit production within seasons may be pollinator limited, an increase in pollination rate might not significantly improve overall reproductive success because such an increase could have an adverse effect on lifetime fecundity.

Cochran (1986), however, believes the effects of resource limitation are subordinate to pollinator limitation. Based on his calculations, two years of complete pollination are equivalent to 10 to 20 years of normal fruit set, and long life spans and low mortality would, in time, permit resource-depleted individuals to resume reproduction. Primack (1996) observed such recovery in several Massachusetts populations of the pink lady slipper. In the clustered lady slipper individuals routinely survive more than 30 years (Lipow et al. 2002), and some old records indicate life spans of over 90 years.

Calvo and Horvitz (1990) also consider the costs of reproduction to be secondary to pollinator limitation. According to their demographic model, increased fitness resulting from higher levels of pollination and fruit set would overcome the relatively low cost of fruiting. Studies of reproduction in the orchid *Tolumnia variegata* (Sw.) Braem were consistent with these predic-



Clustered lady slipper. Photograph by J. Game.

hibited because development of the embryo sac and placental cells does not begin until pollen has been deposited on the stigma. The shift to spontaneous self-pollination, although not unknown, is also difficult because it requires significant morphological changes in the structure of the flower.

An alternate possibility is that flowers could develop which provide a nectar reward. This might reverse the negative reinforcement of repeated visitor behavior in non-rewarding flowers. Moreover, because pollinators that visit unrewarding flowers are likely to sample a variety of other flowers in a search for nectar or pollen, the stigmas of nectarless orchids are often more highly contaminated with pollen from other species than are those of nectariferous orchids, and pollen is

artificial addition of nectar does not always mitigate pollinator limitation, it had a significant effect on both pollen removal (male function) and fruit set (female function) in the pink lady slipper (*C. acaule* Ait.) (Cochran 1986). Neiland and Wilcock (1998) reported that average fruit-set figures measuring the relative reproductive success of nectarless and nectar-producing orchids in North America were 19.5% and 49.3%, respectively, based on fruit to flower ratios. In the clustered lady slipper only the small Oregon population equals or exceeds the average level of fruit production for nectariferous orchids. Four out of five of the remaining populations sampled fall within the range recorded for non-rewarding orchids (2.8-39.0%), including both populations that showed increased

tions (Calvo 1993). A statistically significant reduction in future growth and flowering was observed only in plants subjected to a high pollination intensity treatment (viz., all the flowers in the inflorescence were pollinated resulting in a mean fruit set about 88 times greater than in open-pollinated plants). Simulations revealed that the production of only a few seedlings per fruit could more than compensate the cost of fruiting and that therefore selection for higher levels of pollination should be favored.

Calvo (1993) believes that the low level of pollination and fruit production frequently observed in orchids lacking spontaneous self-pollination may be due to a low correlation between fruit or seed production and seedling establishment. Selection for increased levels of pollination would be ineffectively low if an increase in seed production was not translated into an increase in the number of reproductive individuals produced in the next generation (i.e. an increase in fitness). Under such circumstances pollinator limitation might be evolutionarily stable (Calvo 1993).

Knecht (1996) reported both pollinator limitation and poor seedling recruitment in the clustered lady slipper at her study site in east-central Washington. Plants produced an average of about 4,300 seeds per capsule, but few were able to establish. Aagaard et al. (1999) speculate that seedlings of this orchid may only become established in the earliest stages of forest succession. The clusters of plants now observed occupying mid- to late-successional stages may represent asexually generated descendents persisting through the production of rhizomatous clones, the apparently separate plants derived by dieback or fragmentation of a branching rhizome. This growth habit and the probable long life span of the clustered lady slipper might permit some plants to survive a series of successional stages

until suitable habitat for the establishment of seedlings becomes available (Knecht 1996, Aagaard et al. 1999). If so, management to provide early successional habitat would be required for the development of new colonies and the long-term survival of the orchid.

The early succession hypothesis is interesting, but as Aagaard et al. (1999) point out, additional studies are needed to clearly detail how new populations are established and to distinguish between clone members and seedlings in plant clusters sampled from a range of successional stages. Preliminary DNA investigations now suggest that plants more than a few centimeters apart can differ genetically and may be derived from seeds (Liston pers. comm. in Severs and Lang 1998).

Additional studies are also needed on diapiiid wasps. The reasons for the dramatic variation in natural fruit set (18–69%) are uncertain, at least in part because diapiiid wasp behavior is not understood. Many species of *Cinetus* and other diapiiids remain undescribed. The identification and study of individual species and an understanding of their role in the pollination of this orchid across its range must await the construction of a new key to this group, a task that has only recently been initiated at the Smithsonian (Ferguson, pers. comm. 2004). Once the baseline data are gathered, scientists will be able to provide land managers with better information on which to base decisions affecting the long term survival of this remarkable little orchid.

