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Systemwide Salutations

The last six months in our office have been invigorating as we move forward to implement the recommendations of the NRS Steering Committee on Long-Range Planning.

We miss Roger Samuelson, NRS director emeritus, but see him frequently as he continues his work with the Office of the President as a member of the site selection team for the 10th UC campus. We will continue to solicit his input on the reserve system.

I enjoy the luxury of a superb systemwide staff: our newly appointed Assistant Director Liza Riddle (whom we captured from the State Coastal Conservancy!), Principal Environmental Planner Jeff Kennedy (promoted to this position in July—congratulations, Jeff!), always-there Administrative Assistant and office manager Maggie Drake, Senior Editor Susan Gee Rumsey, our now-career Secretary Sharon Jackson (successfully recovering from a major illness—we're so glad to have you back, Sharon), and visiting Australian student and super Cartographer/Environmental Analyst Andre Zerger. Do not hesitate to contact us with questions, concerns, or ideas.

In addition to our daily work on reserve legal issues, real estate transactions, and environmental and budget concerns, we are reconstituting the Universitywide NRS Advisory Committee (see page 11) and discussing the NRS Long-Range Plan with chancellors, campus administrators, faculty, staff, and students. We delivered a formal presentation to the Board of Regents in March and will give another later this year to the Council of Chancellors.

We are also reassessing the needs of individual reserves through site visits coupled

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Aerial view looking southeast over Lake Berryessa to the Quail Ridge Ecological Reserve, which is located in the left foreground of the peninsula shown here. On the horizon stands Mount Vaca.

Frank Maurer

UC Davis Celebrates Newest NRS Reserve



With much fanfare last November, the NRS welcomed its newest teaching and research site, Quail Ridge Ecological Reserve. A steeply sloping peninsula on Lake Berryessa,

Quail Ridge adds a pearl to the string of reserves managed by the Davis campus.

The history of this site in its present landscape dates to 1957, when Putah Creek was dammed and the rugged hills of Quail Ridge were suddenly surrounded on three sides by newly created Lake Berryessa. Although the ridge was owned in part by public agencies, private land at the base of the peninsula restricted access, and water on three sides protected the area from encroachment.

Local farmer and zoologist Frank Maurer and his wife, Lenora Timm, professor of linguistics at UC Davis, were among the first to recognize the peninsula's natural values. They began surveying the area in 1982 and

in 1984 purchased their first parcel. In 1989, they formed the Quail Ridge Wilderness Conservancy to protect the peninsula, with its native oak woodlands, savannas, and grasslands.

Their efforts culminated in November, when the Conservancy and representatives from the landowning agencies (including the U.S. Bureau of Land Management, U.S. Bureau of Reclamation, and state Department of Fish and Game) joined to sign a memo of understanding with the University. Their cooperation combines over 1,700 acres as the core of the new NRS reserve in a relationship that benefits all concerned. "It's unusual for a large institution like the University and a small, young land trust to collaborate in this way," says Maurer. "Because the Conservancy can maneuver very quickly, we can take advantage of opportunities that UC cannot. The University, with its expertise, can add to the arsenal of knowledge for our grass-roots education efforts."

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Instruction and Research Highlights

A Year in the Life of the Santa Cruz Island Reserve

Editor's Note: Last fall we introduced a column highlighting recent reserve research. In this issue of *Transect*, we focus on the 54,488-acre Santa Cruz Island Reserve, the largest site in the NRS. Located in the Santa Barbara Channel, this reserve provides a topographically diverse, relatively undisturbed, and well-protected site for studies of all aspects of islandology. It is administered by UC Santa Barbara.

Historically, research on this reserve has progressed from basic descriptive work to analyses of ecosystem processes. In recent years, researchers have also instigated manipulative management-related projects, often in cooperation with The Nature Conservancy (TNC), which owns the reserve and most of the island. A sampling of ongoing work, listed by area of inquiry and principal investigator, follows.

Anthropology:

- Jeanne Arnold (UC Los Angeles) continued her studies of the emergence of prehistoric cultural complexity in the island's Chumash Indian population (see *Transect* 7(2):9). The project has recovered substantial data on the group's production and cross-channel exchange of beads and fishhooks.



Joe Bugert

Professor of Natural History Adrian Wenner applies smoke to a colony of bees so that their combs can be retrieved and a queen obtained. The Bee Hunt Project was organized in an effort to remove these introduced European honey bees (*Apis mellifera*) from Santa Cruz Island and allow solitary native bee species to recover from prior competition with non-native honey bees.



Lyndal Laughrin

UC Santa Cruz students are engaged here in fennel eradication on the island as part of a natural history field class taught by UCSC instructors Steve Gliessman, Ken Norris, and Maggie Fusari.

Botany:

- David Young (University of Oklahoma) and Steven Junak (Santa Barbara Botanic Garden) continued their survey of the island's botanical resources. The researchers will soon complete a computerized database of information from herbarium specimens collected on site. An illustrated manual of the island's plants, scheduled for publication early next year, will include botanical descriptions, keys for identification, and a floristic analysis, as well as chapters on the island's physical characteristics and history.

- Nancy Vivrette (Santa Barbara Botanic Garden) added to her 22-year database on the germination of coastal species under varying environmental conditions.

- Lyndal Laughrin (Santa Cruz Island Reserve manager), Ann Bromfield (Santa Cruz Island Reserve), and Mary Carroll (Santa



Adrian Wenner

One of the island's solitary native bees, now being studied by Professor of Entomology Robbin Thorp in the collaborative Bee Hunt Project.

- Barbara Botanic Garden) continued their investigation of fire and its role in island ecosystems (see *Transect* 9(1):8).

Zoology:

- Brian Tissot (Oregon State University) continued monitoring populations of black abalone on the west end of the island after completing his doctoral dissertation on the geographic variation of this species. High mortality over the last several years indicates the presence of an as-yet unknown disease.

- Louis Botsford and Dale Lott (UC Davis) analyzed the impact of the drought on the reproductive rate of an un hunted California quail population.

- Charles Collins (California State University at Long Beach) studied population regulation among the endemic Santa Cruz Island jay, including juvenile dispersal, survival of young between independence and breeding, and age at the time of first reproduction.

- Kevin Crooks (UC Davis master's student) studied the behavioral ecology of the island spotted skunk and island fox, the only large mammals that occur naturally at this site. He tracked six of each species by radio-telemetry to compare their use of resources.

Restoration and Management:

- Susan Beatty (University of Colorado) investigated the ecology of fennel, an alien perennial plant that has invaded some of the island's grassland and coastal sage communities. Based on her previous studies, Beatty recommended several management options to help control this exotic species.



In these two photographs, Kevin Crooks holds an island fox, *Urocyon littoralis*. This small endangered fox ranges over the entirety of Santa Cruz Island and is found on the six largest of California's Channel Islands. It is a close relative of the mainland gray fox (*U. cinereoargenteus*).

