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In this issue:

- Research and Job Opportunities (p. 8)
- Celebrate Nature with the NRS (p. 3)
- Bodega expands MOMS (p. 2)
- NSF Special Competition (p. 3)
- New NRS Publications (p. 7)

Systemwide Office Column

Keeping Them Honest: The Role of the Field Biologist

Ask the typical person on the street what the hottest paradigm in biology is these days. The quick reply will likely be that siren call from Wall Street—biotechnology. Whether biotechnology is a revolutionary direction or no more than a biological tool kit in search of problems is not the subject of this essay. Instead, given the dominant existence of biotechnology, we might more usefully ask: "What is the role of the field biologist in its development?"

Most biologists, or at least the ones I like, agree that an important role of field ecology and evolutionary biology is to keep theorists honest by forcing a reconciliation of theoretical predictions with the reality of observations in the field. I suggest that a similar role exists in the case of biotechnologists.

The popular promoters and detractors of biotechnology have reached rarified heights of hype. In cases where biotechnology means commercial production of unexploited plants or the introduction of novel genomes into nature, long-term success—the truth of the technology—will come from careful field studies.

Indeed, without the empirical contributions of field ecology and evolutionary biology, much of biotechnology has little chance of being cost-effective. Not only would there be little information guiding the search for useful traits, there would be little basis for estimating the effects of

continued on page 6



Larry Ford © 1985

Big Creek Burns!!

On Saturday, July 6, a summer lightning storm ignited an oak tree in the Landels-Hill Big Creek Reserve along the Big Sur coast. The ensuing wildfire, called the "Rat Creek Fire," burned roughly 57,000 acres of the Santa Lucia Mountains of Monterey County in just two weeks.

The fire touched the entire Reserve—burning through all 8,000 acres and 23 vegetation types. Resident Reserve Managers Don Usner and Alisa Fine-man and Reserve Steward Evan Goldblatt were among those who witnessed the wildfire and its aftermath. What follows is Don's personal account:

DAY 1—SATURDAY:

By late morning, unstable tropical air had caused small cumulus clouds to develop off the coast. That afternoon, from the outdoor cafe where we were playing guitar, Alisa and I watched the clouds develop into large thunderheads. About 3:30, lightning began to arc down to the ocean.

As the clouds moved inland, a bolt struck the mountains near the town of Gorda. A few minutes later, another hit Dolan Ridge, on the Reserve. A plume

of smoke rose from Gorda, and engines from the Big Sur fire station sped south.

Within minutes, a second plume appeared above the Reserve. I called this fire in to the Forest Service dispatcher, who reported that all local fire crews had been sent to Gorda. A friend and I jumped into my truck and sped south, watching the puff of smoke grow into a billowing cloud.

At the Reserve we joined Evan, grabbed fire tools, and ran up Dolan Ridge—a 1,500-foot climb in the 80° heat. Near the summit we met the fire—a line of 2-foot flames burning steadily downhill through grassland into live-oak litter. We began cutting a fire line, clearing a 2-foot-wide ribbon to bare soil in advance of the wildfire.

After an hour of frantic labor, we saw a helicopter fly overhead. Soon, a Forest Service firefighter fell in beside us. Six others had been dropped north of the blaze, but with several fires burning in California, there was little hope of getting sufficient help to control this one. Our line was stopping the fire's front, but we were losing ground to its quickly expanding perimeter.

continued on page 4

Reserve Highlights

Bodega Deploys MOMS; Expands Data Base

After four years of planning, budgeting, and engineering, the Bodega Marine Laboratory (BML) and Reserve is implementing a large-scale data-management program, which includes an array of sophisticated data-acquisition sensors that make up its Meteorological Oceanographic Monitoring System (MOMS).

BML recently installed a six-ton mooring which will hold subtidal pressure and temperature sensors to measure wave and tide heights and ocean temperature. These sensors will be linked by cable to a lab-based recorder and statistical computer and monitor (SCM) designed by the SEADATA Corporation specifically for BML.

The oceanographic data will be accessible through the Lab's PDP-1173 mini-computer, as will data from an array of land-based meteorological equipment also linked to the SCM. To complete the coverage of the Reserve's habitats, a field monitor for recording tides in Bodega Harbor will be installed soon.

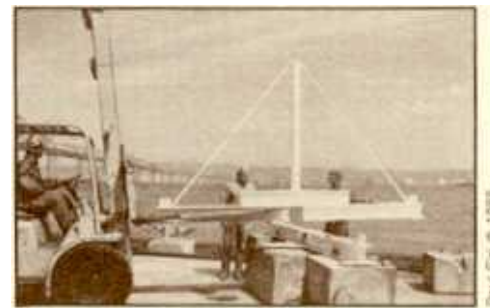
Three National Science Foundation (NSF) grants and one National Oceanographic and Atmospheric Association grant funded the system's hardware. The National Marine Fisheries Service supplied the concrete moorings, while the National Weather Service (NWS) arranged for the a U.S. Coast Guard vessel to

transport and deploy the ocean mooring. The NWS will access the wave and tide data every three hours by a remote interrogation unit in return for sharing the cost of maintaining the system.

