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NRS Director to Retire

"Time to 'repor' Samuelsen!" That was the affirmation I received from a dear friend and confidant when he learned of my decision to retire from the University, pursuant to the University's Voluntary Early Retirement Incentive Program, and to conclude my tenure as Director of the Natural Reserve System on September 30, 1991.

The timing is right, both for the NRS and for me. A firm foundation is now in place for the NRS, and the stage is set to move the program to its next plateau. More specifically:

- the Long-Range Planning Committee, chaired by UC Riverside Chancellor Rosemary S. J. Schraer, is about to release a far-reaching NRS long-range plan;
- 30 natural reserves, encompassing over 130,000 acres and protecting a majority of California's diverse habitat types, have been assembled (and several more will be added before September 30!);
- a 176-acre parcel that was donated for the benefit of the NRS some fifteen years ago will be sold in the near future, and the proceeds will significantly increase the NRS endowment;
- effective working relationships have been forged with The Nature Conservancy, U. S. Bureau of Land Management, State Department of Fish and Game, and a host of other organizations and agencies, private and public;
- an outstanding cadre of support staff have been gathered in the central NRS office, on the campuses, and at NRS reserves.

As the Planning Committee states in its forthcoming report: "Now that the collection

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Geologist Finds Fault at Big Creek

A theory recently developed by geologist Clarence Hall, Dean of Physical Sciences at UCLA, explains why pieces of the Sierra Nevada are scattered up and down the California coast atop ancient sea-floor and oceanic-crust deposits. Hall's theory, if correct, could change the way scientists view the geologic history of central and southern California, including the Landels-Hill Big Creek Reserve in Big Sur, where Hall based much of his research. In a nutshell, Hall believes a large sheet of granitic rocks was thrust northwestward over the Pacific Plate millions of years before it was shuffled northward along the San Andreas fault.

A remnant of this "thrust sheet" can be found in some granitic and metamorphic rocks that lie just behind the manager's house at the Big Creek Reserve, says Hall. This body of rock, 2 1/2 miles long and 1/2 mile wide, is part of a much larger block hundreds of miles long known as "Salinia." In type and age, Salinia appears to be the southeastern extension of the Sierra Nevada, originating somewhere in the Mojave Desert. Traditional geologic theories, however, cannot fully account for its present-day placement.

For example, Salinia now lies *west* of the infamous San Andreas fault, which puts it on the Pacific Plate rather than the North American Plate. Over the last 10 million years or so, the Pacific Plate has moved at least 200 miles northward relative to the North American Plate along the San Andreas fault system. ("If the plates keep moving at this rate," notes Hall, "in just 15 million years, UCLA and UC Berkeley will be the same campus.") Playing this plate movement backwards to pre-San Andreas fault days should realign Salinia with the southern Sierra Nevada from which it came; instead, Salinia ends up too far north.

To further complicate traditional thinking, pieces of Salinia exposed today are surrounded by sandstone and other rocks scraped off the ocean floor, known as the Franciscan Complex.

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UC Riverside Professor Mary Price examines a kangaroo rat, the subject of intensive research at Motte Rimrock Reserve (story on page 2).

Instruction and Research Highlights

Endangered Species Studied at Motte

The Motte Rimrock Reserve is one of two sites in the Perris area where intensive field research is being conducted as part of a two-year effort to develop a recovery plan to save the federally endangered Stephens' kangaroo rat (*Dipodomys stephensi*). The project, led by UC Riverside professor Mary V. Price, is funded with more than \$200,000 from Riverside County, which recently created a kangaroo rat habitat conservation agency.

Professor Price and her colleagues, Patrick Kelly and Ross Goldingay, began work in January 1990 to discover why the Stephens' kangaroo rat inhabits the grassy plains so desirable to developers, while the Pacific kangaroo rat flourishes in more rugged, brushy areas. To better understand differences between the two species, the Price investigators have been live-trapping these 60 gram (2-ounce), nocturnal, burrowing rodents, implanting 3-gram radio transmitters under the skin in their backs, and radio-tracking them.

The implanting procedure takes 10 minutes, is performed with anesthesia, and causes no discomfort for the kangaroo rats, which have an abundance of loose skin on their backs. They recover quickly (in fact, they are released at dusk a few hours after the surgery) and are checked regularly for weight loss or infection. California's Department of Fish and Game required the scientists to implant 25 Pacific kangaroo rats, which are in no danger of extinction, and observe them for a month, to make certain the procedure would not harm them. Only then were they allowed to fit the endangered Stephens' kangaroo rats with transmitters.

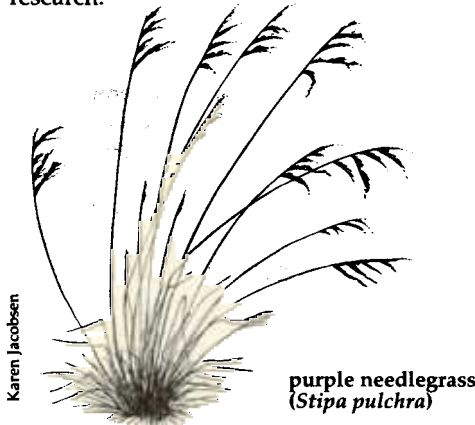
For months, the researchers and their field assistants have spent an average of three nights a week in the field tracking the kangaroo rats; removing them from birdseed-baited, metal box traps; then examining, weighing, and releasing them. By the year's end, they will know much more about the rodent's dispersal patterns, home range, reproduction, survival, and habitat use than ever before.

Data gathered by Price's group will be fed into a spatially explicit, population-simulation model developed by Dr. Michael Gilpin of UC San Diego. The model, which incorporates realistic year-to-year variation in the environment, allows the population size on potential reserves to

be projected far into the future. Thus, it permits the researchers to objectively evaluate alternative reserve designs.

Several other management-related studies of kangaroo rats were conducted at Motte last year. Also guided by Professor Price was doctoral student Rhoda Ascanio, who determined the creatures' territory size by dusting some with fluorescent dyes, then using ultraviolet light at night to retrace their trails. San Diego State University professor Lee McClenaghan, Jr., employed ear-tagging and live-trapping techniques to observe population density over a one-year period, to determine territory size, and to investigate the genetics of the Stephens' kangaroo rats. Working with him were Professor David Truesdale and UC Riverside graduate student Ernest Taylor.

With the data they gather and feed into the Gilpin model, these scientists expect they will be able to calculate how much preserved land the Stephens' kangaroo rats need to survive despite fast-growing population and development throughout Riverside County. Millions of dollars of development await the results of this research.



purple needlegrass
(*Stipa pulchra*)

Grassland Restoration Researched at Jepson

Of all the changes the California landscape has undergone in the last two centuries, one of the most dramatic is the conversion of its grasslands from native perennials to exotic annuals. Preliminary results are now in from research at the Jepson Prairie Reserve designed to help reverse this trend. These results, which were presented in October at the Natural Areas Association Conference, indicate that active management consisting of burning and/or grazing is necessary to restore native grassland species.

In pre-mission days, much of California's grassland was dominated by purple needlegrass (*Stipa pulchra*) and other bunchgrasses adapted both to periodic fire and to light grazing by native herbivores such as mule deer, tule elk, and pronghorn antelope. But the heavy impact of cattle grazing, probably coupled with natural drought, destroyed the bunchgrasses, and exotic flora spread rapidly through the depleted grasslands. The suppression of fire further favored alien annual plants over native perennials.

Operating under the philosophy that simply setting aside land may not preserve its native biological diversity, researchers from UC Davis and the California Nature Conservancy (CNC) designed a 10-year study in 1987 to determine the effects of sheep grazing and prescribed burning on native grasses. They chose Jepson Prairie in Solano County because, having never been plowed for agriculture, it contains one of the largest and best-preserved examples of native valley grassland in the state. Their study is the first to address the combined effect of fire and grazing.

