The NRS
# Transect

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### *Report of the Director*

### Q: When is a reserve more than a reserve? [A: When it's also a regional field station.]

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

Yes, the NRS does include many valuable "protected natural areas" for our study, with current acreage totaling around 140,000. In addition, however, about half of our 32 sites serve as important field stations for regional research that extends well beyond the property boundaries of each reserve. And still other sites hold the promise of becoming such regional centers.

Our lead story in this issue of *Transect* discusses the role that the Valentine Eastern Sierra Reserve — primarily, its component, the Sierra Nevada Aquatic Research Laboratory (SNARL) — has played as facility and think factory for ecological research at, among other places, Mono Lake.

Other reserves now serving as regional field stations include, from north to south: Eagle Lake Field Station, Angelo Coast Range Reserve, Bodega Marine Laboratory and Reserve, Año Nuevo Island Reserve, Younger Lagoon Reserve (with adjacent Long Marine Laboratory), Hastings Natural History Reservation, Landels-Hill Big Creek Reserve, Sweeney Granite Mountains Desert Research Center, Santa Cruz Island Reserve, James San Jacinto Mountains Reserve, Motte Rimrock Reserve, and Boyd Deep Canyon Desert Research Center.

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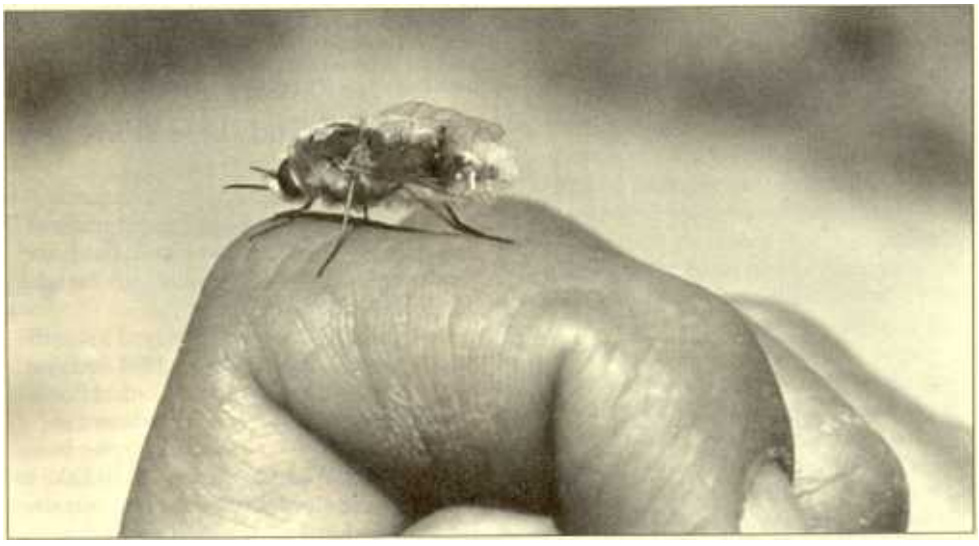

***Lordotus pulchrissimus*, a bee fly species, represents a single component in the complex Mono Basin ecosystem. This furry silver male, perhaps a fierce competitor in his lekking group, is seen here resting on the finger of UC scientist Catherine Toft, one of many UC researchers who have long used the NRS's Sierra Nevada Aquatic Research Laboratory as a home base while studying Mono Lake and the surrounding region. (Photo by Catherine Toft)**

# Mono Lake and other eco-studies find home sweet lab at SNARL

Eastern California, where the Sierra Nevada, Great Basin, Mojave Desert, and Modoc Plateau ecoregions intersect, is characterized by a set of unique regional ecosystems with complex histories. In this remote area of the state, with the nearest UC campus over 250 miles away, the NRS's Sierra Nevada Aquatic Research Laboratory (SNARL) has become the home base for a great deal of highly significant, long-term regional research.

SNARL's contemporary facilities, which Reserve Manager Dan Dawson continues to develop, do much to attract researchers to this regional field station. Likewise compelling is the presence of a large group of on-site resident and campus-based scientists who, through collaboration and mutual inspiration, have turned this NRS reserve into what amounts to a "think tank." Take the well publicized and widely important example of Mono Lake.

Unquestionably, Mono Lake is the region's one ecosystem that has received the most attention from the public, scientists, and policymakers. This body of water is unique globally as well as regionally. Mono evolved from its glacial past as the larger, freshwater, pluvial Lake Russell to its present state as the shallow, hypersaline, hydrologically closed Mono Lake. Its recent ecological story is a dramatic one with decades of threats from development of California's water resources. Ironically, these threats have attracted the research needed to inform decisionmakers about the lake's future. Enter: the University of California.

UC researchers — including undergraduate and graduate students, staff, faculty, and alumni — have played key roles in efforts to understand fully Mono Lake's ecosystem. The majority of research on the

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## But, first, a Mono Lake lesson in history and science...

Early in this century, the City of Los Angeles bought up vast tracts of land — and their riparian water rights — in the Owens Valley and upstream in the adjacent Mono Basin. Having legal control of the riparian waters of Owens River and its many tributaries issuing from the snow-laden eastern Sierra Nevada and White-Inyo Range, Los Angeles — and its Department of Water and Power (LADWP) — initiated landscape change in eastern California that was destined to evolve over several decades.

This region's natural waters, which provided both in-stream flow for native species and water to support agriculture, were captured and transported for urban use via an aqueduct system to Southern California. It was a cleverly efficient, economically sound project designed to provide L.A. with a long-term source of high-quality, cheap water.

Local results, however, were disturbing: Owens Lake desiccated, sections of the Owens River channel left dry, and tributary streams to Owens River dammed and diverted. Mono Lake, too, was altered through this capture and diversion of water from its four, major tributary feeder streams: Lee Vining, Walker, Parker, and Rush Creeks — all of which issue from the Sierra Nevada crest. Diverting as much as 90,000 acre-feet of water each year, beginning in 1941, caused Mono Lake's level to drop about 45 feet (from 6,417 to 6,372 feet) over four decades.

The resulting impacts on Mono Lake, its shoreline, and adjacent upland ecosystems were abrupt and would prove long-lasting. With its freshwater inflow severely reduced, the lake's already extremely high salinity nearly doubled, rising from 51.2 grams to 99.4 grams per liter. Continued increases in salinity, projected from the rate of water withdrawal from the basin, further threatened the viability of the lake's biota.

Each organism has its inherent ecological threshold. Mono Lake's brine shrimp population and associated phytoplankton are threatened by intolerably high salinity. The alkali fly, also affected by high salinity, is threatened by loss of critical hard-bottom habitat that accompanies a declining lake level. Both brine shrimp and alkali fly are, in turn, important food resources for many migratory and breeding birds. The many wetlands, riparian woodlands, and adjacent upland habitats are likewise threatened by decreases in runoff, associated changes in groundwater flow, and blowing dust.

*— D. E-F.*

**This aerial shot of Mono Lake and its local region was taken by the U.S. Geological Survey in 1968, midway through the 45-year period of diversions and lake-level decline. SNARL, located south of Mono Lake, lies outside this photo's parameters, just beyond its upper lefthand edge. (Photo by USGS)**

## Mono Lake finds base at SNARL

*Continued from page 1*

aquatic ecosystem and a high percentage of research on the entire Mono Basin has been conducted out of SNARL, although the lake lies 26 miles to the north.

Last year UC researchers played a significant role in the September 28, 1994 decision by the State Water Resources Control Board to reduce the Los Angeles Department of Water and Power's diversions of water from the Mono Basin and to restore Mono Lake to the 6,392-foot elevation, a level not seen since 1964. Mono Lake advocates cheered this historically and environmentally significant, mandated increase in lake level, coupled with a process for restoring streams, riparian communities, and fringing wetlands. The board's decision will promote the health of the entire ecosystem and all its associated organisms. The entire process by which this decision came about can be viewed as one of California's best examples of contemporary applied ecological science.

