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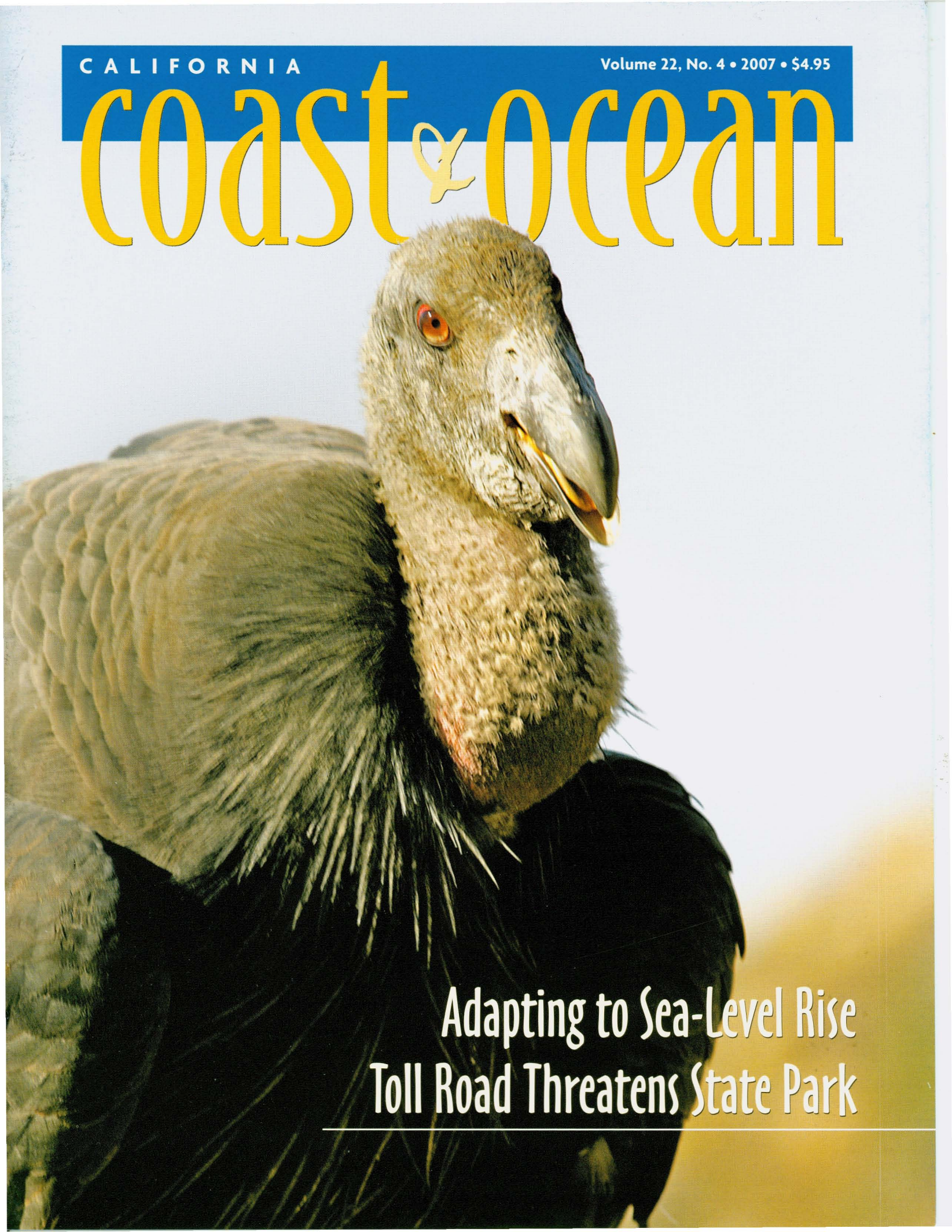

Adapting to Sea-Level Rise

Toll Road Threatens State Park

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Coastal Conservancy

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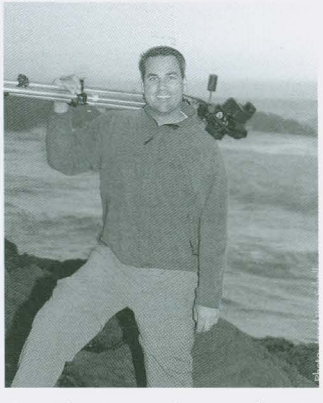

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Kip Evans's photographs have been published worldwide in books, exhibits, advertisements, and magazines including *National Geographic, Rodale's Scuba Diving, Outside, Sea,* and *Coastal Living.* His current selection of fine art photography can be viewed at the Mountain and Sea Gallery in Carmel (www.MountainSeaGallery.com).