This instrumentation is just one source of data feeding into BML's broad-based data-management system, which handles three types of information. For one, there are scientific data generated by Lab and Reserve-based research, by monthly research cruises on fixed transects, and by automated environmental monitors such as MOMS. Second are bibliographic and catalog data from BML's library, and third are the Lab's museum collections data.

Because managing each type of information requires different expertise, three separate staff positions were identified as central to the system's implementation. Following recommendations in NSF's 1982 report on Data Management at Biological Field Stations, BML first recruited a programmer to serve as research data manager.

In addition to acting as a consultant to users of BML's computers, the data manager is responsible for integrating the various information systems at the Lab. One of the first tasks is to compile and reformat marine transect data sets for entry into the Lab's computerized data base. These data summarize monthly plankton and benthic samples collected from 10- and 30-kilometer (6.2- and 18.6-mile) off-shore transects by BML's research vessel, the SUSAN K.



BML personnel attach a mooring superstructure to concrete blocks.

An academic librarian was hired in July to manage BML's library, which includes more than 1,000 reports of research conducted in the Bodega Marine Reserve. And in 1986, a museum technician will be hired to curate BML's vertebrate, invertebrate, and plant collections. Catalogs of these collection will eventually be computerized. The three positions are being funded by the Davis campus, which administers the Lab and Reserve.

When complete, BML's data-management system will provide researchers and students with a wide range of environmental data, biological inventories, and research representing the combined efforts of thousands of scientists over two decades.

—Paul Siri

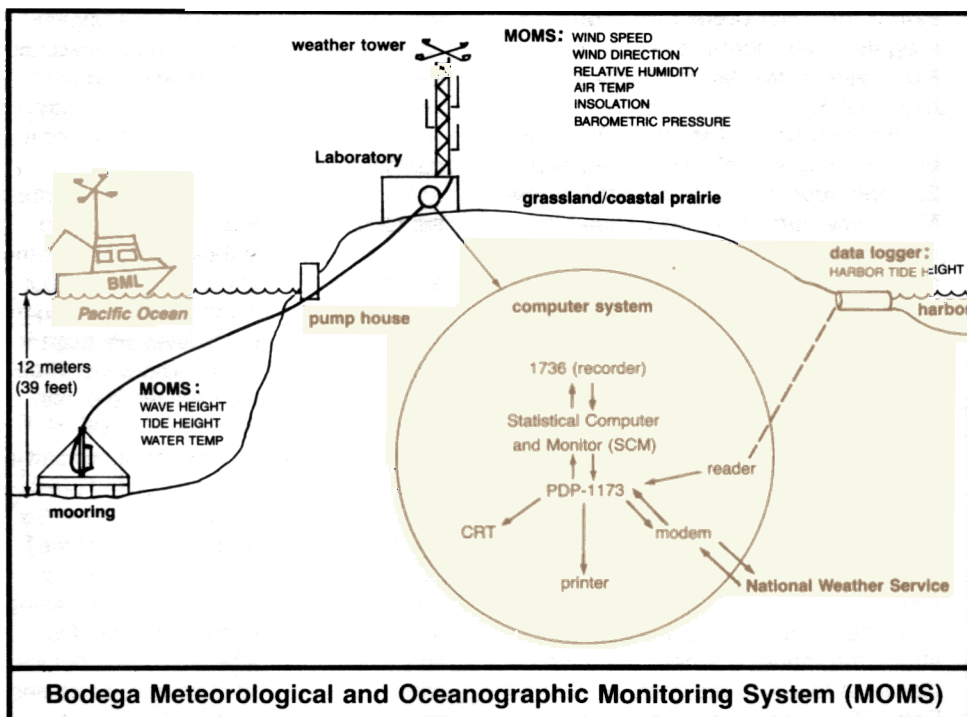
Management Services Officer, Bodega Marine Laboratory and Reserve

Chinese Delegation Visits Deep Canyon

On May 29, a delegation from the People's Republic of China visited the Philip L. Boyd Deep Canyon Desert Research Center. The delegation consisted of eight Chinese scientists, including affiliates of the Institute of Desert Studies in Lanzhou and the Chinese Geographical Society. Representatives of the Washington, D.C. office of the American Association for the Advancement of Science (AAAS) accompanied them.

After seeing the Living Desert Museum, just north of the Reserve, the group went to Deep Canyon. There they viewed the station's film and toured the facilities. Faculty Reserve Manager Bill Mayhew then escorted the group to Riverside via the Palms to Pines Highway, well-known by biologists for the ecological diversity it traverses on its way from the sea-level floor of the Coachella Valley to the forested peaks of the Santa Rosa Mountains.

The delegation, which asked to see Deep Canyon in particular, toured desert research sites all over the country in conjunction with the spring meeting of the AAAS.



National Workshop Spawns NSF Grant Competition for Biological Field Stations

The National Science Foundation's (NSF) Biological Research Resources Program funded a national workshop last fall on the needs of biological field stations. The Organization of Biological Field Stations (OBFS) convened the workshop, which involved representatives of 15 field stations and NRS reserves.

The purpose of the workshop was to provide NSF the information it needed to implement a five-year special competition for field station facility and equipment grants. NSF recently published the workshop's findings and recommendations in a 42-page report, *The Research Needs of Biological Field Stations*. NSF has also circulated a flier announcing the grant competition spawned by the workshop.

