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A message from the director of the NRS

Human illness can be understood only in the presence of health, a state both constant and changing. Height and weight, temperature, pulse, and blood pressure — these are some external indicators of internal health. Such simple measurements chart the maturation of the individual human organism and can signal the onset of problems that may befall some of us.

Likewise, simple, routine measurements of our environment, taken over time, help us understand our world. Detrimental environmental change can only be comprehended when long-term ecological monitoring and research of undisturbed ecosystems has already given scientists the vital statistics that reveal what is healthy and

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In This Issue

"Mud, mud, glorious mud! / There is nothing like mud for cooling the blood. / So follow me, follow / Down to the hollow / Where we will wallow / in glorious mud!"

— "The Hippopotamus Song" (lyrics by Michael Flanders), from At the Drop of a Hat, *by Flanders and Swann, 1960 Parlophone.*

Giant mudslide at Sedgwick Reserve. This past El Niño season caused about 100 landslides of varying sizes at this particular site. Photo by Patti Parisi

Scientists at Sedgwick Reserve master the mysteries of mud

Mud, mud, glorious mud! Researchers at Sedgwick Reserve just can't get enough of it.

During the 1998 "water year," the Santa Barbara area, including Sedgwick Reserve, received more than twice the normal amount of rainfall, compared to the long-term average dating back to 1870. El Niño has kept its promises. Happily, at Sedgwick, the resulting mud and mudslides are generating data that thrill UC Santa Barbara hydrologist Tom Dunne. He is studying how large rainstorms and various forms of land cover affect runoff and erosion by water and landsliding.

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A side view of the same impressive landslide that appears on page 1. Photo by Patti Parisi

When scientists set up monitoring systems on their experimental plots, they may hope they will be privileged to sample a rare, extreme event. But few possess either the patience or funding to design research intended to progress at that leisurely pace. Hydrologist Dunne says of Sedgwick's present mudfest: "Here we have this wonderful opportunity to grab the extreme event, go to the places that are affected by it, and measure its consequences." Then, in "calmer" years, he expects to fill in the picture by measuring more predictable, frequent, and smaller events.

Forewarned of the impending El Niño wet winter, Dunne and his colleague Rorke Bryan, Dean of the College of Forestry at the University of Toronto, prepared to use Sedgwick Reserve "with its range of erosion types, topography, and rainfall patterns as a laboratory for understanding what controls patterns and rates of erosion." They will apply the knowledge they gain at the reserve, says Dunne, to the rest of Central California, including its urban fringes.

"Although [Sedgwick Reserve] is far from an urban area, it allows us to sample the kinds of terrain that are being invaded by urbanization in other parts of this region," Dunne explains. He hopes the information they gain will be used by resource managers, builders, and city planners to minimize risk to human life and property. "The comfortable part of seeing the disasters out here [at the reserve] is that they're not hurting anybody," says Dunne. "In other places, like Seattle, where I used to study landslides, the fact that there are data is tinged with the knowledge that somebody has been injured or lost money by the disasters."

Dunne is interested in the physics of erosion processes: what triggers them, how they change the shape of the land, how they form patterns of erosion, and how they deliver sediment into river channels. For their study at Sedgwick, the researchers hypothesize that the spatial differences in the geology, slope, and vegetation cause the main differences in forms and rates of erosion across the site.

Most of this year's landslides occurred on slopes covered with coastal sage scrub and chaparral. But, Dunne says, it is not yet clear whether the greater number of slides on these slopes is due more to the effects of geological materials, including soils, or to the biotic effects of rooting systems and burrowing animals associated with the vegetation. Water erosion does appear to be more intense under sage and chaparral, Dunne explains, but sorting out the effects of soil, slope, and vegetation will require careful comparisons of paired sites and some field experiments.

For the landslide research, Dunne, Bryan, and UC Santa Barbara graduate student Manny Gabet are mapping the association between different types of landslides, vegetative cover, rock type, and topography. Aerial photographs will serve as templates for the maps. "Then we will measure the resistance of soil to failure, so we can understand the physics of why certain kinds of environments produce landslides and others don't," says Dunne.

For their water erosion study, the researchers plan to generate rainstorms with a rainfall simulator. Using local, long-term, rainfall records, along with information on the intensities of various storms and the size of raindrops, they know how much rain would fall naturally. Dunne has undertaken similar studies in East Africa and the U.S. Pacific Northwest, while Bryan has focused his efforts in East Africa, Mexico, Canada, and Europe. He says: "We can simulate the effects of a gentle rain on erosion or a large tropical gully washer."

The experiments will involve putting the rainfall simulator over a range of landscape characteristics, such as steep and gentle slopes, grasslands, chaparral, and sagebrush. At the top of a plot, the scientists will turn on the rainfall for a fixed period of time; then, at the bottom of the plot, they will measure the amount of washed-off water and sediment. Meanwhile, they will measure the flow characteristics — speed and depth — within the plot. Using these field data, they will build a mathematical model and extend their calculations to other locales. Later, to test their predictions, they will move the rainfall simulator to various research sites.