•Adrian Wenner (UC Santa Barbara) and Robbin Thorp (UC Davis) collaborated with 20 graduate and undergraduate students and two beekeepers to investigate the foraging ecology and distribution of feral honey bee colonies. In an ongoing eradication program, they've removed most introduced bees from the eastern half of the island.

•Diann Peart (Arizona State University doctoral student) and her faculty advisor, D. Patten, studied the impact of feral pigs on coast live oak communities by monitoring the fate of vegetation in experimental pig-proof plots.

•Walter Wehtje (UC Los Angeles master's student) and his faculty advisor, Hartmut Walter, studied the effects of removing feral sheep on the age distribution of a bishop pine grove that sheep had stripped of young trees. TNC removed the sheep, which had been present for a hundred years, from most of the island in the 1980s. The researchers found that, despite the drought, the overgrazed pine grove has responded well to the lack of sheep. This research complements a previous graduate study conducted before the sheep were removed.

Geography and Geology:

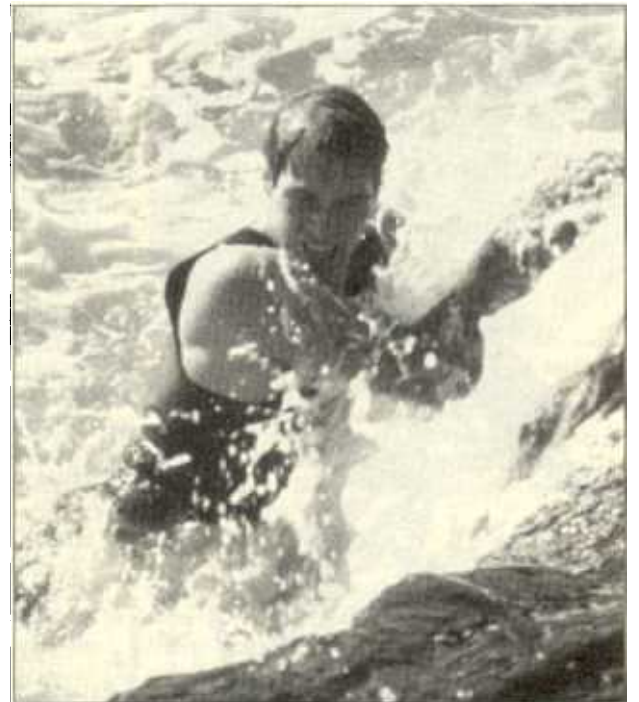
•John Cloud (UC Santa Barbara master's student) and his faculty advisor, Helen Couclelis, began developing an integrated geographic information system for the Channel Islands National Park and National Marine Sanctuary.

•Nicholas Pinter (UC Santa Barbara doctoral student) studied how activity on the Santa Cruz Island fault has shaped the topography and geology of the island. He also worked on pinpointing the age of the most recent rupture. This research is supported by an NRS Mildred Mathias Student Grant.

Instruction

In addition, Santa Cruz Island supports several field courses. Among those held on the reserve over the past year were an intensive four-week field school in archaeology from UC Los Angeles and part of the UC Santa Cruz Field Natural History Quarter. The UC Santa Cruz class completed the second year of a group project designed to remove exotic fennel and promote reinvasion by native species, complementing Beatty's work described above. From other campuses came students enrolled in courses on the biology of the marine-land interface, island biogeography, geological field methods, and research diving.

—Sarah Steinberg Gustafson
NRS Publications Consultant



Various researchers have investigated the island's populations of black abalone (*Haliotis cracherodii*) over time. This 1985 photo was taken during a study by William J. Douros of the effects of intraspecific competition. Douros found that animals at high-density sites reduced reproductive effort and growth rates. Brian Tissot's current research attributes rising mortality rates to the presence of disease.

Instruction and Research Highlights *continued*

Focus on Urban Reserves

Assessing Water Quality at Carpinteria Salt Marsh

Editor's Note: The NRS includes several sites virtually surrounded by urban or agricultural development. Because of their proximity to human activity, these urban natural reserves are easily degraded by impacts ranging from toxic contaminants to invasive exotic species to habitat fragmentation. And because they protect resources rapidly disappearing in their areas, such sites often support endangered species or provide irreplaceable ecosystem services, such as natural flood control.

As a result of both their vulnerability and their importance, urban reserves often require more intensive management than remote sites. They also provide special opportunities for research in the emerging fields of restoration ecology and conservation biology.

In this and future issues, the Transect will present summaries of research aimed at identifying and monitoring human impacts to urban (and non-urban) reserves, reducing the negative effects of such impacts, and restoring degraded habitats. Here we focus on the Carpinteria Salt Marsh Reserve, where biologist Mark Page has initiated a comprehensive study of water quality that builds upon his research on the marsh since the early 1980s.



M. L. Herring

Belding's savannah sparrow, *Passerculus sandwichensis ssp. beldingi*



Salt marsh and tidal flat at Carpinteria Reserve, the site of a comprehensive study of water quality.

Research underway at the Carpinteria Salt Marsh Reserve will investigate the amount, source, and impact of nutrients entering the marsh from adjacent agricultural and urban areas. This work will improve our understanding of estuarine processes and enhance our ability to manage nutrient loading of this coastal wetland.

Carpinteria Salt Marsh, a 230-acre estuary located 20 miles east of Santa Barbara, is one of a few remaining salt marshes in Southern California. UC Santa Barbara manages the estuary's 120-acre core as an NRS reserve. This site provides habitat for breeding populations of many invertebrates found only in estuarine environments, a feeding ground for juveniles of the commercially important California halibut and other fish species, and a feeding and roosting ground for a large variety of resident and migratory birds, including threatened and endangered species such as Belding's savannah sparrow. Salt marsh bird's-beak, an endangered plant, also occurs here.

Carpinteria Salt Marsh has a history of poor water quality. Its natural and man-made tidal channels are conduits to the ocean for freshwater runoff from urban and agricultural land in the Carpinteria Valley coastal plain and from a 6,600-acre watershed that drains a portion of the Santa Ynez Mountains.

More than a decade ago, I found excessively high concentrations of nutrients (nitrates, nitrites, phosphates) and pesticides in surface wa-

ter entering the western portion of the marsh from the north. This water contained 15 to 20 times as much nitrite alone as the water from drainages entering the eastern portion of the marsh. Actions taken in the mid-1980s to mitigate nutrient input have been largely unsuccessful.

The UCSB Marine Science Institute (MSI) recently received an \$88,380 grant from the County of Santa Barbara and the State Water Resources Control Board to conduct the first *comprehensive* study of nutrient loading of the marsh. This study will quantify nutrients in surface *and* groundwater, identify the source of the nutrients, examine the impact of nutrients on marsh biota, and provide recommendations on mitigating or managing the nutrient input.

Nutrients enter the marsh in surface water from drainage channels and also perhaps in groundwater from a shallow perched water table underlying the region north of the marsh. To quantify nutrient loading, we will examine water flow rates and nutrient concentrations in surface and groundwater at 35 sampling stations. Water samples taken three times a month for one year will be processed for nitrate, nitrite, ammonium, phosphate, and particulate and dissolved organic nitrogen by the MSI Analytical Laboratory.