This report provides an important perspective on the contribution of field stations to nationally significant research. The nation's 178 field stations make available for study a diverse array of natural systems and interactions that cannot be reproduced in a laboratory or classroom. Such phenomena as the flow of energy and nutrients through a forest watershed, predator-prey interactions, or the adaptations of species to their environments must, of necessity, be studied *in situ*.

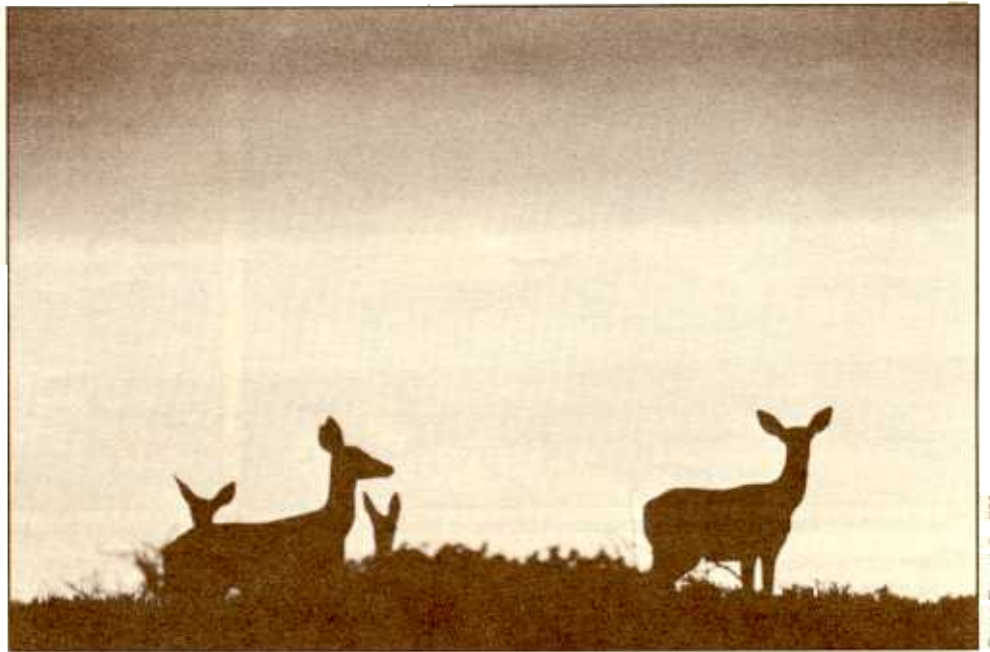
Biological stations facilitate field research by providing housing, laboratory, library, and computing facilities remote from the parent institution, but close to the phenomena under study. The resulting synergy between on-site facilities and the station's habitats and biota enable researchers to integrate observational and manipulative approaches in both field and laboratory settings.

The report emphasizes the need for national assistance in station development for two reasons. First, biological field stations are capable of supporting a wide range of research; more than 60 fields of study conducted at field stations are eligible for funding from 20 NSF research grant programs. Second, field stations typically support a national user community.

The report recommended four areas for increased support: (1) Housing, lab space, and specialized vehicles; (2) Computerized data management; (3) Long-term ecological measurements and site documentation; and (4) Graduate student research training.

The special NSF grant competition spawned by the report is designed to

continued on page 8



Gordon Howell © 1985

You're Invited:

- Event:** **In Celebration of Nature**, a lecture series commemorating the twentieth anniversary of the UC Natural Reserve System.
- Time:** Wednesday and Thursday evenings in April and May of 1986 at 7:30 P.M.
- Place:** UC Berkeley (Wednesdays).
UC Los Angeles (Thursdays).
- Cost:** \$40.00 for the series, in advance.
\$9.00 for a single lecture (space permitting), at the door.
- Speakers:** **Robert Bateman**, a Canadian wildlife artist who combines the style of ultra-realism with the composition of abstract expressionism. Bateman will speak on how he, as an artist, perceives natural landscapes and their resident wildlife. (April 16 & 17)
Joseph L. Sax, Professor of Law at the University of Michigan and author of *Mountains without Handrails*. Sax will address the legal and political aspects of managing national parks and other protected areas. (April 23 & 24)
Thomas Lovejoy, Executive Vice President of the World Wildlife Fund-U.S. Lovejoy will use the World Wildlife Fund's experience with experimental reserves in the Amazon rain forest to illustrate the significance of reserve design to conservation biology. (April 30 & May 1)
Ian McHarg, founder and chair of the University of Pennsylvania Department of Landscape Architecture and Regional Planning, and author of *Design with Nature*. McHarg will talk about the ecological approach to environmental planning and landscape design that he pioneered. (May 7 & 8)
Peter Raven, Director of the Missouri Botanical Garden and past-President of the American Institute of Biological Sciences. Raven, a specialist in tropical plant ecology, will discuss the value of the genetic resources in natural systems to agriculture, medicine, industry, and sustainable economic development. (May 14 & 15)
- Moderators:** **Kenneth S. Norris**, UC Santa Cruz Professor of Natural History and Founder of the Natural Reserve System (Berkeley).
Mildred E. Mathias, UC Los Angeles Professor Emeritus of Botany and Chair of the University-wide NRS Faculty Advisory Committee (Los Angeles).
- Sponsors:** The UC Natural Reserve System and UC Extension at Berkeley and Los Angeles.
- RSVP:** For more information, contact UC Extension at Berkeley (415-642-1061) or UCLA Extension (213-825-7093).