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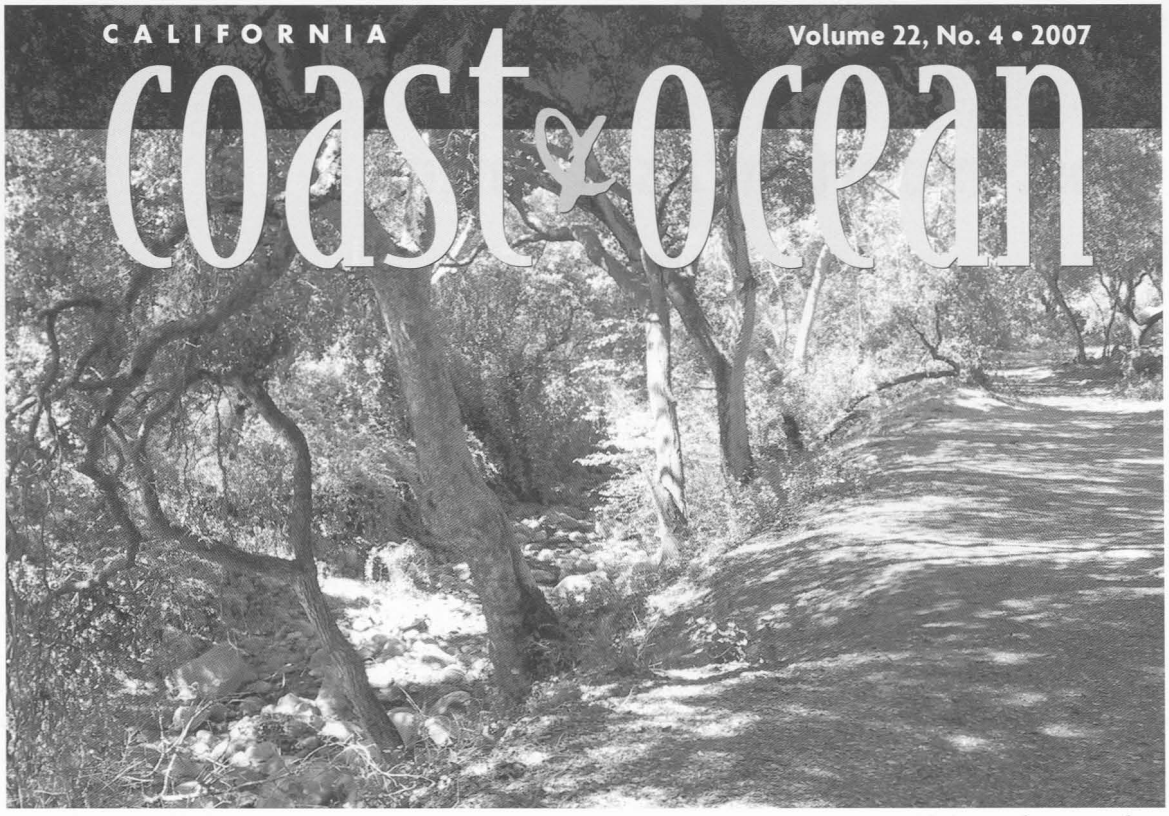


SOUTHERN CALIFORNIA WETLANDS RECOVERY PROJECT

Mission Creek, Santa Barbara
(see p. 40)

Our Most Important Assignment

WE OFTEN WRITE ABOUT restoration projects in *Coast & Ocean* when they are launched, but less frequently report on results. So last January, when a public tour of the Sonoma Baylands was offered as part of the San Francisco Flyway Festival, I signed up.

We had devoted much of the Autumn 1994 issue to the Sonoma Tidal Marsh Restoration Project ("A Marriage Made in Mud") because it was unprecedented and amazing in its day. The Coastal Conservancy had brought together groups that often clashed on environmental issues, including the U.S. Army Corps of Engineers, Port of Oakland, commercial fishermen, and conservation organizations. All found enlightened self-interest in collaborating on an effort to restore lost habitat for two small endangered marsh dwellers. These were not poster species, like the sea otter, whale, or wolf, they were small gray creatures hardly anyone had ever even seen. The salt marsh harvest mouse lives in pickleweed, the California clapper rail inhabits cordgrass, and both keep to themselves. Yet their presence—or absence—became the rationale for a multi-million-dollar project that would benefit many other species and would solve several urgent human problems. We still have a few copies of that issue, so if you want the full story, ask us for one.

On a breezy Saturday I joined a small group and our tour guide, Coastal Conservancy Project Manager Tom Gandesbery, at Port Sonoma-Marin, off Route 37 on San Pablo Bay. I had last seen the Baylands when it was a huge construction site. Now, as we hiked toward the breach in the outer levee where the tide flows in, we were impressed. Willets, curlews, and other shorebirds were pecking for food in the mudflats. Ducks and other waterbirds swam peacefully here and there. We heard calls we tried to identify, raised our binoculars, and ourselves uttered calls typical of novice enthusiasts: "Oh look! Is that . . . ? Or is it . . . ? No, I think it's . . ." It was fun, exhilarating and there sure were birds aplenty.

Walking back to our cars we marveled at how vigorously the wetland had returned. Sure, this was an engineered marsh, it didn't look quite natural, but wind and water were already polishing the rough work of hydrologists and engineers. "Nature is resilient," someone said.

Nature is resilient. That's what I came away with, and it's a joy and an inspiration. Sea-level rise may revise some projections, but nature, with just a little help from human friends, will take over. What a comfort. As we worry about the future, how marvelous it is to see the results of decades-long efforts to remedy what was destroyed by ignorance.

Along Big Sur, we can now see condors in free flight. Pelicans have returned from near-extinction and again are part of our coastal scene. The Aleutian Canada goose population was just 700 in the '70s; now it is around 100,000. The Sonoma Baylands project pioneered an approach that was followed by others. Since it began, 40,000 acres have been preserved for habitat and agriculture in the region between Novato and Vallejo. Highway 37 is being promoted as "the North Bay flyway highway." (Go to www.yourwetlands.org for an audio or video tour.) Sea-level rise may revise some hopes for the future, but this marsh may be able to retreat inland, along with the clapper rail, the harvest mouse, pelicans, willets, and other marsh inhabitants.

