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NRS Associate Director

Vice President—Agriculture and Natural Resources James B. Kendrick, Jr. and NRS Director J. Roger Samuelsen have announced that applications will be received through October 31, 1984, for the new position of Associate NRS Director. Further information is available through the Agriculture and Natural Resources Personnel Office, University of California, Berkeley 94720 (415/644-4320). Refer to: A084-193. The Associate Director will coordinate and supervise systemwide programs and activities directed toward the management and use of reserves in the System, working in close cooperation with the University-wide NRS Advisory Committee and with campuses administering the several reserves. Demonstrated competence in a field science or in natural resource management as well as administrative experience equivalent to the chair of a department at the college or university level, or comparable qualifications, are required. A Ph.D. or appropriate professional degree in a field science or in natural resource management is also required.

In making this announcement, Kendrick and Samuelsen explained that the creation of the Associate Director position will facilitate Samuelsen's assuming additional responsibilities for the Division of Agriculture and Natural Resources as a whole in the area of external relations.

Name Change.

As the new masthead proclaims, our program name has been officially shortened from the Natural Land and Water Reserves System to the Natural Reserve System. The new streamlined name is easier to say and avoids past confusion with programs responsible for water conservation in the state. We like our new name. We think you will too.



Dr. Steven Nodvin supervises the chemical analysis of snow and lake water samples using a computer-controlled ion chromatograph. The sophisticated instrumentation is based at the Sierra Nevada Aquatic Research Laboratory.

Researchers Study Acid Precipitation At SNARL

John Muir called them the "Range of Light" as much for their granitic expanses and sunny subalpine forests as for the winter snows that give them their name. Yet the very granite that gives the Sierra Nevadas their timeless beauty also makes them especially vulnerable to an environmental threat of growing concern—acid precipitation.

Acid precipitation forms when oxides of sulfur and nitrogen emitted from factories, automobiles, and even woodstoves undergo chemical alterations in the atmosphere to produce powerful sulfuric and nitric acids. Dissolved in atmospheric moisture, the resulting precipitation — as rain, sleet, snow, or even fog — can be as acidic as vinegar with potentially lethal effects on the biota of receiving watersheds.

The effects are many, but the chains of cause and effect are difficult to document conclusively. In some cases the elevated acidity of lakes and streams is sufficient to kill aquatic plants and animals directly. In others, the organisms survive the acidity itself only to be killed by toxic substances

such as aluminum which are leached by the acid from watershed rocks and soils. In still others, bacteria and plankton at the base of the food chain are destroyed, starving the higher organisms that feed on them.

Acid precipitation may also have profound effects on terrestrial ecosystems, such as forests, although the total impact cannot be predicted with any accuracy as yet. Populations of soil microorganisms crucial to nitrogen cycling may be depressed, soil toxins may be mobilized, and tree growth and reproduction may be inhibited. With the potential for such major impacts, acid precipitation is a problem of significant concern to scientists and land managers alike.

Fortunately not all watersheds are equally susceptible to damage. Some, because of the chemical composition of their rocks and soils, are able to neutralize the acids before they become a problem, but granitic terrains such as the Sierra Nevadas have little capacity to neutralize acids and are thus par-

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Housing Addition Planned for Bodega

Plans have recently been completed to quadruple existing housing space for faculty, student classes, and visiting scholars at the Bodega Marine Laboratory and Reserve. The project — a joint venture of both the Davis and Berkeley campuses — will be implemented in phases over the next several years as funding becomes available. Plans call for the first phase to begin in the coming year.

The housing additions were designed by Bodega Bay architects J. Carson Bowler and John Cook after a rigorous competition for the project. The design calls for several new buildings in a compact and attractive cluster with existing housing facilities. To accommodate undergraduate students enrolled in intensive full-quarter courses at the lab, the existing 24-bed facility will be augmented by a new building with eight double-occupancy rooms with private baths. This addition will replace the capacity of an existing, substandard dormitory which does not afford adequate privacy for residents. This will free the dorm building for remodeling into a reading room and lounge for student use.

A complex of nine two-bedroom apartments will also be developed to house long-term faculty and graduate student researchers and visiting scholars from other institutions. For visitors staying less than a week and for those attending small scientific

meetings and symposia at the lab, a new unit with 42 single-bed rooms and group bathroom facilities is proposed.