So large is the scale of this applied ecological research that it is a challenge even to identify the many UC researchers who have worked on the Mono Lake ecosystem over the years. We apologize to those whose important research efforts are not mentioned herein: no slight is intended.

It is apparent now that the tide turned on basic research on Mono Lake's limnology as more and more scientists realized that the declining lake levels accompanying the post-1940 diversion of Mono's tributary waters were impacting the ecology of the aquatic and terrestrial ecosystems. Thus, basic research conducted during the 1960s, by such University students as David Mason (UC Davis), on the lake's limnology evolved into broad-based research bent on evaluating all components of the Mono Basin ecosystem.

This interdisciplinary perspective was first applied by an undergraduate student group led by David Winkler (formerly UC Davis, now at Cornell University). In the summer of 1976, Winkler and students from UC Davis, UC Santa Cruz, Stanford, and elsewhere obtained National Science Foundation (NSF) funding to conduct research on the lake's ecosystem. Their data attested to the rapidity of change in this ecosystem and opened the eyes of ecologists, policymakers, and the public.

UC research on Mono Lake has spanned the biological sciences, physical sciences, and environmental policy and law. David Herbst (UC Santa Barbara) and collaborator Tim Bradley (UC Irvine) conducted extensive research on alkali flies, which need hard, submerged substrates (e.g., tufa) to complete their life cycle. The aquatic ecosystem, especially effects of Mono Lake's changing salinity, has been the focus of a large body of work led by the Santa Barbara group of John Melack (also faculty reserve manager for SNARL), Gayle Dana, Robert Jellison, Petra Lenz, and colleagues. This group carried out a tremendous amount of research over the last two decades on the basic limnology, plankton ecology, and population dynamics of brine shrimp, which, along with alkali fly, form the base of Mono Lake's food web. All the aforementioned studies helped inform the Water Board's decision.

Colleagues from UC and elsewhere have performed comparable research on migratory and breeding birds (e.g., California gull, eared grebe, Wilson's phalarope, snowy plover) that feed on the brine shrimp and alkali fly. Leading this research effort are Winkler, Dave Shuford (formerly UC Davis, now at Point Reyes Bird Observatory), Joseph Jehl (Hubbs Research Institute—Sea World), and Margaret Rubega (formerly UC Irvine, now at University of Nevada, Reno).

Meanwhile, the lake's shoreline and upland terrestrial ecosystem have been studied by various ecologists looking at insects, mammals, and plants. Key researchers include Catherine Toft (UC Davis) and associates, John Harris (formerly UC Davis, now at Mills College), Deborah Elliott-Fisk (UC Davis), and James Richards (UC Davis), as well as alumni Dean Taylor (Biosystems) and Ted Beedy (Jones and Stokes). Their studies examine basic descriptive ecology, life history, reproductive biology, ecophysiology, and mechanisms for adapting to various stresses.

Among the studies of physical ecology is the important long-term research of Tom Cahill and the UC Davis Air Quality Group. This work began in 1978, with Air Resources Board (ARB) funding, and included students Lowell Ashbaugh (formerly ARB, now at UC Davis), John Barone (Keystone Research, PA), Bruce Kusko (Franklin Corp, Topeka, KS), and Tom Gill (USDA and Texas Tech). Gill, along with Cahill and Otto Raabe (UC Davis), testified in the pivotal hearings before Judge Finney that terminated diversions in 1989. This decision was based on the


California Regional Field Stations
Intermountain Research and Extension Center (DANR)
Telomichier Marine Laboratory (Humboldt State)
Eagle Lake Field Station (Davis and Chico State)
Gray Davis Dye Creek Preserve (TNC)
Angelo Coast Range Reserve (Berkeley)
Sierra Foothill Research and Extension Center (DANR)
Hopland Field Research and Extension Center (DANR)
Sagehen Creek Field Station (Berkeley)
Blodgett Forest Research Station (Berkeley)
Pepperwood Field Station (Cal Academy of Sciences)
Bodega Marine Reserve [and Bodega Marine Laboratory] (Davis)
Point Reyes Bird Observatory
VESR: Sierra Nevada Aquatic Research Laboratory and Valentine Camp (Santa Barbara)
White Mountain Research Station (San Diego)
Jasper Ridge Biological Preserve (Stanford)
Año Nuevo Island Reserve (Santa Cruz)
Younger Lagoon Reserve [and Long Marine Lab] (Santa Cruz)
San Joaquin Experimental Range (USFS and Fresno State)
Moss Landing Marine Laboratory (San Jose State)
Whitaker's Forest (Berkeley)
Hopkins Marine Laboratory (Stanford)
Hastings Natural History Reservation (Berkeley)
Landels-Hill Big Creek Reserve (Santa Cruz)
Kern River Preserve (TNC)
Carrizo Plain Natural Area (TNC)
Sweeney Granite Mountains Desert Research Center (Riverside)
San Dimas Experimental Forest (USFS)
Santa Cruz Island Reserve (Santa Barbara and TNC)
Motte Rimrock Reserve (Riverside)
James San Jacinto Mountains Reserve (Riverside)
Wrigley Marine Science Center (USC)
Santa Rosa Plateau Preserve (TNC)
Phillip L. Boyd Deep Canyon Desert Research Center (Riverside)
Santa Margarita Ecological Reserve (San Diego State)
Sky Oaks Field Station (San Diego State)
Scripps Coastal Reserve [and Scripps Institute of Oceanography] (San Diego)
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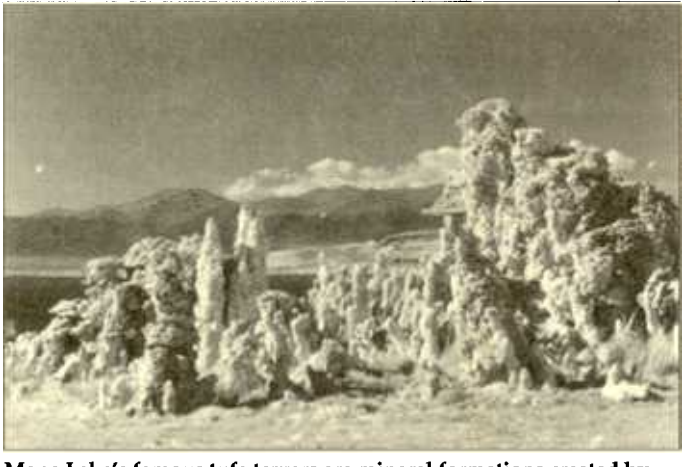
LEGEND
UC Natural Reserve System site (with administering campus)
UC Division of Agriculture and Natural Resources Research and Extension Centers
Other UC field stations (with administering campus)
Other university field stations (with administering campus)
Federal agency field stations (with administering agency)
Privately owned and operated field station
Map produced for NRS by Eric Rainbolt, 1995.

intense and toxic dust storms and air quality at Mono Lake, along with data on impacts of the lake-level decline on gull nesting.

Other notable work includes studies on groundwater by the late Shirley Dreiss and David Rogers (UC Santa Cruz); on the water balance of lake and basin by Peter Vorster (UC Berkeley); on late Holocene and historic lake levels by Scott Stine (formerly UC Berkeley, now at Cal State Hayward); and on geomorphology, stratigraphy, and soils by Stine and Elliott-Fisk. In particular, Vorster and Stine's work, which analyzes recent fluctuations of the lake as related to its water budget, provided valuable input to the Water Board's 1994 decision. SNARL has also hosted research groups from Lamont-Doherty Observatory, University of Southern California, California Institute of Technology, New Mexico Tech, U.S. Geological Survey, and elsewhere — all of them working on important aspects of Mono Lake's complex physical environments.