All this was made possible by a perceptual shift in our society during the 1970s that catalyzed action that led to the Endangered Species Act, the Clean Water Act, the Coastal Act, and other life-saving laws. These enabled creative citizens and public servants to craft imaginative projects that proved that our well-being and that of the natural environment are inseparable.

This unidentified object, probably a buoy, washed up in the Baylands. If you can identify it, please call us.

SONOMA LAND TRUST

Now with the stark recognition of global warming, another perceptual shift is under way. My e-mail inbox keeps being flooded with news of small but sensible and imaginative actions being taken by individuals, communities, and industry to diminish carbon emissions. Stupid things are also being promoted by cynical interests or people who have not thought through the interconnections. It sure doesn't make sense to grow corn to burn, destroying rainforests and wild lands—and in the process leading to a rise in the price of tortillas in Mexico—just so we don't have to get out of our private cars. But common sense is pushing up the grass roots and, as we have surely learned, little victories prepare the way for big ones. If none of this saves us during the growing climate crisis, if we act more responsibly we at least will be healthier and happier.

To nurture the energy and spirit needed for today's challenges, we need to take time to acknowledge and enjoy what has been accomplished thus far. That's our most basic, most important assignment at this moment, because it will help to show us what we can do.

—Rasa Gustaitis

To reach the Sonoma Baylands, take Highway 37 to Port Sonoma-Marin, park and walk.

STEPHEN FRANCIS, COURTESY CA STATE PARKS

A TOLL ROAD WOULD CUT THROUGH A STATE PARK AND SOME OF SOUTH COAST'S LAST WILDLANDS

Too High a Toll

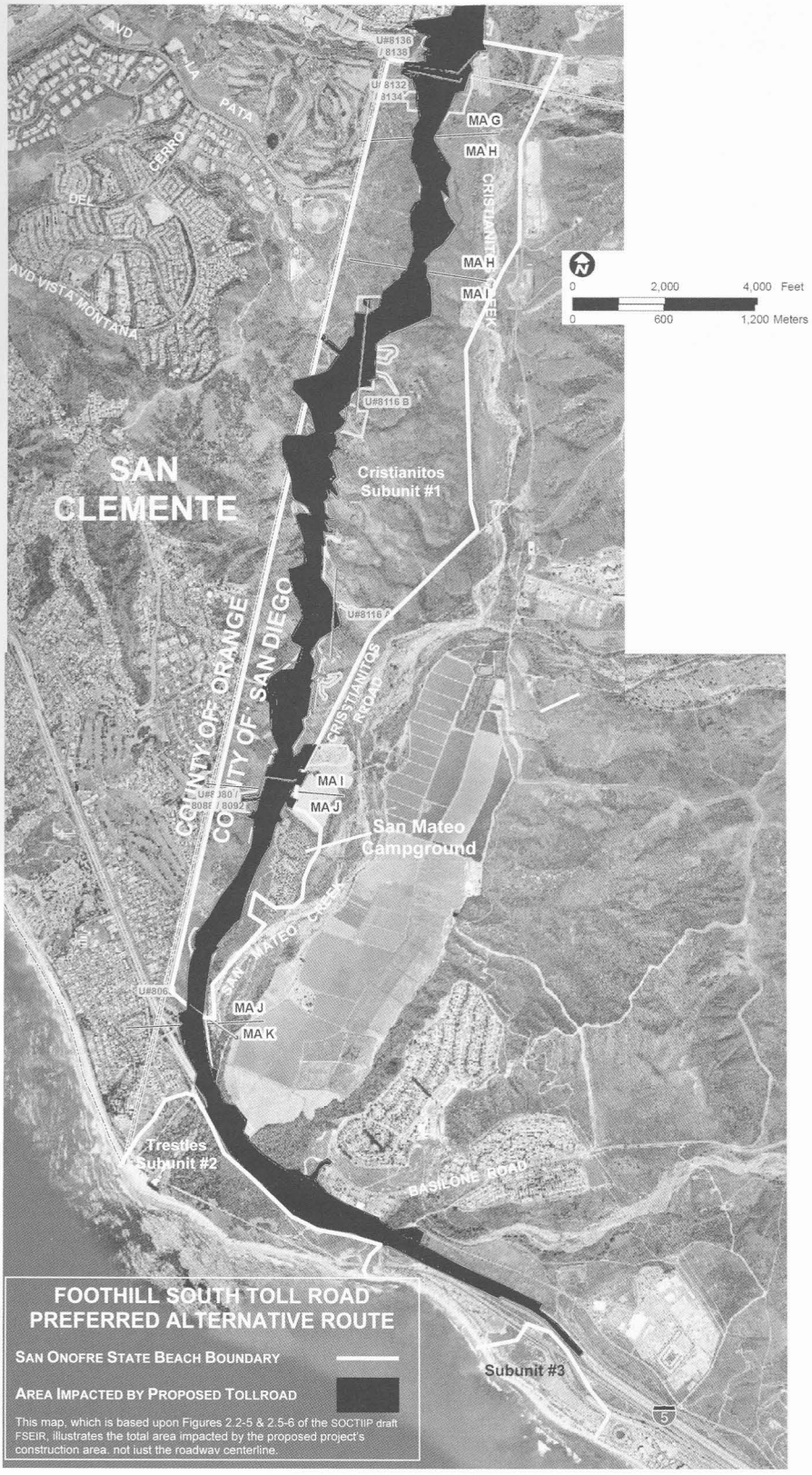
The path to Trestles

EILEEN ECKLUND

DRIVING NORTH FROM SAN DIEGO ALONG the coast on Interstate 5, a traveler passes mile after mile of houses, malls, businesses, and roadways. Every now and then you glimpse the ocean off in the distance or see a grassy hillside, but otherwise you are confined to a virtual corridor of development.