Under the direction of John W. Menke, UCD Professor of Agronomy and Range Science, graduate students Robert P. Langstroth and Heather C. Fossum located and fenced 18 quarter-acre paddocks. Under one of six different treatments, each paddock was either burned or not, and was grazed in spring, summer, or not at all.

The first three years of the study concentrated on the response of purple needlegrass to these various treatments. The researchers mapped all the individual needlegrass plants in each paddock and marked more than 500 for detailed study of biomass, seed production, and reproduction by tillering and fragmentation. They also planted needlegrass seeds within each paddock and monitored seedling emergence, growth, and survival, as well as the effect of seed size.

In early September 1988, researchers burned half of the paddocks. Subsequent burns are planned at three-year intervals—often enough to reduce the seed bank of annuals, which outcompete seedling perennials for water and sun exposure, but not so often as to drain the soil of essential nutrients.

The grazing treatments consisted of putting 15 sheep in selected paddocks for one to three days each year to provide the cropping that large herbivores like antelope would have historically. Six of the plots were grazed in late March; six more in late

August. Researchers timed the spring grazing treatment to remove annual seed heads, and the summer treatment to remove plant litter and open up the grassland canopy.

"The combination of burning and early spring grazing seems to be the best management scenario," says Menke. "I'm optimistic that we're on to a regime that promotes the regeneration and survival of native grasses as well as forbs." He and his students found that even though this combination reduces the quantity of seeds produced by needlegrass, it increases the survival of seedlings, of mature plants, and of new clumps produced when large bunches fragment into smaller clones. Summer grazing, while not as beneficial overall as early spring grazing, is better than no grazing at all; it appears to stimulate the production and growth of tillers.

As the project progresses, Menke plans to study the response of other native species and the grassland community as a whole to burning and grazing. He also plans to examine why the response of needlegrass differs between the tops of mounds and the area between mounds at Jepson, which is known for its hummocky terrain and vernal pools.

This research was supported by the CNC Conservation Biology Program (see page 12), the UC Davis Public Services Research and Dissemination Program (supported by the Hewlett Foundation), and the UC Natural Reserve System.

Field School Excavates Big Creek Middens

Last summer a large, multi-institutional archaeological research, salvage, and stabilization project was undertaken at Landels-Hill Big Creek Reserve in Big Sur. The project was part of a UC Davis archaeological field school that in the past has been held in such diverse settings as MacKerricher State Park on the Mendocino County coast, the Tule Elk Reserve in the southern San Joaquin Valley, and the Reese River Valley of Central Nevada. The 1990 work at Big Creek represents the culmination of archaeological research that has been going on intermittently at the reserve since 1983.

The class ran from the last week of June through the first week of August and involved 20 students, 15 staff from UCD and California State University, Sonoma, as



UCSC student Naomi Bendiner sifts excavated midden, searching for archaeological treasures.

well as members of the Monterey County Native American community. It was designed to take students through the contemporary archaeological research processes from pre-field studies to survey to excavation and laboratory processing. A surface survey at Big Creek had been completed by earlier field classes, so in order to teach students that aspect of field methodology, their first assignment was to survey 1,000 acres of the Los Padres National Forest.

After completing the survey and recording 12 sites, work shifted to the excavation and stabilization of 8 eroding shell middens. Six of these sites are situated in the Big Creek Reserve. This work involved the excavation of approximately 65 cubic meters of midden from sites suffering various types of erosion. Once midden was removed and processed, erosion barriers were built by lining trenches with high-tech filter fabric and piling sandbags filled with sifted backdirt on top of one another to form subsurface walls. The effectiveness of the technique will be monitored through time via photographic monitoring stations established at each site.

Erosion salvage was also undertaken at Andrew Molera State Park and Julia Pfeiffer Burns State Park. Excavation goals were balanced against other resource concerns, notably the threat of disturbance to habitat for the endangered Smith's blue butterfly, the potential visual impact represented by erosion control structures, and the possibility of accelerating erosion through excavation. The intricate legal, ethical, and natural constraints surrounding this work provided

students with a valuable lesson about the realities of archaeological field research in the 1990s.

Materials recovered from all eight sites were washed, sorted, and catalogued at a field laboratory set up at Big Creek. Each student devoted one week of his or her six-week field stint to laboratory work, and through these efforts, five of the sites were completely processed by the end of the project. Processing of remaining site materials is currently underway at UCD and Sonoma State University.

The project promises to be significant since it will produce a large body of artifactual and chronometric data from both shoreline and inland sites. The need for chronological information is particularly acute on the central coast due to a long history of research in areas to the north and south, which has resulted in divergent theories about cultural development.

Site dating is at present far from secure, but it appears that the excavations have produced nothing predating circa 3000 B.C. The absence of earlier site components is somewhat puzzling, since occupation of that antiquity is evident to the north in the Monterey Bay area and to the south in San Luis Obispo County. This divergence may simply reflect the comparatively lower value of the Big Sur Coast, where the rugged terrain makes resource procurement more difficult.

Two unexpected discoveries will also be investigated further during post-field analysis: (1) an apparent serpentine industry; and (2) a well-developed shell industry that includes the manufacture of

Highlights *continued*

shell hooks, scraping tools, and at least a single projectile point. These enterprises served as possible precursors to full-scale craft specialization and will be explored as part of an explanatory settlement model developed for the project area.

The work was supported by a conservation grant from the state Office of Historic Preservation to The Nature Conservancy, which was instrumental in establishing the Big Creek Reserve in 1977.

Terry Jones
Ph.D. Candidate
UC Davis

Prehistoric Boat Built From Reserve Materials

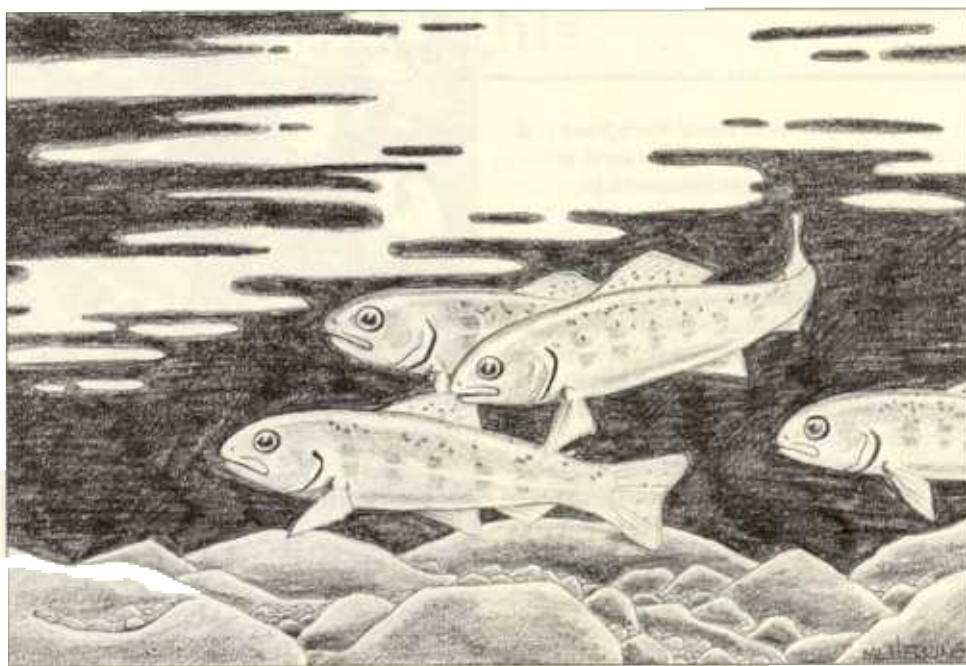
Reeds and willow collected from the San Joaquin Freshwater Marsh Reserve have been used by archaeologist Michael E. Macko to construct a tule balsa, the basic watercraft employed by many prehistoric peoples along the coasts of California and Baja California. Macko, an independent archaeologist, is the owner of Macko Archaeological Consulting.