These nutrients likely originate in the greenhouses and open agricultural fields that lie to the north, but the specific "point" sources have remained elusive. The placement of the water sampling stations will help pinpoint the sources of nutrient contamination.

Determining the biological effects of excessive nutrients on the ecosystem presents the greatest and most interesting challenge of this study. Salt marshes are extremely dynamic systems; salinity, water flow and sedimentation rates, and other factors vary widely over space and time. As a result, it can be difficult to distinguish between natural variations and unnatural perturbations of the environment.

The undiluted effluent from one drainage is locally toxic to small aquatic arthropods, but the effects of diluted effluent on the marsh ecosystem as a whole are unknown. Studies in other estuarine systems have found nutrient addition to enhance the growth of plant biomass or to alter plant species composition. It is therefore possible that nutrients enhance the growth of the green macroalga *Enteromorpha*, which extensively covers a mudflat in the western portion of the marsh used by birds as a roosting and feeding ground. Enhanced growth of this alga could smother benthic invertebrates that provide food for these birds. To test the effects of nutrient addition on macroalgae and invertebrates, the growth rate and biomass of *Enteromorpha* and the diversity and abundance of benthic invertebrates will be compared between a control area and areas receiving nutrient-rich water.

The physical and biological data generated by the MSI study will provide a firm basis for planning and implementing strategies to preserve and enhance the environmental quality of Carpinteria Salt Marsh. In addition, these data will contribute to the general understanding of the functioning of salt marsh systems statewide.

—Mark Page
UCSB Assistant Research Biologist

Snow Science Lab Now In Service at SNARL

The Sierra Nevada Aquatic Research Laboratory (SNARL) has made it easier to study one of its more remote habitats—the snowpack of the Sierra Nevada. SNARL researchers have been conducting snow studies since the mid-1970s. With the completion of the Mammoth Mountain Snow Science Laboratory, they are now better able to investigate thoroughly the properties and processes of an undisturbed snowpack, determining its depth and water content, how fast it melts, and the amount and chemistry of its runoff.

Located at an elevation of 9,600 feet, the lab is in Mammoth Mountain Ski Area, which helped construct the facility. It consists of a 10-by-10-by-20-foot ocean cargo



The SNARL snow science laboratory as seen from outside. The platform and top of the "Santa Claus tower" (center) are visible; the rest of the lab is buried within a seven-foot snowpack. On the far left, Reserve Manager Dan Dawson sits at the top of the snow sampling pit, recording data as a colleague measures snow density.

container buried partly underground and a 25-foot-high tower with a 240-square-foot platform on top. Researchers enter the lab by climbing first up a ladder to the platform, then down the "Santa Claus tower"—another ladder enclosed in a long steel tube—through an opening in the lab's roof.

Inside, the lab is insulated, heated, and wired for electricity. It contains dataloggers for a variety of instruments and sensors located remote from the lab, as well as a PC that allows researchers to process their data on site, in real time.

The lab was set in the ground so that it could receive water samples from the surrounding snowpack. Lysimeter pans located at the soil/snow interface in several spots around the lab collect meltwater from the column of snow directly above them. The water drains into the lab, where researchers can analyze it.

Forty-five feet away from the lab is another tower connected to the platform by a cable that suspends a flat cart in the air above the snow. By attaching instruments to the cart, researchers can analyze the undisturbed snowpack from above.

The lab currently supports three main projects. Jeff Dozier (UC Santa Barbara) and Robert E. Davis (U.S. Army) are measuring the physical and electromagnetic properties of the snowpack in order to model the processes involved in snowmelt. Using instruments attached to the airborne cart, Dozier and Davis are also developing methods for remote sensing of snow with radar and microwave imagery.



The SNARL snow science laboratory as seen from within. The step rungs on the left lead up the Santa Claus tower. In the ceiling, directly above UCSB graduate student Rick Kattelmann (left) and SNARL field assistant Mike Embury (right), is a lysimeter drain that carries meltwater into the lab for analysis.

Roger Bales (University of Arizona) is studying the release of contaminants, particularly acidic ones, from melting snow. When pollutants fall with the snow, they become distributed throughout the snowpack. But when the snow begins to melt, most of the pollutants drain out of the pack right away. Bales is modeling the entire snowmelt process to better understand the factors affecting this contaminant pulse.

John Melack (UC Santa Barbara), Dan Dawson (SNARL manager), and others have been studying the potential impact of acid deposition in high Sierra watersheds since the early 1980s. They have monitored snow

Instruction and Research Highlights *continued*

and rain chemistry at the Mammoth Mountain site all along and have examined the snowpack seasonally by taking samples from deep pits at several sites. Using the Mammoth Mountain site as a yardstick, they will be able to glean more information from the pit samples, as well as better anticipate (and therefore know when to sample) snow-melt across the Sierra Nevada.

SNARL will also use the lab to help the Mammoth Mountain Ski Area develop an avalanche database designed to help recognize and control dangerous conditions.

Mammoth Mountain Ski Area purchased and installed the cargo container at no cost to the reserve. It also provides power to the lab and access for its users. The data-acquisition system was funded through a research grant from NASA to the UC Santa Barbara Center for Remote Sensing and Environmental Optics. The Santa Barbara campus administers SNARL.

—Sarah Steinberg Gustafson
NRS Publications Consultant

James Reserve Participates in Chernobyl And Pollution Studies

Mike Hamilton, resident director of the James San Jacinto Mountains Reserve, recently began two new "Macroscopic" projects. One will educate Russian officials about ongoing health hazards from radiation contamination near Chernobyl; the other will help foresters assess the long-term effects of air pollution on pine trees. Hamilton's Macroscopic, which uses the James Reserve as a prototype, is a Macintosh-based storehouse of information that integrates a geographic information system (GIS) with interactive video and image processing capability (see *Transect* 5(2):1).

Over the next nine months, Hamilton will be involved in an innovative project aimed at verifying the health and environmental risks posed by the 1986 Chernobyl Nuclear Power Plant accident. A \$250,000 grant from the John D. and Catherine T. MacArthur Foundation to the University of Oregon will support the first phase of this endeavor. The goal is to provide citizens and decision-makers in affected areas with accurate information and computer tools for assessing and managing health hazards, as well as facilitating evacuation and land-use planning.

About 300,000 people have already left the area. But many scientists contend that as many as 1.5 million more may need to be evacuated due to the concentration of radioisotopes in the landscape and food chain.

Hamilton will be working with researchers from the University of Oregon and Moscow State University to produce computer models based in part on maps the government recently released of the areas affected

by Chernobyl. The computer models will show the nature, location, and extent of radiation contamination as it moves through the environment.