Then suddenly, just north of Oceanside, the landscape opens up. To the west is the ocean, while to the east flatlands and rolling hills covered with coastal sage scrub extend as far as the eye can see, with only here and there a building or a road. Along this stretch of highway you might actually spot a hawk circling overhead, hunting for its meal among the abundant little critters in the underbrush, or perched atop a telephone pole. This is coastal southern California as it used to look before sprawl took over, and it's still here because you're in Camp Pendleton. Like many military reservations in California, this 125,000-acre Marine Corps base, owned by the Department of the Navy, contains some of the last wild land in its region; this area would likely have been developed years ago if not for the base. San Mateo Creek, one of the last coastal streams in southern California that has no dams or other man-made barriers, flows from its headwaters in the Cleveland National Forest through Camp Pendleton to meet the ocean. Southern steelhead were thought to be extinct south of Malibu Creek until they were found in San Mateo Creek in 1999.

Camp Pendleton also contains a state park, created in the 1970s through a lease agreement with the Navy. San Onofre State Beach gets



COURTESY CA STATE PARKS

The area of San Onofre State Beach that would be affected by the proposed toll road is shown in black. The thick white line indicates the boundaries of each of the park's three subunits; the western boundary of the inland (Cristianitos) subunit is along the Orange County/San Diego County border. The map is a composite of two maps created for an environmental impact report (available at www.thetollroads.com/home/finalseir.htm). Ignore the letter/number labels; they pertain to that report.

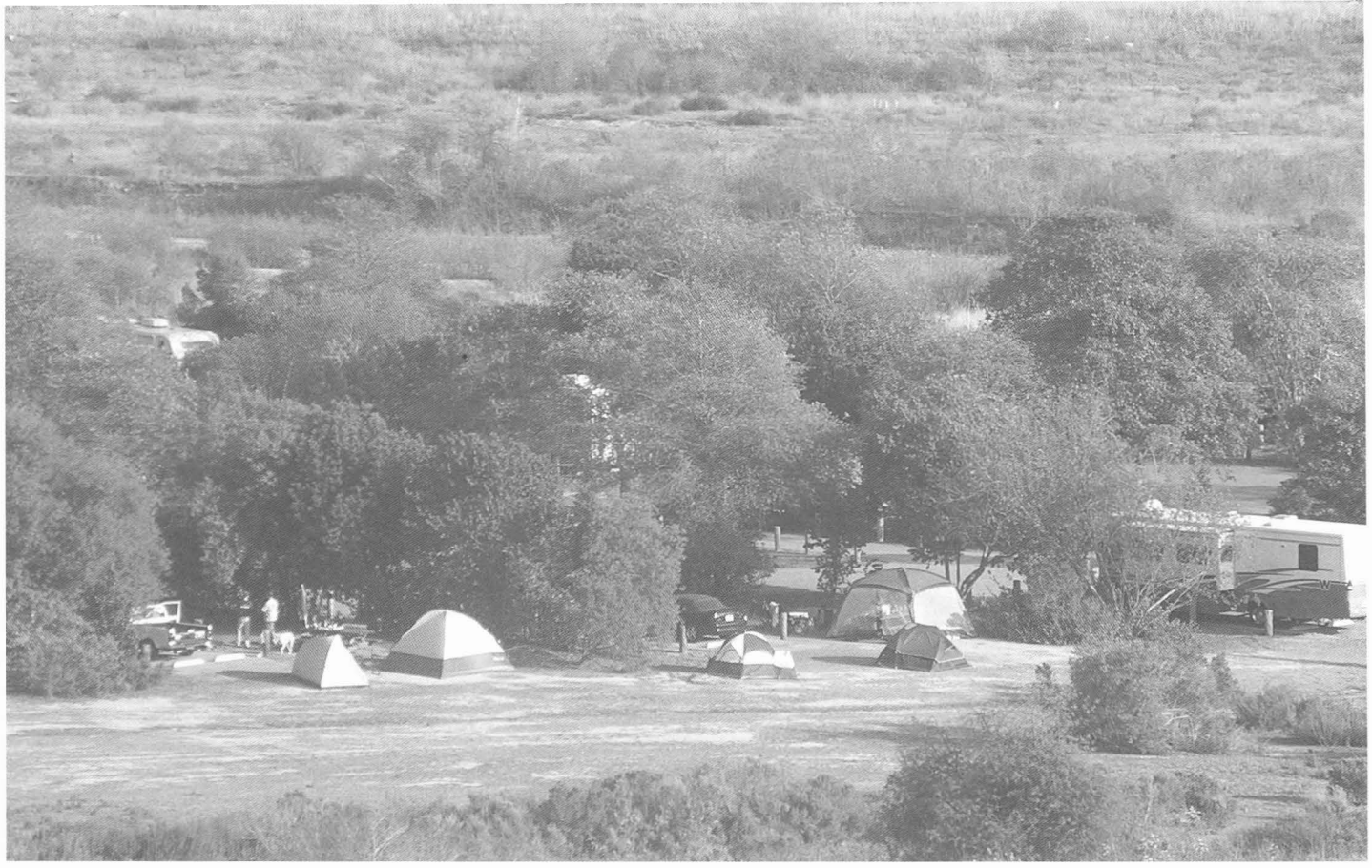
about 2.5 million visits each year, and in 2005–06 was the sixth-most-visited of California's state parks. Reservations for its two campgrounds fill up months ahead, and the 161-unit San Mateo Campground is usually booked solid for the summer. A 1.5-mile trail leads from that campground to Trestles Beach. There are 4.5 miles of beaches within the park, reached by six trails cut through the bluffs. The park is known worldwide among surfers for its surfbreak, Trestles, which is the only stop in the continental United States on the World Championship Tour. Although it is close to San Clemente and I-5, San Onofre State Beach can feel like back country. It might not be this way for much longer, though, if an Orange County toll road authority has its way.