Scientific work often must be framed if it is to have the greatest impact on decision-makers and future public policy. Key in this regard was the work of Harrison Dunning (UC Davis), in the late 1970s and early 1980s, on public trust doctrine and its potential use in protecting Mono Lake resources. Dunning helped develop the legal theory for using the public trust doctrine to limit the exercise of water rights, a theory adopted unanimously by the California Supreme Court in 1983. Several of his students have been involved in aspects of Mono Lake litigation during their careers, including Dan Frink (State Water Resources Control Board), Mary Scoonover (Land Law Section of the Office of the Attorney General, representing State Lands Commission and California Department of Parks and Recreation), Virginia Cahill (private law firm representing California Department of Fish and Game), and Janet Goldsmith and Andy Pollak (private law firm representing L.A.'s interests).



**Mono Lake's famous tufa towers are mineral formations created by freshwater springs bubbling up through carbonated brine and brine-saturated sands. As the lake's waters receded, the towers were exposed and left marooned along the shore. (Photo by Catherine Toft)**

Long-term monitoring of Mono Lake, initiated in the late 1970s, will continue to inform scientists, the Water Board, LADWP, U.S. Forest Service, and others as all watch the system's response to increasing lake levels. While the decreasing lake level after 1940 created one "ecological motion picture" of the response of aquatic and terrestrial system components to increasing salinities, blowing dust, stream incision, and the de-watering of riparian systems and wetlands — now a new eco-movie will be created as the lake goes back up, causing salinities to decline, groundwater tables to rise, stream deposition to occur, and stream and wetland systems to assume more natural states.

The various long-term research projects at Mono Lake, the interactions between environmental interest groups and agencies, and the efforts to educate both the public and decisionmakers on the ecosystem's structure, function, and dynamics brought together the work of faculty, staff, students, consultants, attorneys, and policymakers. As the direction of the Water Board's decision became clear, many former opponents in the process to "Save Mono Lake" began working together to support a consensus recommendation and to discuss how Mono Lake could be restored and its water lost to Los Angeles could be replaced. Science as a process to inform management and policy was coming full circle — and SNARL, fulfilling the role of a regional field station, lay at the hub.

For even an ecosystem so extraordinary as Mono Lake does not exist in isolation. It is linked to other California ecosystems and large-scale processes, which in turn are the subjects of additional regional research based from SNARL. Examples include the long-term, high-elevation watersheds work of Melack, Jeff Dozier, Rick Kattelmann, and Roland Knapp (all UC Santa Barbara) on the effects of acid rain on these watersheds, snow hydrology, and snowpack modeling to enable more accurate snowmelt and stream discharge forecasting, and interactions among high-altitude, introduced fish and native amphibian populations. The downstream, cumulative effects on Mono Lake and other water bodies are apparent.

Stream research has also been a focus of SNARL scientists, including Herbst, Knapp, and Scott Cooper (UC Santa Barbara), as the SNARL experimental stream facilities themselves enable work on different biotic assemblages at different scales.

SNARL is also home base for extensive observation and experimental studies of animal behavior and physiology. The work, both on- and off-site, includes research on sage grouse (Robert Gibson, UCLA), on ground squirrels (Gwen Bachman, UCLA; Warren Holmes, University of Michigan; and Mark Chappell, UC Riverside), and on the Great Basin spadefoot toad (Steve Morey, UC Riverside).

While SNARL's 55-acre land base does provide a setting for important research, the site's significance is even greater as the University's base for research taking place across the larger region dominated by public lands. Through careful development of facilities and infrastructure on site, with the use of various intramural, extramural, and "opportunistic" funding mechanisms, Reserve Manager Dawson has created a modern laboratory and residential complex, despite the fact that he operates at a distance of 375 miles from his administering campus, UC Santa Barbara.

SNARL currently can provide housing for 40, along with a 3,000-square-foot contemporary lab and office building, and a unique system of experimental stream channels for research at different scales. Aquatic research is also facilitated by a series of tanks and tray tables with circulating stream water in the lab. SNARL's walk-in freezer and cold storage provides unusual lab facilities for snow science studies. A full complement of traditional biological labs is also available.

Office space at SNARL is about to increase dramatically with the addition of a 3,000-square-foot building procured as surplus from CALTRANS and already moved on site. The 1930s-vintage, two-story bunkhouse will become a computing facility that will enable researchers to link into the Internet and work remotely, yet as effectively as if they were back at their home campuses. This infrastructure and SNARL's resident staff ably support the University's instructional and public outreach programs as well.

SNARL is an excellent example of a reserve that has surely found its niche, within both the University and the region. It is truly a regional research center of excellence and an important scientific resource for the public of Eastern California, the local, state, and federal agencies, and university researchers interested in this ecologically diverse area of California. With eastern California counties projected to see dramatic growth over the next half century, our wise stewardship of these resources is an important mission worthy of University research.

*— Deborah L. Elliott-Fisk*
*Director of the NRS*

# Reserve Highlights

## Ancestral wetland habitat now being restored at San Joaquin Marsh Reserve

Work is underway on a 6.02-acre, wetland restoration and enhancement project in the San Joaquin Freshwater Marsh Reserve, a 202-acre NRS site adjacent to and administered by UC Irvine. The project was approved by the California Coastal Commission as an off-site mitigation required of Hoag Memorial Hospital for its development impacts in nearby Newport Beach.

The project site lies within an area altered from its original wetland condition over fifty years ago, when The Irvine Company constructed a dam across the marsh to stop sediment transport into Upper Newport Bay and protect commercial salt evaporation ponds located there. A significant portion of marsh was buried under more than two meters of sediment trapped by the dam and was subsequently converted into agricultural fields, cultivated during the 1940s and 1950s. Farming was later abandoned (probably because of water logging and salinity problems), and during the 1960s, 1970s, and early 1980s, the area was reconfigured into perched, shallow, duck-hunting impoundments that were seasonally flooded with imported water. After duck hunting and seasonal flooding stopped in the mid-1980s, the area became predominantly an upland habitat.

Hoag Hospital's mitigation will exhume the ancestral wetlands and re-establish this degraded area as part of the marsh ecosystem. Fully 39,000 cubic yards of sediment will be removed, including 1,100 feet of road-topped dikes that once defined some of the former duck club ponds. Forty percent of the 6.02 acres of restored wetlands will be open-water pond habitat more than four feet deep, with an emergent vegetation habitat covering the remaining 60 percent of littoral zone around the pond edges. Hoag Hospital has established an endowment to permanently maintain the restored site.

Besides re-creating new wetlands, this project has provided a remarkable educational opportunity for UC Irvine students. Working with Academic Coordinator Peter Bowler and Reserve Manager Bill Bretz, students have collected over 3,000 plants from other portions of the reserve for use in establishing the emergent vegetation plant community. Target species include California bulrush (*Scirpus californicus*), Olney's bulrush (*Scirpus americanus*), coastal bulrush (*Scirpus robustus*), and pale spike-rush (*Eleocharis macrostachya*). Experiments have been designed that will compare establishment success between plants directly transplanted from the wild, those that have been in pots for several months (with new root growth),

**Habitat restoration can require heavy labor. (Photo by Peter Bowler)**

and seeded plots. Goodding's willow and mulefat will also be planted along the wetland edge. Students will assist in the planting and monitoring.