To accommodate the increase in resident users, the existing dining hall will be expanded and a new meeting room constructed to handle an audience of up to one hundred people. The entire complex will also be taken off the existing septic system and connected to the community sewage treatment facility. This improvement will ensure the protection of the reserve's nearby marsh habitats.

The expansion project is motivated by the inability of existing facilities to meet the current demand for housing. There is little available housing in the region, and lab-based faculty and students are forced to seek housing as far away as Santa Rosa, Petaluma, and Sebastopol. Sonoma County's local coastal plan endorses the provision of employer-subsidized low-income housing, such as that proposed for the lab. Such housing should reduce the pressure on the limited number of rental units in the local community. Another expected benefit is a reduction in lab-generated commute traffic on scenic Highway One. Preserving limited highway capacity for recreational coastal public access is an issue of major concern to the California Coastal Commission.

Beyond meeting existing needs, the housing project will also provide essential support facilities for planned growth in the research and instructional programs at the lab. Most notable are the plans of the Davis

campus to significantly expand its programs in both the basic marine sciences as well as studies in coastal terrestrial biology. Administrative responsibility for both the marine laboratory and the surrounding reserve was recently transferred from the Berkeley campus to Davis to reflect that campus' increasing involvement with program development and support at the lab.

Although the lab and reserve are separate administrative entities, much of the research supported by the lab involves studies of the reserve's terrestrial and intertidal biota. Appropriately, the marine lab director is also the manager of the reserve. The lab's sophisticated computing facilities, workshop, equipment pool, and comfortable on-site housing greatly enhance the research capabilities for reserve users. Reserve habitats and biota also foster important teaching and research programs that would not otherwise be drawn to the lab. The proposed housing project will materially enhance the teaching and research productivity of both the marine lab and the reserve.

To date, all architectural design, environmental planning, and internal review and approval have been completed for the project. A fund-raising program has been initiated with the encouragement of several private donors. It is hoped that the new facilities will be completed by 1987 when the lab is scheduled to host the annual meeting of the Organization of Biological Field Stations for North America.

—Paul Siri
BML Management Services Officer



Aerial view of Bodega Head looking south along the San Andreas fault zone to Tomales Bay. The Marine Lab is adjacent to Horseshoe Cove and the housing facility is adjacent to Bodega Harbor (circled).



The Bodega Marine Reserve provides faculty and students with a diverse array of subtidal, intertidal, and terrestrial habitats in close proximity to the sophisticated facilities and equipment of the Bodega Marine Laboratory.

NSF Funds Computers at Bodega.

The Bodega Marine Laboratory recently received two grants from the National Science Foundation, totaling \$75,000, to expand its on-site computing capabilities. The first grant will upgrade the lab's mini-computer to a PDP-1173 machine and add a 40-megabyte hard disk for enhanced data storage and retrieval. An emergency power supply is also funded to protect against the loss of valuable data and ensure uninterrupted operation in the event of a blackout. These improvements will give the lab computing capability comparable to that for campus-based shared mini-computers.

The second grant funds a sophisticated remote recording weather station and development of a sub-tidal wave and tide data acquisition system for direct link-up to the computer. Software for data base management and preparation of statistical summaries is also funded.

To support new expanded computing capability, the Davis campus has recently funded two new full-time staff positions for a programmer and a laboratory assistant, to coordinate data base development and maintenance. In addition, a database management advisory committee of faculty and administrators has been established to provide academic and policy guidance for the expanded program.

The database will consist of oceanographic and meteorological data provided by the new sensors as well as data from more traditional terrestrial and intertidal biological inventories, population surveys, and bi-monthly research vessel cruises. The bibliography of lab-supported research publications, as well as data on research grants and the lab's synoptic collections, will also be computerized. A major task will be computerization of the lab's 13 years of hardcopy data files of each of the above categories.

Once completed, the new data base should be an invaluable research resource for both lab and reserve users alike.

—Paul Siri

BML Management Services Officer

A New Perspective for Environmental Research

As representative samples of the California landscape, NRS reserves afford unparalleled opportunities for the study of the dynamics of natural systems. The following editorial, reprinted with permission from the author and *BioScience* magazine, highlights a newly emerging perspective in the study of whole landscapes that may be of interest to reserve users.

AN ECOLOGY OF THE LANDSCAPE

Ideas in profusion flow daily through our lives. Being alert for that rare idea whose significance may mushroom in the future is not only an opportunity, but a responsibility. Here is my candidate for the decade.