The Reserve's newly completed laboratory building at the University Center was reduced to ash, as was all the equipment inside.

Fire—continued from page 1

After another hour, we realized the futility of our efforts. Outpacing us, the fire had worked its way far down the ocean-facing slope. Jumping the line of flames, we gathered on Dolan Point to watch from the safety of the burned-out area.

The fire spread to brush on the western slope, growing more intense as it ran up the steep hillside. Flame-lengths reached 15 feet, culminating in a whirlwind of flames 25 to 30 feet high.

Cut off from retreat via the route we'd come, the three of us escaped the ridge at dusk through Rat Creek Canyon—an unfamiliar, barely passable canyon cut by cliffs and thick brush.

We reached the highway shortly after dark, then hitched rides to the Gatehouse, where Alisa and I live. The Big Sur Volunteer Fire Brigade had set up two engines to protect the house as flames de-

scended slowly toward it. Our home became the fire camp center, where Alisa ladled coffee, made sandwiches for the famished crews, and relayed messages concerning the fire-fighting effort.

About 9:00, I accompanied the fire brigade on a survey of structures in the Big Creek drainage. As we drove, Frank Trotter, a volunteer who had logged Big Creek in the '30s, told stories about the canyon of years past. "It used to be open in here" he said. "None of this brush growing up everywhere."

Decades without fire had allowed fuels to build up all over the Reserve. Now, after six months of below-normal rain, the dry vegetation would carry the wildfire far and wide.

DAY 2—SUNDAY:

This morning the blaze seemed to be under control. We spent the day mopping

up spot fires in Big Creek Canyon ignited by embers falling from the ridge above.

But that evening, warm, dry winds began to blow downslope, and the fire flared up. From a hillside above the University Center, we watched it back into the Big Creek drainage, engulfing a redwood grove in 150-foot flames and leaping up chaparral-covered slopes with 75-foot flames.

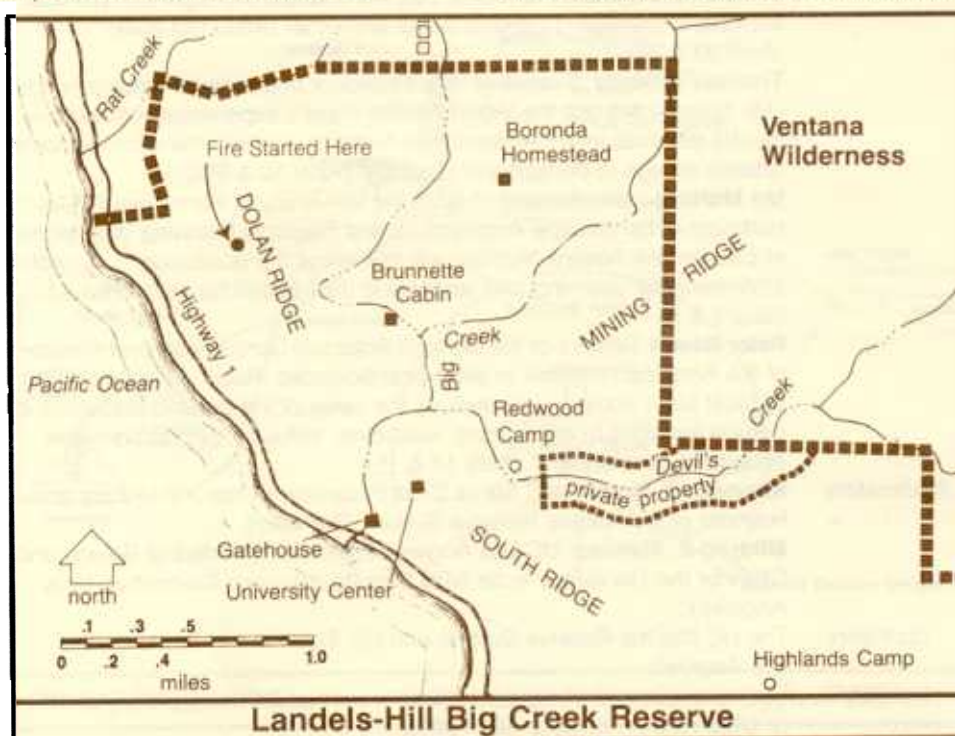
DAY 3—MONDAY:

We woke to shocking news—the fire had jumped a line at Rat Creek and destroyed three homes to the north. On our side, it had crossed Big Creek and was moving quickly up the north slope of Mining Ridge.

While surveying the area, Evan directed two fire crews to the Reserve. The crews—from as far away as New Mexico—were tired from weeks of work on other fires. They had no knowledge of the area, and were unable to establish radio communication with headquarters due to the steep terrain. The fire bosses, who were delighted to see the Reserve's detailed maps, enlisted us as guides.