Creation of this new wetland habitat has also provided a chance to expand species richness in the marsh by introducing selected wetland species from UC Irvine campus in sites likely to be developed. Seeds and transplant material from beardless wild-rye (*Leymus triticoides*), California club-rush (*Scripus cernuus*), and southern tarweed (*Hemizonia australis*, a California Native Plant Society [CNPS] plant 1B) are being collected for introduction to the new wetlands. Wire rush (*Juncus balticus*), otherwise known only from a single small patch in the reserve, will be transplanted to expand its stands in the marsh. The entire 6-acre habitat restoration will be completed in time for the coming rainy season.

In addition to wetland restoration, the reserve will see a continued expansion of coastal sage along the bluffs that surround the wetlands and along the upper slopes of the San Diego Creek corridor, which links the marsh with the Upper (Newport) Back Bay Ecological Reserve. Experimental "canopy projects," which established sage scrub shrubs using transplanted seedlings from natural stands on the Irvine campus, have been extremely successful: self-seeding produced 180 to 200 coastal sagebrush (*Artemisia californica*) seedings/m2 this spring.

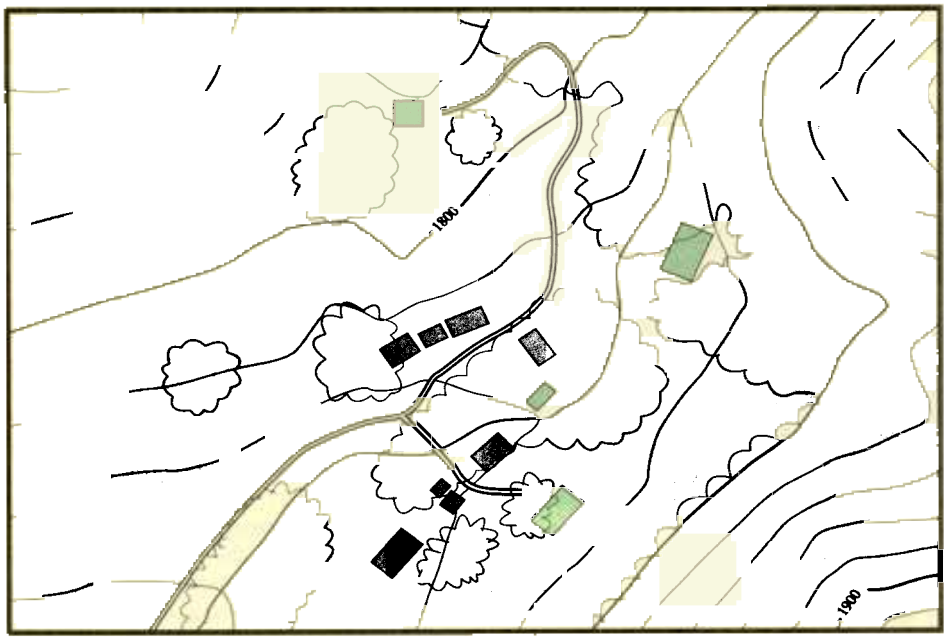
At a September conference, two students and Peter Bowler reported that gnatcatchers were using sage scrub restoration projects and wetland shrubs as a dispersal corridor. The site lies between populations located at the Upper (Newport) Back Bay Ecological Reserve and the UCI Ecological Preserve. Experiments transplanting mature sagebrush and other sage scrub plants have shown that very large plants can be lifted out of the ground during extended rainstorms and survive when transplanted. This mitigation technique allows genetic rescue and provides mature plants that produce seed during the following season.

Other upland restoration efforts have attempted to propagate and expand a remnant stand of maritime bluff scrub. This includes a small population of California boxthorn (*Lycium californica*), which students are using for experiments in propagation techniques. Students are also reintroducing gray coast buckwheat (*Eriogonum cinereum*) from the UC Irvine Arboretum, where plants from the last patch (now extirpated) along Back Bay were rescued. They are the sole survivors of the species's southernmost disjunct location.

The Irvine campus has recently decided to use the 60-acre capped landfill site adjacent to the reserve for coastal sage scrub mitigation, so when restoration is complete, there will be an extensive, new, upland habitat embracing the wetlands.

*— Peter Bowler*
*NRS Academic Coordinator*
*and Bill Bretz*
*NRS Reserve Manager*
*University of California, Irvine*

**The paper grocery bag becomes an important tool for UC Irvine students engaged in collecting seed for the wetlands restoration project at San Joaquin Marsh Reserve. (Photo by Peter Bowler)**




**This representation of the Hastings Natural History Reservation compound, showing roadways, vegetation, and elevation contours, is an example of how such information is displayed on the reserve's geographic information system. For a description of the UCB Museum of Vertebrate Zoology's larger information management project, see MVZ's home page on World Wide Web at http://www.mip.berkeley.edu/mip/mip_projects.html#mvzinfo. For more information about the University of Oregon's ISE Research group, see http://shiva.uoregon.edu/. (Map by Eric Rainbolt)**

# Hastings GIS and GPS prove a learning experience

Hastings Natural History Reservation, with help from the NRS systemwide office and private donations, is developing a geographic information system (GIS) that may serve as a model for other NRS reserves. This new GIS fits into a larger data management scheme created by UC Berkeley's Museum of Vertebrate Zoology (MVZ).

As our researchers' needs range from very simple to very complex, we knew we would have to provide software that could meet the most rigorous demands, while still offering a system that can be mastered by a beginning student. We continue to use Macintosh hardware and software, because we find it the easiest, most maintenance-free platform that meets most of our daily needs. Our original software was Geo/Navigator (Visual Solutions, Inc.), a vector-based GIS able to import files in a variety of formats.

Geo/Navigator was our initial choice because it is quick and easy to learn and has a relational database that can generate reports. The GIS was first designed as a tool for management rather than research, and Geo/Navigator was the best option on the Mac platform. Ability to export data into other programs is essential. Geo/Navigator can export files in the most common GIS formats.

In the last year and a half, introduction of the Pentium and Power PC chips has more than doubled the processing speed of desktop computers. These faster computers can perform complicated GIS functions more quickly than their predecessors. Another new, and possibly the most important, development in GIS has been the introduction of ArcView v.2.1 from ESRI (Environmental Systems Research Institute).

ArcView v.2.1 is part of a suite of ESRI products centered around Arc/Info, the *de facto* standard in the GIS world. ArcView is significant because it brings the complicated world of Arc/Info to the desktop computing environment, allowing non-GIS experts to work with spatial data with relative ease. Since it is part of ESRI product line, projects can be moved back and forth from ArcView to Arc/Info when more complicated analysis is required. ArcView is available for most platforms (PC, Mac, workstations) and has its own language (Avenue), which can program almost any data manipulation.

Another program we plan to use is macGIS, developed by the University of Oregon's ISE Research group. With macGIS, we can view our copies of the digital elevation models (DEMs) provided by the U.S. Geological Survey (USGS). This program can generate various landscape classifications and portray them in three dimensions.

Having software is just the first step to building a GIS. Acquiring electronic versions of maps and corrected aerial photographs for a site is also necessary. Hastings's first data input was provided by UC Berkeley graduate student Heather Carlisle, who digitized the existing USGS 7.5" quadrangle. This initial project was not developed at a fine scale that would be most useful to researchers, and it would be of limited value for management purposes. A detailed topographic survey and corresponding aerial photography was needed in order to create such a project. Yet the cost of this work was too great for either Hastings or the NRS to bear.

Mike Markkula, a private landowner west of Hastings, had been allowing the reserve to use part of Rana Creek Ranch for research. Markkula started using Geo/Navigator to manage information on his properties. When he decided to acquire the baseline aerial photos and new DEMs from those photos for Rana Creek Ranch, he offered to include Hastings as well. In spring 1995, Hammon, Jensen, and Wallen flew Rana Creek and Hastings, then provided electronic files that include a color aerial photo and overlaying maps of topographic lines, vegetation types, and legal and survey boundaries. These files were delivered on compact disks (CDs) in a format that can be read by ArcView 2.1, Geo/Navigator, or any other GIS.