The scientists also plan to study the water erosion that follows from graz-

ing, fire, urbanization, or other disturbances. Dunne will extend his research beyond Sedgwick by conducting the same experiments on burnt areas so that he and his colleagues can build a mathematical model of what fire does to erosion, runoff, and nutrient washoff into the streams and associated effects on water quality.

"By experimentation, mathematical modeling, and longer term monitoring, we'll fill in the picture of these other processes that chronically affect certain environments between the catastrophic events," explains Dunne.

Rorke Bryan is particularly interested in why some soils are more vulnerable to erosion caused by intense rainstorms. "Recently, we've begun to realize that the same soil can behave in very different ways, depending on its history," says Bryan. But he's not talking about a soil's long-term or seasonal history. "What happens to many soils during a storm is conditioned by what it's been like in the last two weeks or since the last rainstorm," he explains.

Bryan says understanding a soil's history and vulnerability to rainfall is important in the context of climatic change. "We know that if we double the rainfall or halve the rainfall (due to climate change), something very exciting is going to happen," says Bryan. "The first stages will probably be fairly subtle: a small increase or decrease in the average interval between storms." However, while conducting experiments in his Ontario lab, Bryan found that if the interval between storms of the same intensity is changed from two to four days, the erosion rate caused by each storm can increase by several orders of magnitude.

Bryan wants to set up plots at Sedgwick to monitor natural rain, to measure how different soil sites change between storms, and to analyze changes to the soils when using rainfall simulation. He hopes to create comparison sites in Ontario and in Mexico's Sierra Madre Oriental. "With these completely different soil types, we can begin to put together a model of how different soil properties respond to storms. Ultimately, we can begin to make some sort of predictive model of which soils will have the most dramatic responses to fairly subtle climatic changes."

The time is perfect now for conducting this research, says Bryan — research that can be used as a land-planning tool. "We always spend our time trying to do this after the event. But if we can build some reasonable *predictive* system of which soils are more vulnerable to climatic change and which aren't, then we can start to apportion our conservation efforts in a sensible way. We can say, 'This area is fairly resilient, while this other area is much more responsive, so we've got to take special precautions.' In advance, it's a heck of a lot cheaper. We can stop the damage before it occurs." — *PP*

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Editor's note: Readers interested in the subject of El Niño and geology/land-mapping may wish to take a look at this website from the U.S. Geological Survey (USGS): <http://geology.wr.usgs.gov/wgmt/elnino>.

Understanding El Niño

What exactly is El Niño? Every few years, unusually warm water appears at the surface of the eastern tropical Pacific Ocean. Water temperatures there can be several degrees warmer than normal. This disrupts the fisheries off the west coast of South America. The phenomenon often appears around Christmas (El Niño means "The Child" in Spanish) and can last for many months, even a year or more. Research has shown that El Niño is part of a complex of changes in the atmosphere and ocean that involves the entire tropical Pacific region and can have far-reaching effects, producing drought in Australia and changing patterns of rainfall in North America. Because El Niño lasts a long time, affects a large area, and produces effects in both atmosphere and ocean, it's not weather. It's an aspect of climate. Recent research suggests El Niño may well be predictable."

— Richard C. J. Somerville
The Forgiving Air / Understanding Environmental Change
University of California Press, 1996 (Paperback edition, 1998)

The Forgiving Air, *a highly accessible handbook, humanizes the great environmental issues of our time — the hole in the ozone layer, the greenhouse effect, acid rain, and air pollution — and highlights the interrelatedness of human activity and global change. Author Richard C. J. Somerville is a professor of meteorology at the Scripps Institution of Oceanography, University of California, San Diego.*

El Niño benefits Wooly Bears at Bodega Reserve

Seventy inches of rain — more than twice the average precipitation — soaked Bodega Marine Reserve this past winter season. The drenching, along with spectacular winter storm swells, washed out "one to five meters of blufftop along a 60-meter-long strip of Horseshoe Cove," according to Reserve Manager Peter Connors, "with 35 meters of the trail itself slipping into the sea." That erosion is a dramatic example of storm impact on the coastal landscape. A much less obvious result of the wet winter is the subject of research by Rick Karban, professor of entomology at UC Davis.

Since 1985, Karban has studied wooly bear caterpillars (*Platyprepia virginalis*) a species native to Bodega Bay. The vegetation at Bodega Bay includes native lupine (*Lupinus arboreus*) and introduced poison hemlock (*Conium maculatum)*. The vegetation has grown tall and lush from the 1997-98 winter/spring deluge, providing an abundance of tasty leaves for the caterpillars — a break from their usual fare of spare, dry summer cuisine.