What do the following have in common? Dust-bowl sediments from the western plains bury eastern prairies, introduced species run rampant through native ecosystems, habitat destruction upriver causes widespread flooding downriver, and acid rain originating from distant emissions wipes out Canadian fish. Or closer to home: a forest showers an adjacent pasture with seeds, fire from a fire-prone ecosystem sweeps through a residential area, wetland drainage decimates nearby wild-life populations, and heat from a surrounding desert desiccates an oasis. In each case, two or more ecosystems are linked and interacting. An action here and now has an effect there and then. Each case involves at least two portions of a landscape, which in turn is a specific heterogeneous land area extending in similar form for kilometers.

What theory explains the spatial heterogeneity of energy, nutrients, water, plants, and animals at the level of a landscape, the setting in which we live? Alas, none. Within landscapes, from suburbia to wilderness, scientists study relatively homogeneous ecosystems (i.e., landscape elements), such as a marsh, a woodlot, an agricultural field, or a housing development.

Landscape ecology, in contrast, focuses on (1) the spatial relationships among landscape elements or ecosystems, (2) the flows of energy, mineral nutrients, and species among the elements, and (3) the ecological dynamics of the landscape mosaic through time. Like a cell or a vertebrate, the landscape therefore exhibits three characteristics, structure, functioning, and change, and indeed represents a challenging research frontier.

An ecology of the landscape is nascent and timely. The field will be developed by basic biologists and ecologists, as well as geographers, foresters, planners and landscape designers, social scientists, wildlife biologists, agriculturalists, and others. Important principles will be drawn from each field, but a central body of landscape ecology theory is likely to emerge concurrently. Such theory may suggest novel solutions to critical environmental problems.

I feel the pulse of landscape ecology quickening. This embryonic area of study apparently has its origins in central Europe. Today universities in several European countries offer programs of study in the field, and a few have an established chair in landscape ecology. In 1981, an international congress was held by the 600-member Netherlands Society for Landscape Ecology, and in 1982, the *sixth* international symposium on problems in landscape ecology was held in Czechoslovakia. Also in 1982, an International Association for Landscape Ecology was formally established, with officers in Eastern Europe, Western Europe, and North America.

Yet, hardly a handful of North American ecologists and geographers has participated in and followed these developments abroad. The glimmerings of interest in the United States are evident, however, as seen in an April 1983 National Science Foundation-funded workshop on landscape ecology held at Allerton Park, Illinois. This emergence of the landscape ecology idea in North America promises original and powerful approaches, quite different from, but complementary to, both the pioneering and current approaches in Europe. I believe a new area of study today must be idea-oriented, not nation- or language-oriented. Thus sustained efforts will be needed to maintain a synergism among scholars with these new North American perspectives and the developments abroad in the field.

A richness of empirical studies, emergent theory, and applications lies ahead. With principles waiting for the curious, and with an expected short lag period between research and the amelioration of environmental and human societal problems, let the young in spirit, looking to the future, "Think Landscape."

RICHARD T. T. FORMAN
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Archaeological Survey At Big Creek

This past summer a team of students and professional archaeologists completed the first part of a two-year survey of the archaeology of the Landels-Hill Big Creek Reserve on the rugged Big Sur Coast. Sponsored jointly by the UC Santa Cruz Summer Session and the Campus' Environmental Field Program, the survey is being conducted as an archaeological field school exercise.

For most of us, archaeological field work conjures up images of elaborate excavation projects. Although excavation is ultimately necessary to answer detailed questions about the past, most modern archaeology emphasizes site location and protection over excavation, unless the site is threatened with imminent destruction. Consequently, the main objectives of the Big Creek study are to comprehensively inventory the

reserve's archaeological sites and to develop plans for their protection and management. Even in the absence of an excavation program, much can be learned about the aboriginal inhabitants from the study of surface artifacts and the analysis of the environmental context in which they occur. Developing such a preliminary understanding of Big Creek's prehistory is a secondary objective of the survey.

Although some archaeological work was conducted on the Big Sur Coast as early as the 1950s, the area is still one of the most poorly understood in California. The Esselen Indians occupied the region from Big Creek north to the Carmel Valley when the Spanish colonized California. But unfortunately, they were among the first tribes to die out under Spanish rule and little is known of their culture and lifestyle. The Big

Creek survey holds the promise of filling a significant gap in our knowledge of the prehistory and adaptive strategies of this little-known aboriginal group, and their impact on the reserve's habitats and biota.