New data can also now be incorporated into this GIS using a global positioning system (GPS). The Hastings GPS and base station were made possible with funds provided by the National Science Foundation (NSF), partially matched by contributions from our neighboring ranches (Oak Ridge, Boekenoogen Ranches, Inc.). We purchased a Trimble Community Base Station and a Pathfinder Basic plus, a hand-held receiver. Our hand-held receiver calculates positions in the field. We download these field positions back in the lab and correct them to within a meter or so in accuracy using base station data. We can then import the corrected field positions into our GIS, where they are portrayed accurately on maps in our computers.

One of our first projects will be to map and mark mutual boundaries. Most Hastings boundaries are not fenced nor even marked. They occur in areas steep and remote — very expensive to survey with traditional methods. By printing out selected parts of our color aerial photos with these points accurately mapped, we can use trees and elevation to locate legal corners and future fenceline locations. We can use the GPS to walk to predetermined points. Say, for instance, we know that our legal boundary lies along a section line: our maps will give us the position (latitude/longitude), we can enter the coordinates into the hand-held unit, and the unit will guide us as we walk the line. We can then mark points, take new data, correct that data, and relocate the boundary line accurately to within about 1 to 2 meters.

Other projects at Hastings that will use our GIS include long-term studies of the reserve's vegetation types, individual oak trees, social groups of acorn woodpeckers, and nesting pairs of western bluebirds.

*— Mark R. Stromberg*
*Reserve Manager*
*Hastings Natural History Reservation*

# "Hot spots" of life found in cold deep at Scripps

Who would have guessed that mats of *detritus* — decaying kelp and sea grass — would prove to be the habitat known to support the highest densities of animals on earth? It was UC San Diego doctoral student Eric Vetter who discovered that these dead mats of seafloor compost are in fact "hot spots," as he calls them, of marine life. For over four years, Vetter has studied these hot spots at the NRS's Scripps Coastal Reserve, with help from his advisor, Paul Dayton, and a grant from the PADI Foundation.

Vetter found that detrital patches on the seafloor are welcome mats for a variety of marine fauna. Common residents include mussels, bryozoans, hydroids, ascidians, muribund sea pansies, and sponges. Also living there are octopuses, crabs, polychaete worms, juvenile fishes, isopods, and snails.

But what really gives the detrital mat its current title of "World's Most Productive Habitat" are a few species of small scavengers: amphipod and leptostracan crustaceans — the diminutive relatives of shrimps and beach hoppers. These macroinvertebrates, tiny yet visible to the unassisted eye, populate the detrital habitat in far greater numbers than those known for any other aquatic or terrestrial animal group. Vetter reported in a recent paper that, at times, these animals achieve a cumulative density of over three million individuals per square meter.

These copious crustaceans feast primarily on decaying plant matter and, in turn, attract a variety of fish predators, including kelp bass and sheephead. "This high level of production is subsidizing fish stock," Vetter explained. "Putting it simply, there are more fishes here than there would be otherwise." What's more, some of the fish exploiting this food source typically eat other, larger prey.

Habitats that are commonly understood to be the world's most productive include tropical rain forests and coral reefs. But according to Vetter: "Nothing else even comes close [to the productivity of the detrital mat]. In terms of biomass, you might find higher values in a beehive, but then that's a nest, not a habitat. If, on the other hand, we compare the detritus mat to the neighboring sandy bottom, the mat is a hundred times more productive."

Vetter offers three criteria for the formation of a "hot spot": (1) generally mild surges or currents, (2) a source of plant material, and (3) a seafloor valley or depression. All three of these conditions exist at the NRS's Scripps Coastal Reserve. For much of the year, ocean conditions are mild along the La Jolla coast, as is typical of most Southern California waters. Abundant plant debris is provided by local kelp beds. Finally, the reserve's submarine canyon provides a natural sink for anything settling along the sides, including vegetative debris, animal remains, and soda pop cans. Mats often accumulate to more than three feet thick.

At the Scripps Coastal Reserve, detrital mats are believed to extend for several acres and may also be widespread elsewhere in the ocean. Hot spots can be found at depths between 45 and 300 feet, and probably much deeper. Between March 1992 and March 1994, Vetter made hundreds of dives into the cold deep to study hot spots. The invaluable help from volunteer divers, mostly UC San Diego graduate students, made it possible to collect samples for lab experiments.

Even though detrital mats lie on the remote seafloor, they are not removed from seasonal cycles. During summer, expansive detritus provides habitat for animals that reproduce continually. By late fall and winter, the mats are reduced by storm waves, as bits and pieces of plant material are carried away. Although the detrital mat decreases in size, it still supports the same high numbers of animals. So, animals on the mat crowd together, increasing their population density. The reduced detritus becomes a life raft for these huddling masses. With less habitat cover, the tiny invertebrates become more vulnerable to fish predators. Later, as summer approaches, more plant material accumulates and the animals spread out again.

Vetter's original research goal was to find out what might be "lurking" in this murky habitat and what effect the detritus has on animals in surrounding waters. After two and a half years, he truly came to appreciate the unparalleled productivity of hot spots; since then, he has received international recognition for his discovery. Dayton says: "Researchers are starting to realize the seafloor is not homogeneous; it's patchy in a functionalized sense. Eric's dissertation provides important documentation for this."

*— Elaine P. Miller*
*Systemwide Senior Science Writer*

**Undersea scientist Eric Vetter, suited up and ready for work. (Photo by Susan R. Green, Scripps Institution of Oceanography Photo Lab)**

## Regents okay Stunt Ranch — UCLA home campus celebrates its sole NRS site

In September 1995, a 12-year-old NRS dream was realized when The Regents of the University of California approved the acquisition and establishment of the Stunt Ranch Santa Monica Mountains Reserve.

The property, located below some of the most dramatic peaks in the Santa Monica Mountains, will become the only NRS reserve administered by UC Los Angeles.

The NRS traded two other properties for 67 acres at Stunt Ranch in a complicated multiagency transaction that took over a decade to finalize. An additional 243 acres of Stunt Ranch will remain with a state agency, the Santa Monica Mountains Conservancy, under an agreement that gives the University access to the property for research and teaching purposes.

Stunt Ranch's proximity to UCLA makes it highly accessible to classes, as well as attractive to researchers who are studying oak woodlands, chaparral communities, and archaeological resources. Classes offered to schoolchildren by a local nonprofit group will continue, as will hiking and equestrian use of a popular public trail.

"The addition of Stunt Ranch to the Natural Reserve System promises to improve public appreciation and scientific knowledge of chaparral communities which form one of the world's most unusual Mediterranean-type ecosystems," said Philip Rundel, faculty reserve manager for the UCLA site.

He added: "Research and teaching at the Stunt Ranch Reserve will center on chaparral, oak woodlands, and grassland ecology, with work conducted by a variety of academic programs, such as biology, anthropology, earth sciences, public health, and resource management."

Carol Felixson has been hired as project manager for the reserve. She is a 13-year resident of Topanga Canyon and was formerly manager of the state's Fire Recovery Center in Malibu.

The few buildings that once existed at Stunt Ranch — including the cabin built by the Stunt brothers, who homesteaded the land in the 1880s as a nursery stock farm — were all burned to their foundations during the Malibu Fire of 1993. Federal Emergency Management Authority (FEMA) funding will be used for site clean-up and reconstruction.

# Instruction and Research Highlights

## Marine mammals from two NRS sites monitored in global-warming project

Searching for signs of global warming, UC researchers plan to take the temperatures of the world's oceans.