"Summer is the stressful time in the life cycle of this species and many others in this habitat," says Karban. "Wooly bears oversummer as small caterpillars, and most of them don't make it. This year I expect much higher rates of survival than usual because of all the food." That may mean a lot of adult tiger moths next summer.

The focus of Karban's research is the caterpillars' diet preferences, including how those preferences change if the caterpillar is parasitized by the tachinid fly, *Thelaira americana*.

The parasites enter young caterpillars during the summer, but don't begin to feed much on them until the caterpillars start to grow rapidly in the winter and early spring. The fly larvae feed on the caterpillars' hemolymph (blood) and fat bodies. When the fly (or flies — in several caterpillars, Karban found as many as *five* of these parasites) is ready to pupate, it chews "a massive hole in the side of the caterpillar — equivalent to a hole the size of a basketball in us — and climbs out," explains Karban. "This oozes for awhile, but seems to heal over in many cases."

Whether a parasitized caterpillar survives depends on several factors: how many parasites the caterpillar hosted (the more hosted, the less likely its survival); the humidity (the caterpillars prefer the Great Outdoors to a humid lab or enclosed container, which kills them); and what the caterpillar was eating.

A wooly bear caterpillar.
Photo by Rick Karban

The resulting adult moth.
Photo by Rick Karban

Karban's research has shown that the parasites enter only young caterpillars and that the caterpillars have an innate preference for lupine. However, once parasitized, the caterpillars mysteriously develop a taste for hemlock. Karban believes this choice helps them to rid their bodies of the parasites.

Karban says it is well accepted that parasites have the ability to alter the behavior of their hosts. One of Karban's intriguing discoveries is that the caterpillar may alter its behavior by changing its food preference to something that helps it survive its invaders, essentially drugging itself as soon as it is parasitized. Meanwhile, unparasitized caterpillars continue feeding on their first choice on the menu: lupine. It's still unclear how the change in diet makes the caterpillars better able to withstand harm from the parasites.

Insects are relatively well studied. Yet, "this behavior (of their changing food preference) is previously undocumented," Karban says. He plans to write a paper about how the weather, including this year's El Niño, affects the abundance of food and its relation to the caterpillar/parasite interaction. He explains: "We still don't have a very good understanding of the factors that control insect population dynamics." — *PP*

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El Niño Season makes life a lot tougher for elephant seal pups at Año Nuevo Island Reserve

Infant elephant seals on the Año Nuevo Island Reserve battled pounding waves and wild storms last winter — and many of them lost.

Newly weaned northern elephant seal pups at Año Nuevo Island Reserve. Photo by Steve Davenport

"Pups are half blubber, half muscle mass," says Guy Oliver, a UC Santa Cruz research biologist. "They are buoyant enough, like corks, that they can literally get flooded off the rookery, away from their mothers." Between late January and early February — coinciding with the season's highest tides — titanic storms delivered waves that carried pups out to sea. Without adequate musculature or ability to swim, the pups drowned.

Researchers use the term *mortality* to refer to the direct impacts of storms on pups on the beach: before the pups are weaned, many are carried off the rocks by high waves and tides. Some are also crushed when the pounding surf forces large numbers of elephant seals close together.

In non-El Niño years, the mortality rate for pups, whether on the island or the mainland, is typically about 7 percent. During this past El Niño season, the mortality rate for pups on the mainland was 20 percent, while pups on the island suffered a 56-percent mortality.

In addition to monitoring how the storms directly affect the mortality of northern elephant seal pups (*Mirounga angustirostris)*, researchers are concerned with how El Niño indirectly affects the entire population. One important study area is the ability of both juveniles and adults to find food at sea. "Although El Niño impacts on coastal pinniped survival were documented in 1983, little is known about the processes underlying difficulties finding food," explains Dan Crocker, a UC Santa Cruz research biologist and a principal investigator on the one-year National Oceanographic and Atmospheric Administration (NOAA)-funded study. "We're attempting to look at changes in the at-sea behavior of animals so we can get a better understanding of how El Niño impacts foraging." UC Santa Cruz biology professors Dan Costa and Burney Le Boeuf are co-principal investigators.

Scientists use the term *juvenile survivorship* when discussing whether elephant seal pups can make it out to sea on their first foraging trip and return safely. Even in normal years, juvenile survivorship is just 50 percent — and it declines significantly in El Niño years. During this El Niño year, the juvenile survivorship rate at Año Nuevo was only 20 percent. Crocker explains: "They're naive to the ocean environment. This is the first time the pups go to sea to learn to make a living. This was a particularly hard year for them to learn that."

Even adults had a lot of trouble finding food this year. At the end of the elephant seal breeding season in March, investigators attached satellite tracking devices and time/depth recorders to 10 adult females to track their foraging trips and their return to the rookery. Researchers can tell from the diving profiles when the females are traveling or foraging. The food the females gather on their foraging trips (several species of squid and fish) must sustain them during their months on land, when they are breeding, molting, or nursing. During the nursing of a pup, adult females lose 30 to 40 percent of their body mass. "The mother has gotten really skinny and the pup's gotten fat," says Oliver. "It's a real obvious transfer of energy." So, a svelte female, having fasted during a month of nursing and used up her stored energy, abandons a weaned pup in order to return to the sea and forage.