Macko gathered materials for his *tomol* (Chumash for "boat") during August and September 1990. In the months that followed, he assembled the frame, hull, and planks using notes gathered by ethnographer John Peabody Harrington in the early 20th century.

The boat is constructed of sun-dried reeds bundled about a pole frame of willow. It consists of a large bottom bundle, or hull, bound with sisal twine and six smaller bundles, reinforced with willow poles and fastened to the sides as planks. The finished craft is approximately 20 feet long and 2 1/2 feet wide.

Early boats of this design were quite seaworthy and capable of cross-channel commerce and fishing expeditions. Macko is planning simple sea trials in Newport Bay to determine the buoyancy, speed, longevity, and strength of his boat. A longer voyage, possibly to California's offshore islands, may be made in summer 1991.

Macko designed his project to determine economic restrictions on marine adaptations by early native Californians. Available technology, materials, cost, and risk are among the factors he has considered. After Macko completes his experiment in the evolution of prehistoric marine technology, the boat will be offered to the Natural History Museum of Orange County.



Juvenile steelhead trout (*Salmo gairdneri*)

Theory on the Number of Links In Food Chain Is Upheld in River Test

(Editor's Note: This article on research conducted at the Northern California Coast Range Preserve originally appeared in the *New York Times*. Copyright © 1990 by The New York Times Company. Reprinted by permission.)

A novel experiment with fish, insects, and algae in a California river has uncovered new evidence in favor of a rather simple ecological theory involving the greening of the Earth. It holds that plants are suppressed when there are even numbers of levels in the food chain of a given habitat, but flourish when there are odd numbers.

The researchers experimentally manipulated a four-level food chain in which steelhead trout and smaller fish ate dragonfly and damselfly nymphs, which in turn preyed on the larvae of tiny, two-winged insects called midges, which in turn fed on algae. In this four-level arrangement, the river was rendered largely barren of algae each summer.

But when researchers removed the fish from the top of the chain, it was disrupted in such a way that the algae increased a hundredfold, carpeting the water with floating mats and thick green, five-yard-long braids of summer growth.

"I was very surprised at how strong this effect is," said Dr. Mary E. Power of the University of California at Berkeley, an expert in freshwater ecology who conducted the experiment in the Eel River in

Mendocino County. It was reported [in November] in the journal *Science*.

Normally, said Power, the fish at the top level of the food chain reduce the population of dragonflies and damselflies at the second level. This allows the population of midges, at the third level, to proliferate. They feed on the algae, keeping the river relatively free of the tiny plants.

With the fish removed and the food chain thereby reduced to three levels, the dragonfly and damselfly population soared. The midge population plunged. And with fewer midges to feed on the algae, the algae bloomed.

The results are considered to be one of the clearest tests of the odd-even theory because it was performed in a stable natural setting where the food chain could be readily altered.

The odd-even theory says that when plant eaters are added to a world where only plants exist, the herbivores will limit plant production and create a relatively barren world. But when predators are introduced to feed on the herbivores, adding a third level to the food chain, the plants rebound and the world becomes greener. This theory was advanced in the 1960s by Nelson Hairston Sr., an ecologist at the University of Michigan, and his colleagues, Frederick Smith and Lawrence Slobodkin.

It was extended in 1977 by Stephen D. Fretwell, then at Kansas State University, who predicted that in ecosystems with four

levels, plant eaters next to the bottom of the food chain would proliferate and decimate vegetation to produce habitats that look barren.

Most scientists, Dr. Power said, now "think the terrestrial world is a three-level world." At the same time, Dr. Hairston said, there is "more and more experimental evidence" that aquatic ecosystems are four-level systems like that of the Eel River.

The study by Dr. Power is "a very nice experimental demonstration" of the four-level aquatic system, said Dr. Hairston, who is now at the University of North Carolina at Chapel Hill. The Power experiment is the first demonstration of the principle in streams, he said.

The theory "is so tidy it's surprising it works," Dr. Power said in an interview. But she said, "It's a very good idea; a lot of the complexity of the world can be added to it, and it can still make sense as a backbone theory for community ecology."

In the Eel River experiment in the summer of 1989, Dr. Power installed a dozen 20-foot-square plastic mesh cages in a stretch of the river's south fork five-eighths of a mile long. The cages were constructed in the stream bed, around boulders to which large standing crops of algae clung. Half the cages contained steelhead and a minnow, called the California roach, that also lives in the river, in natural densities. The other half contained no fish. Insect larvae were able to swim in and out of the cages.

In each cage, Dr. Power measured algae clinging to the rocks. She also netted and weighed all algae floating in each cage. By snorkeling, she counted the fish in each cage during the experiment. At the end, she examined the stomach contents of a sampling of fish to see what they had been eating.

The results were clear: The abundance of algae depends on the activities of predators three levels above them in the food chain.

Dr. Power said she had expected that this clear pattern would be blurred because many fish might be expected to eat everything below



Damselfly larva
(Coenagrionidae)

And What is the Effect of River Otters on Research??

After collecting her data on the effects of fish in river food webs (see accompanying story), Power had intended to study the impact of floating mats of algae on insect emergence. Local river otters, however, discovered her experiment mid-summer and made off with many of her research subjects. According to Power, the ever-curious otters considered her fish enclosures wonderful snack bars and jungle gyms and cavorted in them even while she was 10 feet away. "That's the way field work goes," she says. "You publish about 10 percent, and the rest gets lost downstream."

Power has since figured out how to keep otters out of her enclosures and plans to continue her study of algal mats and insects. Up to six times more adult insects emerge from floating mats of algae than from turfs of algae attached to the river bed. Power knows the mats act as floating incubators for developing insects and may also provide some refuge from fish. By comparing rates of insect emergence between enclosures with and without both mats and fish, Power hopes to tease the effects of incubation and refuge apart experimentally.

Power's aquatic ecology research has been funded by the National Science Foundation and the California State Water Resource Center. She conducts her work at the Northern California Coast Range Preserve (NCCRP), located in Mendocino County on the south fork of the Eel River. A California Nature Conservancy site, NCCRP joined the NRS on a trial basis in early 1989, and is being evaluated for more formal inclusion in the reserve system (see *Transect* 7(2):1).

Sarah Steinberg Gustafson

them on the food chain. To her surprise, she found that the fish fed primarily on the dragonfly and damselfly nymphs rather than the midge larvae.

The reason, she said, is that the midge larvae have developed a defense mechanism that works against fish but not insect predators. The midge larvae not only feed on algae, they also live in it, fashioning camouflage cocoons for themselves.

Similar factors may be at work generally to preserve the clear-cut nature of the odd-even phenomenon, she said.

*William K. Stevens
The New York Times*

Director *continued from page 1*

of habitats nears completion, the NRS is entering a new phase that concentrates on (1) providing the facilities, equipment, environmental monitoring systems, personnel, and support services needed to make its field sites more useful to the UC academic community, and (2) on integrating the NRS into the academic programs of the campuses." Clearly this phase requires new strategies, new funding, and new staffing if the full potential of the NRS is to be realized, and I agree with the Committee's conclusion that leadership for this phase can most effectively be provided by a director with academic credentials.

My personal journey with the NRS has been most gratifying. Little did I know when I left the practice of law and joined the University in 1967 that I would spend the better part of 25 years nurturing an infant program of this importance into maturity. How many people have an opportunity during their lifetime to realize their labors will be even more valued and appreciated decades if not centuries from now? But the time has come to step aside, take a deep breath, and "reput." At the age of 54, I have many interests to explore—environmental law, land-use planning, mediation, and non-profit organizations, to name a few. But I also intend to take time to read a few novels, remodel a kitchen, organize photo albums, sharpen my tennis game, and spend more time with my wife and family!

The greatest joy of all has been derived from the people with whom I have collaborated. Given limited budget and staff support over the years, the NRS would never have survived, let alone flourished, were it not for the dedication, goodwill, and generosity of donors, friends, and University colleagues too numerous to name. All have been inspired by the realization that the NRS is a "now or never" proposition: once lost to development, a potential "outdoor laboratory" is lost forever.