This international project, called Acoustic Thermometry of the Ocean Climate (ATOC), involves the use of low-frequency sound waves and is based on the principle that sound travels faster through warm water than it does through cold water. To determine whether ATOC-generated sound may affect the elephant seal (*Mirounga angustirostris*), UC Santa Cruz scientist Daniel Costa will monitor its behavior at two NRS sites along the central California coast: Año Nuevo Island Reserve (for which Costa is faculty reserve manager) and Big Creek Marine Ecological Reserve.

Average ocean temperatures can be measured by the speed at which sound travels from its source to a receiver thousands of miles away. The proposed location for the California sound generator lies under 3,000 feet of water on Sur Ridge, about twenty miles south of Monterey and twenty-five miles offshore. It is between Año Nuevo Island to the north and Big Creek Reserve to the south. Another sound source is proposed for the waters off Kauai, Hawaii. Sound waves from these two sources would be "heard" by extremely sophisticated receivers at eighteen distant oceanic sites.

During the thirty-month program, ATOC sound would be generated no more than 8 percent of the time. Each period of low-frequency rumblings would gradually turn on over five minutes, reaching a maximum volume of 195 decibels. This level is no louder than other common sounds in the ocean. At three feet away, the sound's intensity would be similar to that produced by the loudest blue whale; at 300 feet, it would be no louder than a small freighter; at the surface, the sound would approximate the intensity of that made by porpoises. Decibel levels in the water differ from those in the air. For example, to maintain the same sound intensity, a rock singer producing 110 decibels in the air would have to belt out 172 decibels underwater.

The ATOC program has provided about $3 million to evaluate the possible effects of the sound on marine mammals. These animals have been the focus of concern, because they rely heavily on their ability to create and detect sounds.

Marine mammals use sound, because it travels far in the sea. Their calls may signal location, intention, age, sex, reproductive status, and identity. Toothed whales, such as sperm whales, use echolocation to find prey and negotiate the environment. In addition, all marine mammals use passive listening, which may help them locate prey, avoid predators, and navigate during migrations. Elephant seals and sperm whales are of special interest to scientists, since they dive the deepest and, thus, the closest to ATOC sound generators.

Costa's method for monitoring elephant seals is based on three years of experiments. In these past studies, scientists (see review at right) transported 79 northern elephant seals from the Año Nuevo rookery to the waters off the Big Creek Reserve, where they were released. Nearly all the seals returned "home" to Año Nuevo in about four days. In fact, the routes they followed took them past the proposed ATOC sound area. Their diving behavior en route was identical to that of free-ranging seals.

Knowing that elephant seals released from Big Creek Reserve will immediately swim back to Año Nuevo, Costa started an at-sea elephant seal monitoring program. He intends to attach acoustic data loggers and time-depth recorders to the backs of twenty elephant seals from Año Nuevo. The equipment enables researchers to relate the behaviors of seals, as they swim, to their acoustic environment. The seals will be transported individually and at different times to the Big Creek Reserve. Ten seals will be released when the ATOC sound source is off; another ten will be release while the ATOC source on.

Costa will monitor the elephant seals (and acoutic conditions) as they swim back to Año Nuevo. The behaviors of seals exposed to the ATOC sounds will be compared to those of seals not exposed. Costa will look for any changes in behavior, including modifications in diving or avoidance of the ATOC sound source. Physiological changes will also be measured. This at-sea monitoring is coupled with the continued collection of baseline data at the Año Nuevo rookery.

UC San Diego is the state lead agency for the ATOC project, and ATOC's principle investigators are located at UCSD's Scripps Institution of Oceanography. The campus is preparing a joint EIS/EIR with the Advanced Research Projects Agency (ARPA). Hurdles remaining to be crossed include permits from the California Coastal Commission, the National Marine Fisheries Service, the Monterey Bay National Marine Sanctuary, and the Army Corps of Engineers. Project approval from ARPA and a lease from the State Lands Commission are also needed.

*— Elaine P. Miller*
*Systemwide Senior Science Writer*

**The elephant seal colony at Año Nuevo State Reserve. (Photo by Steve Davenport)**

# Recent UC book nets world news on recovering elephant seal populations

Many dimensions of the extraordinary lifestyle of the world's largest seal are captured in *Elephant Seals: Population Ecology, Behavior, and Physiology*, a UC Press book edited by Burney J. LeBoeuf and Richard M. Laws.

This 1994 volume has forty authors, including researcher Daniel Costa (see facing page, "Marine mammals from two NRS sites monitored in global-warming project") and is based on presentations made at the first global conference devoted to this massive pinniped (see *Transect* 9(2):7). This conference, held in 1991, was organized by Burney LeBoeuf, former faculty manager of the NRS's Año Nuevo Island Reserve, who has studied elephant seals there since 1967.

It is not surprising that the elephant seal has won the attention of researchers. As this book describes, the seal's physiology and behavior often run to extremes. It is one of the most sexually dimorphic of marine mammals, with striking differences in the appearances of males and females (take the bull's protuberant proboscis, for example). Adult males can tip the scales at 4,600 pounds and outweigh mature females by two to seven times.

The pinniped is extremely polygamous, and competion for the right to mate is a weighty issue among males. Only a few win enough battles to mate; these few will mate with the majority of available females. Moreover, the largest bulls fast for over 100 days during the breeding season; the cows fast while lactating.

The elephant seal's diving ability leaves researchers breathless. Over one-third of *Elephant Seals* takes an in-depth look at diving. Female elephant seals can plunge to the greatest depths — nearly 5,000 feet! No other marine mammal dives deeper, not even the sperm whale. The elephant seal also spends more time submerged during its sea travels than most whales. Current research suggests that the seal dives for forage and that diving behaviors vary with age, sex, reproductive condition, and individual foraging preferences.

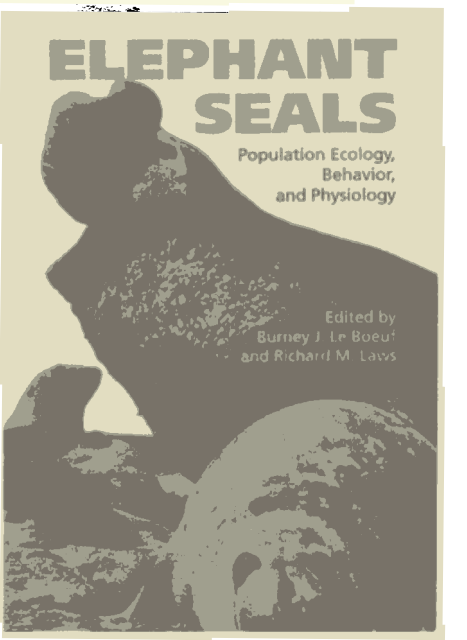
The study of free-ranging elephant seals at sea is developing fast; part of the impetus for both the conference and this book was to share related findings and techniques. Currently, researchers monitor these marine mammals by sonar or by fitting them with radio transmitters, satellite tags, or time-depth recorders. In the near future, researchers anticipate that global positioning system (GPS) devices will be attached temporarily to the some seals. This GPS technology will allow researchers to precisely locate the animals — longitudinally and latitudinally — during their migrations. It is expected the same technology will be used to study other marine mammals.

Although *Elephant Seals* is intended for an audience of elephant seal experts, it is written in a style that can be appreciated by anyone with an understanding of college-level introductory biology — and a willingness to look up an occasional term in a dictionary. Less than a quarter of the twenty-two chapters would be considered overly technical for the layperson. An index helps the reader to navigate through this 414-page book.

We are lucky to have such a book devoted to elephant seals — actually, we are lucky to have elephant seals at all. Both of the world's elephant seal species — the northern elephant seal (*Mirounga angustirostris*) and the southern elephant seal (*Mirounga leonina*) — have suffered profoundly from relentless hunting. The book recounts the commercial hunting of both species and its effects on current populations.