The group will build a digital database using MacGIS version 2, a raster-based system designed by Oregon's Kit Larson and David Hulse. Hamilton's role is to develop multimedia capability for the GIS in order to "bring the message of the models and maps down to a visual level."

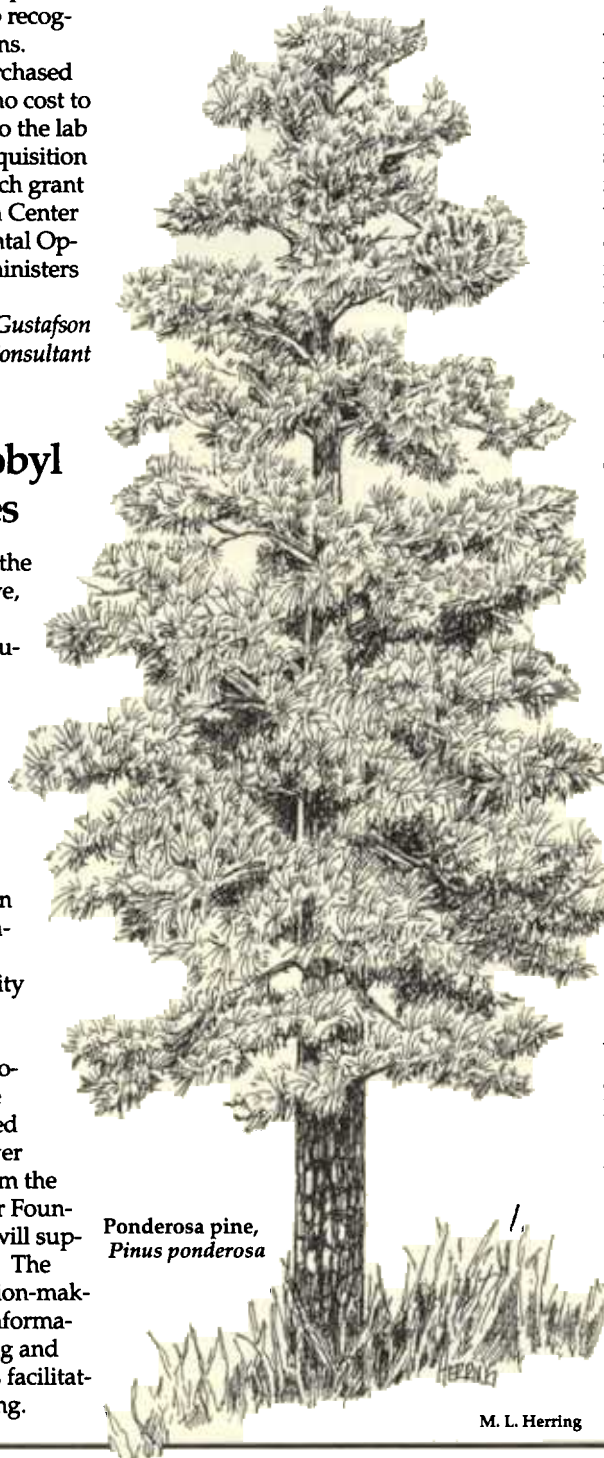
The target study, which is funded jointly by the Russian government and the MacArthur Foundation, covers approximately 200 square miles downwind from the nuclear plant in the Bryansk Region of southwestern Russia. After completing this first phase, the team will conduct a series of workshops demonstrating study results for area residents and local officials. As funding for later phases becomes available, project leaders hope to expand the effort throughout the affected regions of Russia, Byelorussia, and the Ukraine.

Meanwhile back at the reserve, Hamilton has received an \$8,000 grant from the Riverside Fire Laboratory (U.S. Forest Service) to develop a Macroscopic database system that biologists can use to monitor air pollution stress on forest trees.

Hamilton's system will focus on ponderosa and Jeffrey pines in the San Bernardino Mountains and Sierra Nevada, where several agencies are assessing ozone injury to the forest. Scientists currently assess a tree's health by comparing its appearance to previous descriptions of its size, shape, and color. This visual method is highly subjective, particularly if subsequent observations are made by different individuals. Hamilton intends to develop a more objective, quantitative method that will also provide a permanent record for assessing change over time.

Working with Macroscopic programmer Mike Flaxman, Hamilton will design a database that organizes digital video images at scales ranging from needles and branches to whole trees and multi-tree stands. They will collaborate with Paul Miller, a noted air pollution biologist at the Riverside Fire Laboratory, to acquire and incorporate pictures taken in the field into the database. Finally, they will test methods for analyzing the images for changes in color and biomass over time and train fire lab foresters to use the system in their annual assessments of ozone injury.

—Sarah Steinberg Gustafson
NRS Publications Consultant



Ponderosa pine,
Pinus ponderosa

M. L. Herring

News and Notes

Research

NATO Workshop Focuses on Santa Cruz Island Reserve

Last November, an international group of natural and social scientists used Santa Cruz Island as a focal point during a NATO-sponsored workshop. Entitled "Modeling Sustainable Development and Global Environmental Change," the workshop was directed by Professor Richard Berk from the UC Los Angeles Center for the Study of the Environment and Society. Support for the program came from the NATO Science Committees Special Programme: The Science of Global Environmental Change.

The workshop took place at the UCLA Lake Arrowhead Conference Center and included a one-day field trip to the Santa Cruz Island Reserve. Reserve Manager Lyndal Laughrin participated in the conference and led the field trip. In addition to Laughrin, the group consisted of 18 scholars from all over the world, including Greece, Turkey, France, and the Netherlands.

The goal of the conference was to improve the quality of scientific dialogue between

natural scientists and social scientists on issues surrounding global environmental change and its relationship to sustainable development. In particular, the group sought to develop solutions that would make scientific and practical sense by addressing common problems from a variety of perspectives.

To test this method, Berk decided to model discussions on the real problems of a definite geographic area with a substantial database of knowledge. He chose Santa Cruz Island for its unambiguous geographic boundaries, its rich history, the accumulated database and resources of the Santa Cruz Island Reserve, and the archives of the Santa Cruz Island Foundation.

Events

Granite Mountains Reserve Plans Mojave Desert Symposium

The East Mojave Desert (EMD) will be the subject of a workshop scheduled for November 7-8 in Riverside. Coordinated by the Granite Mountains Reserve and the Los An-

geles County Museum of Natural History, the East Mojave Desert Symposium will bring natural resource managers together with the business and academic communities to discuss research and management needs for the region. Its goals are to:

- conduct a multidisciplinary review of current knowledge about abiotic, biotic, and human uses and impacts in the EMD
- promote cooperation across disciplines and between agencies, companies, and individuals conducting research in the EMD
- identify gaps in current and proposed research related to management issues facing the EMD
- establish research priorities and future symposium themes.

The symposium will include keynote speakers, workshops, poster sessions, and published proceedings. Sponsors include Southern California Edison, the UC Natural Reserve System, and the U.S. Bureau of Land Management. Participation will be limited to 150 people. For more information, contact: Helga Schwarz at the Los Angeles County Museum, (213) 744-3446.

