Title
UC Davis Natural Reserve System-Four-Year Report (1999-2003)

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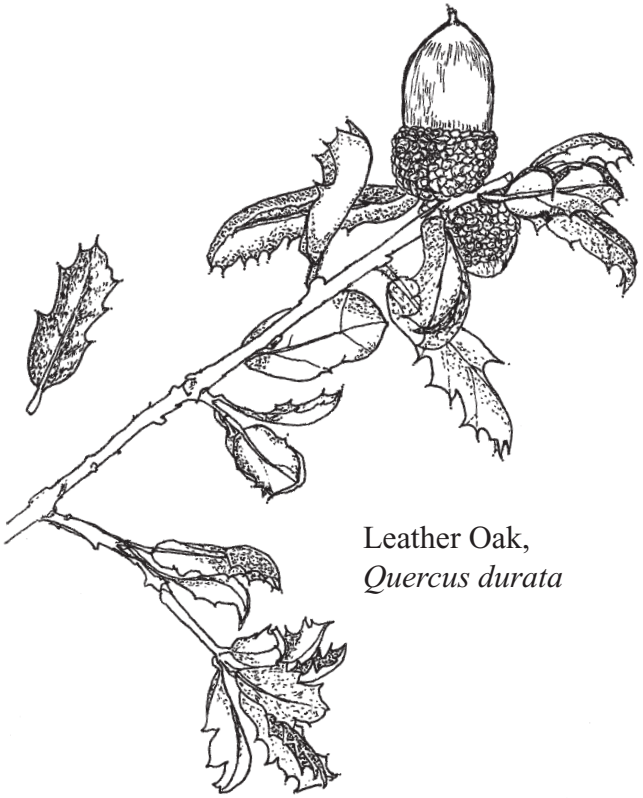
University of California Davis Natural Reserve System

Four-Year Report (1999-2003)

The mission of the Natural Reserve System is to contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California.



Leather Oak,
Quercus durata

"The best work in the natural disciplines all starts with observations in nature. We need those wild places where we can study nature firsthand, places where the intricacy and marvel of the natural world are intact. Everywhere, including California, those places are becoming fewer and fewer-and more precious."

-Kenneth S. Norris, founder of the UC Natural Reserve System

UC Davis Natural Reserve System:
Four-Year Report (1999-2003) & Funding Renewal Request (2004-2009)

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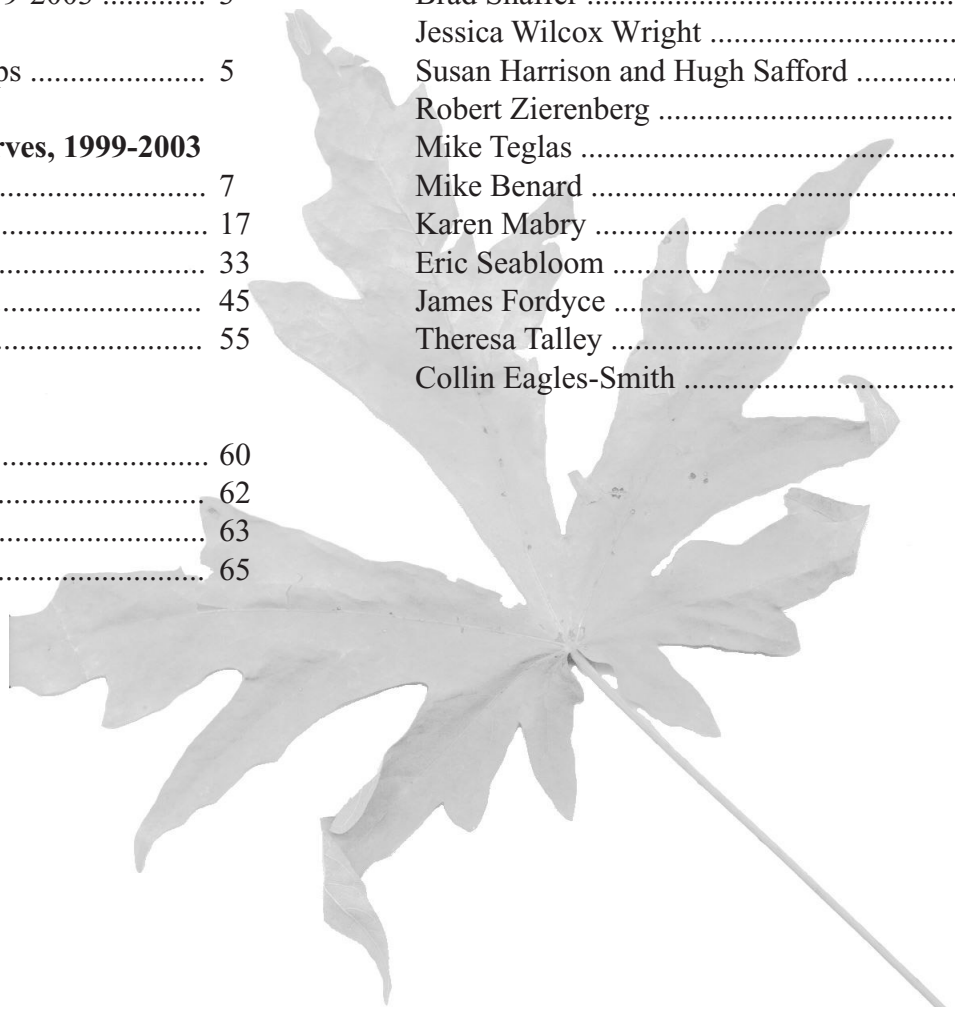


Part I. Report from the Director

Susan Harrison, Professor, Environmental Science & Policy

The Natural Reserves managed by UC Davis are a cornerstone of UC Davis's excellence in the environmental fields. They serve as outdoor laboratories with access to high-quality natural habitats, well-maintained infrastructure, and long-term data bases. In the past four years we have built them into a flourishing academic facility that has hosted 149 research projects (about half by graduate students) and 144 courses with 2415 students. The activities and accomplishments at each reserve are detailed in Part II of this report. Our goals for the next five years are to keep the reserves on their present trajectory of success, and to maintain the investment by the campus in both their physical facilities and the academic programs they support.

Introduction: The Natural Reserve System (NRS) at UC Davis

The UC Natural Reserve System is the largest and most diverse set of university-owned and operated reserves in the world. Its 34 reserves include examples of nearly every major ecosystem in the state. These reserves provide secure sites for long-term environmental research, education and public outreach. They enable monitoring of environmental health, and provide a baseline for ecosystem restoration, in the context of California's rapidly growing population and the changing global environment.

The reserves annually serve thousands of University users and public visitors and support millions of dollars in funded research. The National Science Foundation's Research Resources Program has described the NRS as a "resource of national significance." NRS reserves host two NSF Microbial Observatories and an NSF Long-Term Ecological Research (LTER) site, and another is the test site for the NSF Center for Embedded Networked Sensing. Four NRS sites have been honored with international standing as UNESCO Biosphere Reserves. Several well-equipped and well-staffed NRS reserves have recently attracted substantial donations from foundations and individuals.

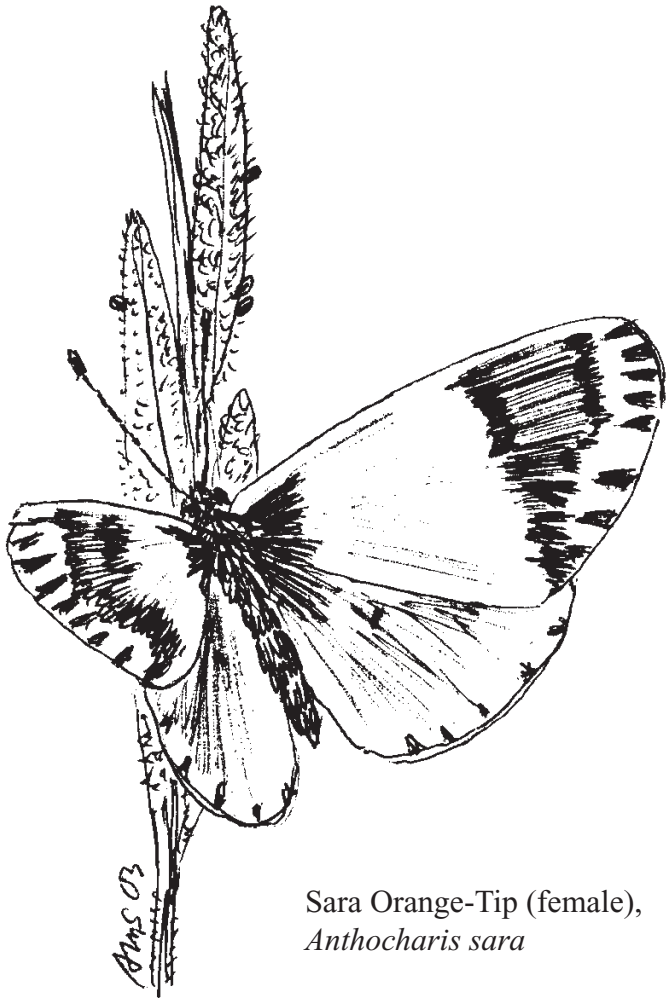
Each NRS reserve is managed by one of the eight general UC campuses, with financial, legal and planning assistance from the systemwide NRS office in the UC Office of the President (UCOP-NRS). UCOP-NRS also provides key informatics tools used by all reserves, such as the Reserve Application Management System, the bibliographic database, the research metadatabase, and a publications program. The Mathias Grant program funded by UCOP-NRS helps graduate students conduct independent research on the reserves.

UC Davis, the campus with the highest level of activity in the environmental fields, manages six NRS reserves. These total over 12,000 acres and represent a rich array of Northern Californian habitats: coastal bluffs and intertidal at Bodega, montane woodland at Eagle Lake, vernal pools at Jepson Prairie, chaparral and oak savanna at McLaughlin, oak woodland at Quail Ridge, and riparian forest at Stebbins Cold Canyon. (See inside back cover for websites where you can learn more about the NRS and each reserve.)

This report focuses on four reserves: Jepson Prairie, McLaughlin, Quail Ridge, and Stebbins Cold Canyon. The UC Davis branch of NRS administers these reserves under the auspices of the John Muir Institute of the Environment within the Office of Research with the oversight of advisory committees (Appendix A). Two Reserve Managers, two Reserve Stewards, and a part-time administrative assistant manage the reserves' daily operations. (Please see Appendix B for our organizational structure and Appendix C for profiles of our staff.) We will also discuss a fifth site, the Eagle Lake Field Station, which is operated by California State University-Chico with financial help from UC Davis NRS. The Bodega Marine Reserve is administered separately by the Bodega Marine Laboratory.

Our goal for the next five years is to stay on the present trajectory of success. We are committed to further developing the reserves' ability to attract and support the needs of hundreds of researchers and instructors. We plan to upgrade the infrastructure, for example by improving the overnight facilities at Quail Ridge and McLaughlin, and to develop new programs, such as public educational and outreach opportunities at several of the reserves. To accomplish these things, our most critical need is stable funding for core staff plus an adequate level of operating support.

I'd like to conclude by thanking the many people who have helped the Natural Reserve System at UC Davis to become what it is today, which has been such a source of pride to everyone involved. It is a great pleasure to work with you. Now more than ever, we need your continued support as we keep doing our best to protect the University's investment in high-quality opportunities for research, teaching and outreach on our Natural Reserves.



Sara Orange-Tip (female),
Anthocharis sara

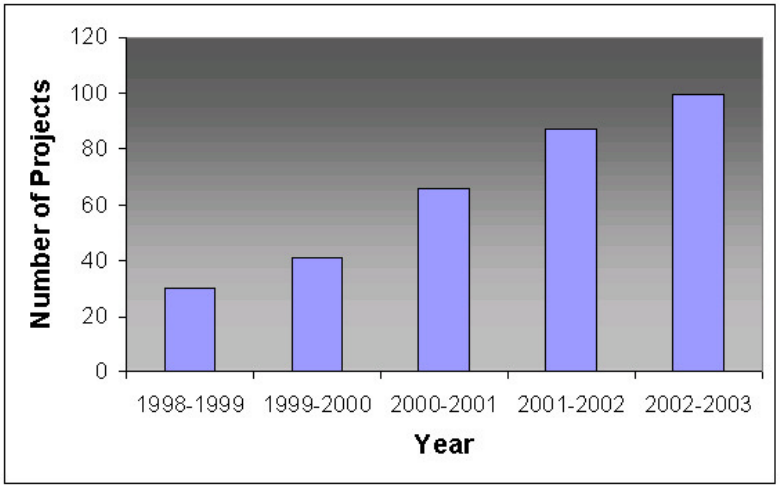
Highlights of Our Four-Year Report (1999-2003)

* Since 1999, the four reserves have supported a total of 149 research projects, with $6,277,000 in funding, and 144 courses with 2415 students.

* The reserves have provided a major resource for graduate training. The $2.6 million NSF IGERT integrative graduate training program in Biological Invasions used McLaughlin for its first-year group project in 2003. McLaughlin has also hosted a $1.3 million group research project funded by the Mellon and Packard Foundations that has supported 16 graduate students and 4 postdocs. The systemwide NRS Mathias Grant program has funded 16 UC Davis graduate students to conduct research on NRS reserves (total $27,690). In total, the four reserves have hosted 74 graduate student research projects (50 from UC Davis) since 1999.

* Use of the reserves has become more interdisciplinary. Examples include the Nature and Culture senior capstone course, which was taught at McLaughlin in 1999 and 2000; the Field Methods in Geochemistry class taught at McLaughlin in 2002; the interdisciplinary Biological Invasions training program funded by NSF IGERT; and the use of Jepson Prairie for manipulative research on vernal pool soils and hydrology.

* The reserves have provided opportunities to deploy technological tools in the field. Examples include the web-based real-time data collection (REMOTE) system at Jepson Prairie and other sites; the UCB-USGS seismologic station at McLaughlin; and the recent planning grant to place remote sensing devices in the field for teaching purposes at McLaughlin and two other NRS reserves (UCB-Hastings and UCSB-Sedgwick).



* The reserves have provided excellent public relations for UC Davis. Examples include our new trails and docent program at Stebbins Cold Canyon (funded by a California Coastal Conservancy grant), our participation in the docent program at Jepson Prairie, and an active program of field trips for public groups at McLaughlin (e.g. Audubon, Sierra Club, local Land Trusts). Such activities have led to favorable news coverage for the UC in Davis, Fairfield, Napa, Lake County and elsewhere (Appendix D).

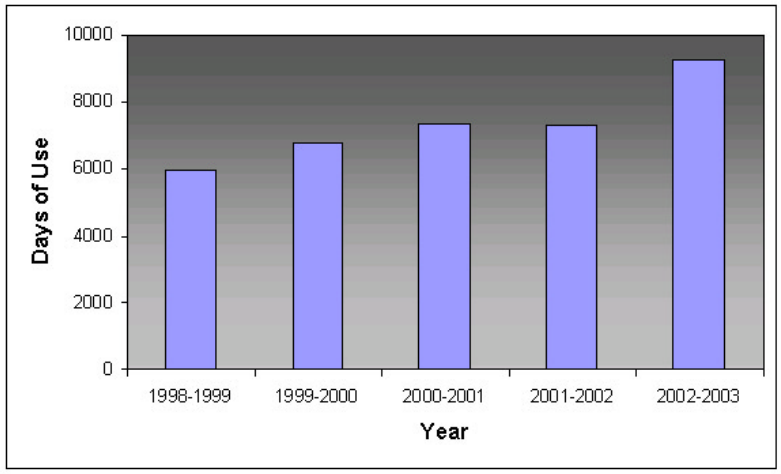
* The campus is much more aware of the reserves. Our Campus Decision-Makers Spring Event series, generously sponsored by the Office of Research, has brought dozens of leaders in all departments to the reserves for educational field trips. Dateline and UC Davis Magazine have publicized our activities. Compared to four years ago, when field biologists were almost the only ones who knew the reserves existed, appreciation of the reserves by the campus community has grown tremendously.

* Through its links with agencies and land conservancies, the UC Davis NRS gets valuable in-kind assistance in such tasks as road maintenance, fencing, patrolling, resolving issues with neighbors, and obtaining grants. The forum for these links is a regional stakeholder group, the Blue Ridge - Berryessa Natural Area Partnership, which won the Governor's Award for Excellence in Environmental and Economic Leadership in 2002. The BRBNA partnership was honored as a model for watershed management and was credited with the "conservation, preservation, and management of over 500,000 acres of natural, wild, agricultural and recreational lands." The NRS director and staff play key leadership roles in this group.

* Many problems remaining from the pre-1999 era are now resolved or nearly so. Complex legal agreements have been completed that govern the use of the McLaughlin and Jepson Prairie reserves. Unclear property and easement rights at Quail Ridge have been addressed in part through a grant-funded land acquisition, and are near resolution through legal review and negotiations. Reserve users are required to adhere to safety rules and sign liability waivers. These examples illustrate how stable and adequate staffing can prevent costly problems on the reserves.

* New information resources make the reserves more accessible and valuable. We have created guidebooks to Stebbins Cold Canyon and McLaughlin that provide a wealth of scientific information in an attractive printed format as well as on our website (see inside back cover), and a Quail Ridge guidebook is in progress. We use new information systems provided by UCOP to effectively track reserve use and archive all publications and metadata (systematic data on what data have been collected).

* There have been setbacks with regard to major funding efforts. The NRS received a $250,000 planning grant from the Packard Foundation for an oak woodland and grassland conservation initiative, and completed our $18 million proposal just as Packard's assets plunged. The NRS submitted a $3 million per year Regents Budget Item that was ranked at the top of 75 submissions, and included in the Governor's 2001-2002 January budget, just months before the abrupt decline in the state budget. The NRS put substantial effort into planning for the National Science Foundation's National Environmental Observatory Network program, which has three times narrowly missed being funded by Congress. Still, these initiatives demonstrate the potential of our reserves to attract major outside funding once the economy improves.



* In contrast to the four reserves managed directly by UC Davis NRS, the use of the Eagle Lake Field Station has not yet grown. We believe this is because the station does not have an academically-trained manager, and we are unable to contribute significant staff time in addition to the funding we provide. However, we believe the station has long-term value to UC research and instruction, and we remain hopeful because of recent changes in CSU-Chico's administration of Eagle Lake.

BERKELEY
1. Angelo Coast Range Reserve
2. Chickering American River Reserve
3. Hastings Natural History Reservation
4. Jenny Pygmy Forest Reserve

DAVIS
5. Bodega Marine Reserve
6. Eagle Lake Field Station
7. Jepson Prairie Reserve
8. McLaughlin Natural Reserve
9. Quail Ridge Reserve
10. Stebbins Cold Canyon Reserve

IRVINE
11. Burns Piñon Ridge Reserve
12. San Joaquin Freshwater Marsh Reserve

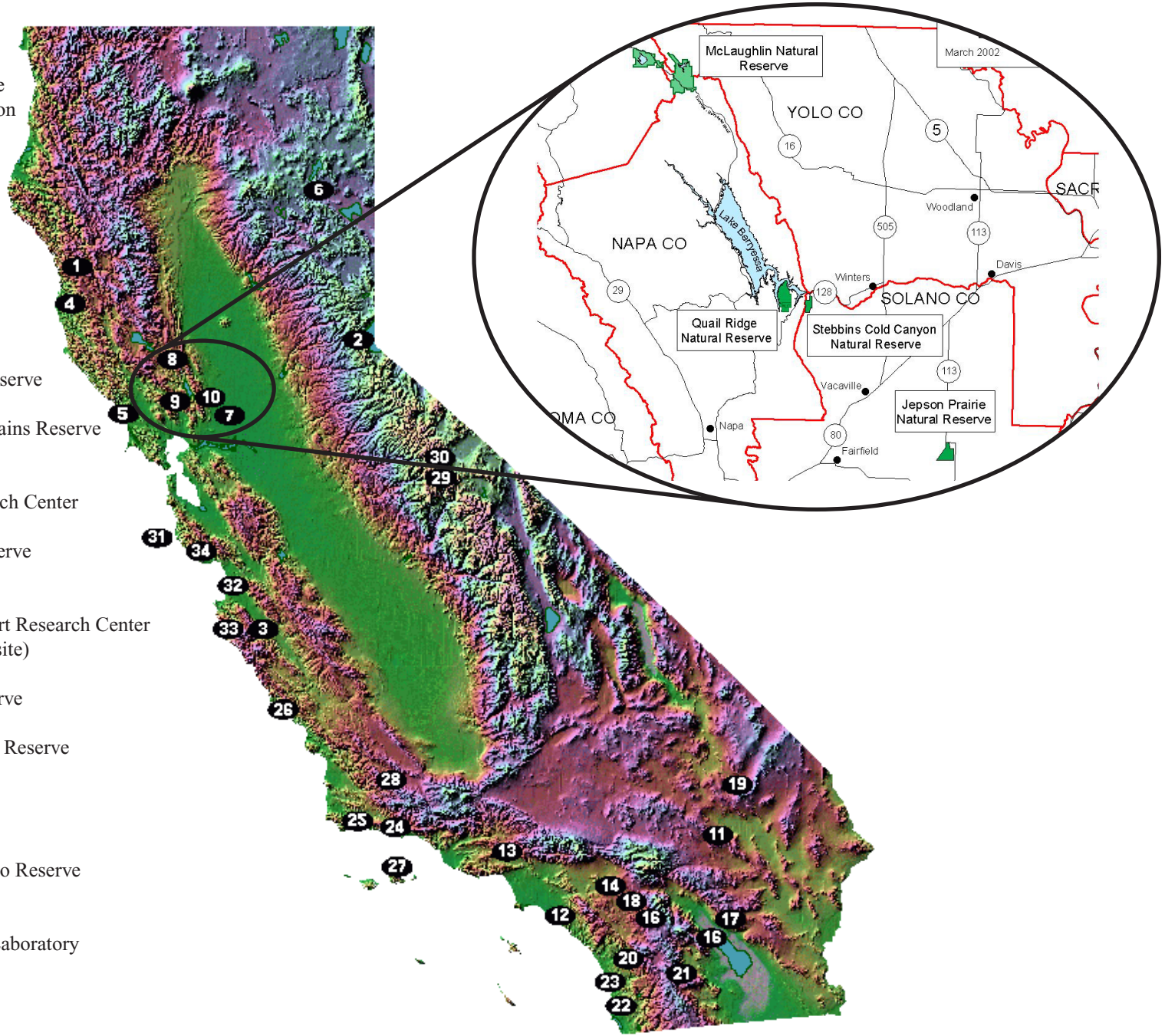
LOS ANGELES
13. Stunt Ranch Santa Monica Mountains Reserve

RIVERSIDE
14. Box Springs Reserve
15. Boyd Deep Canyon Desert Research Center
16. Emerson Oaks Reserve
17. James San Jacinto Mountains Reserve
    Oasis de los Osos (satellite site)
18. Motte Rimrock Reserve
19. Sweeney Granite Mountains Desert Research Center
    Sacramento Mountains (satellite site)

SAN DIEGO
20. Dawson Los Monos Canyon Reserve
21. Elliott Chaparral Reserve
22. Kendall-Frost Mission Bay Marsh Reserve
23. Scripps Coastal Reserve

SANTA BARBARA
24. Coal Oil Point Natural Reserve
25. Carpinteria Salt Marsh Reserve
26. Kenneth S. Norris Rancho Marino Reserve
27. Santa Cruz Island Reserve
28. Sedgwick Reserve
29. Sierra Nevada Aquatic Research Laboratory
30. Valentine Camp

SANTA CRUZ
31. Año Nuevo Island Reserve
32. Fort Ord Natural Reserve
33. Landels-Hill Big Creek Reserve
34. Younger Lagoon Reserve



Jepson Prairie Reserve

Located in the Sacramento Valley, the Jepson Prairie Reserve is an island of remnant natural prairie in a wide alluvial floodplain used primarily for agriculture. The reserve protects one of the best few remaining vernal-pool habitats, which are refuges for a unique flora and fauna; it also contains precious remnants of the native bunchgrass prairie that once covered one-fourth of California. The site provides the only known home for the federally threatened delta green ground beetle and federally and state-endangered Solano grass. Altogether, over 400 species and 64 families of plants, including 15 rare and endangered plants are found on site. The reserve land is owned by the Solano Land Trust; since 1983, UC Davis has provided a supporting role in reserve management.