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GROWING NATIVES: CALIFORNIA BUCKEYE

by Glenn Keator

California buckeye (*Aesculus californica*) grows naturally as a small tree to perhaps 30 feet high, with a broad, beautifully-rounded crown. Pinching back the new shoots encourages it instead to bush out and create a large shrub. Here is a fine plant for seasonal interest: silvery gray bark that's shown to advantage from fall through winter; fanlike, palmately-compound, apple-green leaves in spring and early summer; tight candles of white to palest pink, sweetly fragrant flowers in May or June; and curious, leathery, pearlike



seed pods with glossy brown seeds like chestnuts in fall. The flowers attract a wide variety of pollinators but the nectar is said to be poisonous to honey bees. It's important to note that buckeye seeds are not edible even though they resemble the edible seeds of chestnuts (*Castanea* spp.). The large seeds contain an abundant food reserve but shrivel quickly if not planted immediately; prompt planting assures easy germination and vigorous seedlings. Growth is rapid for the first few years. Decent size for the shrub requires only a few years with abundant water and sun. Later, water can be withheld or applied occasionally; some summer water assures leaves are retained longer.

California buckeye is adapted to especially hot, dry summers once its roots are well established. It can

Clockwise from right: The striking inflorescence of California buckeye (*Aesculus californica*). This flowering stem can be up to one foot in length. Photograph by J. Hickman. • Fruits of the California buckeye, which are similar to all fruits in the horse chestnut family (Hippocastanaceae), to which this species belongs. Photograph by Morin. • Flowers of the California buckeye. Photograph by J. Hickman. Use of photographs courtesy of the University Herbarium and UC Regents.



be grown as a focal point in a small garden, yet it is also capable of growing tall enough to provide shade for a one-story building. It also can be pruned as a hedge or foundation planting, or used in a large container on a semishaded to sunny patio.

Two liabilities of planting this in the garden are lots of leaf litter in fall, and poisonous leaves and seeds. This is not an appropriate plant where young children wander. In a large-scale garden, buckeye can be grown to tree size and used as a companion with live oaks (*Quercus agrifolia* and *Q. wislizenii*), western redbud (*Cercis occidentalis*), and gray pine (*Pinus sabiniana*) for a natural effect.

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DR. MALCOLM MCLEOD, 2004 FELLOW OF THE CALIFORNIA NATIVE PLANT SOCIETY

by Dirk R. Walters

The members and officers of the San Luis Obispo Chapter of the California Native Plant Society (CNPS) nominated Dr. Malcolm McLeod, age 81, to become a Fellow of the California Native Society. Members of the nominating committee included Dirk R. Walters, Bonnie Walters, John Chesnut, David Chipping, Mardi Niles, and Jack Beigle.

Dr. Malcom McLeod became an active member of the San Luis Obispo Chapter shortly after his arrival in the county in the winter of 1973. We are all richer for the contributions that he has made on behalf of California's native flora by his work as an educator, rare plant advocate, author, and chapter leader.

Dr. McLeod was professor of botany in the Biology Department at California Polytechnic State University from 1973 until his full retirement in 1993. In addition to general botany courses, he also developed and taught a course in native plant materials for landscape architecture and ornamental horticulture students. As a result, a number of his students joined the chapter, and later became active members and officers. Several entered the native plant nursery and landscaping trade.

Since his early days as a chapter member, Dr. McLeod has held several offices and been a regular participant in chapter activities. He became chapter president in 1976 and served two one-year terms. Since then, Malcolm has

served wherever the chapter has needed him. Since 1973, on a yearly basis, he leads at least one, and often several, field trips. Malcolm willingly presents regularly scheduled (not to mention emergency) programs at chapter meetings. At our annual plant sale he assists plant purchasers by staffing the Reference Table. Since the early 1980s he served on the chapter Scholarship Committee, which solicits and evaluates native plant study proposals from Cuesta College and Cal Poly State University students, for small cash awards. He has served continuously on our photographic committee, charged with documenting the native plants of our chapter area and maintaining the slide collection that has been developing. Dr. McLeod has also served

as recording secretary in 1996 and 1997, and accepted the task of chapter field trip chair for the year 2002.

The recitation of Malcolm's chapter activities is not complete without the acknowledgement of his lifelong companion and wife, Sybil. She accompanied Malcolm on most of his activities and excursions for the chapter, and served many years as chapter historian. Upon Sybil's untimely death in 2000, Malcolm took over the historian's job and continues it to this day.