Now the challenge for the NRS is even greater. Professor Emeritus Ken Norris, who was singularly responsible for the establishment of the NRS back in 1965, has put it this way: "Its larger pieces are mostly in place, and now comes its role in the future of California. That is the technical role of supporting and, in fact, forming the science and policy that will protect and perpetuate California's natural treasures in the crucial years ahead."

To each of you who has contributed to my watch as Director—especially members of my immediate staff who have toiled so faithfully day in and day out—I extend my deep gratitude.

Roger Samuelsen

Reserve People

NRS Founder Retires

Three years ago, UC Santa Cruz Professor Ken Norris set out for the Mojave Desert with two colleagues to argue about the origins of communication. Not far from the Granite Mountains Reserve, they found an orphaned lamb lying under a joshua tree beside the road. They nursed her back to health on the reserve and named her Lamb Chomsky, after the famous linguist, for the conversation she inspired.

At the journey's end, Norris took the lamb back to his family's "Experimental Gopher Research Ranch and Home for Wayward Animals" in the hills north of Santa Cruz, where she joined his small flock of sheep. "She ended up imprinting on me," he says, meaning that, through her early association with Norris, she modeled a lifelong behavior pattern after his.

Norris has had a similar effect on his students, many of whom view his field courses as turning points in their careers. Norris retired last July from teaching, from his research, and from his key involvement with the Natural Reserve System.

Though he's made valuable contributions to education, research, and conservation, Norris views his involvement with the NRS as "probably the most important thing I ever did." He knew firsthand both the power of field instruction and the difficulty in working on field sites not specifically protected for teaching and research. As a graduate student at UCLA in the late forties, Norris had to abandon his remote desert site because his lizard traps, though carefully camouflaged, were repeatedly pulled from the ground and shot full of bullet holes or carried away. Time and again, he says, individual professors tried to induce the University to establish protected natural study areas, but the University turned down the sites for lack of a statewide plan. So after Norris finished his Ph.D. at the Scripps Institution of Oceanography and joined the UCLA faculty, he and an intercampus committee developed one.

The Regents approved the plan and established the NRS in 1965. Soon after, Norris traveled the state in search of pristine, protectable sites that would represent California's diverse wildlands. His resulting wish list provided the blueprint for the development of the NRS, which now encompasses more than 130,000 acres in 30 sites. Until his retirement, Norris continued as an architect of the system through the University-wide Faculty Advisory Committee—first as its chair, then as the representative for UC Santa Cruz, and, for the past seven years,

as a member of the group's executive committee.

And how does the founder of the NRS view its progress 25 years later? "We achieved a lot more of our dreams than I thought we would," says Norris. "When we started, I wasn't even capable of dreaming we'd get some of the habitats we obtained, such as redwood forest."

However, he would like to see the system become more than just a tool. An NRS better integrated into the University, he says, could be more responsive to the UC mission and to the needs of the state. "Here we are in the middle of an environmental movement in which we now know that our fate rests upon understanding nature's workings, which are exemplified by this system," says Norris. "Yet we haven't given the NRS a central enough place in the University."

Norris thoroughly integrated the NRS into his own educational mission. For 4 years at UCLA and 18 more at UCSC, Norris was a "self-anointed" professor of natural history—what he describes as a multi-view-point discipline that looks at organisms whole in the context of their environment, behavior, physiology, relation to the physical world, and so on, to find out how the organism lives in nature.

Almost every spring quarter since 1973, he and a colleague led about 23 students on a 6,000-mile, three-course odyssey through California, stopping at various reserves to study the natural history of the state. "That's where my soul lies," says Norris of his now-legendary field quarter, in which he saw himself less as a professor than as a gentle guide, showing his students how to see. "Most students find this type of teaching filled with revelation because learning comes from reality, rather than from a teacher telling about the world outside while leaning on the lectern of a cement-walled classroom."

"What's being lost in all the attempts to improve the lecture format and how you shuffle people through it is the enormously important dimension of human diversity," says Norris of the University's efforts to improve undergraduate education. "Education is not a purely intellectual process; it's a pro-



Professor Ken Norris (*Professorus peripatetica ssp. Norrisi*)

cess of social interaction as well. For me, the greatest challenge of the teaching process is to reach students individually—to accept their diversity, salute it, and play upon it."

To meet such a challenge took remarkable energy and rare sensitivity. Norris brought both qualities to his research as well, which has shifted over the years from reptiles to fish to marine mammals—the sign, he explains, of an "undisciplined intellect." In addition to making major scientific contributions in all three fields, Norris has been able to use his research to influence environmental policy and encourage conservation. He designed nets that allow porpoises to escape tuna harvests, served as a scientific advisor to numerous conservation groups and oceanariums, and testified before the Bureau of Land Management for a comprehensive desert management plan and before Congress on wilderness issues.

And now, at age 66, Norris is changing direction again—coming back to himself, as he describes it. "I've been a scientist all my career, but I've been one who felt he didn't completely fit. I always railed against the sterility of the writing," says Norris. "My forte is looking for patterns that other people didn't see while they were being linear."

In that spirit, he plans to focus next on writing about those patterns. He has popular and scholarly books on dolphins in press, and has begun writing essays. "I'm going to tell people all about why rivers work and how come crystals are beautiful and how sand dunes sing," he says. With 214 essay topics identified so far, one of the first he's written about is Lamb Chomsky. Perhaps the imprinting ran both ways?

Sarah Steinberg Gustafson
Publications Consultant
Natural Reserve System

Alumni Honor Dr. Norris With Undergraduate Fund

When more than 200 alumni of Ken Norris's course on the Natural History of California (aka "field quarter") gathered last fall to toast his retirement, they honored him with more than a week-end-long party. They also presented him with thousands of dollars in seed money designed to establish the Kenneth S. Norris Fund for the Natural Environment. "We wanted to honor Ken personally for his inspiring teaching and establish this program in memory of a great class," says Larry Ford (field quarter of '75; a member of the fund's planning committee, now completing his Ph.D. in Forestry and Resource Management at UC Berkeley).

Modeled after the former UC Santa Cruz Environmental Field Program, which Norris coordinated from 1978 through 1986, the new program will enable undergraduates to do first-rate academic research by providing the necessary guidance and support. "One of the real problems of the educational system is that it treats undergraduates as ciphers. They have a lot of subtlety and energy, and have been thinking very hard about who they are and what they want to be," says Norris. "What I want to do with this fund is to reach undergraduates—the ones who haven't made up their minds yet—and help focus them on careers in the environment. Over and over I've found some of the very best intellects in this group."

A planning committee consisting of Norris, colleagues, and former students is developing a vision and structure for the program, which will operate out of the UCSC Environmental Studies Board. Working with University Advancement, it will soon launch an ambitious fundraising campaign, with the goal of raising an endowment for a grants program.

The grant competition will be open to all UCSC undergraduates, and will encourage broad use of the funds by students in social sciences and humanities, as well as natural sciences.

For more information on contributing to the fund, contact Lora Martin, University Advancement, Carriage House, University of California, Santa Cruz, CA 95064; 1-800-933-SLUG. Checks should be made payable to: UCSC Foundation/K. S. Norris Fund.

Stewards Welcomed Throughout System

The position of NRS steward can encompass diverse, multilevel responsibilities. Duties vary according to each site's needs, but the job usually includes direct, hands-on care for a reserve and its facilities. In less than two years, four new stewards have been brought into the reserve system to look after six NRS sites administered by UC Berkeley, Davis, Riverside, and Santa Barbara.

Brian Guerrero divides his time between two NRS reserves managed by UCSB: Santa Cruz Island and Carpinteria Salt Marsh. When he joined the NRS in July 1989, he had already been employed for two years on Santa Cruz Island by The Nature Conservancy. His primary focus is water systems, and he recently completed installation of a 25,000-gallon water storage tank. Guerrero is also a jeweler by trade, with 14 years' experience, including seven years' apprenticeship under a master jeweler.