By June, eight adult females had returned to the rookery. Two had given up their search for food and returned early. Others stayed at sea for an unusually long time in search of food. Females that were most successful in their foraging this El Niño year did no better than the least-successful females in non-El Niño years, Crocker says. In fact, he adds, "the ones with the worst success (the two that came back early) came back starving."

In normal years, Crocker explains, animals come back to the rookery having gained an average of 1 kilogram per day. "But this year, the first one that came back had lost weight. The second

A lumpy carpet of pinnipeds at Año Nuevo.

gained only .22 kilograms per day, and another gained only .40 kilograms per day. Others have gained some weight, but none were as efficient as those in non-El Niño years."

The researchers are surprised El Niño impacted the elephant seals' ability to find food because the mammals are deep divers, while El Niño's warm waters are relatively shallow. The seals find their food in the "deep scattering layer"* that sinks during daylight, rises during dusk, and reaches the ocean surface at midnight. Elephant seals feed on the bottom part of the layer, at between 400 and 700 meters below sea level, depending on time of day.

Crocker explains that foraging dives usually make up about 60 percent of a trip. But this year during El Niño, he says, about 35 percent were foraging dives. One speculation for why this was so is that the warm waters of this particular El Niño went unusually deep. "The changes in diving behavior suggest that El Niño has reduced the amount of food available to the seals, or it changed the cues they use to locate food, making it harder to forage." The question is, says Crocker, whether the females — already weak from nursing and malnourished from lack of food — will be able to recover sufficiently to breed successfully next year.

The researchers are also watching how the population is taking care of its orphans. In the melee created by the pounding surf, pups can become separated from their mothers. This happens in any strong storm, whether or not it is an El Niño year. Adult elephant seals are used to taking in unrelated pups, if they lose their own in a storm. However, an adult female that already has her pup will rebuff an orphan: capable of giving birth to and supporting just one pup per year, she is protective of her assets. Crocker says they can tell which pups are orphans just by observing which ones aren't attached to a teat. These pups are small and skinny and off by themselves. They often have bite wounds from potential foster mothers who rejected them. Some pups starve to death.

El Niño also brought visitors to Año Nuevo: 4,000 to 8,000 California sea lions from the Channel Islands. Most were males and juveniles, but adult females also landed. Oliver says that these animals hadn't landed at Año Nuevo since the last El Niño, in 1992, and that they also may have been confused by the redistribution of prey.

Although this study's funding ends in November, the researchers will continue their long-term diving studies of northern elephant seals. Crocker says they will use a new device, a stomach temperature telemeter (the size of a pill) to record data on the sea temperature of prey in the elephant seals' stomachs. This will help them determine at what depth they are finding food — and how dependent the marine mammals are on oceanographic features. In turn, the 1997-98 El Niño phenomenon is giving researchers the opportunity to study changes in foraging behavior. "The data will increase our understanding of which individuals in a population are most likely to be impacted by reductions in prey availability," explains Crocker. He says the data may be helpful in the management of coastal pinniped populations. — *PP*

For more information about elephant seals, see: <http://www.anonuevo.org/images/eseal1.au>.

Mother-pup interactions among stellar sea lions at Año Nuevo. Photo by Kathryn Ono

**The ocean's "deep scattering layer" is an assemblage of fish, crustaceans, and other organisms that exhibits diurnal migration: at night, they move up toward the surface; during the day, they retreat down into deeper waters. This vertical migration is thought to be driven by light intensity: creatures hide from predators during daylight by descending into darker waters. The phenomenon is called the deep scattering layer because the bodies of migrating sea creatures reflect sound, their assemblage can be detected with depth sounders and, like the ocean bottom, scatters a sonar signal. Seals and other animals that feed in the deep scattering layer follow this vertical migration.*

Big Creek survives El Niño, while reserve staff labor to enhance local emergency readiness

The Landels-Hill Big Creek Reserve on the Big Sur coast, already a remote site, was made even more remote by El Niño. Storms earlier this year repeatedly cut off the reserve from outside help for two and three days at a time — one effect of what the Big Sur Volunteer Fire Brigade (BSVFB) called the "Big Sur Coastal '98 Incident."

The entire Big Sur "incident" was actually a series of landslides, tumbling boulders, and road closures that occurred from December 1997 through May 1998. Highway 1, which snakes along the coast, remained closed until May 22 and is still down to one lane in stretches where bridges are under earthquake retrofit or where unstable slopes are still moving. CalTrans bulldozers and excavators are perched precariously along the hillsides, scraping away material that could gain momentum in another downpour, and preparing the cliffs for revegetation.