"Gutting of the Park"

WHEN PRESIDENT RICHARD NIXON and Governor Ronald Reagan worked to create San Onofre State Beach, they intended it to be—like any state park—protected in perpetuity, even though the land still belonged to the Navy. Nevertheless, Orange County plans to build a toll road through it. Foothill-South, as it is called, would be a 16-mile, multi-lane highway, extending the Foothill toll road from its current terminus at Oso Parkway in Rancho Santa Margarita to I-5 just south of San Clemente.

The damage to San Onofre State Beach could be catastrophic. State Parks Director Ruth Coleman has described it as a "gutting of the park," and she and other officials have said that State Parks might choose to abandon the inland portion of San Onofre State Beach if the road is built. "We are not interested in maintaining some remnants," said Rich Rozzelle, superintendent for the Orange Coast District.

Now in the preliminary design stage, the project still faces significant permit and other hurdles. Three lawsuits to stop the project—two by the State Attorney General and one by a coalition of environmental, recreational, and surfing organizations—have been brought against the Foothill/Eastern Transportation Corridor Authority (TCA), the joint powers agency created by the County and city governments to build and operate the road. The TCA, however, is proceeding with the design work and has collected field data, including boring for soil samples, in the park without State Parks permission. TCA spokeswoman Jennifer Seaton said that the



DON NIERLICH

San Mateo Campground

agency obtained permission to drill in the state park "from the landowner—the military."

The toll road would have four lanes at first but is being designed for expansion to six. The most recent cost estimate for the project is $875 million. It would run through the watersheds of both San Mateo Creek and one of its main tributaries, Cristianitos Creek; through the Donna O'Neill Land Conservancy, a privately owned wilderness reserve with more than 6,000 coast live oak trees; and through the middle of the inland section of San Onofre State Beach, cutting off wildlife and recreational corridors. The road would pass within 200 feet of the nearest campsite in San Mateo Campground and through the ancient village of Panhe, a Native American heritage site where the Juaneño people still hold ceremonies, coming within a few feet of a sacred burial site. Crossing San Mateo Creek on an elevated roadway, it would merge with I-5 near the Trestles Wetland Natural Preserve at the mouth of the creek. The road would travel through the park for approximately four miles and occupy more than 300 of its 2,189 acres.

Sedimentation and polluted runoff from the highway could degrade water quality both in the stream and offshore, affecting surfers, swimmers, and waders as well as steelhead. Rozzelle, who manages 17 miles of coastline for State Parks' Orange Coast District, said the beaches around San Mateo Creek are the only ones that do not have water quality problems. Not yet.

"Putting a road down the throat of a pristine watershed is not a great idea for the coast," said Mark Rauscher of the Surfrider Foundation. The increased runoff and sedimentation would not only damage water quality, Rauscher said, but would alter the flow of sand to the surf breaks at Trestles, potentially altering the waves' formation.

Traffic Drives Planning

STATE PARKS ARE CREATED TO PROTECT the state's most valued natural and cultural resources forever—not until someone decides that the land is needed for something else. "I don't think that people who have paid their taxes for parks, and people who have worked hard over the years to preserve these parklands, intended them to be used as land banks for infrastructure projects," said California State Parks Foundation president Elizabeth Goldstein.

What, then, is the pressing need driving this proposed destruction of public parkland? In a word, traffic—a chronic concern in Orange County. Recent projections by the State Department of Finance show the county's population growing by 20 percent within the next 25 years, from three million in 2006 to more than 3.6

A Family Tradition

DEBORAH AND DANA FRY STARTED bringing their children, Johanna, Ben, Amanda, and Erica, to San Mateo Campground in 1994, when Erica was four years old. "We had four kids in six years, and not a lot of money," recalled Deborah, who teaches sixth grade at a science magnet school near San Bernardino, where they live. A friend told them about the campground, which had opened just a few years before. Scrubby as it was at the time, with newly planted vegetation, the Frys were pleased to find a quiet, family-oriented place to camp just a short walk from the beach, away from the highway but close enough to home that they could get there in an hour's drive. "It was a very economical way for us to get out of the city," Deborah Fry said. "We used to pack everyone in our little black car and just head on down."