Restoration Ecologists to Gather in Canada This Summer

Several hundred landscape architects, biologists, urban and regional planners, horticulturists, ecologists, farmers, environmental educators, and resource managers are expected this summer for the fourth annual conference of the Society for Ecological Restoration (SER). The conference, scheduled for August 9-14, will be held at the University of Waterloo, Ontario, Canada.

This year's meeting themes include:

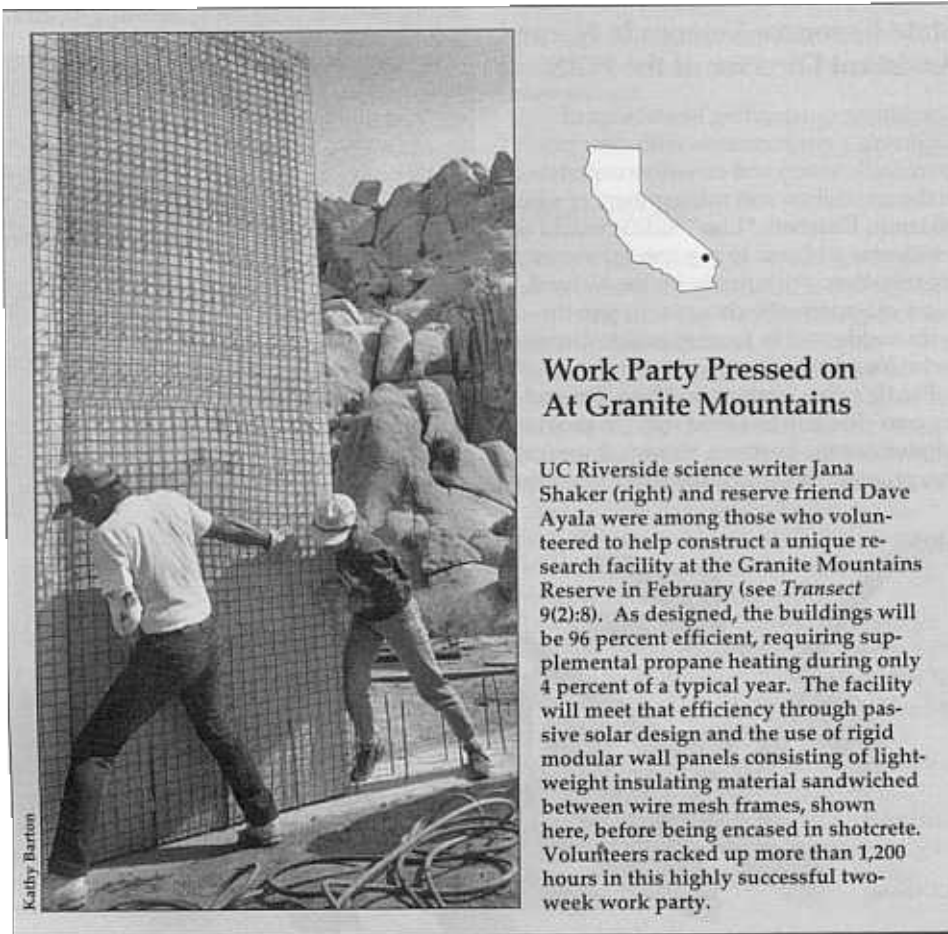
- restoration of urban, urban fringe, and rural lands
- aboriginal perspectives on restoration
- regional landscape planning
- environmental education
- community-based restoration.

Debates are scheduled on certification of restorationists, political advocacy, ethics, and the use of non-native plants. In addition, three days of guided field trips are planned to restoration sites.

For further information about SER and its upcoming conference, contact: Society for Ecological Restoration, 1207 Seminole Highway, Madison, WI 53711; (608) 262-9547.

Once-a-Decade World Meeting Held on Parks, Protected Areas

The International Union for Conservation of Nature and Natural Resources (IUCN) held its World Congress on Parks and Protected



Work Party Pressed on At Granite Mountains

UC Riverside science writer Jana Shaker (right) and reserve friend Dave Ayala were among those who volunteered to help construct a unique research facility at the Granite Mountains Reserve in February (see *Transect* 9(2):8). As designed, the buildings will be 96 percent efficient, requiring supplemental propane heating during only 4 percent of a typical year. The facility will meet that efficiency through passive solar design and the use of rigid modular wall panels consisting of lightweight insulating material sandwiched between wire mesh frames, shown here, before being encased in shotcrete. Volunteers racked up more than 1,200 hours in this highly successful two-week work party.

News and Notes *continued*

Areas from February 10-21 in Caracas, Venezuela. Entitled "Parks for Life: Enhancing the Role of Protected Areas in Sustaining Society," this was the fourth IUCN Parks Congress since 1962. The goal of this once-a-decade event is to promote effective management of the world's natural habitats so they can make their optimal contribution to sustaining human society.

Working sessions of the congress focused on four themes:

- how protected areas can meet society's needs: the social, economic, and political issues
- protected areas in a changing world
- regional planning and protected areas
- the challenge within: strengthening protected area management.

Jeff Kennedy, NRS principal environmental planner, presented papers on facilitating research at parks and protected areas and on the contributions of University-administered field stations to biodiversity conservation and ecosystem management. He also co-authored a paper on the bioregional approach to biodiversity conservation planning now underway in California (see page 10).

The results of the Caracas Congress—including a declaration to the United Nations Conference on Environment and Development, a global action plan for the coming decade, recommendations and messages to policy-makers on key issues, an investment portfolio, and strengthened networks of protected-area managers in each region of the world—will help guide the course of protected areas into the next century.

Publications

There's Always Something Hopping at Deep Canyon

In Deep Canyon, there are grasshoppers from the Coachella Valley dunes to the upper slopes of Toro Peak. Some feed only on creosote bush, others on streamside moss and algae. A new book, *The Grasshoppers of Deep Canyon*, describes 26 species of grasshoppers as diverse as the desert ecosystem in which they live.

R. F. Chapman, professor of entomology at the University of Arizona, has written this guide to encourage an interest in grasshoppers, which, he says, are easy to identify and large enough to observe in the field and manipulate experimentally. He draws on research conducted at the Boyd Deep Canyon Desert Research Center, an NRS site near

Palm Desert, where habitats range from the heat and drought of the Colorado Desert near sea level to the often snow-covered peaks of the Santa Rosa Mountains at more than 8,000 feet.

Chapman discusses the special challenges presented by a landscape of extremes to the grasshoppers' life history, foraging behavior, and distribution. He includes detailed descriptions and color plates to aid quick field identification. And he offers as-yet unanswered questions to prompt further research. How, for example, can grasshoppers survive on creosote bush, which is highly toxic to most animals?

The Grasshoppers of Deep Canyon joins a growing collection of natural history books published in conjunction with the Deep Canyon Reserve. For more information on this or other publications in the series, contact: Boyd Deep Canyon Desert Research Center, P.O. Box 1738, Palm Desert, CA 92261; (619) 341-3655.