At times when Highway 1 was closed, Big Creek's on-site reserve manager, John Smiley, and other Big Sur residents had to traverse the Santa Lucia Mountains via Nacimiento-Ferguson Road to get to stores for food and supplies — this same road became the only route open to researchers working there. The reserve itself suffered minor damage: a bank slipped down, burying a road, while another section of road washed away. Fortunately, Reserve Steward Feynner Arias-Godenez quickly repaired both problems.

"The reserve road system held up remarkably well," explains Smiley. "We will definitely be able to maintain our 'no grading' policy, which allows perennial and native vegetation to grow up and cover the road margins and banks."

The BSVFB's community action team — called the SurCAT — created an information hotline for posting when and how people could get out of Big Sur, and how they could ask for help. Smiley, a SurCAT member, updated the hotline throughout the season, particularly when, in late February, a major highway blockage occurred at Big Creek's Wing Gulch, one and one-half miles north of the reserve entrance.

Big Creek Reserve's rugged topography and remote location complicate efforts to deal with local disasters. Photo by Larry Ford

The SurCAT formed nearly two years ago after fires raged through Big Sur. Penny Vieregge, an American Red Cross trainer, was instrumental in getting the SurCAT recognized as an umbrella group affiliated with the Red Cross. The U.S. Forest Service and the California Department of Forestry also have staff who are members of SurCAT.

"It became clear at our first meeting after the fires that this area has not been adequately mapped," explains Smiley. "Those of us who live here know where the roads are, but emergency personnel don't have that intricate knowledge of the region." That knowledge is crucial for emergency evacuations, putting out fires, and attempts to save homes.

So Smiley volunteered to coordinate an effort to map Big Sur, from the Palo Colorado Canyon to Monterey County's southern border. As Big Creek's reserve manager, Smiley had already begun creating maps on exotic plants and weed management. But the road and topography maps are woefully incomplete. Road damage from the storms put the project on hold this past winter and spring, but today it continues. Smiley is using ArcView, a geographic information system (GIS) software, to map the Big Sur region. His goal is to create a "run book" that fire emergency personnel carry with them on their trucks. "The run book will contain maps and information on whether a house exists along the road, whether there are water sources, such as tanks or swimming pools that firefighters can draw upon, and local contact information."

"The U.S. Forest Service, the state parks, the sheriff's and fire departments — all of these agencies depended on the SurCAT this past El Niño season," explains Smiley. "Those agencies are pushing for this kind of novel community organizing, which makes their job of emergency preparedness easier and much more efficient."— *PP*

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Mistress of emergency planning keeps watch over Stunt Ranch Reserve and surrounding communities

Editor's note: The El Niño season damaged trails at Stunt Ranch Santa Monica Mountains Reserve, but more significant were the consequences to the site's main access, Stunt Road. Facing serious slump failures and road washouts, the L.A. County Department of Public Works is eager to make emergency repairs before the next rainy season. The reserve and its neighbors in the Cold Creek watershed will benefit from this road work. Yet, depending on the weather and time of day, the work will also challenge reserve users and those involved in the planned reconstruction of site facilities by complicating reserve access.

Dealing with road-repair logistics is just one of the diverse, but customary, duties of NRS reserve managers. Stunt Ranch's staff manager, Carol Felixson, coordinates everything from her office at UCLA. The 1996 Calabasas fire (which came within a mile of the reserve) and more recent El Niño flooding and mudslides again called upon Felixson's planning skills and emergency preparedness expertise. This benefited not only the reserve and the University, but also (through her assisting the Topanga Coalition of Emergency Preparedness) the surrounding communities of Topanga, Malibu, and Calabasas.

Carol Felixson, director of education and community outreach for UCLA's Stunt Ranch Santa Monica Mountains Reserve, got involved in emergency preparedness work by accident — an appropriate way to start in that field.

When the 1993 Malibu/Topanga fire swept through the area (burning all of Stunt Ranch's facilities and most of its vegetation), she was enrolled in the UCLA Extension's Professional Certification Program in Public Relations. Soon the governor's Office of Emergency Services needed a public information officer (PIO) in the state's Fire Recovery Center — suddenly, Felixson found herself juggling information between impacted individuals, businesses, local communities, and a wide range of emergency services agencies.

Soon after the 1993 Malibu/Topanga fire came the 1994 Northridge earthquake. Then, in 1994 and 1995, flooding occurred. These back-to-back natural disasters kept the emergency center open two years — a year and a half longer than most such centers. When Phil Rundel, Stunt Ranch's faculty reserve manager, went looking for someone with both writing and community relations skills, as well as experience collaborating with the Federal Emergency Management Agency and other agencies, he found the perfect match in Felixson, then manager/PIO of the recovery center.