George Sheppard, acting supervisor of the crews, drove with me to fire headquarters, where he ordered a retardant dropped on Mining Ridge and requested additional fire fighters, tree fellers, and a bulldozer. We then established an outpost above the University Center, and he directed the crews in the canyon below by radio. They were at work clearing understory trees and shrubs along the north bank of Devil's Creek. George planned to light a backfire from this fuel break to meet the oncoming flames on Mining Ridge, hoping to stop the fire's southerly advance.

About 10:30 A.M., the fire topped the ridge and started downhill into Devil's Canyon, consuming coastal scrub with 4- to 5-foot flames. It also climbed northeast



toward the Ventana Wilderness, burning chaparral with 20- to 30-foot flames. A flying ember started a spot fire half a mile southeast of the main flames, and others followed, speeding the fire's progress by leaps.

At 1:30, when the fire was about halfway down Mining Ridge, the crews began lighting the backfire along Devil's Creek. Two hours later, an ember jumped a fire line on the ridge north of the Gatehouse. Fanned by strong northwest winds, this spot fire burned downslope, threatening both the Gatehouse and the crews up the canyon. George ordered the crews to exit downstream, while Alisa, Evan, and friends hurried to evacuate our belongings.

At the Gatehouse, the crews lit another backfire along the base of Dolan Ridge, which met and stopped the spot fire's run toward the canyon mouth. In the middle of this operation, a column of black smoke rose above South Ridge, indicating the fire had crossed Devil's Canyon upstream. It happened so suddenly that we worried for the safety of two Cat operators who were cutting fuel breaks on South Ridge, just above the fire.

That night, we watched the fire descend the ridge seaward, toward the University Center. At first it seemed the buildings might be spared, but shortly after midnight the laboratory erupted in flame.

All but one crew left, too exhausted to keep working. About 1:00 A.M., the remaining crew lit a spectacular backfire just south of the Gatehouse. The backfire swept up the steep, brushy slope in minutes, its 30-foot flames stopping the fire's downslope advance.

DAY 4—TUESDAY:

In the morning we heard the Cat operators' harrowing tales of escape. One drove just ahead of the fire up South Ridge, then down the incredibly steep slope of Gamboa Point to safety. The other cut a swath in a circle and spent the night under his tractor while the fire burned around him.

The fire continued south, off the Reserve and toward the town of Lucia. At dusk, the steady downslope winds died, aiding an incredible effort of local residents, who saved all but one house in Lucia from burning.

AFTERMATH:

Two days later, I walked the Reserve with NRS personnel to survey the effects of the fire. Rocks and smoldering logs blocked roads and trails, making travel difficult. The University Center cabins were reduced to ash, as was the Boronda Homestead, the Brunnette Cabin, Redwood Camp, Highlands Camp, and the Gamboa Homestead at French Camp—in all, 10 of the 12 Reserve buildings and

2 of its 3 campsites. We found the remains of two oak trees on Dolan Point that apparently took the lightning strike and started the fire.

Overall, the fire was patchy, burning some areas more intensely than others. Where it ran uphill through oak woodlands, it left but skeletons of trees. In most mixed hardwood forests, however, it burned as a relatively cool understory fire that only lightly scorched the lower leaves.

Along the creeks, the canopy remained intact, though much of the understory burned completely. Virtually all of the grasslands, coastal scrub, and chaparral stands on the Reserve burned, most with moderate to high intensities.

Some redwood groves "crowned out," losing their canopies. In fact, most burned more thoroughly than expected, perhaps due to the large accumulation of extremely dry downed limbs and duff present in these stands.

The fire seemed to have little lasting effect on the Reserve's wildlife.

A flight over the area several days later revealed that many areas in the lower Big Creek watershed burned intensely, but the overall burn was moderate. The fire stopped for the most part at the boundaries of the nearby Marble Cone (1977) and Gamboa fires (1981).

Now, three months after the fire, large snags still smolder, and green shoots dot all the slopes. A variety of fire-adapted plants are resprouting plentifully, even before any rain has fallen.

The roads have been cleared, but most trails are still blocked by rocks and trees. Volunteer work crews, composed primarily of UC Santa Cruz students, have helped



Coffeeberry (*Rhamnus californica*), a common chaparral species, is the earliest and most prolific resprouter in the Reserve.

us clear the creeks of debris, open trails, and clean up the remains of cabins.

Because we anticipate problems with landslides and floods, we've evacuated the Gatehouse and closed Big Creek to classes and public tours until spring. The Reserve will, however, do all it can to accommodate researchers.

The fire has been a learning experience for all of us, and will continue to be as we watch the land recover. We now have a chance to develop and implement a prescribed fire program, which was complicated before by the tremendously high fuel loads. Though we regret the loss of Reserve and neighbors' structures, we plan to rebuild with the recognition that fire is a natural—and integral—part of the Big Sur landscape.

—Don Usner

Resident Manager, Big Creek Reserve

Post-Fire Research

The Rat Creek wildfire has provided many opportunities for post-fire studies in the Big Creek Reserve. Among the researchers already using the site is Larry Ford, a graduate student in the Dept. of Forestry and Resource Management at UC Berkeley. Immediately after the fire, Ford began establishing more than 50 plots in order to assess the recovery of coastal scrub and grasslands following fire. This study is being funded, in part, by a \$999.00 Mead mini-grant.