—M. L. Herring
NRS Science Writer

People

State Resource Veteran Is Named Assistant Director of the NRS

Combining outstanding knowledge of California's environments with clear programmatic vision and extensive experience in the acquisition and management of natural lands, Elizabeth "Liza" Riddle would be a welcome addition to any natural resource organization. Fortunately for the Natural Reserve System, she chose to join the systemwide staff in January as assistant director for administration.

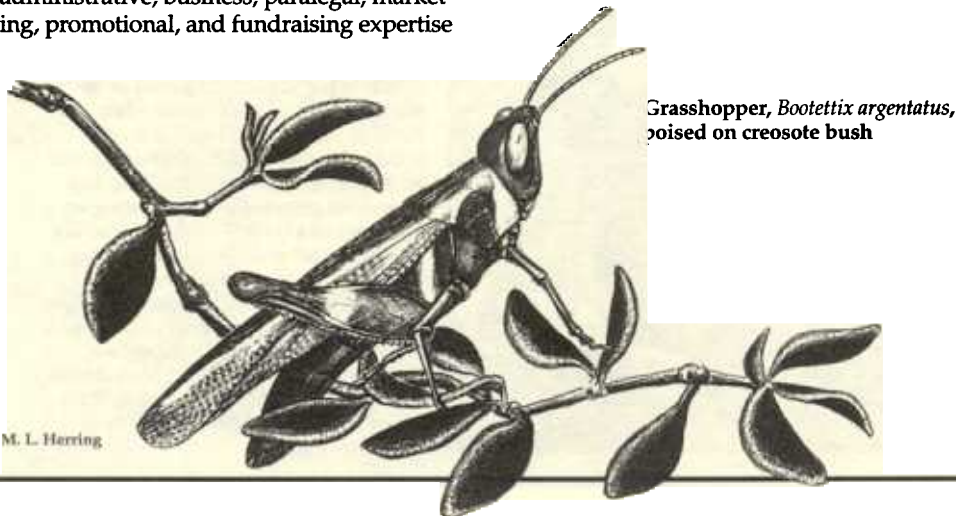
Riddle's new position will be a demanding one. She will be called upon to provide administrative, business, paralegal, marketing, promotional, and fundraising expertise

to the NRS. In her first few months on the job, she has been working to enhance the NRS budget and finalize a number of land acquisition matters. In addition, she has been making it a point to visit each of the more than 30 NRS reserves and potential sites throughout the state. As Riddle says: "It's impossible to understand land issues unless you get out there on the land."

After nearly a decade with the Oakland-based California State Coastal Conservancy, Riddle knows her way around land issues. She started there as an intern and, in 1987, became resource enhancement program manager, a position in which she administered a \$10 million budget and coordinated over one hundred restoration projects in California's coastal zone. She reviewed and assisted in the development of project proposals from local public agencies, devising resource management plans that would preserve, restore, and protect significant coastal resources while providing appropriate public access opportunities. Riddle has also worked for UC's Lawrence Berkeley Laboratory, the U.S. Bureau of Land Management, the U.S. Forest Service, and the National Park Service.

Riddle came to the NRS already thoroughly familiar with the system and its mission because she coordinated grants provided by the California Coastal Conservancy for resource enhancement projects at the NRS's Coal Oil Point, Carpinteria Salt Marsh, and San Joaquin Freshwater Marsh reserves. In addition, she visited several NRS sites while she was a master's degree candidate in environmental planning and Regents Fellow at UC Berkeley.

Riddle is a California native, who as a child used to ride horseback from her home in San Mateo over to Half Moon Bay. These days she is an avid diver, hiker, and backpacker, an artist in several media, and a woodworker. She and her husband, an elec-



Grasshopper, *Bootettix argentatus*, poised on creosote bush

trical engineer from Washington, D.C., are both accomplished photographers, currently in underwater settings.

Like many California natives and long-time residents, Riddle's concern for the degradation of this state's natural resources became the foundation for her dedication to the preservation and sound management of natural lands, drawing her into the field of resource conservation and management, directing her profession over time. "Throughout my career I have sought employment that would be challenging, while providing me with the personal satisfaction of knowing that my actions will contribute to the preservation and enhancement of our environment," says Riddle. She expects that working for the NRS will satisfy both objectives.

—Susan Gee Rumsey
NRS Senior Editor

NRS Cartographer Maps Out The Future of the Reserve System

Opportunity to pursue post-graduate work in geography at UC Davis first attracted visiting Australian student Andre Zerger to this country. Now as cartographer/environmental analyst for the systemwide NRS office, he is staying on awhile longer than he origi-

nally anticipated in order to contribute his special expertise to the wise management of NRS reserves.

Since January, Zerger has been creating computer-based maps of NRS sites and slides that add a visual component to educational presentations about the reserve system. In coming months, he will be involved in developing an environmental database and instructional materials for the reserves.

Zerger earned his B.S. in physical geography from Monash University, in his hometown of Melbourne. As a UC student, he acquired a reputation for excellence in his field and was offered an internship with the prestigious National Geographic Society in Washington D.C.—which he turned down in favor of coming to work at the systemwide NRS office in Oakland.

Outdoorsman Zerger is a ski enthusiast who appreciates the San Francisco Bay Area's proximity to the slopes and gets out on them as often as possible. No wonder that, as an undergraduate, he most enjoyed the field component of geographic work. These days, however, he is also discovering satisfaction in the knowledge that his creative computer labors at systemwide are enabling the field work of others.

Zerger will be a member of the systemwide staff throughout this year. He then plans to return to Australia to complete his honor's thesis.

—Susan Gee Rumsey
NRS Senior Editor

In Memoriam

Edward Durley Landels, whose generosity enabled creation of the Landels-Hill Big Creek Reserve in Big Sur, died this past November in San Francisco. He was 92.

Born in 1899, Landels was a native of Newcastle-on-Tyne, England. He earned his A.B. from Stanford University in 1923, his J.D. from Stanford Law School the following year, and went on to become senior partner in the law firm of Landels, Ripley & Diamond. He practiced for over half a century, specializing in real estate law and banking legislation, before retiring in 1975.

Landels was a pioneer environmentalist. In the late 1970s, he arranged to convey 4,000 acres that he and others owned along the Big Sur Coast to the University through The Nature Conservancy and the Save-the-Redwoods League. Because of the magnitude of Landels' gift—and that of Kenneth Hill, brother of former UC Santa Cruz professor Terrill Hill—the reserve was named in their honor when it was incorporated into the NRS in 1978.

Landels also made many contributions to the UC Santa Cruz Arboretum. In 1982, his substantial donation and pledge of ongoing support made possible the establishment of the Landels Garden, which has the foremost collection of New Zealand plants outside that country.

Landels was well acquainted with New Zealand. A dedicated fisherman, he traveled every year for more than 25 years to New Zealand to enjoy the fabled trout streams. He belonged to the Wyndham Angling Club in New Zealand, the Golden Gate Angling Club, the Oregon Anglers' Association, and the Truckee Fly Fishing Club.