Kevin Williams joined the NRS in December 1989 as a roving steward and now cares for three UCD-administered reserves: Stebbins Cold Canyon, Jepson Prairie, and Putah Creek, a non-NRS campus reserve. He came to the position with four years' experience at Stebbins, first monitoring site use and later helping to oversee the area's recovery following the September 1988 Miller Canyon fire. His duties range from repairing fences to installing weather stations to assisting visiting entomologists locate specimens.

Mike Flaxman, resident steward at the James San Jacinto Mountains Reserve since October 1990, has a strong background in computer programming. He was employed as a contract programmer for the medical school at UCD and as a staff research assistant in the physiology department at UCSF. Before coming to the UCR-administered James Reserve, he spent seven months traveling in Brazil. Now he programs the Macroscopic, an information system designed by Reserve Manager Mike Hamilton that employs interactive video to make it possible for researchers and students to "tour" the reserve via computer.

In November 1990, Mark Johnson became reserve steward at the Hastings Natural History Reservation, administered by UCB. For seven years prior to joining the NRS, he was employed as a carpenter at the Naval Post-Graduate School in Monterey. There he was responsible for the upkeep of 750 houses. Now he performs regular building maintenance on the Hastings lab and living quarters. Freezing temperatures at Christmas

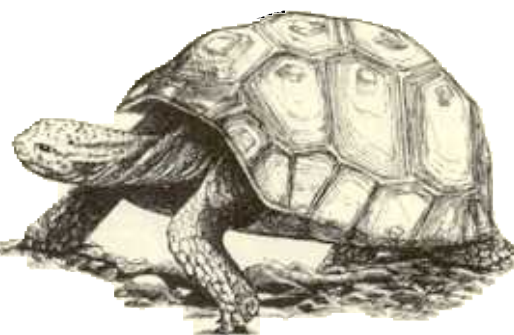
time kept him busy with ruptured plumbing, but did not dampen his enthusiasm for the reserve. He says simply, "It's great out here."

UCR Reserves Receive New Coordinator

John Rotenberry, who came to UC Riverside in July 1989 as a visiting scholar in biology, has become the NRS's third academic coordinator, along with Margaret Fusari at UC Santa Cruz and Isabelle Kay at UC San Diego. Originally a native of Texas, Rotenberry earned his master's and doctorate degrees in ecology from Oregon State University, Corvallis, and was best known there for a decade of research on sage sparrows. He spent ten years on the faculty of Ohio's Bowling Green State University before moving to Riverside.

Rotenberry's major research interest is population and community ecology, with special emphasis on avian studies. He is currently a consultant to the U.S. Bureau of Land Management on the ecology of raptors in Idaho's Snake River Birds of Prey Area. Also, he continues a six-year collaboration with former students at Bowling Green to study parental investment in house wrens.

Rotenberry is filling the gap created when emeritus Professor of Zoology Wilbur W. (Bill) Mayhew retired after managing UCR's reserves for 25 years.



Big Creek Gets Another Smiley

A new addition to the family of Landels-Hill Big Creek Reserve Manager John Smiley and Kim Smiley arrived October 5, 1990. Daughter *Sonrisa*, who started out at 7 pounds, 7 ounces, is nowadays talkative, teething, enjoying her musical mobile, and dancing (with assistance). Her father says she is proving true to her name, which means "smile" in Spanish.

News and Notes

Management

Santa Cruz Island Fire Provides Research Opportunity

Late last June, a fire burned through about 600 acres of disturbed grassland, coastal scrub, and small patches of oak woodland in an isolated area on the northeast side of the Santa Cruz Island Reserve. The blaze was started by a Coast Guard flare during a nighttime rescue of three people whose boat ran into rocks at China Harbor. Fire crews arrived at dawn and completed their control efforts two days later.

The fire provided a ready research opportunity to Reserve Manager Lyndal Laughrin and colleagues Ann Bromfield of Santa Cruz Island and Mary Carroll of the Santa Barbara Botanical Garden, who've been studying fire recovery on Southern California's offshore islands for years.

According to Laughrin, the historical record includes only two natural fires on the islands in the past 150 years, whereas the adjacent mainland undergoes several per year. "Any spot of vegetation on the mainland is likely to burn every 30 to 40 years naturally, so the plants have developed several adaptations to fire," says Laughrin. "The plants on the islands are basically the same as on the mainland. If fire is not part of their lifestyle, have they adapted to the absence of fire or lost their ability to respond to fire?"

With that question in mind, Laughrin's group began establishing transects each time an island fire occurred, natural or not. They now have three study sites on Santa Cruz Island, four on Santa Catalina Island, and will soon begin investigating one on Santa Rosa Island with the U.S. Park Service. By monitoring these sites for many years, the

researchers hope to increase their understanding of fire's role in island ecology and, ultimately, improve island management.

Hastings Gains Aquatic Habitat

Jim Kirk, who owns the Oak Ridge Ranch adjacent to the Hastings Natural History Reservation in Monterey County, has given the University permission to use his Laguna Conejo Pond, a vernal pool, to pursue studies of amphibians and aquatic insects. The pond, located near the Hastings northwest boundary, will be an important new addition to the reserve's range of biological systems. It is likely habitat for the rare California tiger salamander, the western pond turtle, and several plant species limited to vernal pools.

Breeding Desert Tortoises Discovered at Burns Reserve

Adult desert tortoises (*Xerobates agassizi*) have been seen before on the Burns Piñon Ridge Reserve in San Bernardino County. However, in April 1990, a field zoology class led by Santa Monica College Professors Walter Sakai and Norm Hogg discovered the first evidence of nesting on site.

Early in the month, Sakai discovered a dead hatchling approximately 1 1/2 inches long. Over the weekend of the 28th, Sakai, Hogg, and their class observed two very large adults, at least a foot long, within 350 feet from where Sakai found the dead young. The biologists, who also found tortoise burrows in the area, speculate that the adult pair had been parents to the hatchling.

The desert tortoise is state- and federally listed as threatened due to habitat reduction and disease. The current drought has further decreased survival chances for young tortoises.

Eagle Lake Upgrades Station

The five field classes that spent last summer at the Eagle Lake Biological Field Station in Lassen County benefited from numerous large and small improvements at the site. Most recently, the station's laboratory was the focus of a major renovation that included installation of a new ceiling, new wiring, new lights, and new plumbing. For the first time in ten years, running water is available inside the lab. A functional telephone system is anticipated by summer 1991.

NCCRP Improves Facilities

At the Northern California Coast Range Preserve (NCCRP) in Mendocino County, Reserve Steward Peter Steel is working steadily to upgrade facilities and enhance safety, convenience, and comfort at the reserve. The latest improvements include:

- a new telephone system, operating on FM radio waves, at the steward's residence and Wilderness Lodge;
- a solar system that will electrify the dining pavilion and nearby cabins;
- a new bathroom at site headquarters.

Finally, Steel is converting the dining pavilion to a four-seasons building and hopes to complete the work this spring.