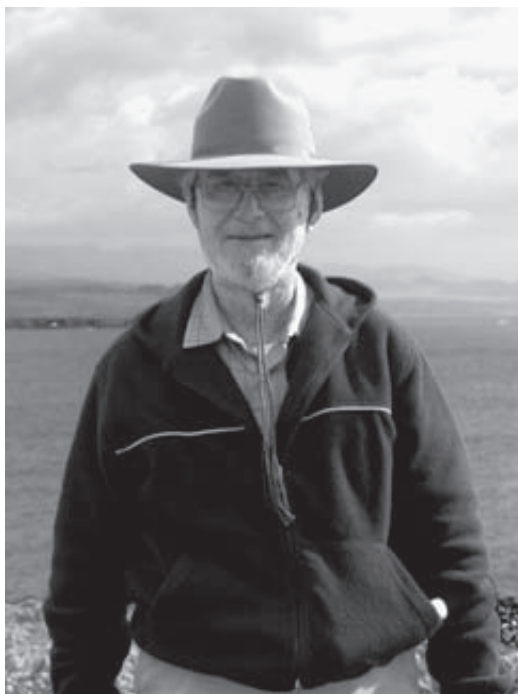
During Dr. McLeod's tenure as chapter president, he encouraged and participated in the *ad hoc* committee that planned and produced the symposium/workshop entitled, *Native Plants: A Viable Option*. At the symposium, Dr. McLeod presented the paper titled,

"Modern Uses of Native Plants." He was the major contributor of information for the proceedings appendix on obtaining, propagating, and growing native plants.

He also served on the editorial committee for the publication resulting from the proceedings, *Native Plants: A Viable Option* (CNPS Special Publication Number 3). In his review of the proceedings (*Fremontia*, April 1979) Marshal Olbrich wrote, "... unusual in book reviews to give special praise to the appendices, but three are of lasting importance and usefulness: Malcolm McLeod's 'Annotated List of California Native Trees and Shrubs with Garden Potential'..."

Dr. McLeod's most signifi-

Dr. Malcolm McLeod. Photograph by M.L. Niles.



cant contribution to the chapter and state organization has been his role as chapter rare plant specialist, serving as chapter chair from the early 1980s through 1992. Dr. McLeod combines three strengths for the promotion of rare flora. First, due to Malcolm's wisdom and tenacity, we have benefited from the continued recognition of individual species which were sometimes unrecognized or lost for decades, while taxonomic fashion has ebbed and flowed around them. Second, Dr. McLeod's indefatigable survey and careful documentation of rare populations has provided a basis for protection of landscapes rich in rare species throughout San Luis Obispo. Finally, Dr. McLeod has the perspicacity to see the very simple practical steps, whether building a barrier to motorcycles or rerouting a road, which proved crucial to protection of a rare plant.

In the spring of 1984, Malcolm took a sabbatical from Cal Poly and visited all of the localities where rare plants were recorded in our area, such as Arroyo de la Cruz, Surf, Calf Canyon, Black Mountain, Carrizo Plain, and Soda Lake. He involved at least 29 members and other people on his excursions. One of his trips to Arroyo del la Cruz included State CNPS personnel, a trip now memorialized as the photograph on the yellow holder used by our Society to display membership application forms.

Dr. McLeod was always diligent in providing rare plant search results to the state office and the California Department of Fish and Game Natural Diversity Database. A paper, co-authored with Dr. David Keil, on rare plants of Arroyo de la Cruz was presented at the State CNPS-sponsored Rare Plant Conference in November 1986. Malcolm also presented a paper on rare plant successes in our area. The data gathered on these trips to places such as the Hearst Ranch (i.e., Arroyo de la Cruz) were to become the basis of

our chapter requesting removal of several proposed home sites in the Arroyo de la Cruz area of the Hearst Ranch Conservation Easement purchase by the state. It appears that this will be done.

His reports provided much of the raw data for several successful rare plant listings. For example, in November 1986, Malcolm wrote the status report for federal listing for the Nipomo lupine, *Lupinus nipomensis*, which is now officially listed by both the federal government and the state of California as endangered. He was always eager to keep the chapter membership aware of progress of the rare plant program. He accomplished this via a succession of general meeting programs and articles in our chapter newsletter, *The Obispoensis*.

In the early 1990s, Malcolm, along with the help of members of the Photographic Committee, put together a 60-page notebook containing photographs and distribution of all the list 1B plants in our chapter area. Copies of this notebook were distributed to county planning agencies. Since stepping down as Rare Plant Chair, he has continued not only as an active member, but also in the role of senior advisor for the committee. He is in the process of training a new generation of rare plant observers.