With approximately 7,000 acres to survey, developing an efficient search strategy was an early and pressing need for the survey team. To develop such a strategy, survey workers visited the State Office of Historic Preservation's Regional Archaeological Clearinghouse at Sonoma State University to review existing site survey records for southwestern Monterey County. There was little information on file. Only two historic sites and four prehistoric sites had previously been recorded in the northern sections of the reserve, one of which had been partially excavated.

There were, however, several indications that more sites existed on the reserve as the field notes of botanists and other reserve users had recorded the telltale occurrence of black earth and shell fragments well-removed from the shore. With so little data available to effectively predict site locations, the initial search strategy called for three-person survey crews to systematically walk the entire reserve in transects spaced 60 to 90 feet apart. The reserve's ruggedness and abundant poison oak soon forced a modification of this approach that team members humorously dubbed the ASAP strategy — "As Systematic as Possible."

In spite of these problems, the first year's field work produced some remarkable findings. Using the revised survey strategy, roughly half of the reserve's 7000 acres were canvassed, documenting a total of 28 sites: sixteen prehistoric, seven historic, and five sites with both prehistoric and historic surface materials. These materials included shell and bone scraps, shell beads, fire-altered rocks, stone tools, projectile points, and the artifacts of early homesteaders. A total of 142 surface artifacts was collected at the 28 sites, including 119 of prehistoric manufacture. In addition, 40 historic features such as old fencelines, grave markers, bridges, and roads were also recorded.

Given the ruggedness of the terrain, the number of prehistoric sites was a surprise. In a similarly rugged setting in the King Range on California's northern coast, Davis researcher Valerie Levelett found less than three sites per 1000 acres. So far, more than twice that density has been documented for the Big Creek Reserve.

Also surprising was the wide range in site elevation and distance from the shoreline, particularly since 19 of the 21 prehistoric sites showed abundant evidence of shellfish harvest. The location of aboriginal garbage dumps, called "middens" by archaeologists, range in elevation from 400



Archaeologist Terry Jones (r.) and students take field notes on Indian artifacts found at the Landels-Hill Big Creek Reserve on the Big Sur Coast.

Galen Rowell

to 2300 feet above sea level and extend inland up to 2.2 miles from the shore.

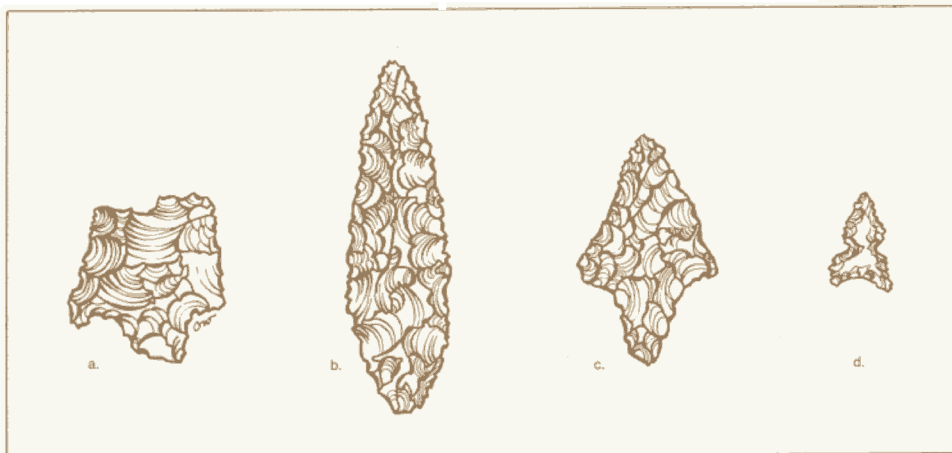
This variation in shell midden location clearly represents a wide range of time and energy that aboriginal inhabitants were willing to invest to obtain these marine resources. One possible explanation for this variation is that middens further from the shore may have been sited to more effectively exploit terrestrial plants and animals over those of the marine environment. (Undoubtedly, such factors as water supply, level ground, and a desire to avoid low coastal fog may also have played a role). Since it is unlikely that all of the sites were occupied concurrently, they may document a time sequence of changing adaptive strategies with shifts in the dependence on marine versus terrestrial resources. Such shifts are of great theoretical interest to archaeologists trying to understand relationships between aboriginal peoples and the resources of their environment.