In 1892, botanist Willis Linn Jepson visited the area around Olcott Lake at what is now the heart of the Jepson Prairie Reserve, and described its flora for the first time. He was soon followed by other UC scientists, and researchers from around the state have visited and studied the area ever since. Poor soils spared the property from the agriculture that claimed the vast majority of the Central Valley. In 1980, The Nature Conservancy (TNC) acquired the site for permanent conservation, and in 1983, TNC and UC signed an agreement that made it a UC Natural Reserve. In 1997, as part of its new statewide management strategy, TNC transferred title to the Solano Land Trust (SLT) while retaining a conservation easement.

In 1999, we became aware that when the title was transferred, the UC agreement did not transfer with it. We then spent three years negotiating with the Solano Land Trust, and a new agreement was finally signed in 2002. This agreement allows UC research and instruction on the site in exchange for our management expertise and assistance.

The distinctive flora of Jepson Prairie requires a great deal of active management to preserve it from the onslaught of goatgrass, medusahead, yellow starthistle, and other invasive plants. A combination of grazing by domestic animals and prescribed burning in the spring is considered the most effective way to preserve vernal pool and grassland plant communities. UC Davis NRS and Solano Land Trust personnel have worked together for years to maintain the successful program of sheep grazing and prescribed burning at the reserve. Recent data from a new monitoring program and from a study by former UC Davis PhD student Jaymee Marty are being used to refine the timing and intensity of burning and grazing for the benefit of native plants.

Over the past 4 years, we have worked to computerize 25 years of grazing and fire data and have developed GIS layers, including burns both past and future, to aid in management and research. We also assist the Solano Land Trust on other methods of control of exotic species, such as the mechanical removal of eucalyptus and the use of herbicides on selected weeds when necessary. We have compiled a complete bibliography that documents the broad and continuous use of the reserve over many years. Finally, we contribute staff time to the reserve's active program of docent-led educational tours.

Jepson Prairie Research

Professor Graham Fogg and his research group, including former postdoc Mark Cable Rains, have been studying the movement of water through the Jepson Prairie area as part of their broader research program on vernal pool hydrology around the state. We worked hard to facilitate their work by finding sites where they could perform controlled manipulations (see Page 10). Professor Mike Singer conducted a study of sheet flow of water across the prairie and its contribution to turbidity in the Sacramento Delta. In another physical science project, Wendy Wilson of Lawrence Livermore National Laboratory used air from the reserve as a rural control in her study of microbial diversity in air samples from the coast to the Sierra foothills.

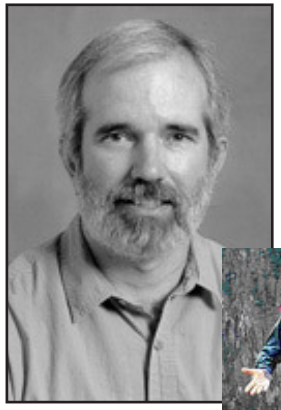
Professor Brad Shaffer and post-doctoral researcher Pete Trenham, two of the world's experts on California Tiger Salamanders and other declining native amphibians, are conducting an ambitious study of large-scale dispersal and its implications for the salamander's habitat requirements (see Page 11). This study, which these scientists note could only be performed at a protected research site such as Jepson Prairie, has taken on great significance with the recent emergency listing of the California Tiger Salamander as an endangered species.

Professor Michael Barbour and an international team of researchers, funded by the Packard Foundation, used the reserve as one site in a statewide survey of vernal pool plant communities. This study will create a new system of botanical classification for vernal pools to aid in designing effective conservation strategies. In the remnant native grasslands in the upland portions of the reserve, University of Michigan professor Carolyn Malmstrom is testing whether an introduced virus

harbored by exotic grasses is contributing to the decline of California's native grasses. UC Davis Ecology graduate students Beth Leger and Kim Reever-Morghan tested how native plants are affected by the herbicide Transline (*clopyralid*), which is commonly used in natural areas to control Yellow Starthistle. Carol Witham, an environmental consultant and long-time contributor to the Jepson Prairie management committee and docent program, has now been monitoring the demography of the endangered Solano grass and Colusa grass at the reserve for over ten years.

Professor Greg Pasternak is using Jepson Prairie as one of the pilot sites for his Real-Time Monitoring of the Environment (REMOTE) program, which allows researchers and instructors access to a continuous stream of environmental data through a system of field-based sensors linked to campus computers. Meteorological sensors were the first to be deployed at Jepson, but in the future we hope to set up a web camera that will monitor the seasonal filling of Olcott Lake.

Above: Conservancy fairy shrimp, *Branchinecta conservatio*
Left: California tiger salamander, *Ambystoma californiense*



Graham Fogg and Mark Rains, Vernal Pool Hydrology

Researchers from UC Davis and the University of South Florida, with funding from the California Department of Transportation, are conducting hydrological and biogeochemical research in vernal pools throughout the Great Central Valley. The overall objectives of the research are to develop functional models of vernal pool hydrology and biogeochemistry that can be easily translated to a variety of locations. Such models will be beneficial in answering a number of questions relating to the hydrogeological conditions necessary to sustain vernal pools; the connectivity between uplands, vernal pools, and down-gradient ecosystems; and the effects of various land use practices on the physical and biological form and function of vernal pools.

Vernal pools occur on three basic geological surfaces, each of which has distinct hydrogeological characteristics. Some vernal pools occur on bedrock, such as those that occur at the Santa Rosa Plateau Ecological Reserve in San Diego County. Other vernal pools occur on duripans, such as those that occur at Mather Regional Park in Sacramento County. Still other vernal pools occur on clay soils and/or claypans, such as those that occur at the Jepson Prairie Preserve in Solano County. This research is focused on vernal pools occurring on these latter two basic geological surfaces.

Top: A vernal pool research location.
Bottom: Olcott Lake

Finding high ground in the wet season.

The Jepson Prairie Preserve and the immediate vicinity represent the most extensive and best preserved examples of vernal pools occurring on clay soils and/or claypans in the Great Central Valley. Therefore, all of our research efforts on vernal pools occurring on clay soils and/or claypans are focused on the Jepson Prairie Preserve and the immediate vicinity. The Jepson Prairie Preserve and the immediate vicinity are in close proximity to our UC Davis base of operations which has allowed us rapid access during critical but unpredictable storm events. Furthermore, the Jepson Prairie Preserve and the immediate vicinity have been extremely well-studied by other researchers which has provided us with an extensive base of knowledge and a community of colleagues that have allowed us to organize our research efforts better. We consider ourselves extremely fortunate to have the Jepson Prairie Preserve as part of the UC Natural Reserve System.

Brad Shaffer,
Terrestrial Habitat Use in the Endangered California Tiger Salamander

The California tiger salamander (*Ambystoma californiense*, or CTS) has been declining over the last decade, and the best available evidence suggests that this is due mainly to the conversion of its habitats to agriculture and residential uses. As the decline continues, a critical issue is how much habitat is necessary to maintain a healthy, breeding population of these amphibians.

Our previous work at the Hastings Reserve (another unit in the NRS) has shown that California tiger salamanders spend virtually the entire year living in underground burrows created by small mammals. Adult salamanders only emerge from their burrows to feed (which they do on land) and breed (which they do in seasonal vernal pools) during the winter rainy season. At Hastings, we also learned that adult CTS will sometimes move several hundred meters from a breeding pond, suggesting that they may need a large area of habitat surrounding a pond. However, we have no idea how these secretive, endangered animals use the landscape—are most of them within a few meters of their vernal pool, or are they widely distributed, but hidden in their underground retreats? We also have no information on the sub-adult phase, which is the first five years of their lives. Do young salamanders move more widely than adults (as is seen in some animals), or are they similar to adults in their terrestrial habitat use?

Setting up drift fence.

To collect the necessary data requires a large, intact habitat with a healthy California tiger salamander population that we can study on a daily basis without interference for several years. Jepson Prairie is the perfect habitat for our study. In December 2002, Dr. Peter Trenham and I set up a unique experiment to determine the distribution of salamanders around the main breeding pool at Olcott Lake in Jepson Prairie. We placed salamander traps 10 m to 800 m away from the pool and trapped them on rainy nights when they come out on to feed. Our goal was to quantify the number of salamanders at different distances from their breeding site, and use those observations to estimate the amount of land necessary to protect a CTS population.

California tiger salamander
Ambystoma californiense

From December 2002 to March 2003 our 68 traps were open for 2696 trap-nights, and we caught 53 males, 74 females, and 62 subadults. Between May and June we captured 445 emerging metamorphs over 330 trap-nights. The spatial distribution of our captures confirm what our earlier work had suggested—tiger salamanders live and forage a considerable distance from their breeding sites. We reasoned that conserving enough land to protect 95% of a population constitutes a reasonable management strategy for a species in decline. For adult CTS, our data indicate that this means a buffer of land about 450 m around a breeding pond. Subadult salamanders move even farther than adults, and the required buffer is 650 m for the same level of protection. The bottom line is that California tiger salamanders require a large area of terrestrial habitat to maintain a normal, healthy population.

During the winter of 2003/04, we plan on continuing our work on California tiger salamanders at Jepson Prairie to learn more about their terrestrial habitat use. We hope to learn more about where immature salamanders spend their time, about how fire management may impact salamander habitat use, and about the importance of burrowing rodent density for salamanders. These questions can only be answered at reserves like Jepson Prairie, where researchers and student have free access to large tracts of intact habitat for our work. The answers that we provide are of interest to land owners, agriculturists, the US Fish and Wildlife Service and the California Department of Fish and Game. Long-term, intensive projects require habitats that can support research projects now and can guarantee them into the future, and the NRS is virtually the sole source for such land in California.

Jepson Prairie Class & Public Use

Open to the public and near both the Bay Area and the Central Valley, Jepson Prairie is a great instructional resource because it provides ready access to several distinctive and important natural habitats. In the past 5 years, a total of 34 different university or college classes have been held at the reserve. Class use is at least as broad as research use, in that it includes physical and biological scientists, geographers, landscape architects and creative writers. On spring weekends there are frequently several classes visiting the Reserve at the same time.

Courses in Aquatic Insects and Invertebrate Zoology visit the Reserve regularly to take advantage of the opportunity to examine Olcott Lake for diverse aquatic invertebrates, including the endangered fairy and tadpole shrimps. Herpetology and other zoological courses are drawn to the amphibian fauna, especially the endangered California Tiger Salamander. The opportunity to view the vernal pool and grassland floras draws a wide range of courses: for example, Field Botany, California Floristics, California Plant Communities, Plant Community Ecology, Plant Geography, and Biogeography. Restoration Ecology courses use sites along Jepson Prairie's sloughs to study successes and failures of wetland restoration techniques. Grazing and its impacts have drawn several agricultural management classes, and a wide variety of experimental and field method classes have set up studies on the prairie. Classes in Soil Genesis and Morphology and Physical Geography have used the Reserve to examine the hydrologic and soil features of the pools.

Since 1984, there has been a very active program of public tours at Jepson Prairie led by an autonomous docent group. Every winter, the docents hold a training course in which volunteer University scientists provide instruction on aquatic invertebrates, plant ecology, pollination biology, grassland management, and current university research. Every weekend in the spring months, the docents lead tours that show off the reserve and convey this knowledge to the public. During the week, the docents lead school groups through the reserve by special appointment. The program has been an overwhelming success, hosting over a thousand visitors every year. The NRS staff help to organize and instruct the docent training program.

Jepson Prairie Research Project Lists

Year	*Research Project*	*Principal Investigator*	*Institution*
2000-2003	Long term monitoring of vernal pool vegetation populations	Barbour, Michael	U.C. Davis
2000-2002	Vernal pool photography project	Bowles, Kenneth	U.C. San Diego
2002-2003	Floristics and phytochemical survey project	Christopher,Daphne	New York Botanical Garden
		Stevens, Hannah	New York Botanical Garden
		Atha, Daniel	New York Botanical Garden
2002-2003	Geographical differences in water utilization by *Nassella pulchra*	Corbin, Jeff	U.C. Berkeley
2002-2003	Investigation and collection of flora for the UC Davis Herbarium	Dean, Ellen	U.C. Davis
1999-2000	Variable mammal diversity in burned and unburned plots	Dusek, Lauren	U.C. Davis
		Maniscalco, Donna	U.C. Davis
		Kennedy, Sean	U.C. Davis
		Sesser, Kristin	U.C. Davis
2001-2003	Is a neighborhood a plant species characteristic - are individuals dispersed or clumped within populations?	Espeland, Erin	U.C. Davis
2001-2002	Analysis of nematode communities of unmanaged and managed soils in California	Ferris, Howard	U.C. Davis
		Tenuta, Mario	U.C. Davis
2002-2003	Vernal Pool Hydrology	Fogg, Graham	U.C. Davis
2001-2002	Status survey and habitat requirements of *Neostapfia colusana*	Hogle, Ingrid	U.C. Davis
2001-2002	Insect pollinator visitation to Downingia	Komure, Brooke	Cal Poly Pomona
1999-2002	A survey of the effects of the herbicide “Transline”	Ledger, Beth	U.C. Davis
		Morgan, Kimberly Reever	U.C. Davis
1999-2000	Effects of mosquitofish (*Gambusia affinis*) on two vernal pool species	Leyse, Karen E.	U.C. Davis
1999-2003	The effects of barley yellow dwarf virus on introduced and native grass species in California and implications of restoration	Malmstrom, Carolyn	Michigan State University
2000-2003	Looking at the interaction of fire and grazing on control of exotic invasive species	Marty, Jaymee	The Nature Conservancy
2002-2003	Effects of landscape dispersal of vernal pool invertebrates	Mazor, Raphael	U.C. Berkeley
2001-2002	Preliminary insect collecting	McBride, Carolyn	U.C. Davis
2001-2003	Long term monitoring of vegetation communities, Jepson Prairie Reserve, Solano County, CA	Meisler, Julian	Solano Land Trust
1999-2000	Training for graduate students in ecology and anthropology	Orlove, Benjamin S.	U.C. Davis
2000-2001	Herpetofauna of California Inner Coast Range	Pauly, Gregory	U.C. Davis
2000-2002	Modeling vernal pool hydroperiod over space and time	Pyke, Chris	U.C. Santa Barbara
2001-2002	Assessing the importance of adaptive evolutionary change in the promotion of the spread of weed populations	Rice, Kevin	U.C. Davis
2001-2003	Range-wide assessment of California tiger salamander demography using skeletochronology	Shaffer, Brad	U.C. Davis
2002-2003	Upland ecology and habitat use of the California tiger salamander	Shaffer, Brad	U.C. Davis
		Trenham, Pete	U.C. Davis
1999-2001	Barker Slough Water Quality Study	Singer, Michael	U.C. Davis
2001-2003	GPS mapping of vernal pools and burrow systems of fossorial animals	Smallwood, Shawn	U.C. Davis
1999-2002	Characterizing vegetation and hydrology interactions for tidal marsh restoration	Spenst, Renee	U.C. Davis
2001-2002	Polyploidy and genetics, versus physiology as the best explanation for *Distichlis spicata* and *Juncus balticus* distributions	Spenst, Renee	U.C. Davis
2000-2003	Ecology and biodiversity of native bees (Hymenoptera, Apoidea) and pollination of showy vernal pool flowering species	Thorp, Robbin	U.C. Davis
1999-2000	Diet and habitat analysis of river otters	Vertefeuille, Becky	U.C. Davis
		Knapp, Rebekah	U.C. Davis
		Schroeder, Kelly	U.C. Davis
		Andvei, Megan	U.C. Davis
2001-2002	Collection of bryophytes and lichens	Weiss, Rob	Jones and Stokes
2001-2003	A study of the Microbial Diversity of air in a Longitudinal Transect of California	Wilson, Wendy	Lawerence Livermore Laboratory
1999-2003	Long term monitoring of rare grass populations, *Neostapfia colusana* and *Tuctoria mucronata*	Witham, Carol	Witham Botanical Consultant
2001-2003	Elaphrus viridis reference site surveys and long term monitoring	Witham, Carol	Witham Botanical Consultant
2001-2003	Plant species survey	Witham, Carol	Witham Botanical Consultant
2001-2003	Monitoring of Natural Biological Control of Tocalote, *Centaurea melitensis*	Woods, Dale	CA Depart. of Food and Agriculture

Jepson Prairie Publications

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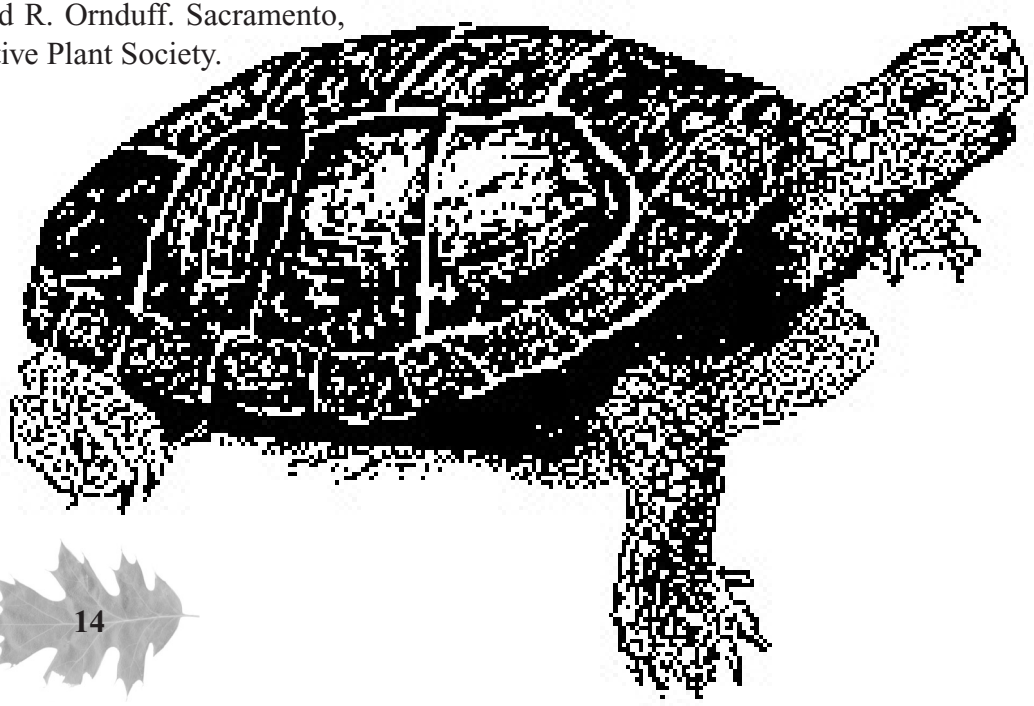


Jepson Prairie Class & Public Lists

U.C. DAVIS UNIVERSITY CLASSES

Barbour	Plant Communities of California (PLB 144)
Barbour	California Plant Communities (PLB 147)
Barbour, Rejmanek	Plant Community Ecology (EVE 206)
Dean	Davis Botanical Society
Elliott-Fisk	Field Methods in Wildlife, Fish, and Conservation Biology (WFC 100)
Greco	Site Ecology (LDA 050)
Grosberg	Invertebrate Zoology (EVE 112)
Jackson, Barbour	Plant Communities of California (EVE 121)
Johnson	Conservation Biology and Restoration Ecology
Lawler	Biology of Aquatic Insects (ENT 116)
Medvitz	Philosophy and practice of international agriculture (IAD 200)
Medvitz	Independent Study - Graduate (IND 200)
Morzenti	Birds, Humans and the Environment (AVS 13)
Morzenti	Raptor Migrations and Population Fluctuations (AVS 16L)
Rejmanek	Wildlife, Ecology, and Conservation Biology (WFC 10)
Rice	California Grasses (AMR 131)
Schwartz	Introduction to Environmental Studies (ESP 10)
Schwartz	Introduction to Methods in Field and Laboratory Ecology (ESP 123)
Shaffer	Herpetology Lab (EVE 134L)
Shaffer	Herpetology (EVE 185)
Stanton	Experimental Ecology and Evolution in the Field (EVE 180A)
Stanton	Experimental Ecology and Evolution in the Field (EVE 180B)
Young	Restoration Ecology (ENH 160)

NON-U.C. DAVIS UNIVERSITY CLASSES

Thomsen	American River College, Physical Geography (GEO 1)
Nosal	American River College, Wildflowers of the Central Valley
Nosal	American River College, Biology Field Course
Davidson	CSU Sacramento, Field Methods in Environmental Science (ENVS 121)
Holtzman	CSU San Francisco, Graduate seminar in biogeography (GEO 810)
Carberry	Sacramento City College, Biology Class
Eigenheer	Sacramento City College, Physical Geography Lab
Serafini	Sacramento City College, Field Botany
Medeiros	Sierra College, Environmental Science
Medeiros	Sierra College, Field Biology
Bartolome	UC Berkeley, Range Assessment (ESPM 278)
Corbin	UC Berkeley, Ecosystems of California (IB 157)
Houston	UC Berkeley, Landscape Architecture/Restoration
Tyler	UC Santa Cruz, Environmental Field Studies
Maurer	UC Santa Cruz, Natural Ecosystems, Ecosystem Management, Introduction to Wilderness (X17, X22, & X11)

PUBLIC ORGANIZATIONS

California Academy of Sciences
California Duck Days
California Native Grass Association
California Pioneer Days
Delta Chapter - Sierra Club
Lepidoptera Society
Napa-Solano Audubon Society
Nevada City Garden Club
Northern California Association of Science Writers
San Francisco Bay Bird Observatory
Sacramento Perennial Plant Club
Solano Farm Service Agency
The Eldorado California Native Plant Society
The Nature Conservancy
Vernal Pool Society
Washington Native Plant Society
University & Jepson Herbaria at UCB
UCD Arboretum
Yuba City Garden Society

Elementary and Secondary Schools

Amy Blank Elementary School
Davis Home School
Emerson JHS, Davis
Grass Valley Home School, Grass Valley, CA.
Holmes JHS, Davis
Homes School Science
Lewis and Clark School
Nature Bowl Homeschooling Groups
Patwin Elementary School
San Jose Home School, San Jose, CA.
Travis Elementary School
Willett Elementary School
Youth Of America

McLaughlin Reserve

The 6,800-acre McLaughlin Natural Reserve lies on a major geologic boundary that creates a diverse mosaic of Inner Coast Range habitats. One-third of the reserve consists of harsh serpentine soils, supporting a rich diversity of unique plant species that have long fascinated evolutionary biologists. The vegetation on serpentine soils at McLaughlin includes special types of chaparral, grassland and riparian plant communities. On sedimentary soils, the vegetation shifts suddenly to more widespread plant communities such as blue oak woodland, annual grassland, and chamise chaparral. Aquatic habitats include three major streams and a reservoir. Use of these lands and associated facilities for research and education was conveyed to UC NRS by the Homestake Mining Company as the company finished operating its environmentally innovative open-pit gold mine at the site. The reserve is surrounded by hundreds of thousands of acres of public land, mostly in a wilderness condition.