The family would pitch camp and hike down to San Onofre Beach for the day. Ben, their second-oldest, liked to skateboard on the paved part of the trail between the campground and the beach, and later became an avid surfer. The Frys preferred San Mateo to Bluffs Campground out by the beach, which Deborah says is more of a party scene and "kind of like a parking lot." At San Mateo they saw other families and church groups, and Deborah and Dana didn't worry about letting the children walk around on their own—something that was very important, Deborah said, to kids growing up constricted by urban life.

Trips to the park became a family tradition, and they often camped there three or four times a summer. They started reserving extra camping spaces and inviting friends down. Although the oldest children have left home, they still meet the family at San Mateo in the summer, sometimes bringing new friends along.

About two years ago the Frys met Brittany McKee of Friends of the Foothills/Sierra Club, who was at the park taking photographs for a brochure about the toll road. They were shocked to hear about it and joined the fight to stop it. Deborah, Dana, and Erica wound up in one of the pictures, holding up a sign that reads "Save Our State Park."

Before long, family members began to attend meetings about the proposed toll road, and in January 2006, Deborah, Ben, Amanda, and Erica went to Sacramento to lobby legislators. "That experience was just unbelievable," Deborah said. "It showed our kids that one person can go to Sacramento and speak for thousands. It's like we see the park through different eyes now. It's our fight, too."

The two youngest Frys, Amanda (now 19) and Erica (16), have become the family's most ardent fighters for the park. "They go to an inner-city high school and it's very stressful," Deborah said. "The peacefulness of the beach is very important to them, and they've been very vocal about it."

Deborah Fry said the park has given her family its own "private little space in nature," much like the quiet places she loved while growing up in the rural Midwest. "I love that walk to Trestles, and that lagoon, and seeing how it changes from season to season and year to year, and the different birds.

"That campground is so different from the other ones, and I just can't imagine it not being there. I don't know where we're going to go to replace it. I was looking forward to bringing my grandkids and nieces and nephews there, and to not be able to do that would be heartbreaking. It's our special place."

—EE

DANA FRY

Erica, Ben, Dana, Deborah, Johanna, and Amanda Fry (left to right)

million by 2030. By then, Rancho Mission Viejo, a ranching and development company that owns 23,000 acres, plans to build 14,000 homes and five million square feet of commercial space in the region served by the toll road.

"[Foothill-South] has been planned for a long time to accommodate the growth in Orange County," said TCA spokeswoman Jennifer Seaton. "Traffic on I-5 is projected to grow 60 percent in the next 20 years." According to the TCA, relieving traffic on I-5 is the primary purpose of Foothill-South.

Orange County Supervisor Bill Campbell, who has served on the boards of the TCA and the Orange County Transportation Authority, said that Foothill-South is necessary to alleviate I-5 traffic but will not, by itself, solve the region's congestion problems. He said the County will also look at improving arterial roads and increasing rail service.

"There's no question that we need to solve traffic problems," said James Birkelund, senior project attorney for the Natural Resources Defense Council (NRDC). "It's just a question of how we're going to do it."

Why not widen I-5 instead of cutting a new road through the state park? TCA's own draft environmental document, released in 2004 and subsequently revised, found that widening I-5 would provide the greatest amount of congestion relief—and would also do the least environmental damage of all the options studied, other than taking no action at all. The TCA concluded, however, that widening I-5 was not feasible because it would displace many homes and businesses and because funding had not been found for it.

The toll road's opponents contend that I-5 can be widened with far less displacement than the TCA claims, or even none, by using alternative designs. Follow-up studies commissioned by the California State Parks Foundation and other conservation groups concluded that a combination of widening I-5 by one lane in each direction and improving existing arterials is the most promising alternative for both congestion relief and minimal disturbance to the environment and nearby communities.

"They basically knew they wanted to build this road through the park," said Birkelund. "They never seriously considered the alternatives."

The dispute continues, with each side arguing that its conclusions are correct. "Caltrans has confirmed that our study of widening I-5 is accurate, that it would require displacement of homes and businesses," said TCA's Seaton.

Some toll road opponents question whether Foothill-South would attract enough drivers to relieve congestion on I-5. They point to Orange County's financially struggling San Joaquin Hills toll road, which has not lived up to usage projections and was in danger of having to default on its bonds until it was bailed out by the Foothill/Eastern TCA in 2005. The bailout deal included a $120-million grant to mitigate future revenue losses to the San Joaquin Hills road due to migration of traffic to Foothill-South (see sidebar p. 8).

If the toll road is built, improving I-5 in southern Orange County could become more difficult and costly: a noncompetition agreement between the TCA and Caltrans (see sidebar p. 8) requires the State to pay the toll road agency if it is forced to default on its bonds because of financial losses suffered as a result of future improvements to I-5 or other state roads, with some exceptions. The noncompete clause expires in 2020, Seaton said.

One thing in all this controversy that is not in dispute is that public transit was never considered as an alternative to the toll road. Seaton said that, as far as she knows, no new public transit projects are planned for this part of Orange County.

How Protected Are State Parks?

BEYOND THE ISSUE OF THE BEST WAYS to accommodate highway traffic, what's at stake at San Onofre State Beach is a much larger principle. If a highway is allowed to be cut through this state park, what's to stop other state parks, preserves, and cultural heritage sites from being targeted for transportation improvements? Open land may look like the easiest way to go in other cases, too. So what does "in perpetuity" mean? What protection do state parks have against ever-intensifying development pressures?