Rugged topography and dense vegetation of the Landels-Hill Big Creek Reserve made a thorough archaeological survey a challenge.

To sort out the possible changes in coastal exploitation patterns, archaeologists need to determine the timing and duration of site occupation to see which were used simultaneously as parts of larger adaptive systems. To accurately make such determinations, systematic excavation data are ultimately needed. In their absence, stylistic similarities between artifacts found on the reserve and those dated elsewhere can be used to develop preliminary estimates of the timing and duration of aboriginal occupation. Projectile points are particularly useful for this purpose.

Excavation data from Monterey, San Luis Obispo, and Santa Barbara show stylistic trends in projectile points that appear to correlate with those for the Big Sur Coast. On the basis of these similarities, the 20 projectile points collected at Big Creek suggest an occupation of the Big Sur Coast spanning three stylistic periods from 4,000 years before present (B.P.) through to the arrival of the Spanish. Five large, heavy, stemmed projectile points indicate aboriginal occupation from 4,000 - 2,000 years B.P. Similar forms from the Monterey Peninsula were recently dated from radi-



Big Creek projectile points: a) early harpoon point with broken tip, ca. 2000 B.C. to 500 A.D., b) hafted knife blade, pre-1-A.D., c) late harpoon point, post-1000 A.D., d) desert side-notch style bow and arrow point, post-1000 A.D.

ocarbon measurements of associated deposits at 4,000 years B.P. Three smaller projectile points, also stemmed, indicate continued occupation from 2,000 to 1,000 years B.P. The most recent phase of prehistoric occupation is represented by the remaining small, lightweight, unstemmed projectile points in the "Desert Side Notch" style. These points, commonly associated with bow and arrow use, have been correlated throughout California with occupation between 1200 and 1700 A.D.

The age span of the Big Creek sites is particularly noteworthy. Dates from the nearest previously-studied sites at Soberanes Creek, 30 miles to the north, and at Willow Creek, 20 miles to the south, indicated human occupation no earlier than 100 years A.D. The Big Creek finds extend the record by more than 2000 years.

When these preliminary dates are correlated with site elevation and distance from the shore, an intriguing pattern emerges. All middens yielding the oldest projectile points are situated inland from the top of the first coastal ridge. Points dating from 2,000 to 1,000 years B.P. are found in all types of topographic settings, and points from the most recent occupation are found only at mid-slope terraces and ridge top sites closest to the shore.

Archaeologists hypothesize that these shifts in site locations over the past 4000



This 100-year old cabin at the Baronda homestead site is one of several post-aboriginal historical sites documented by the Big Creek archaeological survey team.

years indicate changes in the exploitation strategies of the region's aboriginal inhabitants. The earliest inhabitants appear to have had a more terrestrially-based strategy of subsistence and settlement than did later occupants. Although marine resources were exploited, these foods were not of sufficient dietary importance to locate settlements closer to the shore.

By A.D. 100 the range of site locations had expanded to mid-slope terraces and other nearshore sites, with a possible abandonment of some inland sites. Several explanations for this shift have been proposed. The previous adaptive strategy emphasizing terrestrial resources may have been so successful that resulting population increases forced a more intensive exploitation of marine resources. Alternatively, marine resource exploitation from inland camps may have been unsuccessful due to the high cost of time and energy in transporting marine resources inland. If this latter explanation is true, the location shift by A.D. 100 may represent replacement by a new cultural group.

The final settlement shift to nearshore sites would indicate an intensification of marine resource exploitation. This shift may indicate further territorial competition for limited resources or it may indicate the evolution of a trade network using exchange of marine resources to even out seasonal fluctuations in food availability.

Through analyses such as these, archaeologists use material artifacts to reconstruct past cultures and the strategies they used for survival. Much work remains to be done and excavation data will ultimately be needed to distill fact from theory, but one thing seems clear. The archaeological resources of the Big Creek Reserve will materially expand our understanding of the prehistory and aboriginal cultures of the beautiful Big Sur Coast.

—Terry Jones
UCSC Archaeology Instructor



Research assistant, Perry Edgerton, lowers a Scott water sampling bottle through the ice at Eastern Brook Lake, site of a five-year study of acid rain and lake-watershed interactions in the eastern Sierras.