In the late 1980's, Homestake Mining Company approached the UC with a unique offer. Homestake's landholdings at the junction of Napa, Lake and Yolo Counties could become a Natural Reserve for environmental research and education, during and after the period of mining. Attractive features of this offer included the sheer size of the property, its tremendous ecological diversity, and the long interest of UC Davis natural scientists in the unique geology and flora of the area. Homestake also offered many amenities for a research station, such as buildings, roads, fencing, and an extensive environmental database. During the lifetime of the mine, the company would also provide all utilities, maintenance, land management, and other stewardship functions.

An initial UC-Homestake agreement was signed in 1993, but use and development of the reserve remained limited until 1998, when NRS reserve steward Dan Tolson created a small overnight field station in one end of an unused warehouse. Together with our concerted efforts to publicize the reserve, this led to four years of rapidly growing reserve use that flourished side-by-side with a fully operating mine. By 2002, as the mine prepared to close, this unique site had blossomed into one of the most successful reserves in the entire UC Natural Reserve System.

Completing the long-term use agreement required three years of hard work by campus and UCOP staff. Led by the top Superfund lawyer for the Office of General Counsel, a team of UC negotiators worked with their Homestake counterparts to create the final 30-page legal agreement that was signed by UC President Atkinson in 2003. It gives UC an exclusive long-term license to use the site, as well as an option to take title to some of the land, while leaving all reclamation responsibilities and rights with Homestake (now the Homestake Division of the Barrick Gold Corporation). A companion agreement gives the Land Trust of Napa County a conservation easement over the property.

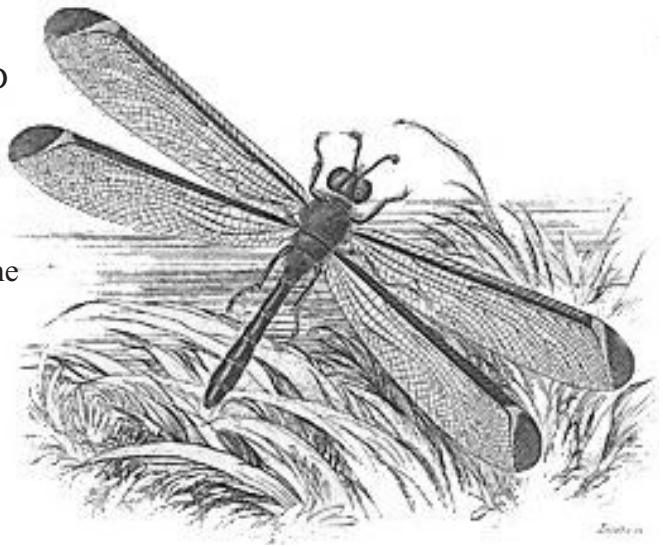
As the mine prepared to close, the reserve could no longer function without an on-site NRS reserve manager. In fall 2002, with generous help from UCOP-NRS, we were fortunate to hire Paul Aigner and Cathy Koehler to share this job. In the

graduate program at UC Riverside, Paul and Cathy had gained diverse experience in ecological research, education, and reserve management. In their first year at McLaughlin, Paul and Cathy turned part of a mine building into their home, while guiding the reserve safely during the difficult period when the mine was being closed and dismantled. Thanks to their diligence, the myriad safety and logistical issues created by mine closure barely affected the reserve's users. Instead, users have been enthusiastic about the welcoming environment created by Paul and Cathy's presence.

Paul and Cathy worked quickly to remodel the mine's former Administration Building into a new base of operations. For a remarkably small cost, they turned it into a field station providing comfortable accommodation for 20 people, as well as a large, pleasant space for meals, meetings and classes. They also worked to upgrade the camping area, which offers rustic but complete kitchen facilities in an attractive location, and is ideal for large class groups staying overnight in the springtime and fall. Securing a good water supply for the field station and campsite continues to present a challenge. Paul and Cathy have also been busy showing new researchers around, developing better information resources, negotiating with the mine and its neighbors, controlling weeds, and performing the many other tasks that make an on-site manager essential to the success of a remote and busy reserve.

The NRS staff put great effort into making Homestake's "gold mine" of environmental data usable to researchers. We created an attractive and information-packed guidebook to the reserve, available in print and on-line, with comprehensive species lists, soil and geology maps, and accounts of all the reserve's major natural and historical features. We continue to improve the website with new publications and other resources. We are working to connect on-site weather stations to the UCD REMOTE network to allow web access to the data in "real time". This will provide the infrastructure for classes to put experiments in the field and follow them from the classroom over the course of a term.

The NRS staff and campus director are active in the Blue Ridge Berryessa Natural Area Conservation Partnership, an affiliation of state and federal agencies, business owners, land trusts and private individuals concerned with the roughly 500,000 undeveloped acres surrounding the McLaughlin Reserve. We sit on the steering, stewardship, database, and outreach committees of this group, which won the 2002 Governors Award for Excellence in Environmental and Economic Leadership. As one sign of our regional role, Paul and Cathy were hired by the California Department of Fish and Game to write the management plan for the Knoxville Wildlife Area, a new 8,000-acre state holding adjacent to the reserve, in parallel with their authorship of the reserve management plan.



McLaughlin Research

Given the reserve's location on a major regional fault, and the mine's extensive data and rock collections describing the geothermal gold deposit, geology was expected to be one of the major attractions of McLaughlin. And indeed, it has been used by UCD scientists for studies of local tectonic structure, gravity anomalies, soil development on different parent rocks, and other geologic subjects.The UCB-USGS Seismological Laboratory has installed a geophysical monitoring station at the reserve, which will be used to conduct and promote research on earthquake processes and earth structure at the regional and global scale, and to provide timely earthquake information.

Mercury research has also been an important theme because of the nineteenth-century mercury mines found on and around the reserve. Professor Charles Goldman and his former students Drs. Darrell Slotton and Sudeep Chandra, funded by Homestake, have used the Davis Creek Reservoir since 1985 for a landmark long-term study of the biochemical processes mediating movement of mercury into aquatic and terrestrial food chains. A research group from the University of Nevada at Reno has used the reserve as a base for their regional study of atmospheric mercury flux.

The evolution and ecology of plants on serpentine soils has been perhaps the single most popular theme of research at the reserve. Professor Susan Harrison and graduate student Amy Wolf studied how the patchy, island-like nature of serpentine outcrops influenced patterns of plant species diversity, and the interactions of specialized serpentine plants with their pollinators. Graduate students Christy Brigham and Kelly Lyons carried out PhD work on rare monkeyflowers and invasive goatgrass, respectively. A 1999 wildfire allowed Harrison and former postdoc Hugh Safford to conduct the first-ever comparison of the fire ecology of serpentine and nonserpentine vegetation (see Page 22).

In 1999, six researchers (UC Davis professors Paul Gepts, Rick Grosberg, Susan Harrison, Kevin Rice and Maureen Stanton, plus former UCD professor Sharon Collinge) won two large interdisciplinary grants from the Mellon and Packard Foundations on "Ecological and Evolutionary Responses of Plants to Habitat Mosaics". Their premise was that ecologists and evolutionists need model ecosystems in which to study how biological diversity is shaped and maintained by a heterogeneous environment, and to merge approaches ranging from GIS and molecular markers to traditional field experiments. This group then made around 20 sub-awards to graduate students and postdocs to conduct studies linked to their overall theme, and this lively group dubbed itself "CRAM" (the Consortium for Research at McLaughlin).

The centerpiece of CRAM is a 500 by 550 meter area affectionately known as The Grid, where soils and plant diversity are measured in detail at points spaced by 50 meters across some of the most striking gradients in geologic, soil and plant diversity found at McLaughlin. Within it are six 50 by 100 meter "gridlets" where the same variables are measured every ten meters. In springtime, the Grid is a brightly colored patchwork of wildflowers, chaparral, woodland, and busy ecologists with their "flags, bags and tags". Researchers Sharon Collinge, Brian Inouye and Kendi Davies are using the Grid to test how ecological diversity is shaped by the interaction between abiotic (soil) and biotic (competition) factors, and in turn, how diversity affects the resilience

of the plant community to climate change, disturbances, and invasions. Researcher Jessica Wright is heading a group effort to use the Grid template to understand how a model species, *Collinsia sparsiflora*, adapts to the variation within its ecological niche (see Page 21).

In another CRAM project, professor Kevin Rice (Agronomy) and postdoc John McKay are studying the role of local adaptation in the spread of invasive goatgrass, *Aegilops triuncialis*. Graduate student researchers and their projects include:

Kit Batten (Ecology), studying the role of soil microbes, especially plant growth-promoting rhizobacteria, in structuring plant communities on heterogeneous soils.

Shira Bell (Soil Science), exploring the role of molybdenum deficiency in structuring microbial and plant communities on heterogeneous soils.

April Boulton (Ecology), studying how harvester ants (*Messor andrei*) can be a source of nutrient subsidies to soil microbial and faunal communities.

Nancy Emery (Population Biology), studying how ecological and evolutionary processes interact to limit the local distributions of plants, focusing on the annual *Gilia tricolor*.

Amy Freestone (Ecology), analyzing how habitat patchiness and physical variation at multiple spatial scales structure the rare plant community of serpentine seeps.

Jen Lau (Population Biology), studying how invasive species affect native plants through shared herbivory, using the native *Lotus wrangelianus* and the introduced *Medicago polymorpha*.

Quenby Lum (Soil Science), conducting experiments on how fire interacts with soil heterogeneity to influence soil nutrient dynamics and the plant community.

Donald McGahan (Soil Science), documenting the role of geologic variation (variable degrees of metamorphosis of peridotite into serpentine) in producing variation in serpentine soils and vegetation.

Julianno Sambatti (Plant Biology), using molecular techniques and field experiments to study the evolutionary ecology of wild sunflowers, *Helianthus exilis* and *Helianthus bolanderi*, in serpentine seeps.

Robin Waugaman (Entomology), using field experiments to discover the adaptive significance of a flower color polymorphism in *Clarkia purpurea*.

As word has spread about the rich mosaic of soils and vegetation at the reserve, interested scientists have arrived from far and wide. Michelle Dudash and Courtney Murren came from the University of Maryland to examine the evolution of invasiveness in Western monkeyflower (*Mimulus guttatus*). Sally Chess came from San Francisco State to understand why evening snow (*Linanthus dichotomus*) closes its flowers during the day in the south but not the north part of its range. Robert Harris from Cornell is studying hybridization in larkspurs (*Delphinium sp.*)... and the list goes on and on. As publications appear in books and journals (over 50 so far) and the reserve's reputation continues to spread, we anticipate that research use will continue in its sustained growth.

Jessica Wilcox Wright,
How *Collinsia sparsiflora* Adapts to the Variation Within its Ecological Niche

In August, 12 researchers from UC Davis got together and planted the 6000 seeds that make up our collaborative research project. This project is the culmination of several years of research efforts and is a combination of the technical expertise of the PI's and Postdocs of the CRAM group. The first thing we did was to analyze the data collected from The Grid to construct a model that describes the "niche" of *Collinsia sparsiflora*, a native California annual that is found on and off of serpentine soils. We then used this model to construct a six-dimensional hypervolume, which contains the variation in the 6 factors found to be important for the *C. sparsiflora* "niche". We then sampled across that hypervolume to find 100 points on the grid that included the broadest range of variation for those 6 factors. Meanwhile, back in the greenhouse, we generated seeds of *C. sparsiflora* through selfing in the greenhouse to create 4 pools of seeds, one from each of the four populations we included in this study. Two of those populations were from serpentine habitats, the other two were from non-serpentine habitats. These seeds were planted into the 100 grid points across 3 of the smaller 10m gridlets. In addition, at 50 points, we planted two plots and cleared all vegetation from one of the plots, to make a competition-free treatment. This will allow us to look more closely at the effects of competition on plant growth across a range of habitats.

The model we used to determine the hypervolume was constructed using only data from plants growing on serpentine soils. Therefore, we predict that plants from serpentine soils will grow best on sites predicted by the model to be "ideal" for *C. sparsiflora*. It is less clear how plants from non-serpentine populations should respond. Previous research has found that there is local adaptation to serpentine soils in *C. sparsiflora*, so we have reason to believe that there are two ecotypes, and thus that there would exist different models that describe the "niche" of the two types. If non-serpentine *C. sparsiflora* grows equally well as serpentine plants on the "ideal" sites, then we conclude that the same model describes the habitat preferences of serpentine and non-serpentine plants. If not, then we conclude that non-serpentine plants have a different set of "ideal" habitats than serpentine plants- further proof for the existence of two ecotypes of *C. sparsiflora* at the McLaughlin reserve.

This experiment is already growing in scope. A side project, looking at herbivory across the different sites where *C. sparsiflora* was planted has been proposed. This project will include surveying plants for herbivory during the course of the growing season, as well as potentially adding insecticide to some separate plots to look at the effects of insect removal on plant performance. Other such side projects may develop over the course of this experiment, and are welcome, given the collaborative nature of this project.

Susan Harrison and Hugh Safford, Fire Ecology of Serpentine Plant Communities

Fire ecology is becoming an increasingly important subject as prescribed fires are used to control invasive exotic plants, stimulate regeneration of fire-dependent native species, and control the risks of catastrophic wildfire. Yet we know little about how the effects of fire on native and exotic plants may vary across mosaic landscapes, where soils and vegetation vary in response to the complexity of the underlying geology.

At the McLaughlin Reserve, the landscape includes large areas of serpentine rocks and soils, interspersed with soils derived from sedimentary rocks. Serpentine rock and the soils derived from it are rich in magnesium and other metals, and poor in calcium and basic nutrients. These shallow, rocky, unproductive soils support a distinct vegetation that is sparse and low-statured but rich in unusual species. So-called serpentine endemics, or plants that grow only on soils derived from serpentine rocks, form an important part of California's unique flora. Over 40 species of serpentine endemic plants are found at McLaughlin. We know almost nothing about their fire ecology.

A wildfire that burned through McLaughlin in Fall 1999 gave us the opportunity to compare the effects of fire on native and exotic species diversity in serpentine and nonserpentine vegetation. We compared responses of plants to fire in grassland and chaparral (shrub) vegetation on each soil. We also compared grazed and ungrazed grasslands. We followed these differences in permanently marked plots for three years after the fire. We expected that because biomass is lower in serpentine vegetation, space and light are more available, and therefore both fire and grazing would stimulate less of an increase in plant diversity in serpentine than the corresponding nonserpentine vegetation.

In chaparral, we found the diversity of both native and exotic species increased more in response to fire on nonserpentine than serpentine soils. In addition, mean fire severity was lower, and mean time since last fire was longer in serpentine than nonserpentine chaparral. In grasslands, both fire and cattle grazing increased total and exotic species diversity more on nonserpentine soil, but increased native species diversity more on serpentine soil.

Our results, published in *Conservation Biology* and *Ecology*, suggest that fire may play a less pronounced role in the maintenance of native species diversity on serpentine than on richer soils. Management of unique, botanically rich, low-productivity habitats such as serpentine must take into account the possibility that different management regimes are needed. Hugh Safford's experience as a post-doc with this project helped lead to his present career as the US Forest Service's lead ecologist for Region 5 (California, Hawaii, and Guam).

McLaughlin Class & Public Use

For years, geology classes visited the mine to view its operation and the exposed ore deposit. In 2002, using geochemical monitoring and mapping data from Homestake, the geology department offered a course in Analytical Methods in Earth Science and plan to continue it in coming years (see Page 25).

The reserve's diverse ecology and good facilities have attracted day and weekend use from a full range of environmental biology field courses, including insect diversity, plant geography, California floristics, ecological field methods, and others.The reserve's unique restoration challenges have provided material for restoration ecology classes. The wildfire in 1999 enticed the San Francisco State University fire ecology class to make a visit.

The new NSF-funded IGERT integrative graduate training program in Biological Invasions used McLaughlin for its first-year group project in 2003. Students visited the reserve, identified the major invasive species problems, and broke into groups to gather information on specific weeds and evaluate the costs and benefits of controlling them. Their work is now being incorporated in the reserve's management planning.

The combination of the stark aesthetics of the landscape and the diverse local culture enticed Professor David Robertson to hold a Nature and Culture field course at the reserve for several years, producing works of art, creative writing, and scientific term papers from the variegated material of the reserve. Says Professor Robertson: "The McLaughlin Natural Reserve is perhaps as close to an ideal nature and culture meeting place as we have yet discovered. NAC has already used McLaughlin as a site for the senior field work class, NAC 180. It is likely to do so again in the next five years. It is also likely to use both McLaughlin and Quail Ridge as overnight field destinations for NAC 1, 100, 120, and the new art course that Ann Savageau is proposing."

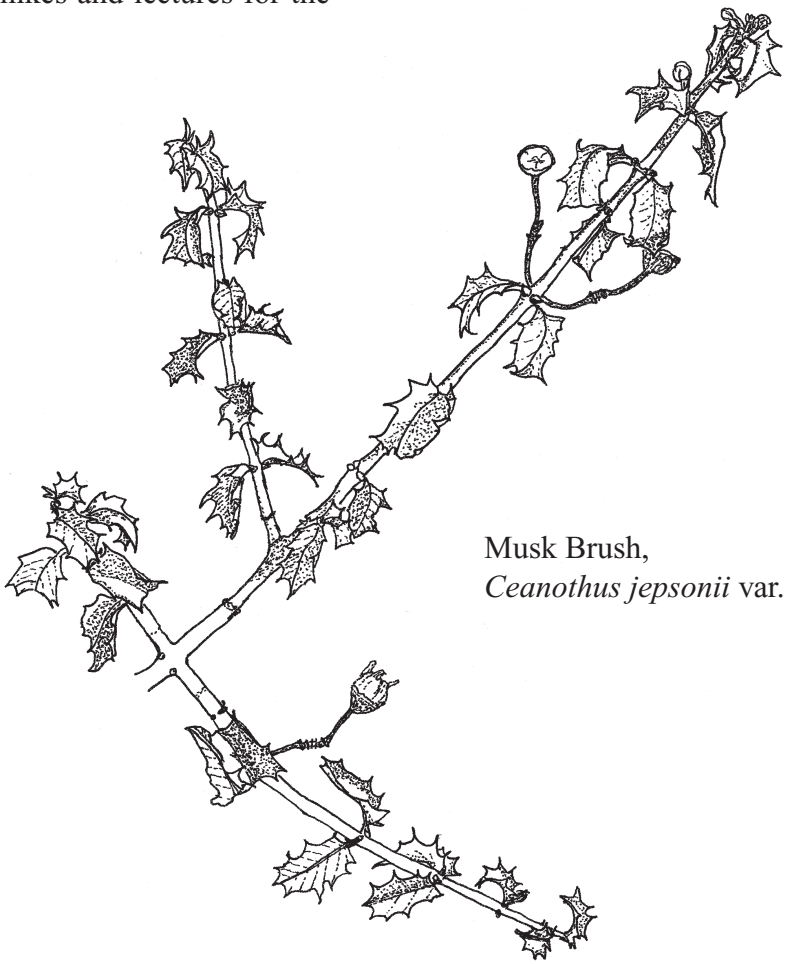
Just as with research, we anticipate that the number of classes using the reserve will grow now that we have on-site staff to invite, guide, and provide information to them, and now that the indoor and camping facilities are much improved.

During the mine years, Homestake provided a regular program of mine

Great Horned Owl

tours for school groups and the general public. As NRS activities increased, we began to provide natural history field trips for groups such as Audubon, California Native Plant Society, Land Trust of Napa County, and Sierra Club. In coming years, we plan to build on these foundations and on Cathy Koehler's experience as a professional environmental educator, to seek external funding for a vigorous program aimed at K-12 students, community college students, and the public. Lake County has especially significant needs for improved environmental education opportunities.

In the past year, Cathy has begun making strong connections with the local community. She helped develop a Science Center at the Lake County Fair, joined a task force for creating a Discovery Museum in Lake County, and participates in the Lake County Science Teachers' Network meetings. She is working with the Lake County Office of Education and the Lake County Science Teachers' Network to develop lesson plans for K-12 field trips. She is participating in the California Regional Environmental Education Community Network (CREEC) to develop environmental education for teachers, and plans to hold Content Improvement Workshops for teachers at the McLaughlin Reserve. She also hopes to offer service-learning opportunities for high school students, research exposure for community college students, and natural history hikes and lectures for the general public.

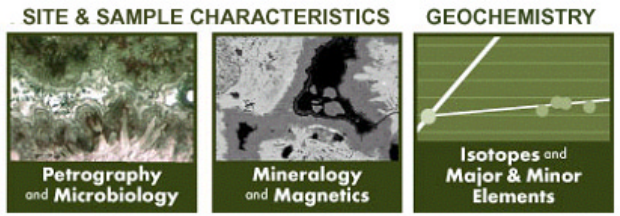


Musk Brush,
Ceanothus jepsonii var. *albiflorus*

Robert Zierenberg, Geology Research and Classes at the McLaughlin Reserve

Geology is taught in the classroom, but is learned in the field. Private land ownership is increasingly limiting access to near campus field areas where geologic education and research can be easily conducted. The McLaughlin Reserve is an important resource for the Department of Geology. Examples of the type of activity that were conducted by the Department of Geology at the McLaughlin Reserve last year include an Undergraduate Senior Research Thesis on the geophysics of the area, a graduate student field trip to the Reserve, and a graduate course in analytical methods that investigated geothermal springs on the Reserve.

Deep drilling at the Geysers geothermal field has encountered igneous intrusive rocks of batholithic proportions, similar to those exposed along the crest of the Sierra Nevada mountains. Standard plate tectonic models for the formation of the Coast Range suggest formation by accretion of marine sedimentary rocks that are incorporated onto the edge of the continent during the period when an oceanic plate was subducting beneath the continental margin. Intrusion of large granitic bodies into the base of this accreted sequence is not predicted by the standard models. These intrusions appear to be related to the "slab window" volcanism that formed the Clear Lake volcanic field and are a potential heat source to drive the geothermal circulation at the Geysers geothermal field. The presence of Clear Lake volcanics and former high temperature hydrothermal circulation in the McLaughlin area raises the possibility that similar igneous intrusions may occur at depth beneath this area. Testing this hypothesis by deep drilling is prohibitively expensive, but there are geophysical techniques, such as detailed gravity measurements, that could potentially reveal the presence of a batholith at depth. Because the geophysical target area is both large and deep, imaging the batholith requires a survey to be carried out over an extensive area, with data transects kilometers long. Because the expected gravity signature is subtle, detailed terrain corrections using a detailed digital elevation model are required. The McLaughlin Reserve is perhaps the only area in the Coast Ranges where access to a large tract of land that has been surveyed at high resolution is available, and thus was invaluable for conducting this research. Data collection was completed in 2003 and processing and modeling are in progress.



Each year the Department of Geology starts the academic year by taking incoming graduate students on a field trip to orient them to the Geology of California. Last fall, the field trip started with a visit to the McLaughlin Reserve to examine Coast Range geology, recent tectonics, ore deposit formation and environmental geology. In addition to the excellent geology displayed on the Reserve property, the class was able to camp at the old homestead site. The availability of the facilities for accommodating a group campsite, combined with the support of the staff at the Reserve, were major contributors to the success of this field trip and we intend to repeat it in years to come.