Landels is survived by his son, Christopher, of St. Paul, Nebraska, and by two daughters, Marcia "Toni" Landels Hyman of San Francisco and Mary Landels Steffen of Monsey, New York. A fund has been established in his memory, for the benefit of the Landels New Zealand Garden, c/o UCSC Foundation, University of California, Santa Cruz, CA 95064.

—Susan Gee Rumsey
NRS Senior Editor

Mendocino Site Welcomes A Brand-New Generation

The NRS family added a member this winter, when Benjamin Heath Steel arrived at the Northern California Coast Range Preserve. Born January 25 to Trish Steel and Reserve Steward Peter Steel, Benjamin is the great grandson of the property's original owners.



Mark Coudy

New at systemwide: Assistant Director for Administration Liza Riddle — a resource veteran out standing in her field.



Susan Gee Rumsey

New at systemwide: Cartographer/Environmental Analyst Andre Zerger is currently making his contribution to field science via computer.

NRS Highlights

NRS Represents UC on New Council to Protect State's Biodiversity

On September 19, 1991, the University of California and nine federal and state groups signed a memorandum of understanding that outlines "California's Coordinated Regional Strategy To Conserve Biological Diversity." Since the unique geological history and climatic regime of this state have produced an enormous array of life unparalleled elsewhere in the United States, preservation of this diverse biota is an enormous task. The newly created California Council on Biological Diversity hopes to facilitate communication among its members and to integrate programs for the "protection of biological diversity and the maintenance of economic viability throughout California."

Biological diversity—or biodiversity—is defined by the California Department of Fish and Game as "the full variety of life and as-

sociated natural patterns and processes." It encompasses many levels of biological, geographical, and temporal organization. Levels of biodiversity interact strongly, so groups working on conservation issues must be aware of one another's actions in order to conserve the full range of biodiversity.

A bioregional approach to diversity (as used by the new council) better reflects the inner workings and multiple levels of nature than does a species-by-species focus. By determining that various agencies working in their specialized areas are not acting at cross-purposes or repeating projects, the council's coordinated program will save time and effort. In addition, the bioregional focus will keep the council aware of specific diversity issues in certain areas, protecting against overly broad proposals that would cover the entire state unnecessarily.

The council's multifaceted program is based upon analyzing what and where biotas exist, understanding their needs, and protecting them for the future. Such work will include a strong consideration of social and economic issues.

The executive council and staff are in the process of organizing numerous panels and working groups to implement the plans. Deborah Elliott-Fisk, interim director of the Natural Reserve System, is a member of the council's staff; she is enthusiastic about the council's potential in California. "Many groups will participate in areas of their own expertise, and the public may join bioregional meetings to voice their ideas," she says. "The University of California will provide the research expertise, and the NRS will be used as monitoring sites, especially in pristine areas such as Boyd Deep Canyon, the Granite Mountains, and the Northern California Coast Range Preserve."

The general idea of maintaining biodiversity is not new. Work towards a complete understanding of California's individuality as a biotic region has been going on since the 1970s. Details of the progression to the new council are outlined in *Fremontia* (vol. 20, no.1), in an article by Marc Hoshovsky, of the Natural Heritage Division, California Department of Fish and Game. Earlier groups, such as the Interagency Natural Areas Coordinating Committee (see *Transect* 7(2):3 and 8(2):5), set the groundwork for combined efforts and regional divisions, and revealed the need for collaboration at higher levels.

Hoshovsky hopes that the statewide biodiversity agreement will provide the "top-down" direction needed to enable at least state and federal agencies to work together at a regional level. This direction, in conjunction with the idea of a "bottom-up" approach of local people identifying needs and concerns, should provide good information for those who implement the programs.

Teamwork is essential to perform the tasks to save and maintain California's diversity. Other parties, such as local governments, conservation groups, industry organizations, and the general public, are encouraged to attend meetings of the state's new biodiversity council and to help in related levels. Once time, plans, and funds are secure, the necessary work can begin. Elliott-Fisk says: "The NRS hopes to play a strong role in the California Council on Biological Diversity and will keep everyone informed through the *Transect*."

—Joy Schaber

NRS Science Writer Intern

What is Biodiversity?

In the simplest of terms, biological diversity (biodiversity) is the full variety of life and its associated patterns and processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.* Biodiversity stewardship differs from what most resource managers have done in the past because it goes beyond our traditional focus on individual game or endangered species, requiring the additional, concurrent consideration of all the following patterns and processes of the natural world:

Natural Patterns and Processes

(distinct and measurable components)

Genetic Diversity

(diversity within and among populations)

Variety of genotypes

Genetic flexibility

Genetic integrity

Species—Populations

(diversity within and among ecosystems)

Rarity

Demographics

Viability, Productivity

Habitat requirements

Spatial requirements (i.e., dispersal)

Temporal requirements (i.e., seasonal behavior)

Communities—Ecosystems

(diversity within and among landscapes)

Richness (i.e., numbers of species and/or habitats)

Structure (i.e., variety of successional stages)

Composition (i.e., variety of trophic levels)

Function (i.e., nutrient cycling, energy flow, species interactions)

Landscapes—Regions

Variety and number of communities, ecosystems

Spatial patterns (i.e., mosaic of ecosystems)

Connectivity (linkages) among ecosystems

Catastrophe insurance (i.e., replication of ecosystems)

* Based on the April 1991 "Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands." This dialogue included representatives from eight federal agencies, eight conservation organizations, three professional societies, five industry groups, two universities, and four congressional committees.

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UC Davis student volunteers working to eradicate the star thistle. Efforts to eliminate this invasive species, which occurs largely along roadsides, are ongoing at the Quail Ridge Ecological Reserve.

Quail Ridge *continued from page 1*

The celebration, sponsored by UC Davis Chancellor Theodore L. Huller, also kicked off a fundraising campaign to begin purchasing remaining private tracts in Quail Ridge and thus finally secure the entire 3,000-acre peninsula for teaching and research as a virtually unspoiled vestige of native California.

Quail Ridge is a rare example of native woodland hills that range in elevation from 500 to 1,500 feet. It protects a great diversity of oak species—valley, interior live, blue, black, scrub, and oracle—as well as hybrids of interior and coast live oak and intergradations of oracle oak. This species mix also contains a wide range of age classes, including some trees under 70 years old.

The diverse understory is predominantly native grasses and forbs, including impressive stands of purple needlegrass, junegrass, California oniongrass, and California fescue. This understory is lush, relatively free of introduced annuals, and without the browse-line so common in grazed areas.

Black-tailed deer roam the peninsula, and mountain lions are seen occasionally. A favorite flyway of local raptors, Quail Ridge is a potential site for the release of rehabilitated birds. Opportunity is here to conduct original inventories, investigate interrelationships between the oak woodland and grassland habitats, and reintroduce fire to a landscape protected by water on three sides.