"Our job for the University and the NRS is about protecting the lands and providing useful field sites for environmental research and class use," Felixson says. "But, in a disaster scenario, as a good neighbor and reliable resource to people and communities in need, our job is to assist with emergency preparedness, response, and recovery."

One key to successful emergency planning, says Felixson, is simply having a good, solid plan. "A plan should not only state what to do if you encounter a rattlesnake and where to go if you're injured, but also make you aware of fire and flood danger. There are stages of risk and stages of decision making," she explains, "and situations can change rapidly."

Felixson says the other key to successful emergency planning is teamwork. "If there's no emergency team to implement a plan, people will go in all different directions. You need to have folks who can calm each other and offer alternatives, such as what route to take out of a structure or up and over the mountain."

Felixson admits her knowledge of potential, lurking dangers can make being out in nature a paradoxical experience. During the past season of record rainfall, she visited Northern California. While she and her friends enjoyed the beautiful green scenery, she also remained keenly aware of all the sloping, saturated hillsides, anticipating the slides that did occur several hours later. Of this level of awareness, she says: "Given what I know from emergency work and have experienced firsthand as a fire, earthquake, and flashflood survivor, I can become concerned about conditions. But I've also learned to look ahead to the best- and worst-case scenarios. After I come up with a reasonable plan, I relax and let the situation work itself out."— *PP*

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Felixson's motto: Be prepared!

Reserve staff recount what happened when El Niño paid a visit to their sites

From Bodega Marine Reserve (Sonoma County):

At every normally dry, interior site I visited this spring — deserts, serpentine grasslands, oak woodlands — it was a spectacular wildflower year. But on the normally damp coast, the extra rainfall (more than twice the normal at Bodega), produced unusually subdued wildflower displays. Instead, it was a grass year, with thicker cover, taller plants, and more flowering stems per plant. For many of the native perennial bunchgrasses at our site, it was the healthiest year we have seen in the past decade. Stands of California brome looked like hayfields, and many other native species were unusually robust. Unfortunately, introduced species also took advantage of the extra rainfall, and patches of the invasive perennial velvet grass have claimed new areas of our reserve. We'll watch closely in future years to see whether these areas are permanently lost to the native plant community.

Connors on the edge: Bodega lost more coastline to El Niño. Photo by Patti Parisi

— Peter Connors
Staff Reserve Manager

From Hastings Natural History Reservation (Monterey County):

We had one of the busiest winters ever, and our researchers just toughed it out. Some had to leave cars on each side of the creek crossing and hike out to get to and from town. We were only isolated for three days, but an emergency action to put in a culvert on a raging creek opened the headquarters again. The action involved [reserve steward] Mark Johnson and me straddling a 36-inch-diameter, plastic culvert while a backhoe and dumptruck unloaded tons of rock within inches of our faces — what a panic!

Why do graduate students insist on driving their trucks on roads they know are too muddy and across deeply flowing water? One student would get stuck at least once a week, and eventually totalled her car trying to cross a creek.

We also saw the appearance of a new bird: black-crowned night herons. Maybe they thought we had ponds. But eventually everything dried up, and they left, too.

— Mark Stromberg
Staff Reserve Manager

From Eagle Lake Field Station (Lassen County):

It was a very wet winter at Eagle Lake, with the lake itself rising two to three feet. We found that one of our more heavily used buildings at the station had some leak problems, so a new roof and ceilings are among the repairs to be made to Ediger Hall [on-site facility] by the end of August. All in all, we weathered the winter quite nicely.

— Jay Bogiatto
Faculty Reserve Manager

From Motte Rimrock Reserve (Riverside County):

El Niño is creating a big fire year [because of the extra fuel load], which started with a fire at Sycamore Park (close to Riverside, but with the same habitat as the reserve). We will probably have to do some mowing in the Stephens' kangaroo rat (SKR) habitat to maintain the total size of the area, a requirement of being an SKR-selected reserve. [On August 30, there were 12 to 15 fires in the vicinity of this site.]

— Barbara Carlson
Staff Reserve Manager

From Valentine Eastern Sierra Reserve — Sierra Nevada Aquatic Research Laboratory (SNARL) and Valentine Camp (Mono County):

As of early July, we still had significant piles of snow in the forest at Valentine Camp. This was more a result of storms and cool weather that persisted into spring rather than a huge winter. At a normal opening date of June 1, we still had 100-percent snow cover in the forest. At the Sierra Nevada Aquatic Research Laboratory (SNARL), we are experiencing a small rodent boom. We are noticing it with *Peromyscus maniculatus*, the vector for hantavirus. I have trapped 25 mice out of my garage, five out of my van, one out of the station vehicle, and six out of a couch in the library. Chipmunk densities also seem to be way up.