One of the most rewarding experiences springing from access to the McLaughlin Reserve, from the point of view of the faculty of the Department of Geology, was the outcome of a graduate class (GEL 281) designed to introduce our graduate students to modern analytical equipment available on campus. The course is taught by Dr. Peter Schiffman, but includes involvement of at least eight other faculty members. This year, the class focused all of their analytical efforts on a suite of fluid and rock samples collected from active geothermal springs on the McLaughlin Reserve. Easy access to the reserve and support of the reserve staff were critical to the success of this class. Having the students define the project and collect the samples in the field provided an important context to the analytical work that made the class much more meaningful to the students. The class was highly engaged and the work they performed resulted in an important discovery of primary deposition of dolomite in these springs. The preliminary results of the class are presented at a web page (http://www-geology.ucdavis.edu/~GEL281/F02/) linked to the McLaughlin Reserve. A group of the students is following up on this project and has a manuscript that will be submitted for publication. This project would not have been undertaken were it not for access to the Reserve.

McLaughlin Research Project Lists

Year	*Research Project Title*	*Principal Investigator*	*Institution*
2002-2003	Spatial variation in pollination of *Dudleya cymosa*	Aigner, Paul	U.C. Riverside
2000-2002	Assortive mating, divergence, and establishment of range edges in plant populations living along edaphic gradients	Barringer, Brian	Cornell University
2000-2003	Plant invasions and the soil microbial community in California serpentine grasslands	Batten, Kit	U.C. Davis
2001-2002	Microbial community nutrient limitations in serpentine soil.	Bell, Shira	U.C. Davis
1999-2000	Nutrient limitations and metal accumulation in congeneric serpentine and non-serpentine species	Blenkush, Ryan	U.C. Davis
		Richards, Jim	U.C. Davis
1999-2002	Examining the affects of granivorous ants on below ground foodwebs.	Boulton, April	U.C. Davis
1999-2000	Maintenance of diversity in plant communities: persistence of rare plants.	Brigham, Christy	U.C. Davis
2001-2003	Scent analysis of the two morphs of *Linanthus dichotomus*	Chess, Sally	San Francisco State University
1999-2002	Plant diversity in spatially complex landscapes: ecological and evolutionary responses to environmental structure.	Collinge, Sharon	University of Colorado
		Grosberg, Rick	U.C. Davis
		Harrison, Susan	U.C. Davis
		Rice, Kevin	U.C. Davis
		Stanton, Maureen	U.C. Davis
		Thiede, Denise	U.C. Davis
1999-2003	Monitoring annual variability in fish population structure at historically monitored sites	Connors, Peter G.	U.C. Davis
2002-2003	Monitoring of reclaimed wetlands	Connors, Peter G.	U.C. Davis
2002-2003	How does spatial scale alter the diversity-invasibility relationship?	Davies, Kendi	U.C. Davis
2002-2003	Patterns of arthropod diversity in serpentine and non-serpentine grasslands.	Davies, Kendi	U.C. Davis
		Boulton, April	U.C. Davis
2001-2003	Preliminary gravity survey of the McLaughlin Reserve: study of local source of active hydrothermal systems	Donohoe, Kevin	U.C. Davis
2002-2003	Density and diversity manipulations in annual grassland plants	Elmendorf, Sarah C.	U.C. Davis
2002-2003	Importance of propagule pressure and disturbance on establishment of an invading weed, *Brassica nigra*	Elmendorf, Sarah C.	U.C. Davis
		Moore, Kara"	U.C. Davis
2002-2003	Modelling species distributions in relation to environmental factors	Elmendorf, Sarah C.	U.C. Davis
		Moore, Kara	U.C. Davis
2002-2003	Heterogeneity at the edges of a *Gilia tricolor* population	Emery, Nancy	U.C. Davis
2000-2001	Atmospheric mercury flux sampling at the Sulphur Bank Mercury Mine	Engle, Mark	University of Nevada, Reno
2002-2003	Field measures of reproductive variance in California annual plants	Espeland, Erin	U.C. Davis
2001-2002	Is a neighborhood a plant species characteristic - are individuals dispersed or clumped within populations?	Espeland, Erin	U.C. Davis
1999-2001	Atmospheric emission of mercury	Fitzgerald, Brian	University of Nevada, Reno
2000-2001	Scientific photography of geologic thin sections	Fletcher, Verda	Private
2002-2003	Understanding the interactions between a native insect community and an exotic plant	Forister, Matthew L.	U.C. Davis
2002-2003	Species interactions to regional diversity: understanding the factors that affect plant diversity in one of California's rare plant habitats	Freestone, Amy	U.C. Davis
2000-2002	Relative influence of habitat heterogeneity and spatial distribution on the local, differential, and regional diversity patterns of the serpentine seep plant community	Freestone, Amy	U.C. Davis
2002-2003	Within-population differences in microsite adaptation and phenotypic plasticity in *Mimulus tricolor*	Gibson, Amanda A.	University of Maryland
2000-2001	Atmospheric mercury flux sampling.	Giglini, Toni	UNR
1999-2001	Aquatic insect assemblages in temporary streams in serpentine and non-serpentine drainages.	Greaves, Mary	U.C. Davis
1999-2000	Self-similarity in the abundance and distribution of species	Green, Jessica Lee	U.C. Berkeley
2002-2003	Disease resistance in *Helianthus bolanderii* and *H. exilis*	Gulya, Thomas	USDA
2001-2002	Disease resistance in wild sunflowers	Gulya, Thomas	USDA
1999-2002	Assessment of mercury emissions from naturally enriched areas and contaminated mine waste.	Gustin, Mae Sexauer	University of Nevada, Reno
2000-2002	Hybridization and introgression in the genus Delphinium	Harris, Robert	Cornell University
2002-2003	Grassland invasions	Harrison, Susan	U.C. Davis
1999-2003	Fire ecology of serpentine and nonserpentine grasslands and chaparral	Harrison, Susan	U.C. Davis
		Safford, Hugh	U.S. Forest Service

Year	*Research Project Title*	*Principal Investigator*	*Institution*
2002-2003	Regional and local richness of serpentine endemic plants	Harrison, Susan Safford, Hugh	U.C. Davis U.S. Forest Service
2000-2002	Molecular ecology of wetwood	Hofstra, Thomas S.	U.C. Santa Cruz
2000-2002	Determinants of diversity of aquatic microorganisms in streams and seeps at multiple spatial scales	Holyoak, Marcel	U.C. Davis
2002-2003	Taxonomic and biological revision of the Pleocomidae, genus Pleocoma	Hovore, Frank Swift, Ian	U.C. Berkeley U.C. Berkeley
2002-2003	Geochemistry of the McLaughlin Mine pit	Hunerlach, Michael	USGS
2002-2003	Examination of the effects of abiotic and biotic factors on the distribution of *Erodium botrys*, *E. brachycarpum*, and *E. cicutarium* along gradients in serpentine soil	Jacobs, Brooke	U.C. Davis
2000-2001	Sedge (Carex) taxonomy	Janeway, Lawerence	C.S.U. Chico
2002-2003	Seismic Observation	Karavas, Bill	U.C. Berkeley
2002-2003	Distribution of moths in the lower coast range	Kareofelas, Greg Patterson, Bill	Lepidopterists Society Lepidopterists Society
2002-2003	Improved vegetation mapping techniques	Kennedy, Jeff A. Keeler-Wolf, Todd Menke, John	U.C. Davis CA Dept. of Fish and Game Aerial Information Systems
2002-2003	The herbivore-mediated indirect effects of the exotic plant *Medicago polymorpha* on the co-occurring native plant *Lotus wrangelianus*	Lau, Jennifer	U.C. Davis
2000-2002	The indirect effects of invasive species on native plant communities	Lau, Jennifer	U.C. Davis
2002-2003	Altered soil resource availability due to fire disturbance and effects on native and exotic plants in a California serpentine grassland	Lum, Quenby	U.C. Davis
1999-2001	Determination of the adaptive edaphic nature of the weed *Aegilops triuncialis* (barbed goatgrass).	Lyons, Kelly	U.C. Davis
1999-2002	The effects of barley yellow dwarf virus on introduced and native grass species in California and implications for restoration	Malmstrom, Carolyn	Michigan State University
2001-2002	Recovery of riparian insect communities in serpentine chaparral following a wildfire in McLaughlin Natural Reserve	Martin, Laurel	U.C. Berkeley
2001-2002	Preliminary insect collecting	McBride, Carolyn	U.C. Davis
2001-2003	Effects of habitat heterogeneity on mating type fitness in *Clarkia concinnna* and *Nemophila menziesii*	McCall, Andrew	U.C. Davis
2002-2003	A lithosequence on ultramafic parent material: soil formation and degree of serpentinization	McGahan, Donald G.	U.C. Davis
2002-2003	Spatial heterogeneity in resource availability on serpentine soils	McKay, John Rice, Kevin	U.C. Davis U.C. Davis
2000-2001	A preliminary phylogeny of galling aphids and their congeric parasites on Arctostaphylos shrubs.	Miller, Don	Trinity University
2002-2003	Interacting effects of propagule limitation, habitat restriction, competition, and seed predation on the spatial distribution of *Lupinus nanus*	Moore, Kara	U.C. Davis
2000-2002	Structural and tectonic studies of the California Coast Ranges, McLaughlin Reserve and adjacent region	Moores, Eldridge	U.C. Davis
2000-2002	Mechanisms involved in the evolution of flower color of the spring wildflower, *Gilia tricolor*.	Morita, Shelah	U.C. Davis
2001-2003	The role of imbreeding in invasiveness: linking phenotype plasticity and imbreeding in *Mimulus guttatus* in home and novel environments.	Murren, Courtney J. Dudash, Michele R.	University of Maryland University of Maryland
2000-2001	Scaling Hg flux and characterizing the RGM in the Sulfur Banks area	Nacht, David	University of Nevada, Reno
1999-2002	A look at the intermediate disturbance hypothesis in chaparral following a wildfire	O'Neil, Susan E.	San Francisco State University
1999-2000	Floral evolution and speciation in Antirrhinum	Oyama, Ryan K.	Harvard
1999-2001	Herpetofauna of California Inner Coast Range	Pauly, Gregory	U.C. Davis
2002-2003	Community assembly on serpentine chaparral: a comparative study of functional traits between serpentine tolerant species and their closest relatives off serpentine	Rajakaruna, Nishanta	Stanford
2002-2003	Long-term variability in restored wetlands	Resh, Vincent H.	U.C. Berkeley
2002-2003	Long-term variability in stream benthic communities	Resh, Vincent H.	U.C. Berkeley
2001-2002	Adaptive variation and invasive potential of barbed goatgrass, *Aegilops triuncialis*.	Rice, Kevin	U.C. Davis
2001-2002	Assessing the importance of adaptive evolutionary change in the promotion of the spread of weed populations, such as barbed goatgrass.	Rice, Kevin	U.C. Davis

Year	*Research Project Title*	*Principal Investigator*	*Institution*
1999-2003	Ecological and evolutionary responses to habitat mosaics:	Rice, Kevin	U.C. Davis
	integrating across spatial and temporal hierarchies of plant biodiversity	Collinge, Sharon	University of Colorado
		Gepts, Paul	U.C. Davis
		Harrison, Susan	U.C. Davis
		Stanton, Maureen	U.C. Davis
		Grosberg, Rick	U.C. Davis
		Thiede, Denise	U.C. Davis
		Davies, Kendi	U.C. Davis
		McKay, John	U.C. Davis
		Jessica Wright	U.C. Davis
		Brian Inouye	Florida State University
2002-2003	Ecological genetics of the invasive barbed goatgrass (*Aegilops triuncialis*) across serpentine soil gradients	Rice, Kevin	U.C. Davis
		McKay, John	U.C. Davis
2002-2003	Rattlesnake response to an infrared squirrel signal	Rundus, Aaron S.	U.C. Davis
2002-2003	Evolutionary ecology of serpentine sunflowers	Sambatti, Julianno B.	U.C. Davis
2002-2003	Determinants of ant species density in oak woodlands	Sanders, Nathan J.	C.S.U. Humboldt
		Crutsinger, Greg"	C.S.U. Humboldt
2002-2003	Petrography, minerology, and geochemistry of McLaughlin Reserve travertines	Schiffman, Peter	U.C. Davis
2002-2003	The role of seed limitation, resource competition, and community complementarity in invasions and restoration	Seabloom, Eric	U.C. Santa Barbara
		Yoshida, Toshi M.	U.C. Santa Barbara
2002-2003	Mercury bioaccumulation monitoring and research in Davis Creek watershed	Slotton, Darrell G.	U.C. Davis
		Slotton, Darrell G.	U.C. Davis
1999-2003	Davis Creek Watershed; UC Davis/Homestake Monitoring Program	Ayers, Shaun M.	U.C. Davis
		Springer, Yuri	U.C. Santa Cruz
2000-2003	An investigation of spatial and phylogenetic mosaics of antagonistic coevolution in California wild flax, Hesperolinon	Stanton, Maureen	U.C. Davis
2001-2003	Evolutionary constraints on the realized niche of *Gilia tricolor*	Stanton, Maureen	U.C. Davis
2000-2002	Consortium for Research at McLaughlin: Testing for adaptive differentation between serpentine and	Wilcox-Wright, Jessica	U.C. Davis
	non-serpentine populations of California native annual plants, *Collinsia sparsiflora* and *Clarkia purpurea*.	Thomson, Diane	U.C. Davis
2002-2003	Dispersal and spread of Goat Grass.	Toren, David	California Academy of Sciences
2000-2001	A moss flora of Lake County, California	Travers, Steve E.	Penn State University
2002-2003	The influence of a serpentine growth environment on reproduction and adaptation of flowering plant species	van Kleune, Mark	University of British Columbia
2002-2003	Evolutionary genetics of *Mimulus guttatus*	Waugaman, Robin	U.C. Davis
2001-2002	Spatial patterns of selection on petal morphs on the wildflower *Clarkia gracilis*.	Weiss, Rob	Jones and Stokes
2001-2002	Collection of bryophytes and lichens	Wheeler, Erica	University of Victoria, B.C.
2001-2002	Reproductive strategy of the triploid form of *Allium amplectens*	Williamson, Jen	U.C. Davis
1999-2001	Biotic and abiotic limits to the spatial spread of exotic revegetation species	Wright, Jessica	U.C. Davis
2002-2003	Serpentine soils and *Collinsia sparsiflora*, a native California annual	Stanton, Maureen	U.C. Davis

McLaughlin Publications

Boulton, A. M. (2000). "Ants as Allochthonous Vehicles for Aboveground Biomass Transport: Impacts on Belowground Foodwebs." Doctoral thesis, Ecology, University of California Davis.

Boulton, A. M., B. A. Jaffee and K. M. Scow (2003). "Effects of a common harvester ant (*Messor andrei*) on richness and abudance of soil biota." Applied Soil Ecology 23: 257-265.

Donahoe, K. (2002). "Preliminary Gravity Survey of the McLaughlin Reserve: Study of Local Source of Hydrothermal Systems." Undergraduate thesis, Geology, University of California Davis.

Dudash, M. R., C. J. Murren, and D. Carr (In press). "Using Mimulus as a model system to understand the role of inbreeding in conservation: genetic and ecological approaches."

Gelbard, J. L. and S. Harrison (2003). "Roadless habitats as refuges for native plant diversity in California grassland landscapes." Ecological Applications 13: 404-415.

Green, Jessica L., J. Harte, and A. Ostling (In press). "Species richness, endemism and abundance patterns: tests of two fractal models in a serpentine grassland." Ecology Letters.

Gustin, M. S., M.F. Coolbaugh, M.A. Engle, B.C. Fitzgerald, R.E. Keislar, S.E. Lindberg, D.M. Nacht, J. Quashnick, J.J. Rytuba, C. Sladek, H. Zhang, and R. E. Zehner (2002). "Atmospheric mercury emissions from mine wastes and surrounding geologically enriched terrains." Environmental Geology: 1-28.

Harrison, S. (1999). "Local and regional diversity in a patchy landscape: native, alien and endemic herbs on serpentine soils." Ecology 80: 70-80.

Harrison, S. and C. Ray. (2000). "Plant population viability and metapopulation-level processes." In S. Beissinger and D. McCullough (eds.), Population Viability Analysis. University of Chicago Press.

Harrison, S. (2000). Population persistence and community diversity in a naturally patchy landscape: plants on serpentine soils. In M. Kato (ed.), The Biology of Biodiversity. Springer Verlag, Tokyo.

Harrison, S., J. Maron and G. Huxel (2000). "Regional turnover and fluctuation in populations of five plants confined to serpentine seeps." Conservation Biology 14: 769-779.

Harrison, S. (2000). "Native and alien species diversity at the local and regional scales in a grazed California grassland." Conservation Biology 121: 99-106.

Harrison, S., K. Rice. and J. Maron (2001). "Habitat patchiness promotes invasion by alien grasses on serpentine soil in California." Biological Conservation 100: 45-53.

Harrison, S., B. D. Inouye and H. D. Safford (2003). "Ecological heterogeneity in the effects of grazing and fire on grassland diversity." Conservation Biology 17: 837-845.

Harrison, S. et al. (2003). Natural History of the McLaughlin Reserve, 2nd Addition. Natural Reserve System. 90.

Jurjavcic, N. L., S. Harrison and A. T. Wolf (2002). "Abiotic stress, competition, and the distribution of the native annual grass Vulpia microstachys in a mosaic environment." Oecologia 130: 555-562.

Lyons, K. E. (1999). "Assessment of Fitness and Spread of the Exotic, Annual Grass, *Aegilops triuncialis*, on Serpentine Soil." Report to the Public Service Research Program.

Reuter, J. E., D.G. Slotton, S.M. Ayers, and C.R. Goldman (1998). "Environmental monitoring for mercury in water, sediment, and biota in Davis Creek and Davis Creek Reservoir." Report for Yolo County..

Robertson, D. (1999). “A Narrow Way to Nearby”, Boise State University Press.

Robertson, D. (2001). "Core Library.” Poster for NAC 180.

Safford, H. and S. Harrison (2001). "Ungrazed roadside verges in a grazed landscape: interactive effects of grazing, invasion and substrate on grassland diversity." Ecological Applictions 11: 1112-1122

Safford, H. D. and S. Harrison (In Press). “Fire effects on plant diversity in serpentine versus sandstone chaparral.” Ecology.

Waddell, S. and Boucher, V. L. (2003). “Common ground at the Donald and Sylvia McLaughlin Reserve.” Poster for annual ANR Continuing Conference

Wilcox-Wright, J. (2001). "*Collinsia sparsiflora* growing on and off of serpentine soils." Abstract from Evolution meetings.

Williamson, J. N. and S. Harrison (2002). "Biotic and abiotic limits to the spread of exotic revegetation species in oak woodland and serpentine habitats." Ecological Applications 12: 40-51.

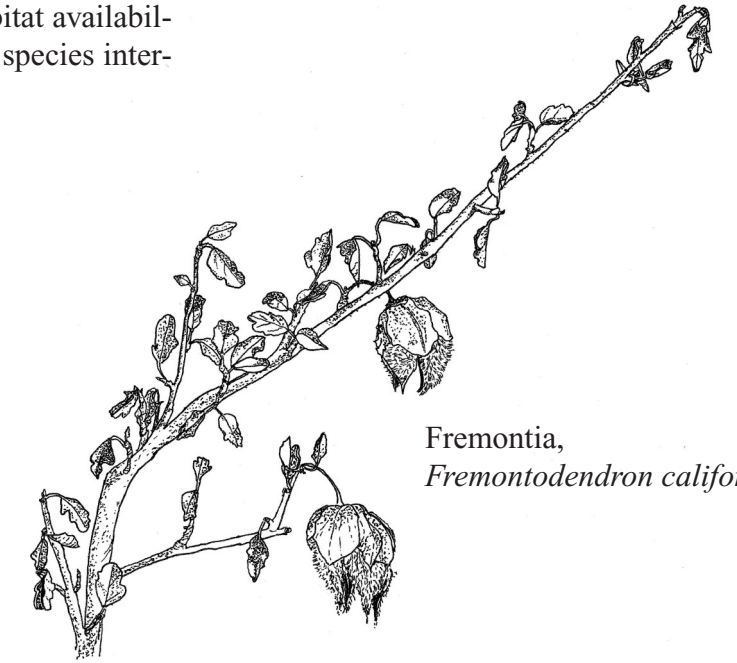
Wolf, A. T. (1998). Population structure and reproductive ecology of serpentine endemic plant species in California’s North Coast Range. Doctoral dissertation, Ecology, University of California Davis.

Wolf, A. T., P.A. Brodmann and S. Harrison (1999). "Distribution of the rare serpentine sunflower (Helianthus exilis Gray, Asteraceae) the roles of habitat availability, dispersal limitation and species interactions." Oikos 84: 69-76.

Wolf, A. T., S. Harrison and J.L. Hamrick (2000). "The influence of habitat patchiness on genetic diversity and spatial structure of a serpentine endemic plant." Conservation Biology 14: 454-463.

Wolf, A. T. and S. P. Harrison. (2001). "Effects of Habitat Size and Patch Isolation on Reproductive Success of the Serpentine Morning Glory." Conservation Biology 15: 111-121.

Wolf, A. T. (2001). "Conservation of endemic plants in serpentine landscapes." Biological Conservation 100: 35-44.



Fremontia,
Fremontodendron californicum

McLaughlin Class & Public Lists

U.C. DAVIS UNIVERSITY CLASSES

Dean	California Floristics (PLB 120)
Dean	Internship (PLB 192)
Elliot-Fisk	Plant Geography (WFC 156)
Gullan	Insects in the Environment (ENT 50)
Harrison	North Coast Range Natural History (ESP 198/298)
Harrison	Graduate Group in Ecology Field Trip
Harrison	Integrative Graduate Education, Research, and Training - IGERT
Inouye	GPS Workshop
Kelt, Elliott-Fisk	Field Methods in Wildlife, Fish, and Conservation Biology (WFC 100)
Kimsey, Ward	California Insect Diversity (ENT 107)
Robertson	Field Methods in Nature and Culture (NAC 180)
Schiffman	Analytical Methods for Earth Scientists (GEL 281)
Young	Restoration Ecology (ENH 290)
Zierenberg	Graduate Group in Geology Field Trip

NON-U.C. DAVIS UNIVERSITY CLASSES

Corbin	UC Berkeley, Ecosystems of California (IB 157)
Parker	CSU San Francisco, Fire Ecology (BIOL 821)

PUBLIC ORGANIZATIONS

Aerial Information Systems
Blue Ridge Berryessa Natural Area Conservation Group
Bureau of Land Management
California Academy of Sciences
California Department of Fish & Game
California Department of Forestry & Fire Protection
California Native Plant Society
Elks Club
Homestake Mining Company
Jones & Stokes
Lake County Farm Service Agency
Napa Sheriffs Deparment
NASA AMES Research Center
Seventh Day Adventist Church
Sierra Club
The Land Trust of Napa County
The Nature Conservancy
UCD Herbarium
United States Department of Agriculture
United States Geological Service

Local Schools

Anderson Valley Junior/Senior High School, Boonville
Middletown Christian School
Napa Home School
Legacy Christian School
Terrace School, Lakeport
Lakeport Home School
Oak Hill Middle School, Clear Lake
Potters Valley School, Mendocino County
Apple Creek Christian School
Middletown Adventist School
Lower Lake Elementary School

Quail Ridge Reserve

Located on a peninsula in one of the driest parts of the northern California Coast Ranges, the Quail Ridge Reserve projects into Lake Berryessa and holds outstanding remnants of native grassland, savanna, and oak woodland habitats. The near-pristine understory is relatively free of introduced weeds and includes large stands of native bunchgrasses such as purple needlegrass, junegrass, California oniongrass, and California fescue. The woodlands harbor a diverse mix of oak species, such as valley, interior live, blue, black, and scrub oak and the hybrid oracle oak. High and rugged, Quail Ridge first became a peninsula in 1958 after Putah Creek was dammed to form Lake Berryessa. The reserve operates by cooperative agreement among peninsula landowners, including UC, U. S. Bureau of Land Management, U.S. Bureau of Reclamation, California Department of Fish and Game, Quail Ridge Wilderness Conservancy and the Land Trust of Napa County.