Quail Ridge not only offers a host of values on its own, but complements a transect of natural reserves managed by UC Davis. From the Putah Creek campus reserve (a non-NRS site), the transect follows the Putah Creek drainage upstream through Stebbins Cold Canyon Reserve and Quail Ridge, to a proposed serpentine and chaparral reserve at the top of the watershed, then traverses the Coast Range to Bodega Marine Reserve.

Although Quail Ridge has no facilities at present, it is but a 30-minute drive west of the Davis campus and 90 minutes north of the Berkeley campus. Once at the reserve, users can access the ridgetop through gated, private dirt roads.

No one may enter the site without permission. For more information regarding its academic use, contact: Reserve Steward Kevin Williams, *c/o* Environmental Studies, 2130 Wickson Hall, University of California, Davis, CA 95616; (916) 752-6949.

Members of the general public who wish to visit the reserve may join one of the monthly interpretive walks led by the Quail Ridge Wilderness Conservancy, which also offers environmental education programs to grammar and high school students. Contact: Frank Maurer, 25344 County Road 95, Davis, CA 95616; (916) 758-1387.

—M. L. Herring
NRS Science Writer

Universitywide Advisory Group Will Reconstitute

The NRS has instituted formal reconstitution of the Universitywide NRS Advisory Committee, following the recommendations of the NRS Steering Committee on Long-Range Planning and the advisory committee itself. The new structure will standardize the appointment method to this important committee and is aimed at revitalizing the group as the NRS becomes an integral component of the University's academic programs.

The Universitywide NRS Advisory Committee has major responsibilities for the overall operation and development of the reserve system. The committee acts, from a Universitywide perspective, to evaluate proposals submitted by campus NRS committees, to

make specific recommendations concerning site acquisition and management, to maintain contact with the scientific community both within and outside of the University, and to advise the UC president (through the VP—DANR and the NRS Director) on general system policy and use.

Traditionally the advisory committee, which is appointed by the president of the University, has been composed of a chair, a representative from each campus (usually the chair of the campus NRS committee), and the director of the reserve system. In addition, a representative of the Office of the Treasurer of The Regents and one from the Office of the General Counsel of The Regents have provided liaison with the committee and the systemwide NRS staff. The NRS director and representatives from the Treasurer's and General Counsel's offices will continue to be *ex officio* (nonvoting) members of the committee.

Once the committee has been reconstituted, all members will serve three-year terms, with the possibility of one consecutive renewal term. Appointments will be staggered to maintain the group's organizational memory from year to year.

President Gardner is soliciting recommendations for all committee positions, including its chair. (UC Los Angeles Professor Emeritus Mildred E. Mathias, who is stepping down as committee chair after many years of insightful and productive leadership, will be truly missed.) Campus representatives will be nominated by their respective chancellors.

In addition, the committee will include several at-large members. Two at-large members will be chosen as new additions to the committee with nominations from current members, chancellors, and Vice President Farrell: one to serve as the committee's "institutional memory" and the other to serve as the personal appointee of the president. A third at-large member will be nominated by the reserve managers to act as their representative, while a second (*ex officio*) reserve manager will serve as an alternate for a one-year term. Finally, we are also pleased to announce a fourth at-large member: a campus coordinator representative—either academic or administrative—who will be nominated by the campus NRS coordinators throughout the system.

The efforts of the past and current Universitywide NRS Advisory Committees are very much appreciated. The committee will continue to work closely with Vice President Farrell, the NRS staff, and me to implement the recommendations of the NRS long-range plan and to develop the reserve system into a unit of excellence within the University of California.

—Deborah L. Elliott-Fisk
NRS Interim Director

Salutations *continued from page 1*

with detailed fiscal analyses. California's environmental history, active tectonics, and varied climate have provided us with a set of habitats and ecosystems unmatched across any geographical area of similar size in the world. Already UC's reserves, as a system, are of higher quality and represent greater diversity than any other university's holdings. It is our goal to fully integrate the NRS into the University's mission as an academic support unit of unsurpassed excellence.

In this endeavor, the concerns of the NRS relate directly to issues of human survival. We can help ensure our survival through accurate monitoring of our environment, particularly those plants and animals that are more sensitive to environmental change than we humans are. We can protect the relatively undisturbed sites needed for this baseline research, places where new monitoring and restoration technologies can be developed and tested. We can commit ourselves to teaching students to understand state and global environments so they will be able to help maintain the ecological and economic viability of California and Planet Earth in the decades and centuries ahead. In the context of this survival strategy, the NRS is an important resource for any discipline needing access to the natural environment, including the natural and social sciences, law, medicine, engineering, and others.

Use of NRS reserves is evolving from inventorying our state's habitats, communities, and species to collecting highly technical and precise quantitative data on ecosystem parameters. Such data will become the basis of models through which we can better understand our ecosystems—how they function and how they can be most wisely managed. The academic and research accomplishments that NRS reserves have made possible over the last 10 years (and, in particular, over the

last 4 years) are substantial. Our user community now extends far beyond UC faculty and students to include an international clientele.

By garnering the intellectual support of the University's Academic Senate, administration, and Regents, we hope to acquire the financial support necessary to develop research and teaching opportunities on NRS reserves to their fullest potential and to interface our academic support plan with UC Cooperative Extension, UC's Research and Extension Centers, the public K-12 school system, and many state and federal resource agencies. Even relatively minor capital investments in the NRS made now by the University will yield major dividends in the years ahead.

—Deborah L. Elliott-Fisk
NRS Interim Director

As this issue of Transect goes to press, we have just learned—to our surprise and sorrow—of the passing of UC Riverside Chancellor Rosemary S. J. Schraer, who died at age 67, two days after suffering a severe stroke.

Chancellor Schraer lent support to the NRS for many years, and her campus administers seven reserves, more than any other UC campus. Last year she chaired the NRS Steering Committee on Long-Range Planning, which recently charted a course for full integration of the NRS into the academic structure of the University. Vice President—DANR Kenneth R. Farrell said: "One of her lasting contributions to the University for which I am particularly grateful was her energy and vision in leading development of the long-range plan for the Natural Reserve System." For this, we too thank her so very, very much.

NRS Student Grants Continue to Support Reserve-based Research

The Mildred E. Mathias Student Research Grants program offers UC students grants of up to \$2,000 for research on NRS reserves. Recipients of the 1992 awards will be announced soon. For information on the next competition, contact the NRS representative on your campus.

Transect Available on Request

tran • sect (tran'sekt), *n.* 1. *Field Science.* A line along which physical and biological data are collected. 2. *Tech. Slang.* A cross-sectional slice of the environment under study.

In a broad sense, the Natural Reserve System is also a transect. It encompasses a cross-section of California's natural diversity in a system of natural areas and field stations specifically reserved for teaching and research. Recognizing this, we have chosen to call our award-winning newsletter the *Transect*. For back issues or a free subscription—two issues per year—write or call the systemwide NRS office.

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