In March 2006, State Attorney General Bill Lockyer filed two suits in California Superior Court in San Diego County to stop the road, one on behalf of the State Park and Recreation Commission, the other on behalf of the Native American Heritage Commission. A third suit was filed the same day by a coalition of conservation organizations that includes the Sierra Club, NRDC, Parks Foundation, Sea and Sage

More Parklands Are at Risk

"WE DON'T JUST SET ASIDE ANY place to be a state park," said Ruth Coleman, director of the California Department of Parks and Recreation. "These are special places." In a 2002 editorial, the *Los Angeles Times* called San Onofre State Beach "one of the beauty spots of Southern California," and concluded that putting a road through it would be "a folly that would be irretrievable."

Such considerations, however, have not stopped government agencies and others from eyeing state parks as potential locations for new roads, railways, power lines, and more; for example, in 2004, high-speed-rail authorities considered routing a train line through the Orestimba Wilderness in Henry Coe State Park, near Gilroy. So far none of the proposals have been successful, but park supporters fear that if Orange County is allowed to build Foothill-South through San Onofre State Beach, it could open the door to infrastructure and development projects in other state parks.

The California State Parks Foundation's 2006 "State of Our State Parks" report lists development pressure and pressure from roads and transportation projects as the second- and third-greatest challenges, after underfunding, now facing the parks. The threat to San Onofre State Beach is "at the top of the list," said Foundation president Elizabeth Goldstein.

Others include San Diego Gas & Electric Company's bid to build massive transmission towers across a wilderness area in Anza-Borrego State Park, plans for two huge dairy farms near the edge of Allensworth State Historic Park, and Big Lagoon Rancheria's proposal to build a casino on its tribal lands on Big Lagoon in Humboldt County, close to three state parks. The 2006 report tallied more than 100 threats to at least 70 state parks.

"What is most scary to us is not so much the individual cases as it is the trend," Goldstein said. "The fact that we're mitigating mitigation [at San Onofre State Beach] shows how extreme the development pressure has become. There are a lot of people who care about these issues, but many think that each case is an exception. But a collection of exceptions become a rule."

"I don't think there's any question that we'll see more of these projects," said Ruth Coleman. "Often they see our parkland as nice open space without houses. The department recognizes the need for infrastructure for a growing population, but we would like these projects to avoid going through the parks. Parks are part of the infrastructure needs of a growing population, too."

—*EE*

The Orange County Toll Road Story

In the 1970s and '80s, Orange County created a road plan to meet future transportation needs, based on population and development projections. This plan included rough routes for three new highways—two in the eastern part of the county and one in the southwest—called the Foothill, Eastern, and San Joaquin Hills highways. The County expected either state or federal funding to pay for the roads' construction, but none was available.

In 1986, therefore, County and local officials decided to build the three roads as toll roads to be financed by bonds sold to private and institutional investors. To do so they created two joint-powers agencies, the Foothill/Eastern Transportation Corridor Agency (TCA) and the San Joaquin Hills TCA. The TCAs are public agencies, with boards of directors composed of representatives of cities in the affected regions and members of the Orange County Board of Supervisors.

The TCAs were to plan, finance, and operate the toll roads, and use the revenues for operation and to pay back the investors. The State would own the roads and Caltrans would maintain them. A noncompetition agreement between the TCAs and Caltrans requires Caltrans to compensate the TCAs for loss of revenue if it improves certain highways and attracts motorists away from the toll roads, causing them to fail to make their bond payments.

In 1987 the Legislature gave the TCAs the authority to proceed, and the three roads were constructed between 1993 and 1999. Now the Foothill/Eastern TCA is proposing to build a 16-mile roadway that would connect the Foothill/Eastern corridor to I-5 in San Diego County. Called Foothill-South, it is the road that would go through San Onofre State Beach.

Motorists pay tolls ranging from $.50 to $6.25 one way to drive on the TCAs' roads, but financially the toll road venture has proved only partially successful thus far. The San Joaquin Hills TCA's projections for traffic proved too rosy and it has struggled financially; the prospect of having to default on its bonds has hung over that agency for years. During 2002–2004, all three Wall Street rating agencies downgraded its bond rating to junk status. The two TCAs attempted to negotiate a merger that would have included refinancing the agencies through a $4-billion bond issue, but that failed in 2004. In 2005, the Foothill/Eastern TCA agreed to bail out its sister agency with more than $1 billion in loans and grants in return for a guarantee that the San Joaquin Hills TCA would not oppose Foothill-South. A $120-million grant included in the package was in mitigation for future revenue losses if Foothill-South diverted traffic from San Joaquin Hills.

Over the years, the TCAs have cultivated powerful friends in Congress and the California Legislature, who have helped move their road-building projects forward and stifle opponents' attempts to block them. In a 2005 article "Route for New Tollway Goes through D.C., Sacramento," *Los Angeles Times* reporters Dan Weikel and Janet Wilson described how the TCA got federal officials to exclude San Mateo Creek from designation as critical habitat for the arroyo toad under the Endangered Species Act, and how its congressional allies worked to exempt San Onofre State Beach from critical habitat designations.

Congressional representatives friendly to the TCA have placed three riders related to Foothill-South on federal defense legislation: one gave the Navy the right to grant the TCA an easement for a toll road on 340 acres within Camp Pendleton, and another exempted the TCA from Department of Transportation Act provision 4(f), which prevents roads from being built on parklands unless there are no "feasible and prudent" alternatives. "As far as I know, San Onofre State Beach is the only park in the nation that has been exempted from 4(f)," said James Birkelund, senior project attorney for the Natural Resources Defense Council. The third rider, passed in 2001, appears to preempt any state law that would interfere with the construction, operation, and maintenance of the toll road, but opponents do not believe it would have that effect, in part because the wording is vague. In 2002, the TCA tried unsuccessfully to strengthen the provision's language.