In the 1980s, the unspoiled Quail Ridge peninsula came to the attention of Davis conservationists Frank Maurer, an organic farmer, and Lenora Timm, professor of Linguistics. They created the Quail Ridge Wilderness Conservancy and began raising funds to acquire the ridge parcel by parcel. With its well-preserved native grasslands, diverse plant communities, and proximity to the Davis and Berkeley campuses, Quail Ridge had the potential to become an important site for field studies. In 1992 the University signed a cooperative agreement that created the Quail Ridge Reserve from a patchwork of conservancy, state, federal, and University-owned lands.

Although the Conservancy led highly successful public field trips and the reserve was visited by a handful of researchers, Quail Ridge's academic potential largely lay dormant until the beginning of the current funding cycle in 1999. In order to attract users, we needed to publicize the reserve, improve access, and upgrade the facilities. Trespass and illegal hunting needed to be stopped, and easement and property boundary issues with neighbors needed to be resolved. Thanks to ongoing efforts on all these fronts, the Quail Ridge Reserve has now evolved into a busy, vibrant research and educational setting.

In 1999, the reserve's roads were largely impassable after years of neglect. With a concerted effort that included culvert installation and the filling of ruts up to four feet deep, most of the road system was drivable by 2000. We continue to perform annual maintenance and to repair additional roads. Balloon-tired vehicles purchased by the NRS make these roads usable 12 months a year, and these vehicles are reserved weeks in advance during many months each year. These improvements in access have broadened our user base by making it possible for researchers to use all parts of the reserve.

The field station at Quail Ridge is a homesteader's cabin that was in a severe state of disrepair. We improved it with new sheetrock, rodent-proofing, a new coat of paint, kitchen renovations, a new porch to replace the rotting one, and new furniture acquired as dormitory surplus. It is now a very comfortable (if still rustic) place for up to four people to spend the night, with computer access, telephone service, and a small lab for processing field samples. This too has greatly improved the usefulness of the reserve, especially for out-of-town and nocturnal researchers.

With $600,000 in grants from the California Coastal Conservancy, we were able to purchase 6 inholdings totalling 549 acres, allowing us to increase control of access to large portions of the reserve. We completed the enormous task of legally posting all of the UC properties against hunting and trespass (as well as UCD managed Quail Ridge Wilderness Conservancy and Department of Fish & Game lands). Working with Campus Counsel and others, we are nearing clarification on property boundaries and road easement issues with neighbors. We are also negotiating new regulations that would exclude firearms on some of the public lands within the reserve. All of these initiatives have greatly increased our ability to control access and to protect research and teaching interests.

We created a website for the reserve that provides important information resources such as the vegetation map, soils map, road map, and aerial photo (digital orthophoto quad) of the reserve. We are in the process of creating a natural history guidebook with species lists and other key information that will be available in print and on the website. We have also publicized the reserve through the Ecological Society of America newsletter, at national meetings, by means of a recently published brochure, and at seminars at local universities.

Over the past 5 years we have put major efforts into controlling spot infestations of weeds such as yellow star thistle and goat grass. If allowed to spread unchecked for even a few years, these weeds could severely compromise the ecological integrity that is one of Quail Ridge's biggest attractions to researchers and instructors.

An analysis in the 1991 "Final Report of the Natural Reserve System Steering Committee on Long-range Planning" showed that facilities were the single strongest predictor of reserve use. The success of the program at Quail Ridge has borne this out - largely as a result of our efforts to improve facilities, many researchers are spending significant periods of time at the field station, engaging in studies that would be impossible without secure research sites and on-site accommodations.

Quail Ridge Research

Since 1999, the number of research projects has increased sixfold. One of the first to arrive on the scene was graduate student Mike Benard (Population Biology), who found the reserve to be the ideal place for his pathbreaking work on gene flow and natural selection in treefrogs (see Page 37). Another was Professor Doug Kelt (Wildlife, Fish and Conservation Biology), who realized the reserve harbored secure, undisturbed populations of small mammals that could be used in behavioral studies. With great help from Mike's and Doug's enthusiasm, the reserve soon attracted more zoologists from Davis and Berkeley. It now hosts experimental field studies of natural populations of treefrogs, rattlesnakes, lizards, wild turkeys, ground squirrels, deer mice, and woodrats.

Graduate student Mike Teglas from the Center for Vector-Borne Diseases (see Page 36) is studying the long-term dynamics of tick populations and the diseases they carry. Mike and his advisor, Professor Janet Foley, realized that only on protected research lands such as Quail Ridge can they map tick populations, measure disease prevalence, and monitor the shifting spatial dynamics of disease "hotspots" over time.

The reserve has long attracted botanists and plant ecologists because of its beautiful bunchgrass stands. Now it has become host to an experimental study by Dr. Eric Seabloom (UC Santa Barbara) that is examining the conditions under which native bunchgrasses can establish themselves and spread, with important implications for grassland restoration (See Page 40). Eric's plots are at the tip of the peninsula, in an excellent bunchgrass stand that was barely accessible a few years ago. At the same time, Professor Carolyn Malmstrom (Michigan State) is trying to find out whether native bunchgrasses are being decimated by a disease that is carried by exotic annual grasses.

Other botanical researchers have asked whether, why, and how fast exotic plants are spreading. Undergraduates Sarah Ratay and Charles Hohn, supervised by Professor Susan Harrison (Environmental Science and Policy), found evidence that roadsides may help goatgrass by providing disturbed habitat, but they found no evidence that roads act as the "corridors" by which goatgrass seeds move. They were helped by the comprehensive weed mapping effort carried out by graduate students Ingrid Hogle and Jeffrey Clary.

Princeton professor Claire Kremen, working with UC Davis emeritus entomologist Robbin Thorp, used Quail Ridge as a baseline site in her study of native bees that pollinate agricultural crops. She found that farms near wildlands such as Quail Ridge receive more reliable pollinator services than farms far from wild areas. Entomologists Greg Kareofelas and Bill Patterson continue to monitor and record the moth and butterfly fauna of the reserve, and their findings of over 500 species have recently been published. Under the auspices of Professor Penny Gullan (Entomology), an international team of entomologists recently visited the reserve to conduct a survey of scale insect diversity.

These studies illustrate the wide range of research topics that can be pursued only 40 minutes drive from Davis. As these studies are published and the reserve's reputation spreads, we anticipate that use will continue to increase substantially.

Quail Ridge - Featured Research

Mike Teglas, Coevolutionary Relationship between *Ixodes* spp. tick and *Anaplasma phagocytophilia*

Ticks are second only to mosquitoes in their importance as vectors of bacterial, viral and protozoal diseases worldwide. Ticks and their pathogens are a good system in which to study the evolution of virulence (deadliness), transmissibility (tendency of an infected host to infect more hosts), and a variety of other aspects of host/pathogen population dynamics. This is because many tick-vectored disease agents are highly specialized for survival in specific vertebrate and invertebrate hosts. Theory predicts that while virulence in such a system may evolve either upward or downward, transmissibility should always increase because this maximizes the pathogen's reproductive success.

My work involves the bacterium *Anaplasma phagocytophilum,* which causes the disease known as granulocytic ehrlichiosis in humans and domestic animals, and the deer tick, *Ixodes* spp., which carries *Anaplasma.* The *Ixodes-Anaplasma* shows a great deal of geographical variation. Different species of *Ixodes* carry *Anaplasma* in different places: *Ixodes scapularis* in the eastern U.S., *I. ricinus* in Europe and *I. pacificus* in California. Interestingly, while over 400 human cases of granulocytic ehrlichiosis have been diagnosed in the upper Midwest and northeastern United States since 1994, only 8 cases have been reported in California. In dogs, the disease is manifested in a less severe form in California than it is in the eastern U.S but it is much more common in California than is human disease.

I hypothesize that, in this system, tightly coevolved tick-pathogen pairs exhibit higher transmissibility compared with poorly coevolved pairs. To test this, I am using molecular methods to analyze the evolutionary relationship between distinct *Anaplasma* strains and their various *Ixodes* hosts across the U.S. and Europe. It appears that *Ixodes* spp. may have arisen in Australia, migrated to Asia, and then moved to North America. Preliminary analyses suggest that the California form of *Anaplasma* is a recent branch from European strains. The coupling of European-derived strains of *A. phagocytophila* with a possibly Asian-derived species of tick, *I. pacificus,* in the West may have been an evolutionarily recent event. Thus, the weak (young) coevolutionary relationship between *A. phagocytophila*, its California vector *I. pacificus*, and the only identified reservoir, *N. fuscipes,* the dusky-footed woodrat, may be an important factor in the low prevalence of granulocytic ehrlichiosis in this state.

Left: Adult male Ixodes
Below: Ixodes male

My work will test basic predictions about the evolution of transmissibility in a natural host-pathogen system. Many important studies of wildlife and associated pathogens rely on secure long-term access to high-quality study sites. The Quail Ridge Reserve provides us a place to collect tick vectors and small mammals in close proximity to our laboratory, with the assurance that we can keep returning to monitor our study system over time.

From left to right: The deer tick (Ixodes scapularis) adult female, adult male, nymph, and larva on a centimeter scale.

Mike Benard, Selection and Gene Flow in Amphibians

Some of the best evidence for evolutionary processes comes from looking at members of the same species in different environments, and finding there are consistent genetically-based differences in traits (such as body shape, color, size, or behavior) that confer a survival or mating advantage to individuals in their home environments. Such "local adaptation" is strong evidence for natural selection at work. However, population genetic theory predicts that local adaptation can only occur if there is not too much "gene flow", or movement of individuals among different environments. Gene flow has long been recognized as a constraint on adaptive evolution, but very few empirical studies have addressed both gene flow and adaptation in natural populations.

My research examines whether Pacific treefrogs are locally adapted to the ponds they are found in. The ponds I study vary in two major ways that affect the survival of treefrog tadpoles: 1) how quickly they dry out, and 2) the abundance of predatory beetles. Variation among ponds in the body shape (morphology) of tadpoles may reflect local adaptation to these factors. My study aims to be one of the few that has actually estimated parameters for models of the interaction between gene flow and selection, used those estimates to make a prediction about adaptation, and then tested that prediction.

My preliminary data suggests at least some degree of local adaptation can occur on a small scale (3 km). I reared families of tree frogs from two ponds in a common environment. Frogs from the quickly drying pond metamorphosed sooner and smaller, while those from the slow-drying pond metamorphosed later and larger. I have also conducted field experiments that show that tadpoles with shorter tails are likelier to survive in the presence of predatory beetle larvae. Finally, I conducted a breeding experiment that demonstrated there is a genetic basis to variation in tadpole growth rates and shape. This spring I will conduct a large experiment in which I raise groups of tadpoles from 25 different ponds under controlled conditions. I will test for a relationship between pond characteristics (drying time, predator density, and proximity to other ponds that differ in predators and drying time), and tadpole body shape and growth rate.

To estimate how much treefrogs move between ponds. I gave pond-specific marks to 2,500 metamorphosing frogs at three ponds on the reserve in the spring 2002 and recaptured these frogs as adults in 2003. I found that 7-13% of adult frogs immigrated from another pond. In spring 2003 I marked 6,300 metamorphosing frogs at all four ponds on the reserve, and I will recapture them in 2004.

This study is only possible because of the many advantages of working on a UC Natural Reserve. I have spent 3-7 nights a week at the reserve from mid-January to mid-July. During the frog breeding season, I collected up to several hundred frogs across four ponds in a night, brought them back to the station at Quail Ridge, measured and marked all of them, and released them the following night. Having a laboratory and field station within a half-hour ATV drive of my ponds made this possible. When I was photographing and marking anesthetized tadpoles, the nearby station laboratory reduced their stress and increased their survival. I placed expensive electronic temperature dataloggers, 12 large (6' diameter) water tanks and up to 70 smaller tanks outdoors containing tadpoles in experimental treatments, which would not have been safe outside of a research reserve. Finally, the staff of the UC reserve has always been very generous in helping me with many of the logistical problems I have faced, such as transporting my equipment and filling my water tanks.

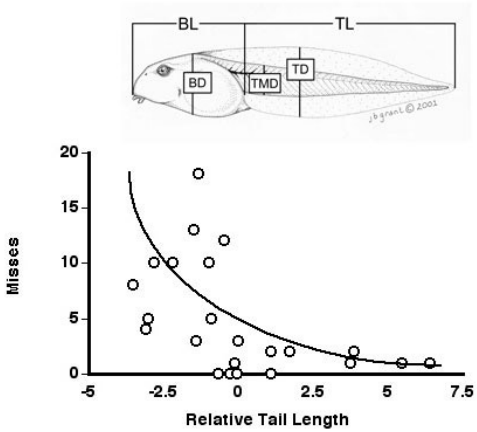
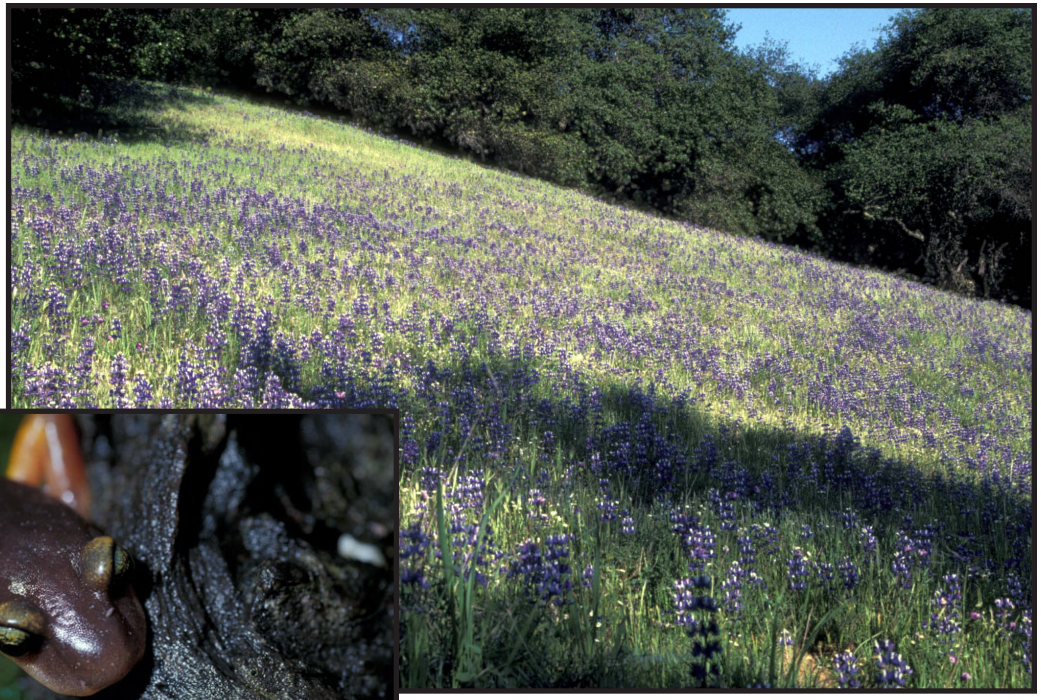


Figure 1: The relationship between relative tail lengths of 26 pacific treefrog tadpoles and the number of times that a beetle strikes and misses a tadpole before catching it.

Quail Ridge Classes & Public Use

Since the new reserve funding began, the number and variety of courses using the Quail Ridge Reserve have increased dramatically. In the early years of the reserve, most class use was through the Department of Wildlife, Fisheries and Conservation Biology, and while use by WFCB has continued, classes from Plant Biology, Evolution and Ecology, Environmental Science and Policy and Entomology have also taken advantage of the outdoor classroom provided by the reserve.



Courses in insect diversity, California floristics and herpetology have helped to build accurate and comprehensive species lists for the reserve while providing students with the opportunity to experience firsthand the process of survey work and taxon identification. More experimentally oriented classes such as Field and Laboratory Methods in Ecology, Field Methods in Wildlife, Fish and Conservation Biology have capitalized on the habitat diversity and protection provided by the reserve. Classes from UC Berkeley and Sacramento State use the reserve regularly as well.

In deference to the fragility of the habitat and concerns of neighbors, we have diverted most of our public outreach efforts from Quail Ridge to the nearby Stebbins Cold Canyon Reserve, which was already open to the public. Working with staff at the California Coastal Conservancy, we secured funds and created a successful public education program of docent-lead tours at Stebbins (see Stebbins Public Outreach section).

An active outreach program does take place at Quail Ridge under the auspices of our reserve partner, the Quail Ridge Wilderness Conservancy. Much of their program accesses the peninsula by boat, circumventing many of the concerns with respect to weeds and neighbors.

Karen Mabry, Dispersal and habitat selection behavior of brush mice

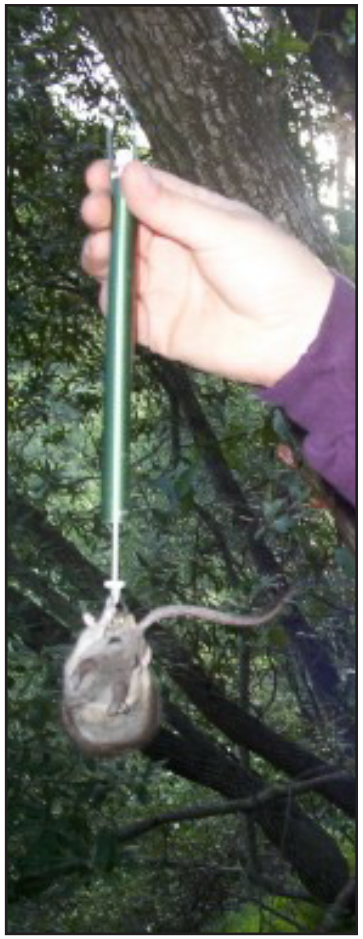
My research focuses on how brush mice move through different habitat types, and how their movement patterns and habitat selection are affected by their experience. Animals may prefer familiar habitat because experience makes them more efficient in using resources. The tendency of dispersing animals to settle in the same habitat type they were reared in has been called habitat imprinting or habitat preference induction. Habitat imprinting may influence the maintenance of genetic variation, within-species behavioral diversity, and the dynamics of populations in spatially complex habitats.

The Quail Ridge Reserve is an ideal location to study this because there are abrupt transitions between oak woodland and chaparral, and brush mice (*Peromyscus boylii*) are abundant in both of these habitats. Individual brush mice may be reared in either oak woodland or chaparral, but may disperse to and settle in either habitat. Oak woodland is dominated by interior live oak and California bay, and has an open understory and thick canopy. Chaparral is a dense, shrubby mixture of chamise, toyon, and scrub oak, usually less than 3 m high.

To compare population densities and demographic parameters between oak woodland and chaparral, I am live-trapping mice across habitat boundaries. To track juvenile mice born in both habitats, I use radio-telemetry. I spend many nights at the Reserve tracking mice during January - June, when most juvenile dispersal takes place, and I plot the radio-locations of each individual on the Napa County Vegetation Map. These data will allow me to determine if movement patterns are affected by habitat itself, or by familiarity with a habitat, and whether dispersers tend to use and settle in their natal habitat more often than expected by chance.

In addition to continuing the live-trapping and radio-telemetry, in 2004-2005 I plan to use microsatellite DNA markers to investigate relatedness among brush mice, and to determine the natal home ranges of juveniles by assigning them to mothers. I also plan to use fluorescent powder tracking to obtain movement paths at a finer scale than can be obtained by radio-telemetry. I will use these paths to explore the effect of habitat type and familiarity on movement parameters such as path complexity, total distance traveled, and movement speed within each habitat.

Not only is Quail Ridge an excellent site for my study, but the GIS data and vegetation maps provided by the NRS staff have been invaluable. The NRS staff helped me locate my sites, and since these sites were far from the field station, they moved a camper out there so I would have a place to stay between telemetry readings on cold spring nights. My research would have been very difficult without the resources and support provided by the UC Natural Reserve System.



Above: Weighing a brush mouse.
Far Left: Radio collar.
Left: *Peromyscus boylii*

Eric Seabloom,

The role of seed limitation, resource competition, and community complementarity in invasions and restoration

When we look around the grasslands on California's hillsides, almost all the plants we see are exotic species from the Mediterranean region of Europe. In the 200 years since Europeans arrived, California's native perennial bunchgrasses have been almost completely replaced by exotic grasses such as wild oats, soft brome, and medusahead, and exotic forbs such as yellow starthistle. This is one of the most dramatic conversions of a native plant community that has ever occurred in the world, and the reasons for it are still not well understood. The conventional wisdom blames some combination of livestock grazing and the intrinsically greater competitive ability of the exotic species over the natives.

Since most of the exotic species have an annual life-cycle, unlike the native perennials, this grassland conversion has had potentially major ecological effects. Not only California's native plant and animal biodiversity, but also ecosystem processes such as nutrient cycling and fire regimes, have almost certainly been greatly altered. Ongoing grassland invasions continue to erode the value of grasslands for livestock grazing. So far, attempts to use managed fire or grazing to control invasions and restore grasslands have met with limited success.

To better understand grassland invasions, we initiated a study in 1999 at UC Santa Barbara's Sedgwick Reserve. By tilling the soil and replanting it, we were able to create pure stands of either native bunchgrasses or exotic annual grasses. Then we "invaded" stands of full-grown native grasses with seeds of exotics, and *vice versa*. The results were a great surprise. We found that native grasses could invade and establish themselves in exotic grasslands, but exotics could not invade and establish in stands of natives. This was true even under a full range of additional treatments we tried, such as disturbance and fertilization. This result seemed to contradict the conventional wisdom about the competitive superiority of exotic species over the natives they displace.

Our interpretation is that native bunchgrasses are actually competitively superior to exotic annual grasses, but that the recovery of native grasslands is strongly limited by the lack of sufficient seeds. If this is true, it implies that the decline of native grasslands was caused by past events, such as drought and overgrazing in the nineteenth century. It also implies that restoration may not be as forbidding a task as has often been thought. However, we need to expand and strengthen our findings using parallel experiments at multiple sites.

We have recently set up field experiments at the Quail Ridge, McLaughlin, and Hastings (UC Berkeley) Reserves, as well as Sedgwick, where we will test the ability of communities of various mixes of native species to re-invade exotic annual grasslands. The reserves offer us the opportunity to assess the robustness of our results across a 700 km latitudinal gradient. They also offer us places where we can conduct long-term monitoring of naturally occurring stands of perennial bunchgrasses. Our hope is that through combining the rigor of controlled field experiments with geographic breadth, long-term observations and modeling, we can contribute a better conceptual and practical understanding of Californian grassland invasions. We could not do this without the secure high-quality field sites provided by the UC Natural Reserves.