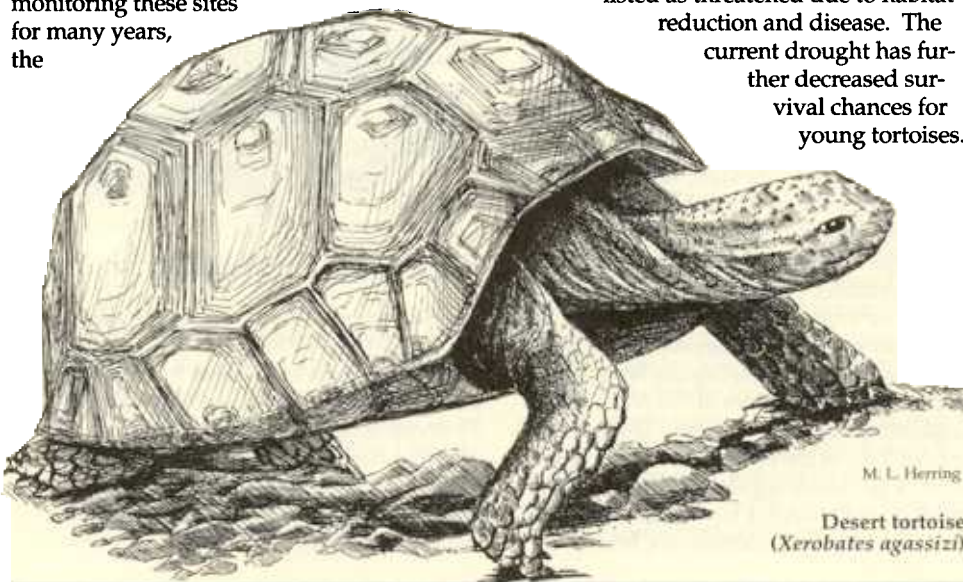
Grants

Student Grant Program Announces This Year's Winners

The Natural Reserve System is proud to announce the award of grants totalling nearly \$20,000 to 15 UC students who will be conducting research at eight NRS sites, as part of the Mildred E. Mathias Student Research Grants 1990-91.

From UC Berkeley: Peter Matti Kotanen will investigate revegetation of meadows disturbed by feral pigs at NCCRP (\$1,940). Philip N. Hooe will analyze dispersal in the cooperatively breeding acorn woodpecker at Hastings Natural History Reservation (\$1,740). Michele A. Seidl will study incision of bedrock channels and their tributaries at NCCRP (\$550).

From UC Davis: Amos Bouskila will examine microhabitat utilization by desert rodents at Granite Mountains Reserve (\$2,000). Andrew Dyer will study restoration of native California grasslands at Jepson Prairie Reserve (\$1,200). Michelle Geary-Mallett and John Charles Hunter will study the structure, dynamics, and ecophysiology of seedling



M. L. Herring

Desert tortoise
(*Xerobates agassizi*)



Acorn woodpeckers, male (left) and female (*Melanerpes formicivorus*)

Karen Jacobsen

establishment in an old-growth mixed evergreen forest at NCCRP (\$2,000).

From UC Irvine: Luis M. Mota-Bravo will examine plant chemistry and insect herbivory at Landels-Hill Big Creek Reserve (\$1,200). Felisa A. Smith will analyze the dietary strategy of the desert woodrat at Granite Mountains Reserve (\$1,422).

From UC Riverside: Rhoda M. Ascanio will investigate how interactions between two species of kangaroo rat influence their habitat use at Motte Rimrock Reserve (\$1,200).

From UC Santa Barbara: Cheryl J.

Briggs will research the effect of parasitoid species on the population dynamics of a gall-forming midge at Landels-Hill Big Creek Reserve (\$2,000). Adrian Laurence O'Loughlen will study vocal ontogeny and dialect maintenance in the brown-headed cowbird at Valentine Eastern Sierra Reserve (\$1,200). Nicholas Pinter will examine recent fault motion and late-Quaternary strain at the Santa Cruz Island Reserve (\$1,400).

From UC Santa Cruz: Katherine Courtney and Swarup Wood will analyze the movement, metabolism, and influence on nitrification of redwood monoterpenes in an undisturbed redwood ecosystem at Landels-Hill Big Creek Reserve (\$1,997).

Congratulations to all!

Big Creek Teacher Receives Environmental Education Grant

Science teacher Kim Smiley and colleagues recently received a \$25,000 grant to build upon the environmental education program she is developing at the Landels-Hill Big Creek Reserve (see *Transect* 8(1):2). The grant comes from a new program in the State Office of Education designed to help bring ecology into the classroom.

Smiley's one-year project, dubbed Project REAL (for Rural Ecology Action Lab), will begin this fall and will be centered around the oak tree. Students in grades six through nine at Pacific Valley School in southern Big Sur will visit the Big Creek Reserve to learn about animals that depend on acorns and oaks, historical uses of oaks, associated plants, and the physics and chemistry of the tree. The students will then employ what they've learned to design and construct interpretive trails on site and to develop study units for distribution to other schools and use by other classes that come to Big Creek. The grant includes funding for computers and software that will help students gather and disseminate their ecological data.

Appointments, Events, and Additions

NRS Director Appointed to UCB Natural Resources Board

NRS Director Roger Samuelsen has been appointed a founding member of UC Berkeley's College of Natural Resources (CNR) Advisory Board. The board, which met for the first time last fall, is charged with providing advice, a diversity of viewpoints, and information on trends in natural resources, as well as generating support for CNR projects.

Other members of the board include W. Don Maughan, Chair of the State Water Resources Control Board, William Penn Mott, Special Assistant to the Secretary of the Interior, and Martin J. Rosen, President of the Trust for Public Land.

Conference to Convene On Ecological Restoration

Restoration of surface-mined lands, Third World tropics, and national forests will be discussed in symposia at the Society for Ecological Restoration (SER) third annual conference in Orlando, Florida on May 20-23. In addition, papers and posters will be presented on all aspects of ecological restoration. The last day of the conference is devoted to field trips to local restoration projects.

Beth Hendrickson, caretaker of the Coal Oil Point Natural Reserve, described her experience of SER's second annual conference, held in Chicago last May: "I was stimulated, inspired, and informed! In an era when

most of what we environmental types do seems to be just holding back the inevitable tide of development, these folks are reclaiming damaged and destroyed ecosystems. Of course, they recognize that this is not a substitute for trying to preserve existing natural habitats, but it is encouraging to find that, with some intelligent tinkering and the resilience of nature, a damaged or lost habitat *can* be restored to a functional level."

The SER is a young organization for a new and fast-growing field. The journal of the SER, *Restoration and Management Notes*, contains valuable information about restoration methods in various ecosystems and is oriented to a diverse audience that includes ecologists, managers of parks and preserves, engineers, and landscape architects. This bi-annual journal is available for \$15 per year from: Journal Division, University of Wisconsin Press, 114 North Murray St., Madison, WI 53715. SER members receive the magazine with their membership, which costs \$25 per year.

For more information, contact: Society for Ecological Restoration, 1207 Seminole Hwy., Madison, WI 53711; (608) 262-9547.

NRS Grows by 100+ Acres

Several significant additions from various sources over the past year are enhancing NRS sites. These include:

A gift of 54 acres from Ida Dawson to the Dawson Los Monos Canyon Reserve. The reserve, which consists of a stream-cut valley, is the result of a series of previous gifts of land from Mrs. Dawson starting in 1963. Her most recent gift increases the reserve's area to 217 acres, adding additional streamside coast live oak forest and adjacent grassland meadow.

A gift of 14.5 acres from Juniper Ridge Investors to Valentine Camp, a component of the Valentine Eastern Sierra Reserve. Established in 1973, this reserve contains one of the few nearly pristine montane meadows in the region. This gift expands Valentine Camp to more than 150 acres and provides an important ecological buffer between the reserve and planned local development.

An addition of 41 acres with a house and workshop to the Burns Piñon Ridge Reserve. The reserve, which is located on the westernmost edge of the Mojave Desert, was established in 1972 with land acquired from Jean and Bruce Burns, part by gift and part by purchase. The newly acquired residence will provide housing for an on-site manager and laboratory space for visiting researchers.

Fault *continued from page 1*



Geologists have long wondered how 100-million-year-old slabs of Sierra Nevada granitic rocks found their way into the middle of sea-floor sedimentary rocks and oceanic crust that are 150 million years old.

Past theories have viewed the pieces of Salinia found at Big Creek, Point Lobos, Point Reyes, and other spots along the coast, as fault slivers. These slivers were supposedly shuffled into their present positions by lateral movement along strike-slip faults. All of this movement, according to conventional wisdom, occurred following the collision of the Pacific and North American plates some 30 million years ago. But Hall feels that evidence at Big Creek, in particular, does not support this traditional view. "It's a rugged place," he says. "Not many people are willing to go crashing through the poison oak, so the previous interpretation was accepted as gospel."