— Dan Dawson
Staff Reserve Manager

From Coal Oil Point Natural Reserve (Santa Barbara County):

The combination of high tides, strong creek flows, and huge surf stripped away much of our foredune habitat at the reserve. These dunes had also been greatly eroded by the '82-83 El Niño and had never recovered, despite our protective fencing. Every day, we would ford the rushing creek mouth to reach the dunes and reclaim bits of fencing that were sliding down the eroded duneface into the surf. We were impressed with how quickly people started trespassing into the reserve without the fence. We reinstalled it, reducing trespassing on the dunes.

Surfers enjoyed the dune erosion because sand from the dunes ended up in the ocean, creating nice waves.

We saw many dead, starved, and sick sea lions on the beach, perhaps due to reduced food availability. One sea lion gave birth at the reserve. In many cases, the sea lions have been harassed and attacked by off-leash dogs. The sea lion pup was orphaned by its mother after a dog attacked it, and it is now being cared for and raised by the Marine Mammal Center. One of our biggest challenges is to get dog owners to respect wildlife on the reserve beach.

One welcome effect of the storms is that we saw several black skimmers, which appear to have fled storm damage in Southern California. These large, ternlike birds are unusual in our area, and it was a treat to watch them skim through the waves at sunset. Hopefully, they may stick around and make the reserve their new home.

— Kevin Lafferty and Cristina Sandoval
Reserve Stewards

From Boyd Deep Canyon Desert Research Center (Riverside County)

It's the best wildflower season that we have had since the '83 El Niño.

— Al Muth
Staff Reserve Manager

From San Joaquin Freshwater Marsh Reserve (Orange County):

It's going to be a big biting season for our mosquitos!

— Peter Bowler
NRS Academic Coordinator, UC Irvine

Want more information? Check these websites …

On long-term monitoring & research

- *Long Term Ecological Research Network (LTER):* <http://lternet.edu>
- *CA Environmental Resources Evaluation System, developed by the CA Resources Agency:* <http://www.ceres.ca.gov>
- *Information Center for the Environment:* <http://ice.ucdavis.edu>
- *Ecological Society of America (ESA):* <http://esa.sdsc.edu/FLED/FLED.html>

On El Niño

- *Scripps Institution of Oceanography, UC San Diego:* <http://sio.ucsd.edu/supp_groups/siocomm/elnino/elnino.html>
- *Environmental & Societal Impacts Group at the National Center for Atmospheric Research (NCAR):* <http://www.dir.ucar.edu/esig/enso/>
- *National Oceanic and Atmospheric Administration (NOAA):* <http://www.elnino.noaa.gov/>
- *National Aeronautics and Space Administration (NASA):* <http://airsea-www.jpl.nasa.gov/ENSO/welcome.html>
- *Desert Research Institute:* <http://www.wrcc.sage.dri.edu/enso/enso.html>
- *Environmental News Network:* <http://www.enn.com/specialreports/elnino/>

On emergency Preparedness & Recovery

- *UC Division of Agriculture and Natural Resources (DANR) — Natural Disaster Information Web Page:* <http://danr.ucop.edu/whatsnew.htm>
- *Federal Emergency Management Agency (FEMA):* <http://www.fema.gov>
- *National Weather Service (NWS):* <http://www.nws.noaa.gov/>
- *CA Department of Transportation (CalTrans) — Highway Info:* <http://www.dot.ca.gov/hq/roadinfo>
- *Emergency Preparedness Information Center:* <http://TheEpicenter.com/>

A fond farewell to NRS founder Kenneth S.Norris

Kenneth Stafford Norris, acclaimed marine-mammal researcher, beloved teacher of natural history, and founder of the UC Natural Reserve System, died August 16, 1998. He was 74.

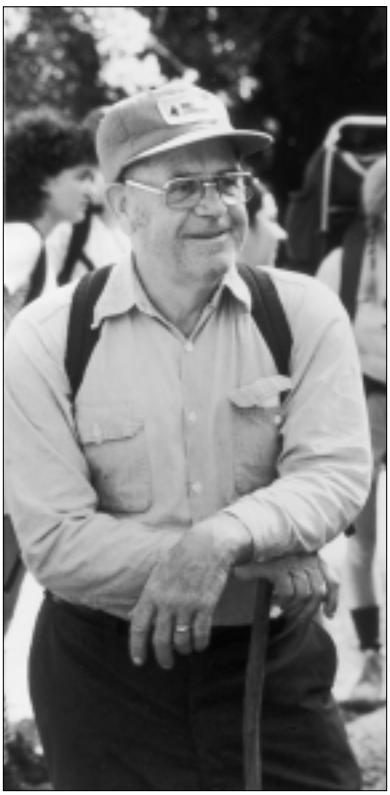
As a scientist, teacher, author, and champion of the natural world, Norris left a rich and varied legacy. He retired in 1990 after 18 years as a professor of natural history at UC Santa Cruz, but remained active until recently.

Norris's research contributions alone reflect a remarkable range of accomplishments. Groundbreaking investigations by Norris and his various research teams have revealed much of what is now known about whales and dolphins, particularly their social patterns and echolocation skills. Yet, in a very different setting, it was as a desert ecologist at UCLA that Norris discovered circadian rhythms in snakes and the function of color changes in reptiles and amphibians.