Part of a larger dissertation project that includes other central coast sites, Ford's research will assist land-management agencies in understanding and predicting vegetation changes, planning for wildfire recovery, and developing prescribed fire objectives.

Another Reserve user is Terry Jones, a research associate at UC Santa Cruz. Jones plans to take advantage of the lack

of brush cover to re-survey the Big Creek Reserve for archaeological sites.

The fire also provides a chance to study the response of Big Creek's population of Smith's Blue Butterfly (*Euphilotes enoptes* ssp. *smithi*), an endangered subspecies for which the U.S. Fish and Wildlife Service has prepared a recovery plan. Post-fire changes in hydrology, landslide morphology, and soil nutrient dynamics are but a few other potential research topics.

There is extensive—though qualitative—baseline data on the Reserve's geology and biotic communities, making comparative studies possible. In addition, a brochure focusing on the wildfire's effects will be available in February. For information on using the site, contact the Environmental Field Program, 223 Kerr Hall, University of California, Santa Cruz, CA 95064, (408)429-2836.

gene-environment interactions and the behavior of variants in nature. How would biotechnicians know what to look for? How can biotechnology "create" a useful allele without understanding the context of interactions and variance among alleles, genomes, populations, and environments? Can we realize the full potential of biotechnology without support from field studies?

Ecology and evolution, the theater and play of biology, must be viewed as essential components in any modern configuration of biology. They represent the holistic counterweight against the unbalancing effects of reductionism, that trend which is growing like Topsy in our fragmented universities. Just as political economies run by technocrats have foundered because they had sophisticated methodology but lacked systematic philosophy, a reductionist biology may proliferate techniques but is unlikely to progress intellectually.

Thus, there are important roles for the field biologist in the arena of biotechnology. But there are also situations where the tools and interests of the biotechnician may provide opportunities to explore fundamental questions in field biology. The introduction of a new allele with known phenotypic expression is an opportunity to study the dynamics of an artificial evolutionary event. The search for plant compounds of pharmaceutical and agricultural interest provides a chance to explore how plant secondary defenses vary among populations, both genetically and as a response to stress.

There is then a need for field ecologists and evolutionary biologists to invade the community of biotechnology, a process that should be seen as reciprocal altruism, not competitive displacement.

—C. Ronald Carroll
Associate Director, NRS

Editor's Note: In the Sept. 27 issue of *Science*, the Environmental Protection Agency (EPA) announced the formation of a Biotechnology Risk-Assessment Program designed to fund research on the interaction of recombinant microbes with the environment. The National Science Foundation (NSF) announced a related grant program in the Oct. issue of the *NSF Bulletin*, identifying microbial ecology as a priority for research development over the next five years through its Ecology Program. For more information, contact Ramone J. Seidler, U.S. EPA, 200 SW 35th St., Corvallis, OR 97333 and/or NSF's Patrick Flanagan (202-357-9734).

News and Notes

Reserve Managers Gather for Workshop: The Bodega Marine Laboratory and Reserve hosted the second annual NRS Reserve Manager's Workshop in early September. Twenty-five NRS personnel attended the three-day meeting to discuss a wide range of issues, including computerization for data analysis and management, emergency preparedness for oil spills and wildfires, control of invasive non-native species, management for genetic conservation, and methods of fostering reserve-generated research.

A highlight of the workshop was participation by the new director of the National Science Foundation's Biological Research Resources Program, James L. Edwards. Edwards introduced the new competition for field station grants and answered questions. Reserve Managers Dan Dawson and Steve Davenport then gave progress reports on their NSF facilities grants for the Sierra Nevada Aquatic Research Laboratory and Año Nuevo Island Reserve.

The workshop also provided the first opportunity for reserve personnel to meet Ron Carroll, the NRS' new associate director. Carroll outlined his plans to develop a graduate research fellowship program that supports reserve-based research. He also discussed possible new directions for the systemwide NRS office.

UCR Acquires Dixon Nest Collection:

The James B. Dixon Ornithological collection, now housed at UC Riverside, was dedicated on April 21, 1985. It comprises roughly 130 local nests and eggs, 85 of which are now on display.

Dixon (1886–1978), a prominent Escondido citizen, began collecting nests as a hobby in the early 1900s. In 1958, he gave part of his assemblage to Palomar College in San Marcos.

Recently, Dixon's family decided to move the collection from Palomar College to UCR. Dean of Natural and Agricultural Sciences Irwin Sherman provided \$6,000 to build new cabinets, and Zoology Professor Bill Mayhew went to work preparing the nests, along with matching birds, for display.

The Dixon collection joins a pre-existing exhibit of specimens from five NRS sites. The entire display, located on the second floor of the Life Sciences Building, is now on the route used for groups touring the campus. "We get swarms of grade-school students, as well as groups from the general public," says Mayhew. He also uses the exhibit as a teaching lab for his zoology classes, which use the knowledge gained from the display to identify animals and nests in the field.

Several members of Dixon's family attended the dedication ceremony, including his niece, Frances Beven Ryan, donor of the Ryan Oak Glen Reserve in San Diego County. Mrs. Ryan and Ethel Norman—Dixon's granddaughter—were responsible for UCR acquiring the ornithological collection.