Hall, who is willing to go crashing through the poison oak, has developed a novel theory that solves the mystery of Salinia by taking a fresh look at local faulting. In the process of remapping the region's geology, Hall realized that Big Creek's block of granitic rocks is not sandwiched between two nearly vertical faults, as traditionally thought. Instead, he says, it is *underlain* by a single, locally horizontal fault, known as the Sur fault. According to Hall, the Sur fault is part of a large, relatively old thrust fault extending from northwestern to southeastern California, rather than one of numerous strike-slip faults associated with the more recent San Andreas fault system.

This new interpretation of the Sur fault led Hall to view the area's geology as the result of two distinct types and stages of fault movement. The first began about 65 million

years ago. At that time, Big Creek's granitic rocks were located in the Mojave Desert, and the North American and Pacific plates had yet to collide. The conveyor-beltlike action of subduction was pulling oceanic crust down beneath the continent off the coast of California.

Salinia was then firmly attached to the North American Plate, but probably protruded from a relatively straight continental coast. Like the front edge of a giant surfboard, this protrusion rode northwestward as the continent skimmed over subducting crust. As a result, says Hall, Salinia was thrust some 110 miles to the northwest, forming a granitic sheet atop oceanic crust and Franciscan Complex of subducted rocks.

"This explains why you have an island of granitic rocks in a sea of Franciscan rock," says Hall. "Granitic rocks are deep-seated intrusive rocks formed tens of kilometers beneath the surface. We normally think of these types of rocks as the roots of a continent. But if you look at Salinia in cross-section, what you have are granitic rocks *on top of* the Franciscan Complex and oceanic crust—simplistically, granite on top of sandstone and basalt."

In Hall's view, pieces of Salinia found today, such as the one exposed at Big Creek, are not slivers that extend deep into the earth. Instead, they are remnants of the edge of a giant thrust sheet that slid over oceanic crust and has now all but eroded away. "This piece at Big Creek is a model for all of Salinia, from Point Arena to the Tehachapis," says Hall. "The point of contact is the Sur fault—I call it the 'sole' of Salinia."

The second major stage of large-scale movement began about 10 million years ago.

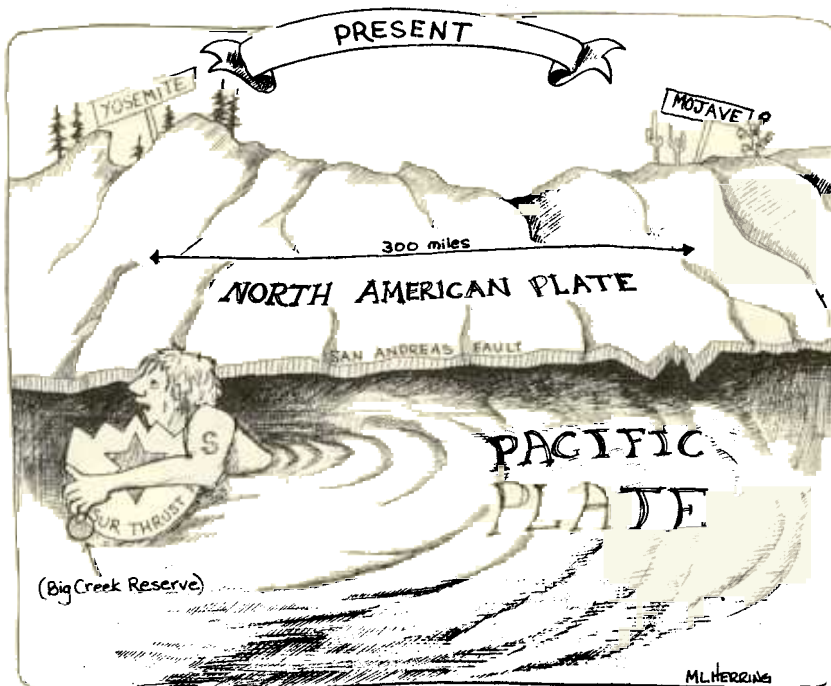
The Pacific Plate had plowed into the North American Plate about 20 million years earlier, causing the San Andreas fault to propagate up and down the coast. As the two plates scraped against each other along this fault, Salinia was torn loose from the continent and carried northward along with the Pacific Plate some 220 miles to its present location.

Hall's theory not only accounts for the odd juxtaposition of granite and sea-floor sediments, but also operates in reverse. That is, if the movements he describes are played backwards, Salinia lines up with appropriate rocks in the southern Sierra Nevada.

Hall's research, funded by the American Chemical Society, will be published as *Special Paper 266* by the Geological Society of America this fall. His study is based on four summers of mapping the rugged central Coast Ranges, including the Big Creek Reserve. "This is a difficult place to map," says Hall. "There are some decent outcrops at Big Creek where you can trace the fault relatively easily, but I also used things like ant hills and gopher holes because these animals bring up grains and fragments of rocks from below the soil. By examining these chips, you can tell what the substrate is and determine the location of the fault."

According to Reserve Manager John Smiley, Hall's theory has generated a "snowball effect" of interest in the region's geology, and he expects increasing numbers of geologists to travel to Big Creek for a look at the granitic rocks behind his house.

Sarah Steinberg Gustafson
Publications Consultant
Natural Reserve System



Publications

Hastings Publishes First Flora

The Hastings Natural History Reservation recently produced the *Flora of the Hastings Reservation*. Written by James R. Griffin, the reserve's plant ecologist, the publication is the result of more than 50 years of plant collecting by a number of ecologists. Its list of 624 taxa, including 428 native species, reflects both the diversity of the site's flora and the completeness of the Hastings herbarium, which is housed at the reserve.

In addition to a catalog of vascular plants, the flora includes references and a species index. It also contains information on the herbarium's development, on distribution and abundance of reserve plants, and on floristics and numbers of taxa.

Though the press run of the *Flora* is limited, the publication is available on site to reserve users.

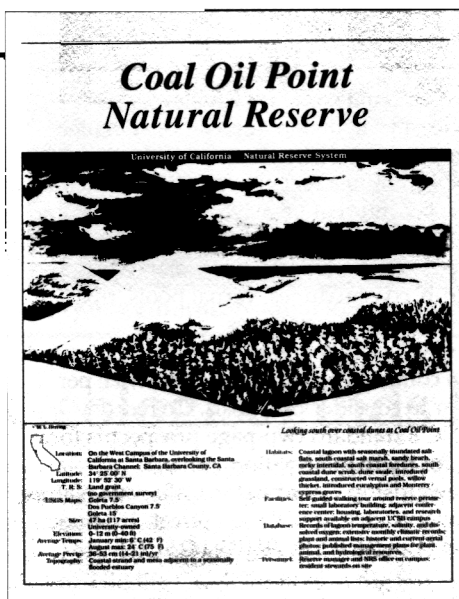
Handbook Now Available For Motte Reserve Users

Students and faculty who wish to use the Motte Rimrock Reserve will find a wealth of site information in the *User's Handbook for the Motte Rimrock Reserve*, produced in 1990. Written by Wilbur W. Mayhew, UC Riverside professor emeritus and former reserve coordinator, and Barbara A. Carlson, Motte reserve manager, the handbook consists primarily of maps and tables designed to assist users in locating specific areas, habitats, and organisms. It includes sections on the reserve's climate, general features, habitats, study transects, photo sites, fires, flora, fauna, and recommended reading.

UC Publications Feature NRS

So far this year, two UC publications have featured the Natural Reserve System. The first was *California Agriculture*, the research journal of the Division of Agriculture and Natural Resources (DANR). In the January-February issue, DANR Vice President Kenneth R. Farrell devoted his regular editorial to the NRS, its contributions to the University, and its future.

And in February, *UC Riverside* magazine included a story on NRS reserves administered by UCR. It highlighted the multimedia MacroScope developed by Mike Hamilton at the James San Jacinto Mountains Reserve, research on endangered species at the Motte Rimrock Reserve, and the design of one of the world's first completely self-sufficient field research facilities at the Granite Mountains Reserve.