Quail Ridge Research Project Lists

Year	*Research Project Title*	*Principal Investigator*	*Institution*
1999-2003	Natural selection, gene flow, and local adaptation in Pacific Treefrogs (Hylidae: *Hyla regilla*)	Benard, Michael	U.C. Davis
2002-2003	Biochemical defenses of ground squirrels to rattlesnake venom	Biardi, James	U.C. Davis
1999-2000	Territory and nest characteristics of the Western Grey Squirrel	Brown, Sarah	U.C. Davis
		Hanson, Laura	U.C. Davis
		Roessig, Julie	U.C. Davis
2001-2002	Invasibility of remnant native grass stands	Clary, Jeffrey	U.C. Davis
2000-2001	A management plan for dealing with invasive exotic plants	Clary, Jeffrey	U.C. Davis
		Hogle, Ingrid	U.C. Davis
2002-2003	Geographical differences in water utilization by *Nassella pulchra*.	Corbin, Jeff	U. C. Berkeley
2002-2003	Investigation and collection of flora for the UC Davis Herbarium	Dean, Ellen	U.C. Davis
2002-2003	Understanding of the avifaunal diversity of the Quail Ridge Reserve	Engilis, Andy	U.C. Davis
2000-2002	Understanding the interactions between a native insect community and an exotic plant	Forister, Matt	U.C. Davis
2002-2003	Phylogenetic Systematics of Scale Insects	Gullan, Penny	U.C. Davis
2000-2001	Are roads corridors for exotic species? A case study from a peninsular natural reserve.	Hohn, Charles	U.C. Davis
		Ratay, Sarah	U.C. Davis
2002-2003	The diversification of multispecific coevolution	Horjus, Kate	U.C. Santa Cruz
1999-2003	Lepidopitera survey of Quail Ridge	Kareofelas, Greg	Lepidopterists Society
		Patterson, Bill	Lepidopterists Society
2001-2002	Home range characteristics of Western Gray Squirrel	Kelt, Doug	U.C. Davis
2002-2003	Seasonal leaf gas exchange measurements of various oak species, to derive biophysical parameters - measurements of photosynthesis	Krebs, Theresa	U.C. Berkeley
2000-2003	Native bees, native plants and crop pollination in California	Kremen, Claire	Princeton University
2001-2003	The herbivore-mediated indirect effects of the exotic plant *Medicago polymorpha* on the co-occurring native plant *Lotus wrangelianus*	Lau, Jennifer	U.C. Davis
1999-2002	Determination of the adaptive edaphic nature of the weed *Aegilops triuncialis* (barbed goatgrass).	Lyons, Kelly	U.C. Davis
2002-2003	Habitat selection by a generalist small mammal	Mabry, Karen	U.C. Davis
1999-2002	The effects of barley yellow dwarf virus on introduced and native grass species in California and implications for restoration	Malmstrom, Carolyn	Michigan State University
2001-2002	Preliminary insect collecting	McBride, Carolyn	U.C. Davis
1999-2003	Social and genetic structure in dusky-footed woodrats	McEachern, Mary Brooke	U.C. Davis
1999-2001	Herpetofauna of California Inner Coast Range	Pauly, Gregory	U.C. Davis
2002-2003	The role of wild turkeys in California oak woodlands in relation to native flora and fauna	Punkay, Eric	U.C. Berkeley
2001-2003	Rattlesnake response to an infrared squirrel signal	Rundus, Aaron	U.C. Davis
2002-2003	Determinants of ant species density in oak woodlands	Sanders, Nathan J.	C.S.U. Humboldt
		Crutsinger, Greg	C.S.U. Humboldt
2002-2003	The role of seed limitation, resource competition, and community complementarity in invasions and restoration	Seabloom, Eric	U.C. Santa Barbara
		Yoshida, Toshi M	U.C. Santa Barbara
2002-2003	Coevolutionary relationship between *Ixodes spp*. tick and *Anaplasma phagocytophila*	Teglas, Mike B.	U.C. Davis
2001-2002	Collection of bryophytes and lichens	Weiss, Rob	Jones and Stokes
2000-2002	Evolution and ecology of a wasp-mite symbiosis	Yang, Louie	U.C. Davis
2001-2002	Lizard - mite associations in natural populations	Yang, Louie	U.C. Davis

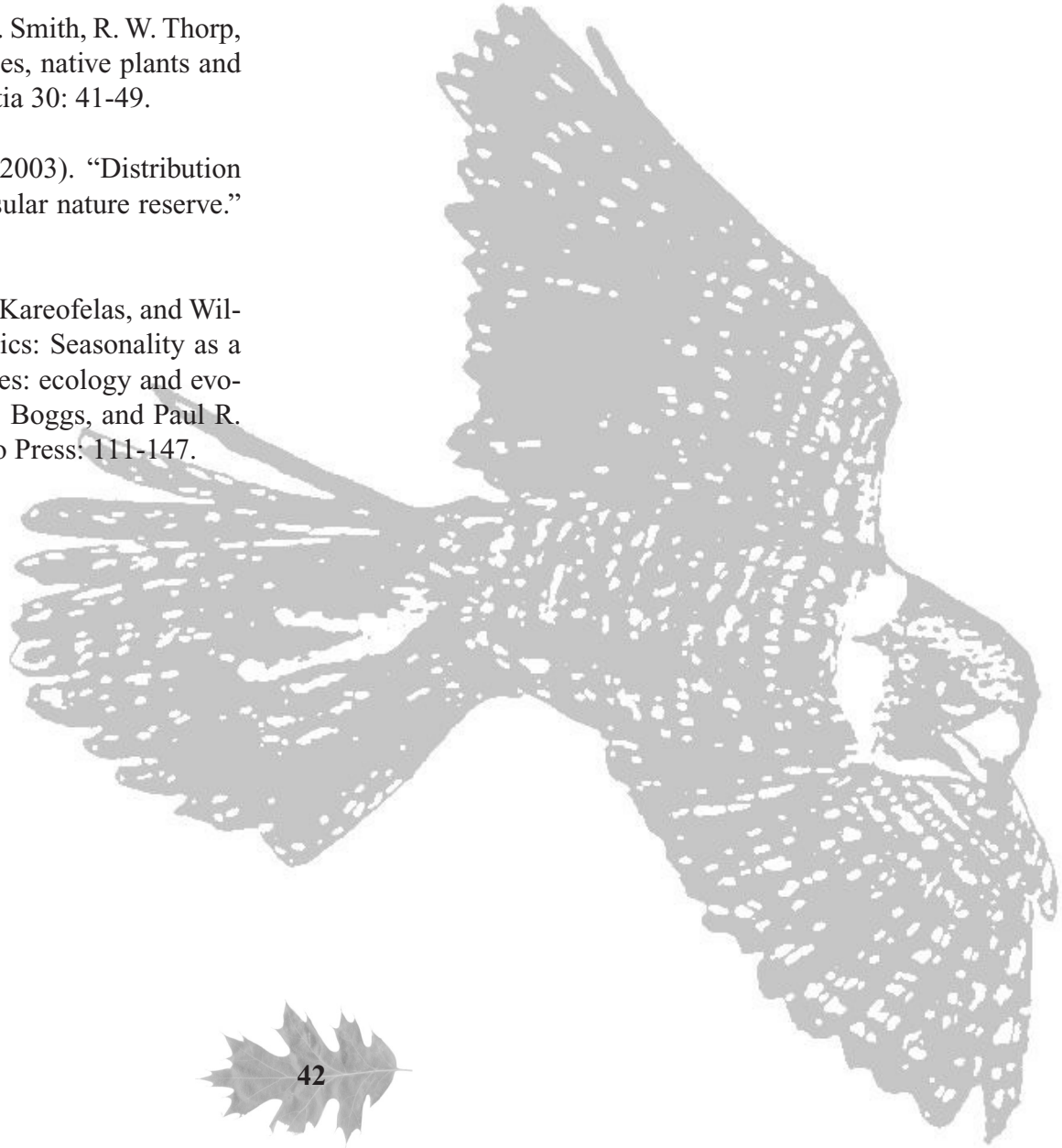
Quail Ridge Publications

Benard, M. F. and J. A. Fordyce. (2003). “Are induced defenses costly? Consequences of predator-induced defeses in western toads, Bufo boreas.” Ecology 84: 68-78.

Kremen, C., R. L. Bugg, N. Nicola, S. A. Smith, R. W. Thorp, and N. M. Williams (2003). “Native bees, native plants and crop pollination in California.” Fremontia 30: 41-49.

S. Harrison, C. Hohn. and S. Ratay. (2003). “Distribution of exotic plants along roads in a peninsular nature reserve.” Biological Invasions: in press.

Shapiro, A., Richard VanBuskirk, Greg Kareofelas, and William D. Patterson (2003). Phenofaunistics: Seasonality as a Property of Butterfly Faunas. “Butterflies: ecology and evolution taking flight.” W. B. W. Carol L. Boggs, and Paul R. Ehrlich. Chicago, University of Chicago Press: 111-147.



Quail Ridge Class & Public Lists

U.C. DAVIS UNIVERSITY CLASSES

Anderson, Eadie, & Elliott-Fisk	Field Methods in Wildlife, Fish, and Conservation Biology (WFC 100)
Benard	Center for Population Biology Field Trip
Dean	California Floristics (PLB 120)
Eadie	Lab Biological Conservation of Wild Birds (WFC 110L)
Engilis	Field Ornithology (WFC 110L)
England	UCD Extension - Fall Birds of Northern California (Birds X425.10)
Kelt	Directed Group Study (WFC 198/ ECL 290)
Kelt	Ecology and Conservation of Wild Animals (WFC 110L)
Kelt	Seminar in Ecology (ECL 290)
Kimsey	California Insect Diversity (ENT 107)
Rice	Graduate Group in Ecology Field Trip
Schwartz	Introduction to Field and Laboratory Methods in Ecology (ESP 123)
Shaffer	Herpetology (EVE 134)
Toft	Evolution and Ecology Field Trip

NON - U.C. DAVIS UNIVERSITY CLASSES

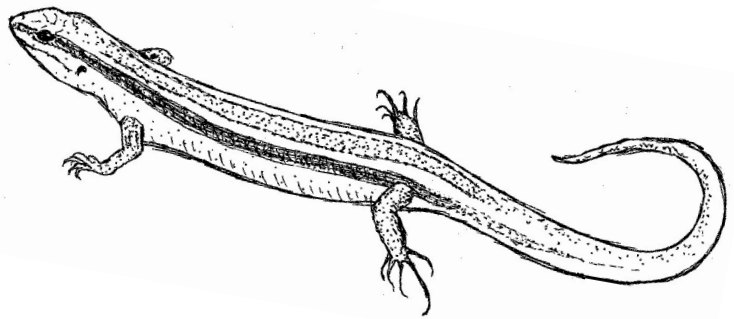
Davidson	CSU Sacramento, Field Methods for Environmental Science (ENVS 121)
Power	UC Berkeley, Ecosystems of California (IB157L)

PUBLIC ORGANIZATIONS

Bureau of Land Management
Bureau of Reclamation
California Department of Fish & Game
California Department of Food & Agriculture
California Department of Forestry & Fire Protection
Jones & Stokes
Lepidopterists Society
Putah Creek Discovery Corridor
Quail Ridge Volunteer Group
Quail Ridge Wilderness Conservancy
Stebbins Docents
The Land Trust of Napa County
The Nature Conservancy
UCD Herbarium
UCD Outreach Educational Project
United States Department of Agriculture

Local Schools

Don Julio Jr. High School
Markham Elementary School
Pioneer Elementary School



Stebbins Cold Canyon Reserve

Set in a steep north-facing canyon of the northern Coast Range, Stebbins Cold Canyon provides excellent opportunities to study plant and animal communities of both the inner and outer Coast Ranges. Differences in slope, exposure, and moisture regimes promote a variety of undisturbed habitats, including valley and foothill grasslands, blue oak woodland, chamise chaparral, lower montane chaparral, mixed riparian woodland, and intermittent foothill stream. Year-round springs provide watering areas for many wildlife species, such as bear, mountain lion, deer, ringtail, and turkey. Adjacent protected lands held by U.S. Bureau of Land Management and the California Department of Fish and Game are also available for study, and greatly expand the effective research area.

Homesteaders in the 1930s raised goats in Cold Canyon, and the canyon's name comes from a stone "cold house" built to store goat cheese. The original trail up the canyon was a dirt road leading upstream from Highway 128 to the site of the old homestead. In 1979, the University of California bought the first of two parcels in Cold Canyon, which had become a popular hiking destination for local residents. The new Natural Reserve was named for eminent UC Davis plant evolutionist G. Ledyard Stebbins, who had long brought students to the canyon for natural history appreciation and research. While much of the use at Stebbins is still from the general public, it also receives considerable use by campus researchers and instructors. At the same time, we are making it more of an educational resource for the community.

In 2000, with a generous grant from UCOP-NRS, we doubled the length of the trail system by creating a loop from the lush canyon floor to the top of the Blue Ridge west of the canyon. This took many hours of labor by stewards Shane Waddell and Dan Tolson, aided by crews from the California Department of Forestry. The trail leaves the canyon trail near the homestead and ascends the ridge in a series of switchbacks that include many steps and a small bridge over a travertine spring. At the ridgetop, the trail follows the crest to the precipitous cliff overlooking Monticello Dam, then descends steeply to the highway. This new loop has been very popular with hikers and naturalists, with its dramatic vistas and changes in vegetation.

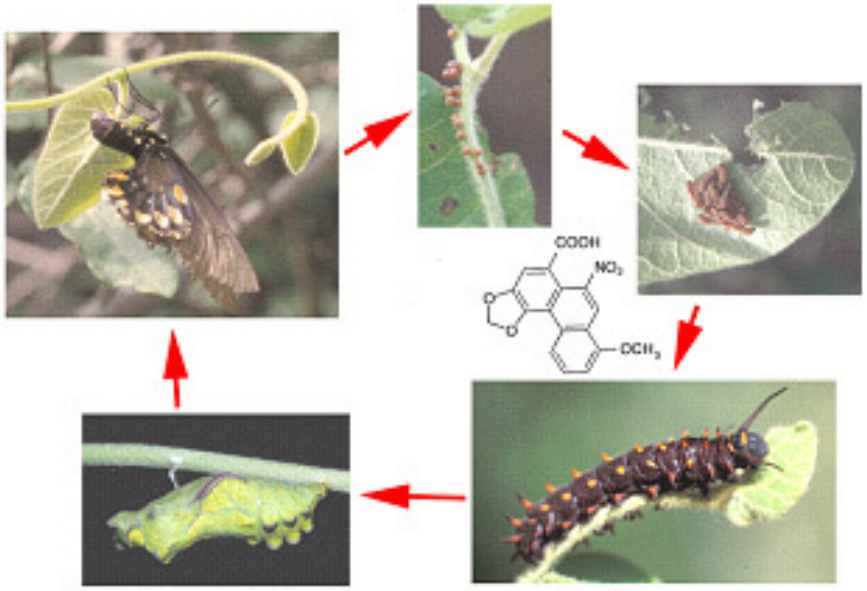
While the trails were being improved, we placed new signs at the entrance to the reserve with rules, general information, and a topographic map of the trails. We want to be sure that hikers know what they are facing before they attempt the loop trail with its steep climb!

In 2001, The Natural History of Stebbins Cold Canyon Reserve, edited by graduate students Correigh Greene and Mikaela Huntzinger, opened a new world for reserve users with its information-rich accounts of the reserve's natural features. This guidebook has sold briskly in local bookstores and has become a cornerstone of guiding new researchers and instructors to the reserve. We also placed the guidebook material on the reserve's website. The book and the website provided a model for subsequent efforts at the McLaughlin and Quail Ridge Reserves. They became key resources for an externally funded program of docent-led tours that we created in 2001.

James A. Fordyce, The Adaptive Significance of Aggregative Feeding of the Pipevine Swallowtail

Larvae (caterpillars) of some butterfly species feed on their host plants in conspicuous groups, or aggregations. Studies have shown that this seemingly odd behavior may be explained by group thermoregulation, collective defense from predators, or greater efficiency of group feeding than feeding alone. But few researchers have asked how plants themselves respond to aggregative feeding. It is now a paradigm in ecology that plants are not passive participants in their interactions with herbivores. Plants may respond to herbivore damage through the production of chemical toxins, spines, latex, or other defenses. My work has examined whether such plant responses to herbivores are dosage-dependent, and in turn, whether this might sometimes explain the evolution of large clutch size and aggregative feeding in herbivores.

My work has focused on the pipevine swallowtail butterfly, which feeds exclusively on pipevines (*Aristolochia* spp.).Unlike populations elsewhere, the California population of this butterfly lays large clutches of eggs and its larvae feed in tight aggregations. Larvae sequester toxic alkaloids (aristolochic acids) from the plant, which protect the larvae and adult butterflies from most predators. The only host plant available to the California population of the pipevine swallowtail is the endemic California pipevine (*Aristolochia californica*). My research was motivated by the idea that aggregative feeding in the California population of the butterfly might represent an adaptation to this unique host plant. My research uses ideas from population genetics, phylogeography, and chemical ecology.



Life cycle of Pipevine swallowtail (*Battus philenor*)

In my field experiments, I was able to document that larvae grow faster in large groups because they compromise the structural and chemical defenses of the plant. Fast growth helps larvae to escape predators and unfavorable weather, and to more quickly reach a level of toxicity that defends them. These benefits are brief, however, and the host plant raises its level of defense within days of being damaged. The benefits of group feeding appear to be unique to the Californian host plant, as I found by using transplant experiments between California and Texas. From genetic evidence, I inferred that the California population of the butterfly is of recent origin, implying that large clutch size is a recent trait that may be an adaptation to the novel host plant. This is one of the first studies of aggregative feeding to include such an evolutionary analysis, and to show how herbivore-induced plant responses may influence herbivore life-history evolution.

Most of my work was conducted at Stebbins Cold Canyon, because it has abundant, undisturbed riparian habitat supporting the plant and the butterfly. The security and reliability of access to Stebbins Cold Canyon have allowed me to safely study these species and compare their interactions from year to year. The success of my graduate carrier was largely a consequence of the support of the NRS staff and unlimited access to the reserve. Each of the seven chapters of my doctoral dissertation has included work conducted at Stebbins Cold Canyon and has been published in such journals as *Ecology, Evolution, Oecologia, Journal of Animal Ecology,*. and the *Journal of Chemical Ecology*.

Stebbins Cold Canyon Research

Because of its diversity and near-pristine condition, Stebbins Cold Canyon has long been a popular site for basic survey work on Coast Range flora and fauna. Long-term sampling of the butterflies and moths by John De Benedictis, ants by Philip Ward (Entomology), plants by Ellen Dean (Herbarium) and many other botanists, and other such efforts have yielded excellent lists of many groups of species. In turn, this knowledge attracts new research. Recently, botanists from the Brooklyn Botanical Garden visited to survey plant chemicals with possible economic uses, and biologists from Humboldt State University initiated a study on ant diversity.

Although it is open to the public, Stebbins has also been a popular destination for field experimental research. People generally find their flags and cages stay well-hidden even a few yards from the trail, because of the steep terrain and thick vegetation. Jim Fordyce, a graduate student now on the faculty at the University of Tennessee, used the reserve for his dissertation research on the pipevine swallowtail butterfly (See Page 44). Theresa Talley, also a graduate student, is taking advantage of the reserve's excellent riparian habitat for her research on the endangered Valley Elderberry Longhorn Beetle (See Page 48). Professor Janet Foley (Veterinary Medicine) and her student Mike Teglas have found the Stebbins and Quail Ridge reserves ideal for their studies of wildlife-vectored pathogens (Quail Ridge, Page 36).

Professor Andy Sih (Environmental Science and Policy) is using Stebbins in studies of the evolutionary ecology of stream organisms, including work by his graduate students Lauren Pintor on behavioral tradeoffs in aquatic animals and Anja Wehrman on the interactions between enviromental stresses and predation.

Dale Woods of the California Department of Food and Agriculture is monitoring the effects of an insect (*Chaetorellia succinea*) and a rust disease (*Puccinia centaurea*) on the noxious weed tocolote (*Centaurea melitensis*) at Stebbins. These two European species have recently migrated to the area, and Dale hopes they can act as biological control agents on tocolote. Tom Hofstra from UC Santa Cruz used Stebbins as one of his sites to look at the molecular ecology of "wetwood" - a disease of forest trees caused by a community of up to 15 taxa of anaerobic bacteria. Tom is looking at diversity of the pathogens as a function of tree size and landscape attributes. He is collecting material from a number of NRS sites throughout the state.

Theresa S. Talley, The Conservation of a Rare Riparian Beetle

Over 90% of riparian forests have been lost to development over the past 200 years. Species most affected by this loss are habitat specialists such as the Valley Elderberry Longhorn Beetle, VELB (Fig. 1), which lives its whole life on elderberry, a common riparian shrub. This beetle was federally listed as threatened in 1981 with habitat loss cited as the main reason. Little was known about this species other than its dependence on elderberry. The goal of my project is to learn more about how landscape-level processes influence the success of this beetle. Pristine riparian areas are scarce, making reserves like Stebbins Cold Canyon invaluable for studying the habitat requirements of this species.

The elderberry beetle lives in localized patches of elderberry shrubs, and a network of these local populations form a regional beetle population, which may span whole river courses with little or no exchange between rivers. The surrounding vegetation type or land use could influence dispersal between elderberry patches; for example, dense vegetation or orchards may block chemical cues that the beetle uses to locate elderberry. The range of landscape types available along Putah Creek makes it ideal for studying such factors. Along the western stretch of lower Putah Creek, beetle occurrence tended to be more common in the Reserve and in the county park than in the roadside habitat between the two.

Figure 1

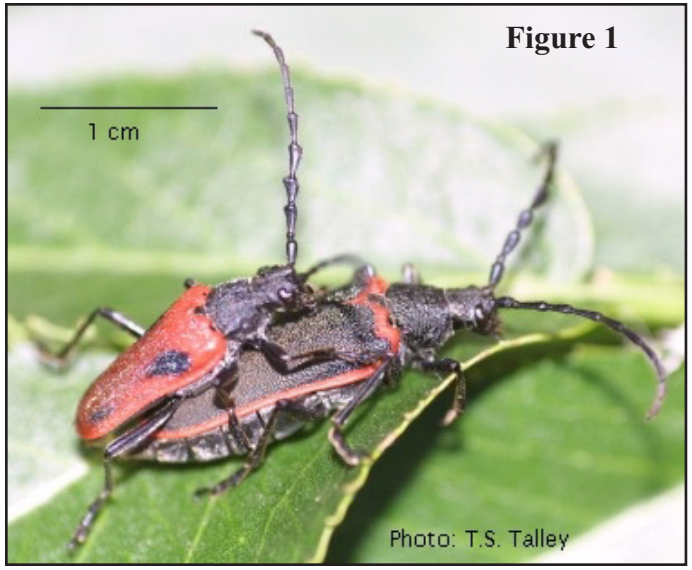
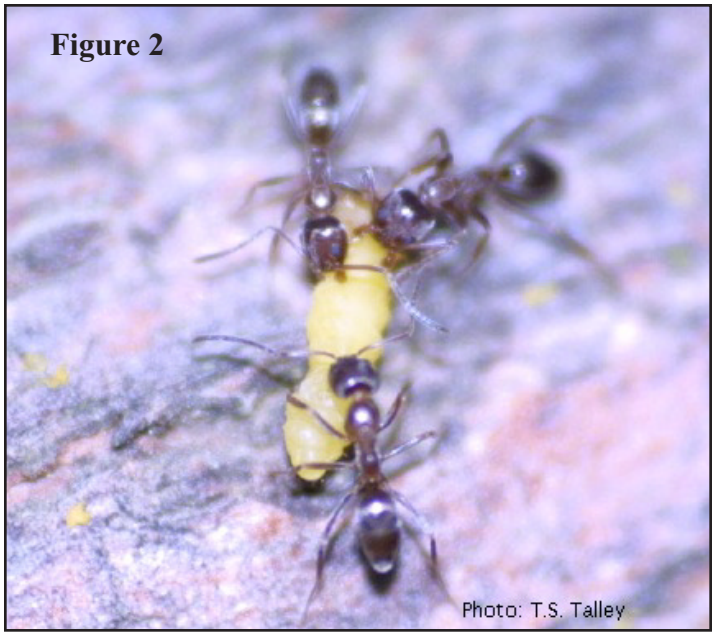


Figure 2



Since the beetle is strongly tied to its host plant, it is susceptible to local conditions such as the quantity and quality of host plants and predators. I am censusing the size, number, condition and nutritional content of elderberry shrubs, as well as the presence of the beetle. My preliminary results suggest that beetles use plants with a range of nutritional contents and that the availability of food is not a limiting factor.