We relate a story told by Dr. McLeod's Cal Poly Biology Department colleagues. When Malcolm started at Cal Poly, he refused to allow his assigned typewriter to remain in his office because, as he said, "I do not type!" He told the staff to give the typewriter to someone else. Today, some 30 years later, he has mastered typing on a computer, as well as book and pamphlet formatting. Malcolm has worked with numerous chapter members to strengthen our chapter's outreach and education programs. In 2001, he was the lead author and produced the Dune Mother's Wildflower Guide, published by State



Dr. McLeod at Coreopsis Hill. Photograph by M.L. Niles.

CNPS and SLO chapter publications committee and available from State CNPS or central coast bookstores and gift shops. In 2004 Dr. McLeod produced the color 14-page pamphlet, *Highway 58 Wildflowers*. In 1994, Malcolm provided many slides, much of the text editing, and the accompanying species list used for the creation of a 22-minute video entitled, *Central Coast Wildflowers*. Publications that he is currently working on include one on native plant communities and important species of the Carrizo Plain National Monument, and an update of the rare plants of San Luis Obispo County notebooks, to be published as a CD.

Dr. McLeod has also been an emissary of native plants in other organizations besides CNPS. For the last eight years he has been academic advisor to our County's fledgling botanical garden. This garden plans to specialize in plants of the five Mediterranean climates zones. Malcolm has encouraged them to strengthen their California native plant holdings, conducted public activities at the garden, and provided educational forums for its members. Dr. McLeod has done much to further objectives of CNPS; his recognition as a Fellow of this society is highly deserved.

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LETTERS

The following letters are in response to the special issue on stewardship, *Fremontia*, Volume 32, No. 3 (July 2003).

Landmark Issue

Thank you for hitting me where I live with your issue on stewardship and plant communities. The practice of land care has always been more or less central to people who lived for long on the land. The First People engaged in extensive landscape-scale manipulation of ecosystems, and the notion of the "Wilderness" was only the impression Europeans had from looking with untutored eyes at a tended garden. Peasant farmers, whose future and past were tied to the land, were inherently conservative. The US has not been well served by the availability of a frontier that permitted land

tenure to be a "skim the cream and move on" experience.

Some of us now recognize we have reached the end of the frontier, and are regaining the perspective of those who were tied to the land. But there are plenty of economists, elected officials, and dreamers worldwide who are seduced by the frontier mindset. Growth is good, increased resource extraction is good, technology will provide replacements for exhausted resources, and an increasing gross national product will benefit everyone, whether the GNP per capita increases or not.

Your Volume 32, Number 3 will be a landmark issue. Thoughtful readers will be able to return to it time after time for years and gain new resolve to do "the best they can, with the re-

sources they have, in the time they have, wherever they are." I wish I'd invented that phrase, but I have to credit a child, born with AIDS in South Africa, who has now passed on.

Earle W. Cummings
Milo Baker Chapter

A Good Read

I always love the way *Fremontia* looks, but this is the first time that I've read an issue from cover to cover. This issue is truly inspirational. Great job, Pete [Holloran, Convening Editor for this issue]! I think every issue should include similar articles, or at least one. In my opinion, this is the most important message to get across and the best way to bring more people into CNPS.

Marilyn Smulyan
Yerba Buena Chapter

BOOK REVIEW

A Natural History of Ferns, by Robbin C. Moran. 2004. Timber Press, Portland, Oregon. 302 pages, 145 illustrations, 26 color photos. Hardcover. Price \$29.95.



Figure 50 of *A Natural History of Ferns*, whose caption reads, "Horsetails were named *Equisetum* (Latin *equus*, horse, and *seta*, bristle) because of their resemblance to a horse's tail." Figure from Robbin Moran's *A Natural History of Ferns* redrawn from Alice Tangerini's illustration in O. Tippo and W.L. Stern (1977), *Humanistic Botany*.

This book is a cornucopia of 33 informative and entertaining essay-like chapters about the natural history of ferns, arranged in six sections: The Life Cycle of Ferns, Classification of Ferns, Fern Fossils, Adaptations by Ferns, Fern Geography, and Ferns and People. It is intended for both general readers and fern specialists, and it has a nine-page glossary for those unfamiliar with the terminology. Over 160 references are provided for those who wish to dig deeper.

A Natural History of Ferns is not a flora or identification key but picks up where field guides leave off. The reader will be rewarded with a variety of fascinating insights, of which a few are sampled here:

- Some ferns actually catapult their spores as a result of the forces acting when the spore cases split open.
- An estimated 5% of fern species worldwide can reproduce by forming buds somewhere on their roots, stems, or leaves.