Peregrine falcon (*Falco peregrinus*). A nest of this endangered species is among those now on display at the Riverside campus.

Publications

Carpinteria Salt Marsh: Wayne R. Ferren, Jr., Curator of the UC Santa Barbara Herbarium, has written a 300-page natural history of the Carpinteria Salt Marsh, complete with color photos of the site's habitats. Included is a section on the potential environmental effects of proposed alterations to the area.

This 230-acre marsh encompasses the 120-acre Carpinteria Salt Marsh Reserve, a component of the NRS administered by the Santa Barbara campus. The Reserve lies 20 miles east of campus along the Santa Barbara coast.

Ferren lists seven wetland vegetation types, including tidal channels, regularly flooded marsh and mud flats, and irregularly flooded low marshland. Upland habitat types include highly disturbed areas such as berms, dredge spoils, and roadsides, as well as dunes, grassland, coastal scrub, and cultivated vegetation.

At least 55 families and 252 species of plants inhabit the marsh, including 12 regionally rare species and 1 federally-listed endangered subspecies: Salt Marsh Bird's-Beak (*Cordylanthus maritimus* ssp. *maritimus*).

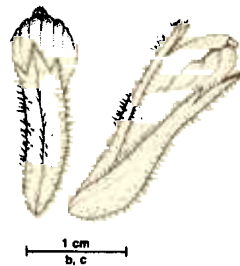
Most of the marsh, however, is dominated by pickleweed (*Salicornia virginica*), a succulent whose growth appears to be unaffected by tidal variations—at least within limits. An interesting series of aerial photographs in Ferren's book documents that pickleweed is killed by prolonged freshwater flooding that occurs when the mouth of the marsh is blocked by sand.

This new finding has important implications for the management of estuaries, says Dave Coon, assistant director of the Marine Sciences Institute at UCSB. "What's significant is that even if you lose *Salicornia*, you can get it back within a relatively short period of time—about ten years," he says. Coon adds that the book is so comprehensive—and so unusual in that respect—that it will remain a valuable resource for many years.

The book features a beautifully illustrated flora, abundant historical photographs—both aerial and ground-based—and numerous fold-out maps. It was in preparation for seven years, with partial funding from the systemwide NRS office.

Carpinteria Salt Marsh: Environment, History, and Botanical Resources of a Southern California Estuary (UCSB Herbarium Publication No. 4 and NRS Contribution Series No. 13) is available for \$15.00 from Wayne Ferren, Dept. of Biological Sciences, University of California, Santa Barbara, CA 93106. Make checks payable to the UC Regents.

Salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*), from one of the many illustrations in Ferren's book. This endangered annual reaches its northern limit at the Carpinteria Salt Marsh.



Flora and Fauna of Cold Canyon: Faculty and graduate students at UC Davis have compiled an 84-page natural history of the Stebbins Cold Canyon Reserve, including a flora, fauna, and discussions of the area's geology and land-use history. The book is illustrated with almost 40 drawings, figures, photos, and maps.

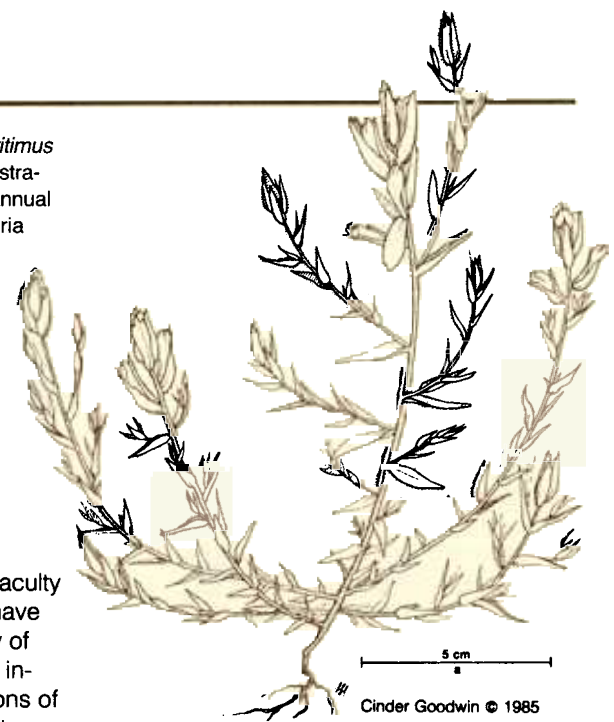
The Reserve, named in honor of G. Ledyard Stebbins, Professor Emeritus of Genetics at UCD, is located about 20 miles west of Davis on the north slope of the Vaca Mountains near Lake Berryessa. It spans 277 acres, but surrounding public lands bring the total land available for study to more than 4,000 acres.

The hot dry summers, cool wet winters, and beautiful springs of Cold Canyon typify the northern inner coast ranges of California. Chaparral and oak woodland cover the steep slopes, which range from 350 to 2,437 feet in elevation. Six plant associations—grassland, blue oak savannah, chaparral, chamisal, live oak woodland, and riparian live oak woodland—support at least 325 taxa of plants. Thirty-four species reach their northern or southern limits in the Vaca Mountains.