During the nineteenth century, northern elephant seals were taken from beaches and

*Continued on page 10*




## "Seal" of approval goes to long-time Año Nuevo Island scientist

Pick up a publication about elephant seals and, more likely than not, you will find Burney LeBoeuf's name listed somewhere. Even if he didn't write it, you can be pretty sure he's at least cited.

Extremely prolific, LeBoeuf has gained respect internationally for his long-term studies of these colossal pinnipeds — thirty years' worth at Año Nuevo Island Reserve. He is the former faculty reserve manager for this NRS site, as well as professor emeritus of biology at UC Santa Cruz. LeBoeuf's extensive body of oft-cited work includes an early paper on elephant-seal dialects and has turned up in such popular media as *Psychology Today* magazine (an article about elephant-seal mating behavior).

According to LeBoeuf, elephant seals, despite their intimidating girth, can actually be relatively easy to study on land. In *Elephant Seals: Population Ecology, Behavior, and Physiology* (see review at left), LeBoeuf reveals that these noisy giants are unafraid of humans and do not flee when approached or examined. They are readily tagged by researchers, a process ideally carried out at weaning (a month after birth) and one that is critical for long-term studies of behavior, growth, aging, and survival.

One research activity not possible until recent years, when LeBoeuf helped to figure out a way to do it, is the weighing of a bull elephant seal. This feat should not be taken lightly, as the largest males can bulk up to 4,600 pounds for the mating season. In 1992, LeBoeuf and his colleagues at UC Santa Cruz designed the first elephant seal scale: a device much like a bar scale for weighing cattle, but made of aircraft-strength aluminum. To entice a hefty male onto the scale, the researchers created a comely fiberglass elephant seal cow and played recordings of female mating calls. This attracted males from 100 yards away.

Although LeBoeuf has focused much of his research on the northern elephant seals of Año Nuevo, his work serves as a model for the study of elephant seals at other rookeries. Researchers studying southern elephant seals, which live in the Antarctic region, look to LeBoeuf for his methods of monitoring the pinnipeds at sea. In recent years, LeBoeuf began monitoring elephant-seal diving behavior with sophisticated equipment that will one day most likely be used on other marine mammals.

Indigenous to Louisiana, LeBoeuf traded bayou country for Pacific coast during the sixties. He earned his doctorate from UC Berkeley in comparative psychology in 1966. After spending a year at the radiobiology laboratory at UC Davis, he settled down at UC Santa Cruz. When not performing his professorial duties, LeBoeuf enjoys going to sea in his Zodiac, making wine from grapes grown in his own vineyard, and dining in France.

*— Elaine P. Miller*
*Systemwide Senior Science Writer*

Newly weaned northern elephant seal pups at Año Nuevo Island Reserve. Some of them will one day resemble the big bull shown below. (Photo by Steve Davenport)

## World news on elephant seals

*Continued from page 9*

islands along the coast of North and Central America for their blubber and oil. By the late 1800s, the seal had been presumed extinct three times. It was first thought to be extinct in the late 1870s.

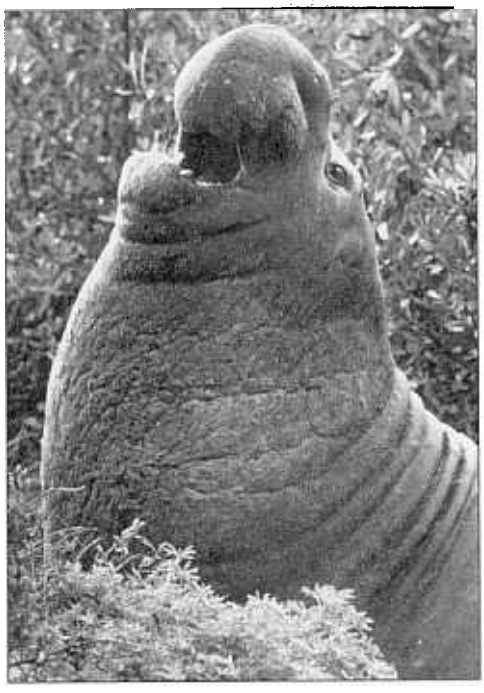
Then, during 1880, a small herd of 335 seals was found lumbering in Baja California near Bahia San Cristobal. All were slaughtered in four years by the crews of six ships; once more the species was considered extinct. No elephant seals were seen again until 1892, when nine were discovered at Isla de Guadalupe off the Mexican coast. Seven of the nine were killed for the Smithsonian's museum collection, with the justification that they were doomed for the sealer's trypot anyhow. A third time, the seal was presumed extinct. Small numbers continued to show up at Isla de Guadalupe through 1911, and museum collectors continued to kill them.

Protection for the elephant seals came at last in 1922, when the Mexican government declared Isla de Guadalupe a biological reserve. In the 70+ years that have since elapsed, the species has grown remarkably. Nowadays the entire northern elephant seal population, including Año Nuevo's colony, increases by 6 percent annually; currently it stands at about 127,000 seals. Researchers estimate that the total population of northern elephant seals in 1890 was as few as twenty.

No other large vertebrate has come so close to extinction — and made such a rapid recovery. This rebound, however, comes at the expense of genetic diversity. Due to the "bottleneck" in survivors a century ago, today's elephant seals are thoroughly inbred and all nearly genetically identical.

Meanwhile, researchers still struggle to understand why the southern elephant seal, which makes its home in Antarctic waters, has not recovered as well as its northern relative. Despite increases in some southern colonies, the overall population of the southern elephant seal, now many decades after the hunt, remains at hunting-era levels and, in fact, appears to be declining.

*— Elaine P. Mille*
*Systemwide Senior Science Write*



Bull elephant seal. (Photo by Steve Davenport)

**News from Santa Cruz**

## UC campus now offers Ph.D. in Environmental Studies

Last fall, UC Santa Cruz became the first campus in the UC system to offer a doctoral program in environmental studies. The field includes environmental analysis in land-use planning, environmental policy and planning, environmental regulation, land-use planning and biodiversity, and political economy.

This summer, the UCSC program was further enhanced by the establishment of the Pepper-Giberson Endowed Chair in Environmental Studies, made possible by a generous gift from Dr. Alan G. Giberson and Margaret S. Lyons Giberson, of Los Gatos, California. Funds generated by this endowment can be used to support existing faculty research, bring in a new faculty member, or offer courses that the campus would otherwise not be able to offer.

## Marine research lab open to visitors (for a small fee)

Long Marine Laboratory, UC Santa Cruz's internationally recognized center for marine mammal research, has begun charging a small entry fee for visitors attending its public education programs.

Entry to the research station now costs $2 for adults and $1 for students over age 16 and senior citizens. Children under age 16 and members of the Friends of Long Marine Lab are admitted free.

The lab, which is adjacent to the NRS's Younger Lagoon Reserve and which provides facilities for research conducted at the NRS's Año Nuevo Island Reserve, hosted 295 organized tours for 9,939 students during the 1994-95 school year. Visitor counts rose from 27,000 in 1993 to 32,500 in 1994 and are continuing to increase. Work will soon begin on a $4.4-million Visitor Education Center.

Long Marine Laboratory is open to the general public on Tuesday through Sunday, 1 to 4 p.m. Tours for groups of schoolchildren must be arranged in advance.

For more information, call: (408) 459-4308.

# New managers make a mighty start at pending site ...

In November 1994, we became managers of Sedgwick Ranch near Santa Barbara, an NRS site with final reserve approval pending. After six years on the periphery of the NRS as managers of the UC (but non-NRS) Sagehen Creek Field Station near Truckee, we are thrilled to have officially joined the NRS at long last.