NRS Press Distributes New Display Map, Brochure

For the first time, NRS fans can display a poster depicting all the reserves. Known as the "NRS Centerfold," this brochure fits into a #10 envelope and folds out to a 16-by-18-inch poster. One side describes the NRS in general; the other contains a map, identifies the locations of all NRS sites, and offers brief descriptions of each, along with the current contact address and phone. The centerfold was created to mark the 25th anniversary of the NRS.

The NRS also produced a brochure for the Coal Oil Point Reserve last year. The publication describes the site's natural resources and contains information on access, facilities, and use. Brochures for many other NRS sites are also available. Contact the systemwide NRS office for a publications list and free copies of its publications.

Recent CPS Report Focuses On Conserving Biodiversity

"The time has come to evaluate the status of the state's biological resources, to determine what threatens the continued existence of these essential resources, and to chart a course of action to guarantee the long-term future of California's biological diversity. The threats are now quite evident, but the opportunities for action and improvements are still available; the time to act has arrived," write Deborah B. Jensen, Margaret Torn, and John Harte in *In Our Own Hands: A Strategy for Conserving Biological Diversity in California*. If taken to heart by California's decision-makers, this beautifully written, compelling document will have a major and lasting influence on the state's environmental policy.

In Our Own Hands provides an overview of biodiversity, its importance to the economic health and quality of life of all Californians, causes and consequences of past losses, continuing and impending threats to biodiversity, and barriers to biodiversity conservation. The final chapter proposes a 10-part strategy for state action, providing a framework for a future California where growth and development can occur in concert with the conservation and enhancement of the state's biological resources.

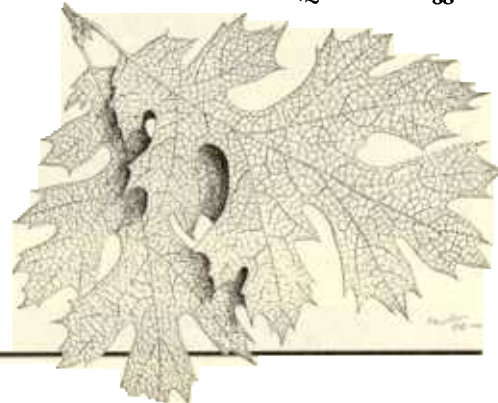
Jensen and Torn are graduate students working under Harte in UC Berkeley's Energy and Resources Group. Their study was funded by the California Policy Seminar, a joint program of UC and state government to link systemwide University resources with state policy concerns. To obtain a copy of this report, which was published in April 1990, send \$10.00 (includes postage) to: California Policy Seminar, 109 Moses Hall, University of California, Berkeley, CA 94720; (415) 642-5514.

Summer Issue of *Fremontia* Devoted to California's Oaks

Last year was the "Year of the Oak," so designated by the California Legislature in recognition of the genus *Quercus*, its place in the state's landscape, its value and troubling decline. To honor the spirit of this designation, the July 1990 issue of *Fremontia*, the journal of the California Native Plant Society, focuses on the California native oak. Its articles cover subjects ranging from the distribution and ecology of different species of oaks, to the wildlife that depends on them, and finally to policies and practices that affect the future of the oak in California.

This special 112-page issue, four times longer than most issues of *Fremontia*, deserves a lasting place in any Quercophile's library. It is available for \$10.00, including shipping and handling, from: California Native Plant Society, 909 - 12th St., Suite 116, Sacramento, CA 95814.

California black oak leaves (*Quercus kelloggii*)



Opportunities

Student Grants Support Research on NRS Reserves

The NRS's Mildred E. Mathias Student Research Grants program provides grants of up to \$2,000 each to UC students for research on NRS reserves. The 1990-91 winners are announced on pages 8-9. For information on next year's competition, contact your campus NRS representative.

Nature Conservancy Funds Management-related Research

The California Nature Conservancy (CNC) offers grants of up to \$20,000 for work on natural areas through its Conservation Biology Research Program. These grants are *not* limited to research on CNC preserves. They are, however, designed to provide specific information for conservation and management of threatened and endangered species and habitats.

The program is divided into three areas: (1) management-related investigations, such as the use of prescribed burning, control of invasive exotic species, and effects of livestock grazing on natural communities; (2) preserve-design projects that can guide decisions on the optimal size and shape of natural areas for maintaining habitat integrity; and (3) studies that will answer questions regarding the population biology and taxonomy of rare species.

In accordance with applicable federal laws and University policy, the University of California does not discriminate in any of its policies, procedures, or practices on the basis of race, religion, color, national origin, sex, marital status, sexual orientation, age, veteran status, medical condition, or handicap. Inquiries regarding this policy may be addressed to: Affirmative Action Director, University of California, Agriculture and Natural Resources, 300 Lakeside Dr., 6th flr., Oakland, CA 94612-3560; (415) 987-0097.

A steering committee reviews prospecti twice a year, then requests more detailed proposals on selected projects. In 1991-92, the committee will give priority to research on (1) control of invasive exotic species and (2) management of the following vegetation types: native perennial grasslands, salt bush scrub, coastal dunes, vernal pools, riparian forests, and desert oases.

CNC accepts applications the year round; the committee generally meets twice per year to consider proposals. To receive CNC's standard two-page prospectus form or for more information, contact: Stewardship Coordinator, California Nature Conservancy, 785 Market Street, 3rd floor, San Francisco, CA 94103; (415) 777-0487.

Desperately Seeking Steward

California Academy of Sciences
Pepperwood Ranch Natural Preserve
seeks unpaid land steward to live in house on preserve in exchange for duties performed. For more information: Pepperwood Ranch Natural Preserve, 3450 Franz Valley Rd., Santa Rosa, CA 95404.

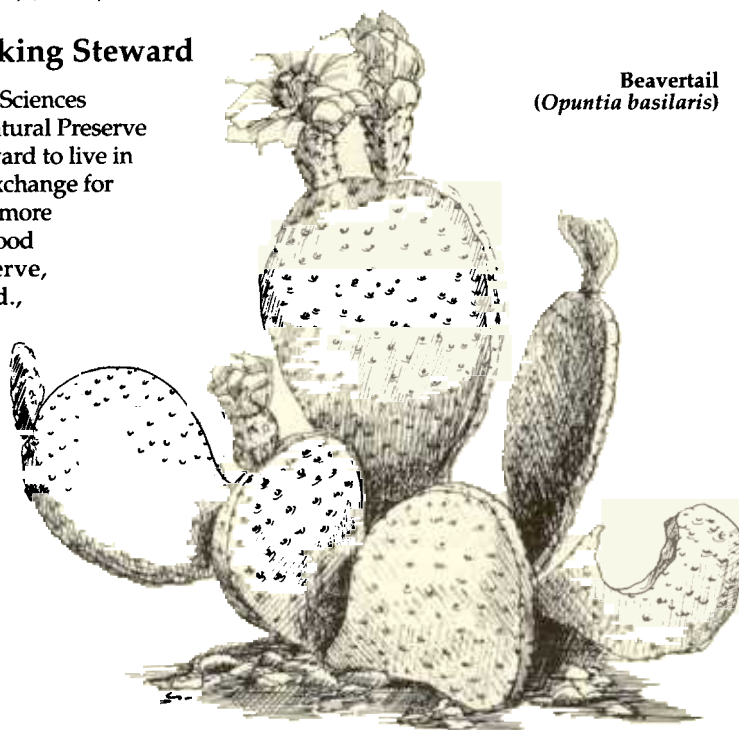
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Sarah Steinberg Gustafson
and Susan Gee Rumsey
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tran • sect (tran'sekt), *n.* 1. *Field Science.* A line along which physical and biological data are collected. 2. *Tech. Slang.* A cross-sectional 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.

Beavertail
(*Opuntia basilaris*)



M.L. Herring

04-UJ14

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