The book lists 175 resident species of vertebrates. The invertebrate fauna is much larger, but only a few groups have been catalogued in detail. Thirty-six species of butterflies are confirmed in Cold Canyon, and another 30 are believed to visit the Reserve. Sixty-four genera of aquatic and semi-aquatic insects are confirmed; terrestrial invertebrates are poorly understood at present.

Editor Ron Cole says the book is a good overview but "certainly not the definitive work." He hopes the book will stimulate more research in the Reserve so that future editions will be more complete.

Flora and Fauna of the Stebbins Cold Canyon Reserve (Publication No. 29 of the UC Davis Institute of Ecology), edited by Wesley W. Weathers and Ronald Cole, is available from the Institute of Ecology,



Wickson Hall, University of California, Davis, CA 95616, for \$3.50. Send checks, payable to the UC Regents, to the Institute, Attention: Pat Hale.

Reserve Brochures: Brochures on the following sites are now available: Pygmy Forest Reserve, Ryan Oak Glen Reserve, San Joaquin Freshwater Marsh Reserve, Philip L. Boyd Deep Canyon Reserve, and Santa Cruz Island Reserve. Designed for prospective reserve users, these publications describe the natural resources of the sites and contain information on reserve access and use. For free copies, contact Sarah Gustafson in the systemwide NRS office (see back page).

Twentieth Anniversary Report: *Natural Reserve System: The First Twenty Years* will be available in December. This 4-color 24-page booklet describes the purpose and history of the NRS, and highlights various teaching, research, and public service projects based on reserves. It features color photographs by Galen Rowell, whose images have appeared in such publications as *National Geographic* and *Natural History*. A limited number will be available from the systemwide NRS office.

Join the Friends: The Reserve System is pleased to announce the formation of the Friends of the NRS. This group will share in the successes of the System by participating in special events, visiting sites, and contributing to the reserves or the programs they support. *Transect* subscribers will receive a Friends brochure soon.

Opportunities

Job Opening: Resident Personnel at the Granite Mountains Reserve

The job classification has not yet been determined, but the position will entail administrative, maintenance, and management responsibilities. This Reserve is in the Mojave Desert, midway between Needles and Barstow. It is isolated (75 miles from the nearest grocery store), rugged, and has only minimal improvements. The position will be advertised early next year. Contact Bill Mayhew, Dept. of Biology, 3310 Life Science Bldg., University of California, Riverside, CA 92521, to be placed on the mailing list.

Mead Mini-Grants Available for Reserve-Based Research

Are you long on ideas but short of funds? The Giles W. and Elise G. Mead Foundation wants to help. In July, it renewed its grant to the Natural Reserve System, making \$10,000 available in the form of mini-grants of up to \$1,000 apiece for student research.

The Mead moneys, which are administered out of the systemwide NRS office, are to help fund fact-finding projects that will generate the data needed to make informed decisions affecting the management of NRS sites.

The grants have no application deadline; proposals will be considered as long as money is available. The funds are intended to cover expenses such as travel, data processing, and equipment. The money can also be used in producing the final report, which must present the findings and recommendations in a form useful to policy makers.

Initiated in 1983 with a grant of \$7,000, the Mead mini-grant program has sup-



The San Joaquin Freshwater Marsh Reserve, located adjacent to the Irvine campus, was the site of one Mead-grant recipient's study of water quality.

ported 8 student projects so far. One recipient was Elizabeth O'Brien, a graduate student in civil engineering who specialized in water resources at UC Irvine. She discovered that leachate from a land fill next to the San Joaquin Freshwater Marsh Reserve was toxic to plants. O'Brien's \$1,000 mini-grant allowed her to identify the components of the leachate using X-ray microprobe techniques and assess its threat to the Reserve.

Kevin Guse, a senior in zoology at UC Davis, received a \$700 grant to conduct an 8-month bird survey at the Jepson Prairie Reserve. The Reserve's Management Advisory Committee is considering substituting existing stands of introduced eucalyptus with a restored riparian forest of native trees. Guse judged the potential effects of this proposed change on Jepson Prairie's avifauna.

Mead funds have also supported work at Landels-Hill Big Creek Reserve, Dawson Los Monos Canyon Reserve, Santa Cruz Island Reserve, Granite Mountains Reserve, and Fish Slough, a potential addition to the NRS.

For more information, contact Dan Cheatham in the systemwide NRS office.

NSF Competition—

continued from page 3

address recommendations (1) and (2). For 1986, \$800,000 will be available with \$1,500,000 projected for 1987. Awards will be limited to \$100,000 per grant.

Grant requests will be evaluated using several criteria, including the scientific merit of the research supported by the improvements, evidence of broad research use and demand, and demonstrated need for the items requested. Although cost sharing by the station's parent institution is not mandatory, it "will greatly strengthen a proposal."

—Jeff Kennedy
Environmental Planner, NRS

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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 newsletter the *Transect*. For a free subscription—two issues per year—write or phone the systemwide NRS office: (415)644-4211; ATSS 8-532-4211.

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Natural Reserve System
2120 University Ave, 4th floor
University of California
Berkeley, California 94720



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