The invasive Argentine ant is spreading throughout riparian habitats in California. Given that this ant preys on the larvae of related beetles in South America, and that a negative relationship between the ant and the VELB has been found in sites along Putah Creek, it is likely that the ant is a significant threat. My field observations reveal that the ant will attack and kill VELB larvae (Fig 2). The ant community within Stebbins Cold Canyon Reserve remains free of this invader, making this area a potential refuge for the VELB.

This project will make important contributions to ecology and conservation, as well as to the educational process of graduate and undergraduate students. Stebbins Cold Canyon is important for this study because it allows study of this species throughout its geographical range and across a range of habitat types. My study plots, traps and markers are relatively protected from vandalism and are safe from the pesticides and pruning that are used in public areas.

Stebbins Cold Canyon Class & Public Use

Thanks to its proximity, accessibility and diversity, Stebbins Cold Canyon has long been used by classes from UC Davis and other local colleges in a broad range of subjects. Some, such as Michael Barbour and Marcel Rejmanek's Plant Community Ecology course and Peter Moyle's Stream Ecology course, have collected systematic data at the reserve for many years, and thus have greatly added to our knowledge base.

Ellen Dean's California Floristics class, Plant Biology 102, takes 50 undergraduates to Cold Canyon each year. Seeing the plants in the field rather than in a jar in the lab is a great eye-opener for them. They learn the difference between poison oak (*Toxicodendron*) and its near-twin Rhus, how soap root (*Chlorogalum*) is used, how monkeyflower (*Mimulus*) stigmas move after pollination, how to make elderberry (*Sambucus*) whistles, how to tell the different oaks (*Quercus*) apart, and on and on. It is a beautiful drive and walk, and a great introduction to California plant life.

Sharon Lawler's Biology of Aquatic Insects travels to Cold Canyon each spring because the exceptionally clear stream pools makes it one of the best places in the area to view aquatic insects. Students can watch immature mayflies and stoneflies do 'push ups' to fan their gills, or feed by scraping algae off of the rocks. Immature black flies can be found in high-flow areas, attached by silk 'life lines' to boulders. Hellgrammites lurk under rocks and stalk the other insects, while adult dragonflies and damselflies fly past, snagging insects on the wing.

Other UC Davis courses visit Stebbins to study bioregional landscapes (Rob Thayer), parasite biology (Lynn Kimsey), insect identification (Phil Ward), nutrient science management (Will Horwath), wildlife field methods (Doug Kelt and Debbie Elliott-Fisk), nematology (Steve Nadler) and others. The beauty of the site, ease of observing the rich flora and fauna, and convenience to Davis combine to make Stebbins a favorite of environmental science classes each year.

Hiking at Stebbins Cold Canyon was recreational but not educational until 2001, when the California Coastal Conservancy awarded the UC Davis NRS $22,500 to develop an environmental education program, as part of a land acquisition grant for Quail Ridge. Stebbins seemed the perfect place because it was already open to the public and visited by thousands of enthusiasts each year. Outreach coordinator Helen Kota worked with UCD faculty and staff to develop a docent training curriculum that combined in-depth natural history with an appreciation of the role of environmental research. Docents learned to present this information in a stimulating, effective way, and then led two hikes per week in spring and one per week in summer.

Docent hikes were tailored to the participants' interests and fitness, but usually took a leisurely pace from the highway to the homestead with its beautiful maple and laurel grove. A few groups took the entire loop to view the dramatic sandstone ridges and the dense chaparral they support. Frequent stops allowed opportunities for the docents to point out the plants, animals and geomorphology. A foothill pine might be tapped to induce velvety tree ants to emerge so everyone could sniff their distinctive scent. A dip-net might be dropped into the creek and the catch of tadpoles and aquatic insects examined. Rocks might be turned over in a respectful search for scorpions and salamanders.

The Coastal Conservancy funding for the program ended in August 2003. We are currently working with the Putah Creek Discovery Corridor, a program that promotes educational activities on University, Solano County and state Department of Fish and Game (CDFG) lands along Putah Creek. We are continuing the program at a reduced level with modest grants from the county and CDFG, and searching for more funds from agencies and foundations.

In Spring 2002, we had a very successful Campus Decision-Makers field trip to Stebbins. Eminent campus scientists explained geology, stream invertebrates, insects, plants and wildlife to an enthusiastic group of about 50 participants, including the Provost.

Stebbins Cold Canyon Research Project Lists

Year	*Research Project Title*	*Principal Investigator*	*University*
1999-2003	Selection and gene flow in amphibians	Benard, Michael	U.C. Davis
2000-2002	Bryophyte Collection	Beyer, Cheryl	U.S. Forest Service
2002-2003	Floristics and phytochemical survey	Christopher, Daphne	New York Botanical Garden
		Stevens, Hannah	New York Botanical Garden
		Atha, Daniel	New York Botanical Garden
1999-2000	Creative writing for Putah Bioregion project	Colby, Seth	U.C. Davis
2002-2003	Investigation and collection of flora for the UC Davis Herbarium	Dean, Ellen	U.C. Davis
1999-2003	An inventory of the Lepidoptera of the Stebbins Cold Canyon Reserve	De Benedictis, John	U.C. Davis
1999-2003	Mortality, Growth, and Behavioral Consequences of Gregarious Feeding of the California Pipevine Swallowtail.	Fordyce, James	U.C. Davis
2000-2002	Molecular ecology of wetwood	Hofstra, Thomas	U.C. Santa Cruz
2001-2002	The diversification of multispecific coevolution	Horjus, Kate	U.C. Santa Cruz
2000-2003	Native bees, native plants and crop pollination in California	Kremen, Claire	Princeton University
1999-2002	The effects of barley yellow dwarf virus on introduced and native grass species in California and implications of restoration	Malmstrom, Carolyn	Michigan State University
2001-2002	Preliminary insect collecting	McBride, Carolyn	U.C. Davis
2000-2001	A preliminary phylogeny of galling aphids and their congeric parasites on Arctostaphylos shrubs.	Miller, Don	Trinity University
1999-2003	Herpetofauna of California Inner Coast Range	Pauly, Gregory	U.C. Davis
2001-2003	Behavioral carryovers, tradeoffs and performance correlations across situations	Pintor, Lauren	U.C. Davis
2002-2003	Determinants of ant species density in oak woodlands	Sanders, Nathan J.	C.S.U. Humboldt
		Crutsinger, Greg	C.S.U. Humboldt
2002-2003	Evolutionary ecology of stream organisms	Sih, Andrew	U.C. Davis
2001-2003	Integrating population biology, landscape ecology and natural history to conserve a threatened riparian insect.	Talley, Theresa	U.C. Davis
2002-2003	Coevolutionary relationship between *Ixodes spp*. tick and *Anaplasma phagocytophilia*	Teglas, Mike B.	U.C. Davis
1999-2003	California ant biogeography	Ward, Phil	U.C. Davis
2001-2002	Interacting effects of pesticides and predators on amphibian survival, behabior, and development	Wehrmann, Anja	U.C. Davis
2000-2002	Collection of bryophytes and lichens	Weiss, Rob	Jones and Stokes
2001-2003	Monitoring of Natural Biological Control of Tocalote, *Centaurea melitensis*.	Woods, Dale M.	CA Dept. of Food and Agriculture
2000-2002	Evolution and ecology of a wasp-mite symbiosis	Yang, Louie	U.C. Davis
2001-2002	Lizard - mite associations in natural populations	Yang, Louie	U.C. Davis
2002-2003	Encyrtidae of California	Zuparko, Robert L.	U.C. Berkeley

Stebbins Cold Canyon Publications

Benard, M. F. and J. A. Fordyce. (2003). "Are induced defenses costly? Consequences of predator-induced defenses in western toads, *Bufo boreas*." Ecology 84: 68-78.

Fordyce, J. A. (2000). "A model without mimic: Aristolochic Acids from the California Pipevine Swallowtail, Battus philenor hirsuta, and its host plant, Aristolochia californica." Journal of Chemical Ecology 26: 2567-2578.

Fordyce, J. A. (2001). "The lethal plant defense paradox remains: inducible host-plant aristolochic acids and the growth and defense of the pipevine swallowtail." Entomologia Experimentalis et Applicata 100: 339-346.

Fordyce, J. A. (2003). "Aggregative feeding of pipevine swallowtail larvae enhances hostplant suitability." Oecologia 135: 250-257.

Fordyce, J. A. and A. A. Agrawall. (2001). "The role of plant trichomes and caterpillar group size on growth and defence of the pipeline swallowtail *Battus philenor*." Journal of Animal Ecology 70: 997-1005.

Fordyce, J. A. and C. C. Nice. (2003). "Contemporary patterns in a historical context: Phylogeographic history of the pipevine swallowtail, *Battus philenor* (Papilionidae)." Evolution 57: 1089-1099.

Fordyce, J. A. and. C. C. Nice. (In Press). "Geographic variation in clutch size and a realized benefit of aggregative feeding." Evolution.

Fordyce, J. A. and A. M. Shapiro. (2003). "Another perspective on the slow growth / high mortality hypothesis: chilling effects on swallowtail larvae." Ecology 84: 263-268.

Gadau, J., S. G. Brady, and P. S. Ward, (1999). "Systematics, distribution, and ecology of an endemic California *Camponotus quercicola* (Hymenoptera: Formicidae)." Annals of the Entomological Society of America 92: 514-522.

Kremen, C., R. L. Bugg, N. Nicola, S. A. Smith, R. W. Thorp, and N. M. Williams (2003). "Native bees, native plants and crop pollination in California." Fremontia 30: 41-49.

Kruse, J. J. and F. A. H. Sperling. (2001). "Molecular Phylogeny Within and Between Species of the Archips argyrospila Complex (Lepidoptera: Tortricidae)."Annals of the Entomological Society of America 94: 166-173.

Moores, E. M. and J. E. Moores. (2001). Geology of the Putah Creek - The Great Valley Sequence. Website: http://bioregion.ucdavis.edu/book/

Moyle, P. (2001). The Stebbins Cold Canyon Reserve. Website: http://bioregion.ucdavis.edu/book/

Oqvist, C. R. (1999). Surface and Bedrock Geology of the Cold Canyon Area, Vaca Mountains, Solano County, California. Master's thesis, Geology, University California Davis.

Pauly, G. B. and M. F. Benard. (2002). "Crotalus viridis rreganus." Herpetological Review 33: 56-57.

Ward, P. S. (1999). "Deceptive similarity in army ants of the genus Neivamyrmex (Hymenoptera: Formicidae): taxonomy, distribution and biology of *N. californicus* (Mayr) and *N. nigrescens* (Cresson)." Journal of Hymenoptera Research 8: 74-97.

Stebbins Cold Canyon Class & Public Lists

U.C. DAVIS UNIVERSITY CLASSES

Barbour, Rejmanek	Plant Community Ecology (EVE 206)
Benard	Center for Population Biology Field Trip
Dean, Potter	California Floristics (PLB 102)
Elliott-Fisk	Field Methods in Wildlife, Fish, and Conservation Biology (WFC 100)
Elliott-Fisk, Rejmanek	Wildlife Ecology Conservation (WFC 10)
England	UCD Extension - Fall Birds of Northern California (Birds X425.10)
Gordon, Sakmoto	Identification and uses of plants (FRS 001L)
Griswold	UCD Arboretum
Horwath	Nutrient Cycling Management (SSC 109)
Kimsey	Biology of Parasites (ENT 156)
Kindsvater	Geography Graduate Group Field Trip
Lawler	Biology of Aquatic Insects (ENT 116)
Mogel	Plant Pathology
Moyle	Stream Ecology (WFC 123)
Nadler	Nematode Systematics and Evolution (NEM 206)
Orlove	Ethnography (ESP 133)
Pearcy	Plant Ecology (EVE 117)
Quinn, Schwarts	Introduction to Methods in Field and Laboratory Ecology (ESP 123)
Shapiro	Eco Trop Latitudes (EVE 138)
Thayer	The Bioregional Landscape (LDA 181H)
Ward	Graduate Group of Ecology Field Trip
Ward	Insect classification and identification (ENT 107)

NON-U.C. DAVIS UNIVERSITY CLASSES

Graves	American River College, Biology Class
Serafini	Sacramento City College, Field Botany (BOT 241)
Stauffer	DQ University, Biology Class
Wheeler	CSU Sacramento, Geology

PUBLIC ORGANIZATIONS

4-H Hiking
Boy Scout Troups
Brownie Troups
Bureau of Land Management
California Department of Fish and Game
California Department of Forestry and Fire Protection
California Department of Transportation
California Duck Days
California Lichen Society
California Native Plant Society
Girl Scout Troups
Jones & Stokes
Lawerence Livermore National Laboratory
Lepidopterists Society
Mission Oaks Hiking Club
Northern California Herpetological Society
Putah Creek Discovery Corridor
Solano Audubon Society
Solano Land Trust
The Nature Conservancy
UCD Arboretum Gardeners
UCD Cosmos Program
UCD Herbarium
UCD Outreach Educational Project
United States Fish and Wildlife Service
United States Forest Service
Woodland Seventh Day Advenists
Yolo Audubon
Yolo Hiker

Local Schools

Davis Waldorf School
Emerson Jr. High School, Davis
Holmes Jr. High School, Davis
Lee Jr. High School, Woodland
Woodland Christian School

Eagle Lake Biological Research Station

Located in remote, sparsely populated northeastern California, Eagle Lake is the state's third largest lake and harbors one of its most intact native fish faunas. The lake lies on the volcanic Lassen Plateau at the boundary between Sierran conifer forests and Great Basin pinyon-juniper woodlands. Much of the surrounding land is accessible National Forest and private timber land. The Eagle Lake Biological Field Station properties are owned and operated by California State University - Chico, with the UC Davis NRS as a management partner. The dormitories, cabins, kitchen, and classroom/lab space make Eagle Lake one of our better equipped field stations. It has been an especially valuable place for research and instruction in wildlife and fish ecology.

In 1945, biologists from CSU-Chico began coming to Eagle Lake to study its abundant wildlife and the lake's unique fish fauna. In the 1960's, a group of CSU-Chico biology faculty and students bought 23 acres next to the lake and built modest cabins. Over the years since, they added acreage and buildings, so that the station now consists of 62 acres of pine-juniper habitat with rustic accommodations for up to 30 people. Over the years around 50 journal articles and 15 masters' theses have been produced from work at the station, primarily on wildlife and fish biology. Several CSUC courses are regular visitors, including a summer course in Zooarchaeology and Field Ecology.

The station was also being used by several UCD researchers and courses, mainly from the Wildlife, Fisheries and Conservation Biology Department. In 1988, with CSUC under severe financial stress, the UC NRS agreed to be a management partner and to provide part of the station's funding. In 1992, after a visit by the UC Davis management commitee, this agreement was renewed. The station is now run by an academic Director from CSUC, Jay Bogiatto, and a resident caretaker who maintains the facilities. The $30,000 per year from UC Davis NRS is 37% of the station's budget.

In 1999, Susan Harrison and Shorty Boucher visited Eagle Lake to talk with its administrators about how to increase the use by UC Davis researchers and instructors. In 2000, CSU Chico personnel visited UC Davis to continue this conversation. Since 1999, as use at our other four reserves has more than doubled, use by Davis researchers and instructors at the Eagle Lake Field Station has remained at the same modest level. The long distance and the absence of an academically trained on-site manager have made it hard for UC Davis to stay involved in the management of the station and to develop a vigorous academic program there.

In 2003, a group of CSU-Chico faculty organized in support of the field station to ensure that it survives through the current budget difficulties and keeps serving the academic needs of both institutions. This group has agreed to work with its UC Davis counterparts to advertise the station and make it welcoming to prospective users, and they also plan to write grants

for station improvements. Professor Dan Anderson of WFCB has agreed to help lead the UC Davis end of this effort by chairing the UCD advisory committee. The Eagle Lake station provides the only facility for university field work in an enormous, largely wild and little-studied region of California, and so we believe it is worthwhile to keep working with our CSUC colleagues to maintain it for the future.

Eagle Lake Research

Professor Dan Anderson is now in his eleventh year of censusing grebe populations at the lake, as part of a long-term study of western grebe population ecology and the effects of mercury in California. His future plans include working with a student on osprey and bald eagle interactions, continuing a long-term population study of osprey, and doing comparative bird population studies between Eagle Lake and Clear Lake. UC Davis graduate student Collin Eagles-Smith has been studying the lake's food web ecology and using it as an uncontaminated comparison site for examining the biomagnification of mercury in aquatic ecosystems (see Page 58).

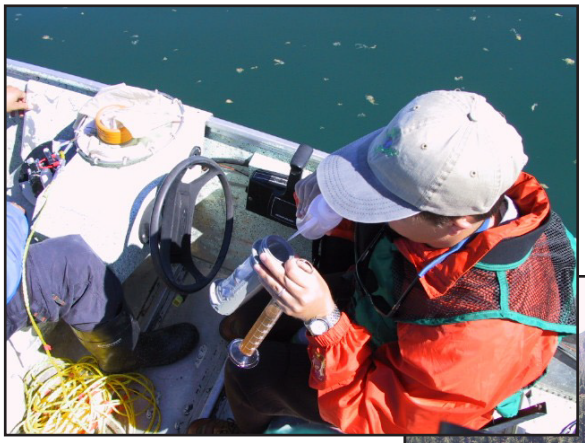
Mary Brooke McEachern, also a UC Davis Ecology graduate student, is near completion of her doctoral work on the effects of social and genetic structure on the population dynamics of the dusky-footed woodrat. After several years of intensive fieldwork at Eagle Lake, she is now back on campus doing microsatellite DNA work. Her results so far show that woodrat densities are significantly lower in mixed-conifer forest than juniper woodland, and that woodrats are genetically differentiated both between these two habitats and among woodrat "neighborhoods" within habitats. Woodrat neighborhoods show more fine-scale genetic distinctiveness in the juniper woodland than in the conifer forest. Mary suspects that this is because the higher population densities in juniper woodland leads to higher rates of polygyny, or mating by males with several females. Females mating with a given male are usually related, due to the fact that females stay close to home. This leads to closely related offspring and, in turn, to small-scale genetic population structure.

Woodrats and other small mammals were abundant around the station five years ago, but the Great Basin drought subsequently caused steep declines in their populations. With the drought appearing to break this year, it's hoped that mammal populations at Eagle Lake will rise again soon. Meanwhile, though, Mary is poised for novel findings about how the loss of genetic variation that occurs during population declines may be modulated by variation in social and genetic structure. Such findings will have great relevance for the field of wildlife conservation genetics. Mary's work was funded in part by an NRS Mildred E. Mathias Grant, which she used to pay for travel, primers, reagents, and DNA extraction kits. Collin was a Mathias Grant awardee as well.

Collin Eagles-Smith, Impact of Trophic Dynamics and Intermediate Trophic Level Structure on the Biomagnification of Mercury in Aquatic Ecosystems

My research at Eagle Lake Field Station has focused on three related aspects of the lake's biological community. First, I am characterizing the food web of the lake from an energetic perspective by attempting to quantify energy flow through many of the feeding linkages that occur between predators and their prey. By tracing the ratios of certain naturally occurring stable isotopes in the biota, from bacteria to birds, I have been able to identify seasonal changes in the pathways of energy flow from plankton through aquatic birds.

Closely linked to this work, and in conjunction with studies at other lakes throughout the country, I am examining the bioaccumulation of mercury through the aquatic food web of Eagle Lake. Though Eagle Lake contains very little mercury, it is useful as a reference lake for comparison to other more contaminated systems. Preliminary results indicate that although the lake is not very contaminated, mercury bioaccumulates more efficiently through the food web there than many other lakes. I am currently examining potential mechanisms for this result. Fortunately, even with this efficient bioaccumulation, the mercury in the lake's biota is still barely detectable and far below concentrations known to cause any negative effects.



The final area of my research focuses on a unique interaction between two zooplankton. One species, *Daphnia pulicaria*, appears to be able to detect a chemical signal from another, *Diaptomus sicilis*, which enters the brood chambers of *Daphnia pulicaria* in order to prey upon their nutritious eggs and neonates. Young *Daphnia pulicaria* appear to respond to this chemical signal by growing to a smaller adult size, thwarting the ability of Diaptomus to enter the brood chambers. This shift in the size distribution of *Daphnia pulicaria* appears to also have a cascading effect through the rest of the lake's food web by inducing a diet shift in the dominant predatory fish (Eagle Lake rainbow trout) towards more energy-rich food items.

Eagle Lake Class & Public Use

In fall 2000 and 2002, the station hosted WFCB 101, Field Studies in Wildlife Biology, taught in 2000 by Drs. John Eadie and Dirk Van Vuren with help from Andy Engilis, and in 2002 by Drs. Doug Kelt and Dan Anderson. In their two weeks in residence, the 10-12 students learned to use live traps, radio-telemetry, mist-nets and other techniques to study mammal, bird, and reptile faunas. Using the station's boats, they explored the lake and learned seining and other fish sampling techniques. They designed and conducted independent studies and produced research papers in a journal format.

In summer 2001, the station was also visited by Soil Science 105, Field Studies of Soil Resources, taught by Professor Randy Southard (Land, Air and Water Resources Dept.) In this intensive five-week field course at sites around California, 21 students learned identification, description and classification of soils, and the relationship of soils to geology, vegetation, climate and human activities. They spent three days at the station, mapping the soils, using the lab for particle size distribution and soil cation exchange analyses, measuring soil hydraulic conductivity in the field, and estimating standing biomass on different soils.

The station is used intermittently for retreats and field trips by agencies, high school classes, and scouting groups. Plans are being developed to increase the non-academic use of the station as a means of generating revenue.