Acid Rain *Cont'd. from p. 1*

ticularly vulnerable.

Most of the research on acid precipitation has been conducted in Scandinavia, Europe, and eastern North America. Until recently, little research has been conducted on acid rain in the Sierras, even though they lie on the vulnerable downwind side of the most populous state in the nation. Researchers from the Santa Barbara and the Riverside campuses are now beginning to study the potential effects of acid rain and snow on the Range of Light.

Their base of operations is the Sierra Nevada Aquatic Research Laboratory, more commonly referred to as SNARL by its users. Once a US Fish and Wildlife Service research station, SNARL is now administered by the University of California's Santa Barbara campus as a component of the Valentine Eastern Sierra Reserve. Located at an elevation of 7,000 feet at the base of the eastern Sierra escarpment, SNARL provides researchers with ready access to the Sierra high country as well as Great Basin habitats east of the range.

A three-year project begun in June of 1981 has generated important baseline data on Sierran lakes and acid precipitation with \$35,000 in funding from the UC Water Resources Center. Spearheaded by Santa Barbara Professor John Melack, graduate student John Stoddard, and SNARL Manager Dan Dawson, the current chemical status of 73 alpine and subalpine lakes was determined in three surveys during the summers of 1981 and 1982. In addition, precipitation chemistry and volume for both rain and snow was monitored at SNARL

and at the 9600-foot level of Mammoth Mountain. The latter site is the highest precipitation monitoring station in the state, and its snow pack is broadly characteristic of the high-elevation snow pack for much of the Sierra Nevadas.

The lake survey revealed that high Sierran lakes are mildly acidic, but no more so than unpolluted snow. Atmospheric carbon dioxide gives unpolluted snow a slight natural acidity. More importantly, however, the data confirmed that Sierran lakes have few dissolved ions with little capacity to buffer or neutralize acid inputs.

The precipitation data were particularly interesting. Snow in the fall, winter, and spring was not abnormally acidic. Summer rain was up to 100 times more acid than winter snows. Fortunately, 10 to 30 times more water falls as snow than as rain so the lakes are dominated by the mild natural acidity of the snow pack. Because Sierran lakes have only a weak buffering capacity, increases in snow acidity could have a major impact on these lakes. Snow packs in upstate New York, for example, are already so acidic that spotted salamanders can no longer survive in snowmelt ponds there. Researchers worry that similar biotic stresses might occur in the Sierras if snow-pack acidity increases significantly. The Santa Barbara research provides the important baseline against which potential future changes such as these can be monitored.

Building on the foundation of baseline data developed by this research, John Stoddard is embarking on an intensive study of the limnological and ecological patterns of a representative alpine lake and watershed for his doctoral research. Although his study site, Gem Lake, is located in the John Muir Wilderness at an elevation of 11,200 feet, it is only 25 miles from SNARL by road and trail, making it easily accessible for long term research.

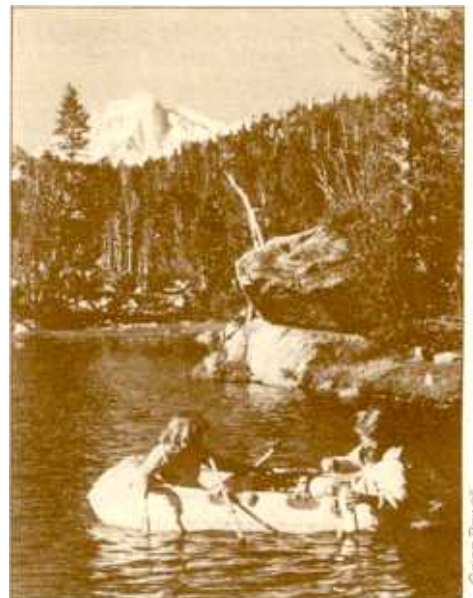
Ultimately, researchers would like to have sufficient understanding of lake and watershed interactions to be able to predict changes in the chemical composition of Sierran lakes as precipitation chemistry changes. To do so, it is essential to understand the sources and sinks of chemicals and nutrients in a natural watershed and how they are cycled through contiguous terrestrial and aquatic ecosystems.