- Ants live inside potato-like stems of a tropical fern (*Solanopteris*) in a symbiotic relationship.

- Some tropical ferns adapt to low-light conditions by being iridescent.

- There are ferns that exist as tiny, perennial, filamentous or ribbon-like gametophytes, reproducing through specialized buds but never producing sporophytes (the familiar spore-bearing plants with roots, stems, and leaves).

The author is curator of ferns at the New York Botanical Garden, and is also a writer and teacher. He interweaves his delightful stories with anecdotes from his own experience. I agree with Oliver Sacks who wrote in his Foreword that this book "is stimulating, enthralling, a beautiful companion for any fern lover."

Guenther Machol
Santa Clara Valley Chapter



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MATERIALS FOR PUBLICATION

Members and others are invited to submit material for publication in *Fremontia*. Instructions for contributors can be found on the CNPS website, www.cnps.org, or can be requested from *Fremontia* Editor, Linda Ann Vorobik, vorobik@rockisland.com, or c/o University and Jepson Herbaria, 1001 Valley Life Sciences Bldg. #2465, University of California, Berkeley, CA 94720-2465.

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Elegant clarkia (*Clarkia unguiculata*) next to a bird bath in a Sunnyvale garden. Photograph by Agi Kehoe.

SUNDAY, APRIL 17, 2005, 10 A.M. TO 4 P.M.

FROM THE EDITOR

Each of 2005's four issues of *Fremontia* celebrates the 40th anniversary of the California Native Plant Society (CNPS): each issue begins with an article about one fourth of the 32 chapters, followed by one or more articles on the state programs. The article on chapters for this issue is introduced by CNPS President, Carol Witham, then progresses to summaries of the state's seven southernmost chapters, each written by one or more representatives of that chapter. Upon reading them I wished I could visit every one: attend a plant sale in LA; picnic with the South Coast Chapter; or explore the desert with Mojave Chapter members.

There is so much to do and learn, and so much fun to be had at the local level that it is possible to forget about all the work done (and fun had?) at the state level of our Society. Upon his departure from CNPS, Mike Tomlinson provides an overview of the state organization and an introduction to the state programs of CNPS. Look for in-depth articles about individual programs in the next three issues.

Two provocative articles follow, each with an ecological bent. In the first, authors Keith Greer and Holly Cheong tell the story of managing for the endangered willow monardella (*Monardella linoides* ssp. *viminea*) in a

riverbed in the San Diego area. In the second, orchid expert Charles Argue provides a detailed account of clustered lady slipper sex (i.e., pollination in *Cypripedium fasciculatum*).

Glenn Keator shares his wisdom on growing native plants with a discussion of the California buckeye (*Aesculus californica*), and Dirk Walters introduces us to the society's newest Fellow, Dr. Malcolm McLeod. Congratulations, Malcolm! You and all CNPS Fellows stand for all that California Native Plant Society members can be proud of in this, our 40th year.

Linda Ann Vorobik
Fremontia Editor

CONTRIBUTORS

Charles Argue, PhD, is a plant biologist specializing in the study of pollen grains. His articles have appeared in the *American Journal of Botany*, *Canadian Journal of Botany*, *International Journal of Plant Sciences (Botanical Gazette)*, *Grana*, *Pollen et Spores*, *North American Native Orchid Journal*, and as chapters in a number of book-length publications.

Holly Cheong, a former biologist with the City of San Diego's Multiple Species Conservation Program, is now an environmental planner for the Southern Nevada Water Authority.

Mark Elvin, a former wildlife biologist with the US Fish and Wildlife Service, is the senior botanist for Dudek and Associates in San Diego, California.

Keith Greer is the deputy planning director and program manager for the City of San Diego's Multiple Species Conservation Program.

Glenn Keator, PhD, is a freelance teacher and botanist at California Academy of Science, Strybing Arboretum, Regional Parks Botanic Garden, and Merrit College, and author of many books, including *Introduction to Trees of the San Francisco Bay Region*.

Michael Tomlinson is now working at the Provost's Office of Advancement at UC Davis, but served from 2003-2004 as the *Bulletin* editor and the first development director for CNPS.

Dirk R. Walters, along with the nomination committee from the San Luis Obispo Chapter, is well-acquainted with our latest CNPS Fellow, Malcolm McLeod.

Carol W. Witham is a consulting biologist specializing in the endangered plants and animals of vernal pools. She is currently president of CNPS and founder of *VernalPools.org*, a grassroots organization dedicated to saving California's vernal pool landscape.



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