Sedgwick is very different from Sagehen. However, it bears considerable resemblance to another NRS site where we both did our doctoral work: the Hastings Natural History Reservation in upper Carmel Valley. In fact, the organisms we studied at Hastings — including yellow-billed magpies, California poppies, and lace lichen (*Ramalina menziesii*) — are also abundant at Sedgwick, so we feel right at home.

Sedgwick Ranch encompasses 5,100 acres located in the Santa Ynez Valley of northern Santa Barbara County. The area occurs at the conjunction of the northern and southern California biotic provinces, where the north-south Coast Ranges meet the east-west Transverse Ranges. Sedgwick straddles a major fault, the Little Pine Fault, and consists of two very different substrates: one-million-year-old Paso Robles alluvial deposits and 120-million-year-old Franciscan formation with serpentine outcrops. Vegetation varies widely across these geologic backgrounds.

In addition to its 5,000+ UC-owned acres, Sedgwick offers access to over 100,000 acres of adjacent U. S. Forest Service land in the Los Padres National Forest and the San Rafael Wilderness (the site of recent releases of California Condors). Our proximity to these areas broadens the habitats available to students and researchers. Although the UC-owned portion of Sedgwick currently has no facilities (except for two port-a-potties!), plans have been made to acquire or begin building a field station sometime in 1996.

Over the past year, we spent a great deal of time familiarizing ourselves with this vast piece of land and relaying our discoveries to classes at all levels and to the docents and staff of local institutions, such as the Santa Barbara Museum of Natural History, Santa Barbara Botanic Garden, and Lotusland. We have also been facilitating ongoing research from UC Santa Barbara. As we develop facilities, we hope to attract classes and researchers from a wider area.

In addition to its traditional field science users, Sedgwick has a core of local artists who use it as a model and inspiration for their work. Much of the art produced by this group has been made available to the Santa Barbara County Land Trust for fund-raising and to the University for use in various publications.

Sedgwick has unlimited potential for a wide variety of research, educational, and community service uses and for a developing core of users. We feel fortunate to have the rare opportunity to assist in the inception and development of a new reserve.

*— Mark Reynolds and Virginia ("Shorty") Boucher*
*NRS Reserve Managers*

Sedgwick Ranch. (Photo by Mark Reynolds)

# ... and the NRS campus director concurs

Mark Reynolds and Shorty Boucher are excellent managers and have contributed greatly to the establishment of Sedgwick Ranch as a valuable resource for research, teaching, and public outreach.

Since last fall, Reynolds and Boucher have established an office, acquired needed equipment, and coordinated with private and public organizations. On an ongoing basis, they:

- discuss management and policy issues with adjacent landowners and govermental agency personnel,
- raise awareness in the surrounding community of the mission of the NRS,
- regularly patrol the ranch for trespassers,
- monitor cattle grazing,
- advertise the ranch and identify potential users,
- screen applicants and oversee users,
- advise researchers, and
- lead field trips for community organizations, primary and secondary schoolchildren, and adults.

They have:

- assisted in the development of research plans to deal with the effects of livestock grazing on the ranch's terrestrial vegetation,
- started terrestrial vertebrate surveys and monitoring programs that deal with stream chemistry and vernal pool fauna,
- researched background data and provided information and assistance, regarding acquisition and management of the heir's parcel,
- developed user information brochures and packets, and
- helped to develop, set up, and occupy the NRS booth at Santa Barbara's recent Earth Day event.

Their current efforts are centered on:

- developing a site management plan,
- working with local fire officials to develop a fire management plan,
- maintaining a meteorological station,
- continuing to survey and monitor local fauna and flora, and
- establishing resource databases, including the archiving of printed materials, entering of existing data onto the computer, developing of GIS maps, and writing a natural history of the ranch.

Although Reynolds and Boucher (known universally as "Mark 'n' Shorty") act as a team to manage Sedgwick Ranch, they have their separate areas of expertise.

Mark Reynolds, trained as a vertebrate ecologist (Ph.D., UC Berkeley), has been especially active in developing monitoring and survey programs for terrestrial vertebrates. He continues to perform research and publish papers in ornithology. Virginia "Shorty" Boucher, trained as a grassland ecologist (Ph.D., University of Oregon, Eugene), has concentrated on training and/or research in plant ecology, fire management, equestrian use of the ranch, and GIS technology. In addition, she also serves on the University-wide NRS Advisory Committee.

I believe their collective efforts will result in Sedgwick Ranch becoming one of the jewels of the Natural Reserve System.

*— Scott Cooper*
*NRS Director, UC Santa Barbara*

*Report of the Director*

## Reserves as regional field stations

*Continued from page 1*

Our reserves that have the potential to fill a regional role (although perhaps at a smaller scale) include, in the north, the McLaughlin Reserve and, in the south, the Burns Piñon Ridge and Stunt Ranch Santa Monica Mountains Reserves. All await the development of further facilities and infrastructure. Finally, such pending reserves as Sedgwick Ranch, near Santa Barbara, and the Ft. Ord Reserve, near Monterey, will undoubtedly become regional research centers.

NRS field stations act as guy lines for a network of California natural resources field stations, with reference to number of sites, number of users, research dollars, on-site facilities, and other parameters. Other University of California units also constitute an important part of this matrix: Blodgett Forest Research Station, Hopland Field Research and Extension Center, Intermountain Research and Extension Center, Sagehen Creek Field Station, Sierra Foothill Research and Extension Center, Whitaker's Forest, and White Mountain Research Station (see map on page 3). Additional agricultural research and extension centers may play a significant role in the near future as agricultural and natural resources studies become more tightly linked, according to Director of DANR Facilities Planning and Management Harry Carlson.

All of these stations support an ongoing University presence, even in remote parts of California. Furthermore, our reserves greatly enhance not only the field stations offered by other universities around the state (California State University system, Stanford University, and the University of Southern California, among others), but also those of such private entities as The Nature Conservancy (e.g., Kern River Preserve) and the California Academy of Sciences (Pepperwood Ranch),

**Home away from home for so many researchers working in the Eastern Sierra Nevada, SNARL is located at the base of Mt. Morrison. (Photo by Galen Rowell)**

as well as the research accommodations available at some state parks, national forests, and national parks.

Nowadays we are expected to do more with our limited University resources. In this context, let us take advantage of the NRS field stations as we broaden our field teaching in many disciplines across the campuses, work with the public in local watershed management and restoration projects, interface with our youth and their teachers in primary and secondary school programs, and generally make available the services of our great University to all citizens of our state.

*— Deborah L. Elliott-Fisk*
*Director of the NRS*

## Free subscription — and now we're on the Web as well!

**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 UC Natural Reserve System is also a transect. It encompasses a cross-section of our state's natural diversity in a system of natural areas and field stations specifically created to support teaching and research. Recognizing this, we chose to call our award-winning newsletter the *Transect*. For back issues or a free subscription, write or call the systemwide NRS office.

And nowadays anyone with Internet access can view the current *Transect* — and much, much more about the NRS — by linking with our home page on World Wide Web (WWW). Our Internet address is: **www.ucop.edu/DANR/nrs/nrs.html**. If you have any questions about accessing NRS information through WWW, contact the NRS's Web coordinator, Eric Rainbolt, at **eric.rainbolt@ucop.edu**.

*Editor's note: Director of the NRS Deborah L. Elliott-Fisk thanks Carol Cruzan Morton, of the UC Davis News Service, for use of information from her article in the Winter 1994 issue of* UC Davis Magazine *— also, Tom Cahill, Dan Dawson, Hap Dunning, John Melack, and Cathy Toft for their review of her draft lead article in this issue of the* NRS Transect.

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