Researchers from the Department of Soil and Environmental Science at the Riverside campus have set out to do just that in a five-year study initiated last summer. With \$130,000 in funding from Southern California Edison's Program of Excellence in Energy Research, Dr. Steven Nodvin, Dr. Lanny Lund and Dr. Al Page from the Riverside campus will monitor the chemical and water budgets of the Eastern Brook

Lake watershed. Located at an elevation of approximately 10,000 feet some 19 miles from SNARL, Eastern Brook Lake lies just outside the John Muir Wilderness in the same Rock Creek drainage as Gem Lake. Integrated watershed studies that investigate interactions between terrestrial and aquatic systems are very complex. Researchers will use sophisticated computer-controlled chemical analyzers housed at SNARL to process the thousands of water and soil samples to be taken over the life of the project. Research results will provide important detailed data on the chemical dynamics of high Sierran watersheds, giving scientists insight into their likely response to acid precipitation.

The California legislature recently acknowledged the importance of such research by passing the Kapilov Acid Deposition Act of 1982. Through a system of taxes on industrial polluters, some \$22 million will be generated over the next five years for pollution research with funding administered by the State Air Resources Board (ARB). Most of the funding is targeted for the Los Angeles Basin, but some is available for research in the Sierras. Although the Santa Barbara project was among the first detailed studies in the Sierras, many other research projects are now underway, spearheaded by researchers throughout the UC system. A year and a half ago the National Park Service also began a program of research in acid precipitation in the Sierras. A study of the Emerald Lake basin of Kings Canyon National Park recently received major ARB funding, and Santa Barbara faculty are actively involved in that project as well.

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Research assistant, Perry Edgerton, and reserve manager, Dan Dawson, lower a water sampler and a temperature/dissolved-oxygen probe into Eastern Brook Lake after the spring thaw.

Acid precipitation research is not the only work currently supported by SNARL. Geologists from the Santa Barbara campus are using SNARL as a base of operation for their studies of magma injection and crustal deformation in the adjacent Long Valley Caldera. A volcanic hazard alert is currently in effect for the region. Funding is provided by the USGS Earthquake Prediction and Hazards Reduction Program. Another study by Dr. John Melack and his colleagues from Santa Barbara is in its sixth year of a comprehensive analysis of the ecology of Mono Lake, a half-hour drive north of SNARL. This project has received funding from the Packard Foundation, the National Geographic Society, the Conservation Endowment Fund, the Los Angeles Department of Water and Power, and the Santa Clara Audubon Society.

In addition, Professors Jack Bradbury and Sandra Vehrencamp from the San Diego campus, have just begun a study of the energetics and behavioral ecology of the sage grouse, a species that engages in spectacular courtship displays in meadows less than a mile from SNARL. Dr. Jeff Dozier and his colleagues from Santa Barbara are in their sixth year of a long-term study of snowmelt hydrology in the High Sierras. Dr. Dozier is developing computer models to predict snowmelt runoff from satellite remote sensing data. The field work needed to test the models is based out of SNARL.

Out-of-state researchers also find SNARL a valuable research resource. The University of Michigan's Dr. Frank Hooper has characterized SNARL as the only site in North America where he can study the effect of altered stream flows on populations of aquatic insects and the fishery they support. This research is made possible by weirs on the natural and artificial channels of Convict Creek flowing through SNARL. These control structures allow adjustments to the flow regime of an otherwise natural stream. Dr. Hooper's research will provide much-needed data to predict the ecological impact of the many small hydroelectric power projects now being proposed throughout the western United States.

Such diversity of research is clear evidence of the value of SNARL as a remote field station for regional environmental studies. SNARL is open for research and teaching use year-round and use is by permit only. Permits can be requested by contacting Ms. Shirley Clarke at the Marine Science Institute, University of California, Santa Barbara 93106.

—Jeff Kennedy
NRS Environmental Planner

News and Notes

Big Creek Designated A Biosphere Reserve. The United Nations Educational Scientific and Cultural Organization (UNESCO) recently designated the University's Landels-Hill Big Creek Reserve as a component of the California Coast Ranges Biosphere Reserve. The area joins a worldwide network of 226 biosphere reserves in 62 countries. Under the aegis of UNESCO's program on Man and the Biosphere (MAB), this network of protected samples of the world's major ecosystem types is devoted to conservation of nature and scientific research. Each reserve serves as a benchmark against which human impact on the environment can be measured.