His stature as a scientist enabled Norris to influence public policy in significant ways. As a scientific adviser to the U.S. Marine Mammal Commission, for example, he helped write the Marine Mammal Protection Act of 1972. Norris also led a national campaign to reduce the numbers of dolphins killed in tuna-fishing nets.

The author of several books on whales, dolphins, and porpoises, Norris received the prestigious John Burroughs Medal in 1992 for his book *Dolphin Days: The Life and Times of the Spinner Dolphin*.

Norris was especially proud of his role in creating the UC Natural Reserve System (NRS). As an assistant professor at UCLA, Norris recognized the need to reserve undisturbed natural areas for teaching and research.



Ken Norris as students in his field quarter class knew him. Photo by Don Usner

Through the efforts of Norris and others, the NRS was established in 1965. In June 1998, the NRS received a $4-million endowment from the David and Lucile Packard Foundation, which was named the Kenneth S. Norris Endowment Fund for the California Environment as a tribute to his leadership.

Norris was born August 11, 1924. He earned his B.A. and M.A. in zoology from UCLA; in 1959, he received his Ph.D. in zoology from the Scripps Institution of Oceanography, La Jolla. In 1953, two years into his doctoral studies, Norris was hired as the founding curator at Marineland of the Pacific, the country's second oceanarium.

In 1959, Norris returned to UCLA to teach herpetology and continue his earlier research on desert reptiles. His interest in marine life eventually led him to Hawaii, where he served as founding scientific director of the Oceanic Institute from 1968 to 1971, while continuing a part-time association with UCLA. His research in Hawaii included studies of spinner dolphins and fish culture. He also helped to establish Hawaii's Natural Land Reserve System.

In 1972, Norris came north to UC Santa Cruz to serve as director of the Center for Coastal Marine Studies (now the Institute of Marine Sciences). Norris held the post from 1972 to 1975, working with biology professor William Doyle to secure land and funding for what is now the Joseph M. Long Marine Laboratory.

Norris chaired the Environmental Studies Department from 1977 to 1979. He then founded and coordinated the Environmental Field Program, which provides financing for undergraduate research projects.

Norris was legendary for his ability to inspire students. He taught the popular "Field Quarter" class in UCSC's environmental studies program, a wide-ranging and rigorous course in the natural history of California. Each spring, Norris led two dozen Field Quarter students into this state's mountains, forests, and deserts to learn firsthand from nature. As a teacher and mentor, Norris influenced students at both undergraduate and graduate levels, helping to launch the careers of many over the years.

Norris died peacefully at UCSF Medical Center, surrounded by his family, after several months of illness. He is survived by his wife, Phyllis; his brother, Robert; his children, Susie Norris, Nancy Norris Littlestone, Barbara Gaskell, and Richard Norris; and six grandchildren.

— Tim Stephens
UCSC Public Information Office

Message from the NRS director

Continued from page 1

"normal" in nature. Species diversity, reproductive rates, weather conditions, nutrient and pollution levels — these are some measurable parameters that shape our understanding of what constitutes a healthy environment.

El Niño's much-publicized impacts are often misrepresented. El Niño is not an anomaly, not an abnormal environmental perturbation. Rather, it is a naturally occurring and cyclical event. Overlying the tidal cycle and four familiar seasons are rhythms of much longer periodicity. But understanding these patterns and their effects on biota requires us to take a long view of life.

The NRS's 33 sites across the state are a window on the natural world that affords us this privileged perspective. As time passes, we develop a fuller appreciation for the complexities of these relatively undisturbed locations. Then, when oil spills and other accidents occur, we can draw upon years of meticulous observations to determine how the healthy ecosystem and its inhabitants should look. Or when floods, mudslides, and other natural disasters occur, we can use our long-term datasets to determine how an ecosystem is being impacted and whether the effects are truly deleterious or in fact beneficial.

Whether we are trying to restore general health to degraded habitats, mitigate specific adverse impacts of human development, or educate today's policymakers and tomorrow's scholars, we learn, through long-term ecological research and monitoring of our reserves, how to care for our world and support our environmental health.

Now as we mourn the very recent passing of NRS founder Ken Norris, we also recall his words, even more relevant today than they were over 30 years ago: "The most basic rules of the world — the ones we all live by — are ecological rules. You can't study them or even perceive them very well in a classroom or laboratory. Whether one is a botanist, a biologist, or an earth scientist, it's imperative to go out on the mountainside, watch the rain fall over a valley, dig into the earth beneath a fallen tree, or wade a creek for cobbles with sources upstream. The best work in the natural disciplines all starts with observations in nature."

— *Alexander N. Glazer*
Director, Natural Reserve System

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Photo by Susan Gee Rumsey

Good-bye, Ken.