Appendix A: Committee Lists

UCD Campus
Advisory Committee Members

2003-2004

Rick Karban (chair), Entomology
Dan Anderson , Wildlife, Fish & Conservation Biology
Sid England, Office of Planning
Margaret Hauselt, Graduate Student, Geography
Doug Kelt, Wildlife, Fish & Conservation Biology
Ellen Mantalica, Center for Integrated Watershed Science
Andrew McCall, Graduate Student, Entomology
Jeff Mount, Geology
David Robertson, English
Maureen Stanton, Evolution & Ecology
Randy Southard, Land, Air & Water Resources
Robbin Thorp, Entomology
Cathy Toft, Evolution & Ecology
Neelam Vij, Undergraduate, Bio. Sci.
Phil Ward, Entomology

Ex-Officio

Paul Aigner, UCD Natural Reserve System
Virginia Boucher, UCD Natural Reserve System
Susan Harrison, Environmental Science & Policy
Cathy Koehler, UCD Natural Reserve System
Dan Tolson, UCD Natural Reserve System
Shane Waddell, UCD Natural Reserve System

1999-2003

Sid England (chair), Office of Planning
Peter Connors, Bodega Marine Laboratory
Kirsten Copren (grad student), Entomology
Holly Doremus, Law School
William Horwath, Land Air & Water Resources
Rick Karban, Entomology
Peter Moyle, Wildlife Fish & Conservation Biology
Mark Schwartz, Environmental Science & Policy
Robbin Thorp, Entomology

Jepson Prairie
Management Committee Members

2003-2004

Robbin Thorp (chair), Entomology
Jim Ball, Solano Land Trust
Holly Ganz, Graduate Student, ENT
Louise Jackson, Vegetable Crops
Rob Klinger, Graduate Student
Kate Mawdsley, Jepson Docents
Jaymee Marty, The Nature Conservancy
Kevin Rice, Agronomy & Range Science
Brad Shaffer, Evolution & Ecology
Carol Witham, California Native Plant Society

Ex-Officio

Shorty Boucher, UCD Natural Reserve System
Burrows Hamilton, Grazing Concession
Ken Poerner, Solano Land Trust
Shane Waddell, UCD Natural Reserve System
Daniel Burmester, Depatment of Fish & Game
Susan Harrison, Environmental Science & Policy
Larry Serpa, The Nature Conservancy
Carolyn Yale, Environmental Protection Agency
Susan Hill, U.S Fish & Wildlife Service
Jim Steinert, Jepson Docent
Sam Ziegler, Environmental Protection Agency
Malcolm Evett, Jepson Docent
Julian Meisler, Solano Land Trust
Tim Vendlinsky, Environmental Protection Agency
Dan Tolson, UCD Natural Reserve System

McLaughlin
Management Committee Members

2003-2004

Sid England (chair), Office of Planning
Christy Brigham, Environmental Science & Policy
Peter Connors, Bodega Marine Laboratory
Joyce Gustein, Public Service Research Program
Bob Matthews, Geology
David Robertson, English
Mark Schwartz, Environmental Science & Policy
Darell Slotton, Environmental Science & Policy
Randy Southard, Land, Air & Water Resources
Rob Thayer, Landscape Architecture
Robert Zierenberg, Geology

Ex-Officio

Paul Aigner, UCD Natural Reserve System
Virginia Boucher, UCD Natural Reserve System
Susan Harrison, Environmental Science & Policy
Cathy Koehler, UCD Natural Reserve System
Dan Tolson, UCD Natural Reserve System
Shane Waddell, UCD Natural Reserve System

Quail Ridge
Management Committee Members

2003-2004

Doug Kelt (chair), Wildlife, Fish & Conservation Biology
Mike Benard, Graduate Student, Evolution & Ecology
Deborah Elliott-Fisk, Wildlife, Fish & Conservation Biology
Kevin Rice, Agronomy & Range Science
Lenora Timm, Linguistics

Ex-Officio

Virginia Boucher, UCD Natural Reserve System
Susan Harrison, Environmental Science & Policy
Dan Tolson, UCD Natural Reserve System
Shane Waddell, UCD Natural Reserve System
Rich Burns, Bureau of Land Management
Jim Swanson, California Department of Fish & Game
Frank Maurer, Quail Ridge Wilderness Conservancy
Steve Rodgers, Bureau of Reclamation
John Hoffnagle, The Land Trust of Napa County

Stcbbins Cold Cnayon
Management Committee Members

2003-2004

Phil Ward (chair), Entomology
Joyce Gustein, Public Service Research Program
Sandy Harcourt, Anthropology
Theresa Talley, Graduate Student, ESP
Dirk Van Vuren, Wildlife, Fish & Conservation Biology
Truman Young, Environmental Horticulture

Ex-Officio

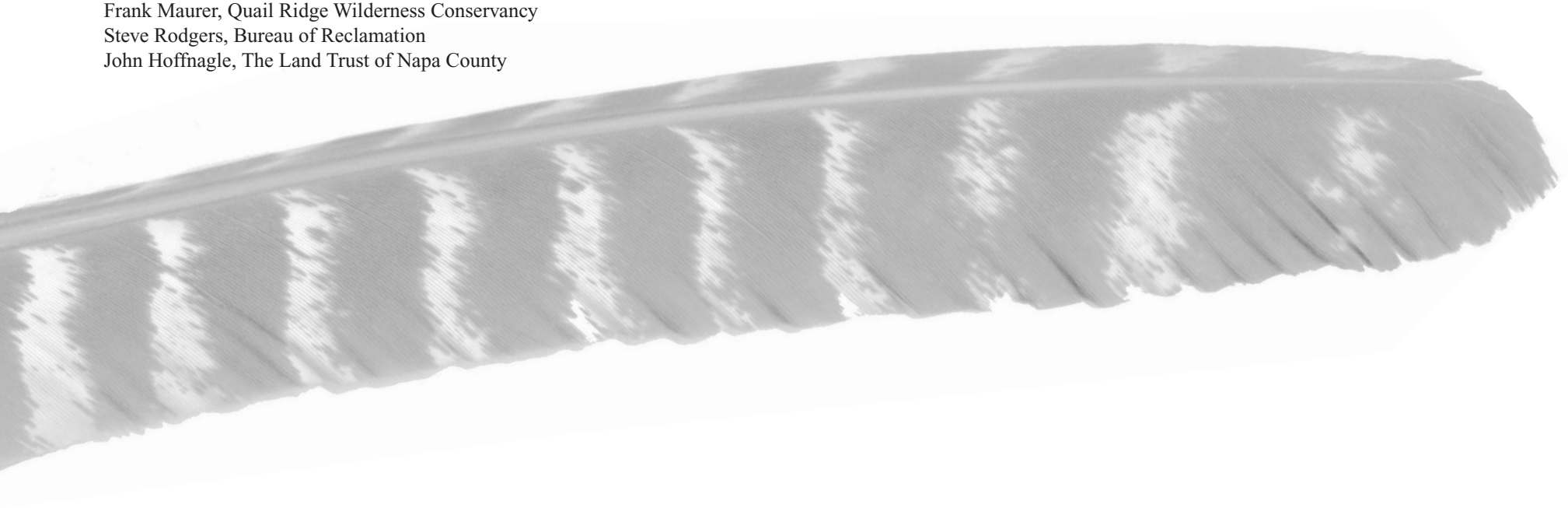
Virginia Boucher, UCD Natural Reserve System
Susan Harrison, Environmental Science & Policy
Dan Tolson, UCD Natural Reserve System
Shane Waddell, UCD Natural Reserve System

Eagle Lake
Management Committee Members

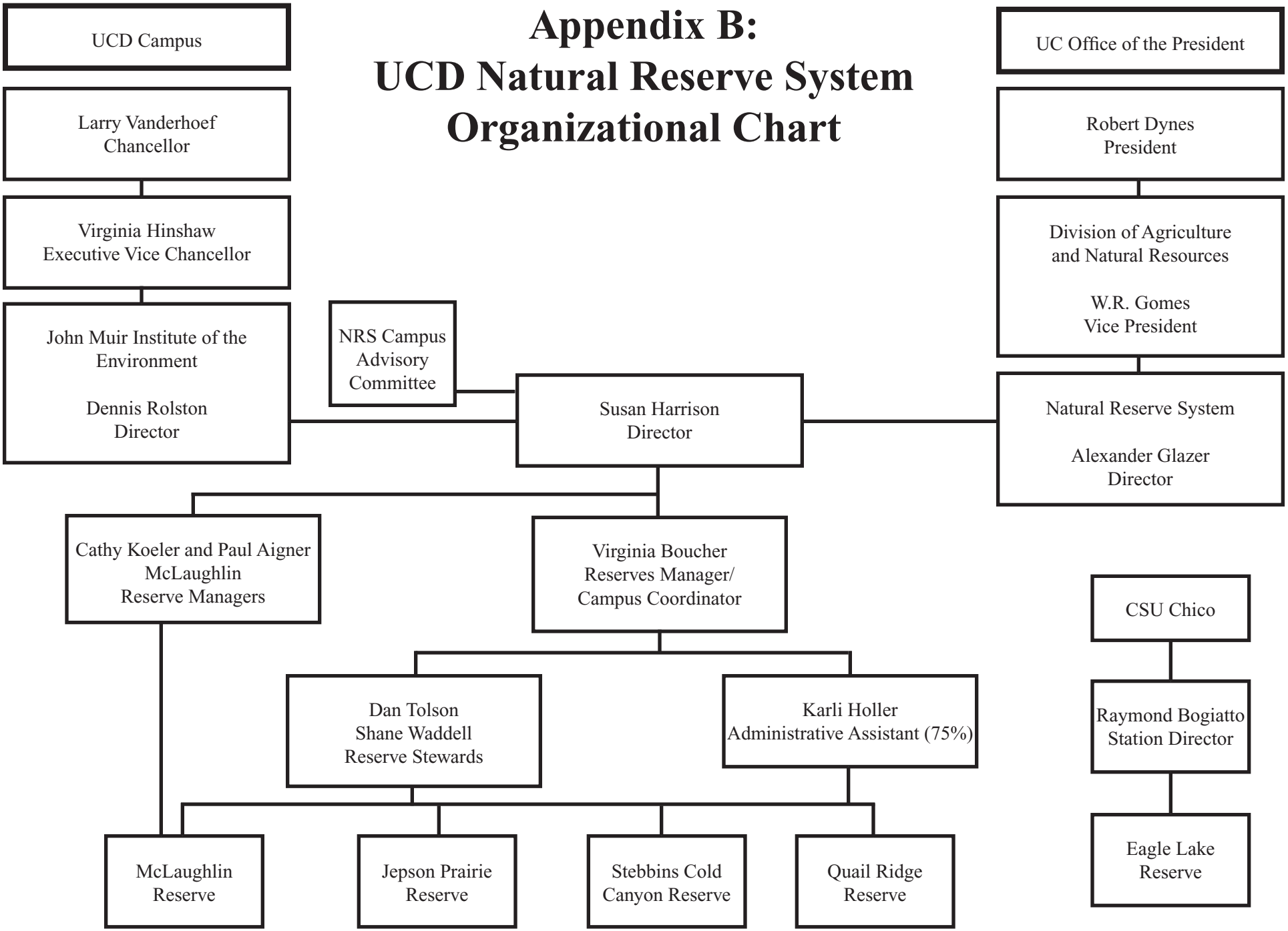
Collin Eagles-Smith, Graduate Student, WFCB
Joaquin Feliciano, Student Housing
Doug Kelt, Wildlife, Fish & Conservation Biology
Peter Moyle, Wildlife, Fish & Conservation Biology
Marcel Rejmanek, Evolution & Ecology
Randy Southard, Land Air & Water Resources

Ex-Officio

Virginia Boucher, UCD Natural Reserve System
Susan Harrison, Environmental Science & Policy



Appendix B:
UCD Natural Reserve System
Organizational Chart



Appendix C: Personnel Profiles

Susan Harrison

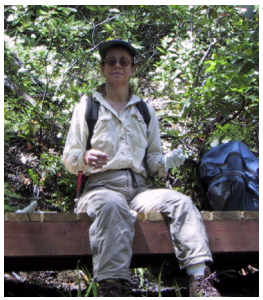
* Campus Director, UCD Natural Reserve System, 1998-present
* Professor, Environmental Science & Policy, 1991-present
* B. S. Zoology, UC Davis, 1983
* M. S. Ecology, UC Davis, 1986
* PhD, Biology, Stanford, 1989

Susan's research interests include landscape ecology, habitat fragmentation, geographic patterns of plant diversity, fire ecology, and invasion biology. Her work focuses mainly on the oak woodland and chaparral habitats of the California Coast Ranges, and serpentine habitats around the state. She teaches ecology and conservation biology, and is active in regional conservation organizations.

Paul Aigner

* Co-manager, McLaughlin Reserve, 2002-present
* B. S., Resource Management, UC Berkeley, 1992
* M. S., Forestry, Northern Arizona University, 1996
* Ph. D., Evolutionary Ecology, UC Riverside, 2003

Paul has studied the ecology, evolutionary biology, and onservation of plants and animals in the southern California coastal sage scrub, as well as the effects of firewood harvesting on bird populations in oak woodlands. Paul's dissertation research on plant-pollinator interactions took place on the California Channel Islands, where he gained considerable experience in field station management. He participates in the Society for the Study of Evolution and the American Society of Naturalists, and maintains an active research program in pollination biology.



Virginia Boucher

* Reserves Manager, UCD Natural Reserve System, 1999-present
* B. S. Biology, Swarthmore College, 1973
* PhD, Biology, University of Oregon, 1985

"Shorty" has managed reserves for the University of California since 1989: at Sagehen Creek Field Station (UCB) in the Sierra Nevada (1989-94), at Sedgwick Reserve (UCSB) in the Santa Ynez Valley (1994-99) and now at UC Davis. Her interest in reserve management began during her dissertation and post-doctoral work at the NRS Hastings Reserve. During her tenure as a reserve manager, she has served as vice president of the Organization of Biological Field Stations and as the elected managers' representative on the University-Wide Committee for the Natural Reserve System.

Cathy Koehler

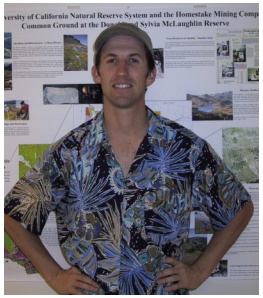
* Co-manager, McLaughlin Reserve, 2002-present
* B. S., Zoology, Calgary University, 1987
* M. S., Behavioral Ecology, Calgary University, 1991
* Community Education Specialist, Rancho Santa Ana Botanic Garden, 2001-2002

Cathy has studied the conservation and restoration of coastal sage scrub, surveyed the bird faunas of southern Californian military bases, and received her masters' degree on the breeding biology of bats. She then moved into the development and implementation of K-12 and public education on science and natural history. She is now pursuing this interest by collaborating with Lake County educational organizations and chairing the Outreach and Education committee of the Blue Ridge Berryessa Natural Area conservation partnership.

Dan Tolson

* Reserve Steward, UCD Natural Reserve System, 1996-present
* B. A. Environmental Studies and Anthropology, UCSC, 1990

Dan, a Davis local, has been hiking Stebbins Cold Canyon since 1978. His first involvement with the NRS was as a student at UC Santa Cruz, where he served on the Chancellor's Special Committee For Land Use Policy, which oversaw those areas of the UCSC campus that were part of the "Campus Reserve". Dan put himself through UCSC by working weekends and holidays as a carpenter, construction worker, and handyman; and thus brings a variety of construction and maintenance skills to his position. Dan has worked for the Mono Lake Committee and the National Park Service, and is now in his 7th year as Reserve Steward with UCD-NRS. In 1999, Dan received the Research Outstanding Employee of the Year award for meritorious performance.



Shane Waddell

* Reserve Steward, UCD Natural Reserve System, 2000-present
* Reserve Steward, UCSB Natural Reserve System, 1998-2000
* B.A. Mathematics and Economics, UCSB, 1993

Shane began working with the NRS in 1998 as Reserve Steward at the Sedgwick Reserve. In 2000, he worked as a Land Steward at the Santa Margarita Ecological Reserve, part of the San Diego State University Reserve System. In addition to his duties as reserve steward at UC Davis, he manages the databases, including GIS, meteorological, grazing, maps, water quality, air quality, and web pages for the four campus reserves.

Karli Holler

* Program Manager, UCD Natural Resreve System, 2003 - present
* Administration Assistant, Genetic Resources Conservation Program, UCD, 2000 - 2003
* Office Manage, UCD Internal Audits, 1995 - 2000

In summer 2003, Karli Holler joined the NRS as a 75% time administrative assistant. Karli has been at UCD since 1985 and was able to organize all of the bills and timesheets as soon as she hit the ground. She comes to us from Genetic Resources Conservation, and we look forward to many productive years with her at the helm.

Ringtail, *Bassariscus astutus*

Appendix D: Press

McLaughlin Reserve Articles

"Where Worlds Collide: Guns, Miners, Nature", *Napa Valley Register* (11/26/2000)
"Unique Plan For Napa Wildernss", *Napa Valley Register* (1/6/2001)
"County Wants Federal Plan For Knoxville Area", *Napa Valley Register* (2/1/2001)
"Board Considers New Knoxville Public Lands Management Plan", *Record Bee* (2/22/2001)
"Nature Taking Back Gold Mine", *Napa Valley Register* (12/2/2001)
"Reserved For Education", *Datelline - UC Davis* (3/29/2002)
"Conservation Group Honored", *Davis Enterprise* (12/5/2002)
"Research in Reserve", *Davis Enterprise* (12/15/2002)
"Going Once…Gold Mine Sold!", *Empire News* (1/30/2003)
"Good as Gold - Mine Turns Into Nature Reserve", *Daily Republic* (6/1/2003)
"End of a Golden Era: Mine on Auction Block", *San Francisco Chronicle* (1/3/2003)

Nature taking back gold mine

Unique plan for Napa wilderness

By JAY GOETTING
Register Staff Writer

NAPA

The search for gold will turn into the search for knowledge at the old Homestake mine as UC Davis moves in and converts the mine into a research facility.

That conversion is just one example of the public-private partnerships that locals hope can be used to manage a wild area that stretches from eastern Napa County all the way north to Williams.

A Roberta Mundie and Associates study, funded by the Packard Foundation, provides a basis for the possible establishment of a unique public-private partnership to manage the natural area in the Blue Ridge-Berryessa area of Napa County. It also includes lands in Yolo, Lake, Solano and Colusa counties.

The 300,000 acre area stretches from Monticello Dam in eastern Napa County to near Williams in Colusa County. The

SUBMITTED PHOTO
Susan Harrison, right, a biologist at UC Davis, says she is "not one that appreciates the aesthetics of mines," but looks forward to involvement with the natural preserve will be created. She is pictured with Sylvia McLaughl staunch environmentalist and wife of the late D

DAILY REPUBLIC

Good as Gold

McLaughlin Reserve manager Cathy Koehler looks over white morning glories near the tailing pond of the Homestake Mine.

managers, Cathy Koehler and Paul Aigner, above, look over the pit, where mine equipment sits, below, of the Homestake Mine near Knoxville.

Mine turns into nature reserve

Though the land is closed to

Quail Ridge Reserve Articles

"Native grasses under attack", *Davis Enterprise* (9/3/1999)
"Reserved For Education", *Dateline - UC Davis* (3/29/2002)
"Research in Reserve", *Davis Enterprise* (12/15/2002)
"Feds Want New Policies Against Guns, Poaching Near Berryessa", *Napa Valley Register* (9/2/2003)

Research in reserve

University of California keeps outdoor options open for science and the public

By Crystal Ross O'Hara
Enterprise staff writer

Most people think of university laboratories as dingy rooms inhabited by "lab rats" and cluttered with Bunsen burners and beakers.

But University of California researchers also have access to acres of reserve land filled with lush landscape, rugged hills, tall trees, streams and ocean life. UC Davis directly operates four such reserves, which include a wide variety of habitats such as serpentine soils, vernal pools and native grasses. They are: the McLaughlin Natural Reserve, the Stebbins Cold Canyon Reserve, the Quail Ridge Reserve and the Jepson Prairie Reserve. UCD also has a hand in operating the Bodega Marine Reserve and the Eagle Lake Field Station.

The indefatiga-ble Virginia Bousch-

Wayne Tilcock/Enterprise photo

FAMILY TREK: Jim Gorny of Davis helps his daughter Lea, 3, look for lizards midway on the trail to the ridge at Stebbins Cold Canyon Reserve near Lake Berryessa.

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Jepson Prairie retains flavor of past

Jepson Prairie Reserve Articles

"Restoring Jepson Prairie", *Vacaville Reporter* (1/30/2000)
"Spring Spectical", *Vacaville Reporter* (5/5/2002)
"A Visit to our Local Reserves", *Davis Enterprise* (6/22/2000)
"Reserved For Education", *Dateline - UC Davis* (3/29/2002)
"Research in Reserve", *Davis Enterprise* (12/15/2002)

Keeping the best in reserve(s)

UC Davis Natural Reserve System manager Virginia Boucher, left; postdoctoral researcher Pete Trenham and retired staffer Jim MacIntyre of the land, air and water resources department investigate a vernal pool water sample near Jepson Prairie Reserve.

Sylvia Wright/Davis Enterprise

RESERVED FOR EDUCATION

Campus wildlands emerge from shadows with new leaders, funding

By Sylvia Wright

Susan Harrison was headed for medical school when she took a summer job counting bugs at Bodega Marine Reserve and found her true calling: ecological field studies.

At the time, Bodega was the only one of the six units in the UC Davis Natural Reserve System that was truly fulfilling its mission of teaching and research. While the other UC campuses supported their 27 reserves with staffing and maintenance budgets, UC Davis did not. As a result, its reserves were, as Harrison puts it, "the slow child in the system."

Yet the UC Davis reserves held fabulous

10,000 acres in diverse California ecosystems including the coastal bluffs at Bodega, montane forest at Eagle Lake, vernal pools at Jepson Prairie, chaparral and savannah at McLaughlin, oak woodland at Quail Ridge and riparian forest at Stebbins Cold Canyon.

Today, 18 years after the Bodega reserve showed her a new future, Harrison is returning the favor. A UC Davis professor of environmental science and policy, she now directs the campus Natural Reserve System and is the first director given the time and money needed to help the slow child speed up.

Much of the credit for getting things rolling goes to Alex Glazer, a longtime UC

sor of molecular and cell biology who became director of the University of California Natural Reserve System in January 1998.

Glazer's office administers and partially funds all of the UC NRS sites, now totaling 34, the balance of the funding comes from the campuses. For day-to-day administration, each campus manages some of those 34. (Complicating matters, some campuses also manage reserves that are not units of the UC NRS, such as UC Davis' Putah Creek Riparian Reserve — see related story page 2 — and UC Berkeley's Sagehen Reserve.)

"I immediately saw that Davis was the only campus with so many of its reserves nearby," Glazer says now. "That's a huge

Stebbins Cold Canyon Articles

"A Visit to our Local Reserves", *Davis Enterprise* (6/22/2000)
"Reserved For Education", *Dateline - UC Davis* (3/29/2002)
"Reserve is a Hiker's Paradise", *Davis Enterprise* (5/16/2002)
"Grant, UCD Funds Open New Trail to the Public", *Davis Enterprise* (5/17/2002)
"Habitat Plan Affect Yolo", *Daily Democrat* (11/19/2002)
"Research in Reserve", *Davis Enterprise* (12/15/2002)
"Storm Was Unusual Event", *Winters Express* (1/2/2003)

Acknowledgements

This report was written by Susan Harrison and Virginia Boucher and laid out by Shane Waddell. Additional input was provided by Cathy Koehler, Paul Aigner, Dan Tolson, and Shane Waddell. Special thanks go to the those providing sections on their research: Mark Rains, Brad Shaffer, Jessica Wilcox Wright, Susan Harrison, Robert Zierenberg, Mike Teglas, Mike Benard, Karen Mabry, Eric Seabloom, James Fordyce, Theresa Talley, and Collin Eagles-Smith.

Silk Tassel Bush (male),
Garrya congdonii

Illustrations were provided by:

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Page 14	Western Pond Turtle	USFWS
Page 18	Dragonfly	S, Chandra
Page 23	Great-horned Owl	USFWS
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Page 10	Fogg Research	M. Rains
Page 11	Shaffer Research	K. Leyse
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Page 36	Teglas Research	M. Teglas
Page 36	Ixodes	CDC
Page 36	The deer tick	J. VanDyk
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Page 64	Waddell	A. Schairer
Page 64	Holler	S. Waddell
Page 68	King Snake	M. Benard

Take a virtual tour of the reserve system by visiting the following websites:

UC NRS, http://nrs.ucop.edu

UC Davis NRS, http://www.nrs.ucdavis.edu

Jepson Prairie Reserve, http://www.nrs.ucdavis.edu/jepson.html

McLaughlin Reserve, http://www.nrs.ucdavis.edu/mclaughlin.html

Quail Ridge Reserve, http://www.nrs.ucdavis.edu/quail.html

Stebbins Cold Canyon Reserve, http://www.nrs.ucdavis.edu/stebbins.html

Eagle Lake Biological Field Station, http://www.csuchico.edu/biol/EagleLake/eaglelake.html

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