In notifying the NRS of the award, the MAB secretariat for the U.S. Department of State summarized the award's significance by noting that biosphere reserve designation "... reflects international recognition of its scientific and educational value. It also represents a responsibility to use the area to develop the knowledge and practical skills for sustainable conservation of representative examples of the world's major ecosystems, and to share new insights with scientists, resource managers, and policy makers, both domestically and internationally."

Portions of the Los Padres National Forest's Ventana Wilderness encompassing the Big Creek watershed were also incorporated into the Biosphere Reserve. The Big Creek Reserve is located on the rugged Big Sur Coast 45 miles south of Monterey.



Big Creek, third largest stream on the Big Sur Coast, drains the heart of the new Biosphere Reserve on the Big Sur Coast.



Sherman Chickering, seen here amidst herbarium sheets from his personal collection, made important contributions to the newly published flora of the Chickering American River Reserve.

American River Flora. A flora of the headwaters basin of the North Fork of the American River has recently been completed by faculty and graduate students from the Davis campus Botany Department. The study area centered on the Chickering American River Reserve and covered a 31-square-mile area above the 5750-foot elevation. The study area also encompassed the nearby Onion Creek Experimental Forest administered by the US Forest Service's Pacific Southwest Forest and Range Experiment Station.

The survey documented 547 species and subspecies of vascular plants representing more than ten percent of the vascular flora for the state. Such high species diversity in such a small area is the result of diverse metamorphic, volcanic, and igneous substrates and a wide range of slopes and aspects. Habitats surveyed included white fir-mixed conifer forest, red fir forest, lodgepole pine forest, aspen groves, willow thickets, mixed riparian woodland, wet and dry subalpine meadows, montane chaparral, alpine lake margins, and alpine fell fields. The Pacific Crest Trail traverses a corner of the reserve and study area.

Much of the flora represents over ten years of field work by Sherman Chickering, a San Francisco lawyer and prominent Berkeley alumnus. The Chickering Reserve is administered by the Berkeley campus. The flora was published in the November 1983 journal of the Botanical Society of California — *Madroño* 30(4):52-66. A limited number of reprints are available from the systemwide NRS office.

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UC Davis researchers collect aquatic insects from the Jepson Prairie Reserve's Olcott Lake. Its summer-dry lake bed provides the only known habitat for Solano grass (*Tuctoria mucronata*), a state- and federally-listed endangered species.

News and Notes *Cont'd. from p. 7*

Master Plan Wins Award. A student-prepared master plan for the University's new 1600-acre Jepson Prairie Reserve has received an award of merit in the research category from the Northern California Chapter of the American Society of Landscape Architects. The plan was developed as a class project in landscape architecture and environmental design under the guidance of Davis professor Kerry Dawson. It assembles resource inventory data on the natural and cultural features of the site and develops a range of options for habitat management, endangered species preservation, and facility development. It also forms the basis for a five-year management plan now being prepared for the site. The reserve features perhaps the finest remnant of California's native bunchgrass and vernal pool habitats, including habitat for three federally-listed endangered plant and animal species.

In a blind-juried competition, eight jurors praised the project for its sound use of biological data as the basis for plan development, and for its identification of future research needs. Jurors also appreciated its value for site interpretation and educational use, characterizing it as a cross between a management plan and a minitextbook. The sophistication of the plan's maps, charts, and tabular summaries was also cited in light of the exceptionally small budget for the project. The plan is part of a two-year traveling exhibit now touring the west coast.

The Jepson Prairie Reserve is a cooperative project of The Nature Conservancy and the NRS. The Conservancy purchased the reserve in 1980 from the Southern Pacific Land Company as part of its \$15 million California Critical Areas Program. The Conservancy and the University recently concluded a cooperative management and use agreement which incorporates the prairie into the University's reserve system.

In Memoriam. After a year-long illness, Bruce Burns II died of cancer last November. At his request, his ashes were scattered on the desert property he loved so much. The Burns Piñon Ridge Reserve, near Joshua Tree National Monument, is named in honor of his parents, who conveyed the land to the University for teaching and research use. The reserve is administered by the Irvine campus.

Bruce is survived by his mother, Jean Burns, and by his children, Elizabeth, 20, and Gordon, 17. His wife, Kay, died in 1980. His caring warmth, sense of humor, and great love of the natural environment will be sorely missed by all who knew him.

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tran' sect (trăn' sêkt), 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 representative cross-section of California's natural diversity in a system of natural areas and field stations specifically reserved for teaching and research use. 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 532-4211).

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