In the California Legislature, the TCA was able to block a bill proposed in 2001 by Senator Sheila Kuehl (D–Santa Monica) that would have restricted roads in state parks, as well as budget language inserted by Assemblyman Pedro Nava (D–Santa Barbara) in 2006 that would have prohibited the toll road's construction through San Onofre State Beach and provided funding for an independent University of California study on alternatives for relieving traffic congestion on that stretch of I-5.

And, despite the TCAs' assertions that no taxpayer dollars are used to finance the building of its toll roads, their congressional allies earmarked $8 million in federal funding for Foothill-South in a transportation infrastructure improvement bill passed in 2005.

—EE

Audubon Society, Laguna Greenbelt, Inc., Endangered Habitats League, and Surfrider Foundation. The Park Commission and conservationists' suits alleged that the TCA violated the California Environmental Quality Act (CEQA) by failing to adequately assess the road's environmental impacts, identify mitigation measures, and properly study alternatives that would cause less environmental harm. The Heritage Commission suit contends that the TCA violated laws that prohibit public agencies from causing damage to Native American historical and ceremonial sites located on public property. As of late March 2007, a State Court of Appeals judge in San Diego was considering whether the venue should be moved to Orange County.

Even if the lawsuits fail, the TCA must obtain permits for the toll road from the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, the California Department of Fish and Game, the Coastal Commission, and the Regional Water Quality Control Board, among others. The Navy must also grant permission for the road to run through its property.

Many people who live in this region care deeply about what happens to this last intact piece of open land, and many have come to its defense. Surfers from around the world have expressed their concern about the potential damage to Trestles. Local and national organizations have campaigned against the road, rallying citizens to write letters and turn out for meetings. The Parks Foundation is studying possible legislative options, and has joined Surfrider Foundation, Sierra Club, NRDC, Audubon California, Endangered Habitats League, and Laguna Greenbelt, Inc. in a coalition called Save San Onofre (www.savesanonofre.com; the TCA's website with information about Foothill-South is www.ftcsouth.com).

But many people who live in the region spend a lot of time sitting in traffic, and local political support for the toll road is also strong. To date, the TCA has defeated legislative attempts to protect the park and convinced Congress to pass special legislation and federal officials to grant exemptions favoring the toll road (see sidebar p. 8).

On February 23, California Assemblyman Jared Huffman (D–San Rafael) introduced

Trestles surf break at San Onofre State Beach is legendary among surfers.

PHOTOS THIS PAGE: STEPHEN FRANCIS, COURTESY CA STATE PARKS

PHOTOS THIS PAGE: EILEEN ECKLUND

Left: San Mateo Campground

Right: A beach shelter

AB 1457, which would prohibit state or local agencies from building roads on state parkland except under very restricted conditions. The bill will likely get its first hearing, in the Assembly's policy committee, in April. Similar legislation has been proposed a number of times over the years, but so far none has been passed.

"This Is the Last One"

THE TCA HAS SAID THAT IT WILL WORK to offset the toll road's impacts on the environment and on park users both during and after construction. Its plan includes installing detention basins with state-of-the-art filters to capture and treat stormwater runoff, building a soundwall to shield the campground from traffic noise, and building bridges and culverts to serve as wildlife crossings. It disputes claims that the road could affect the surf break at Trestles, citing studies it commissioned as part of its environmental impact study (see attachment 11 to the TCA's final SEIR at www.thetollroads.com/home/finalseir.htm).

"There has never been a road built that didn't pollute," countered Surfrider's Mark Rauscher.

San Onofre State Beach and Camp Pendleton, together with surrounding parks and open space, harbor a tremendous diversity of habitat types, animals, and plants, many of which are rapidly disappearing elsewhere. Federally protected or threatened species that live in the region include the arroyo toad, least Bell's vireo, California gnatcatcher, Pacific pocket mouse, tidewater goby, and probably steelhead trout, which were last documented in San Mateo Creek in 2003. "It has everything that was there, except the grizzly bear," said Dan Silver, executive director of the Endangered Habitats League. "Biologically, this is the best that's left in southern California."

For people, the park will become ever more valuable as the area's population grows. "The reason there are so many visitors to San Onofre State Beach every year is because eight million people live within an hour's drive," said Brittany McKee of Friends of the Foothills, a local task force of the Sierra Club that has been very active in opposing the road.

Allen Greenwood, a cofounder of San Diego Trout, pointed out that mitigating the proposed road's damage by setting aside comparable land elsewhere in the region isn't possible because nothing else like San Mateo Creek remains elsewhere along the southern coast. "You can't say you have 30 more streams like San Mateo Creek," he said. "This is the last one."

One more irony in this story is this: both San Mateo Campground and the Donna O'Neill Land Conservancy were created as mitigation for other development projects in the region—O'Neill for the community of Talega, built on what was Rancho Mission Viejo land, and the campground for a parking lot built on part of the state park's land by the San Onofre Nuclear Generating Station, just down the coast. "This park has been nibbled at before," said Elizabeth Goldstein. "At some point you have to ask, where does it end?"

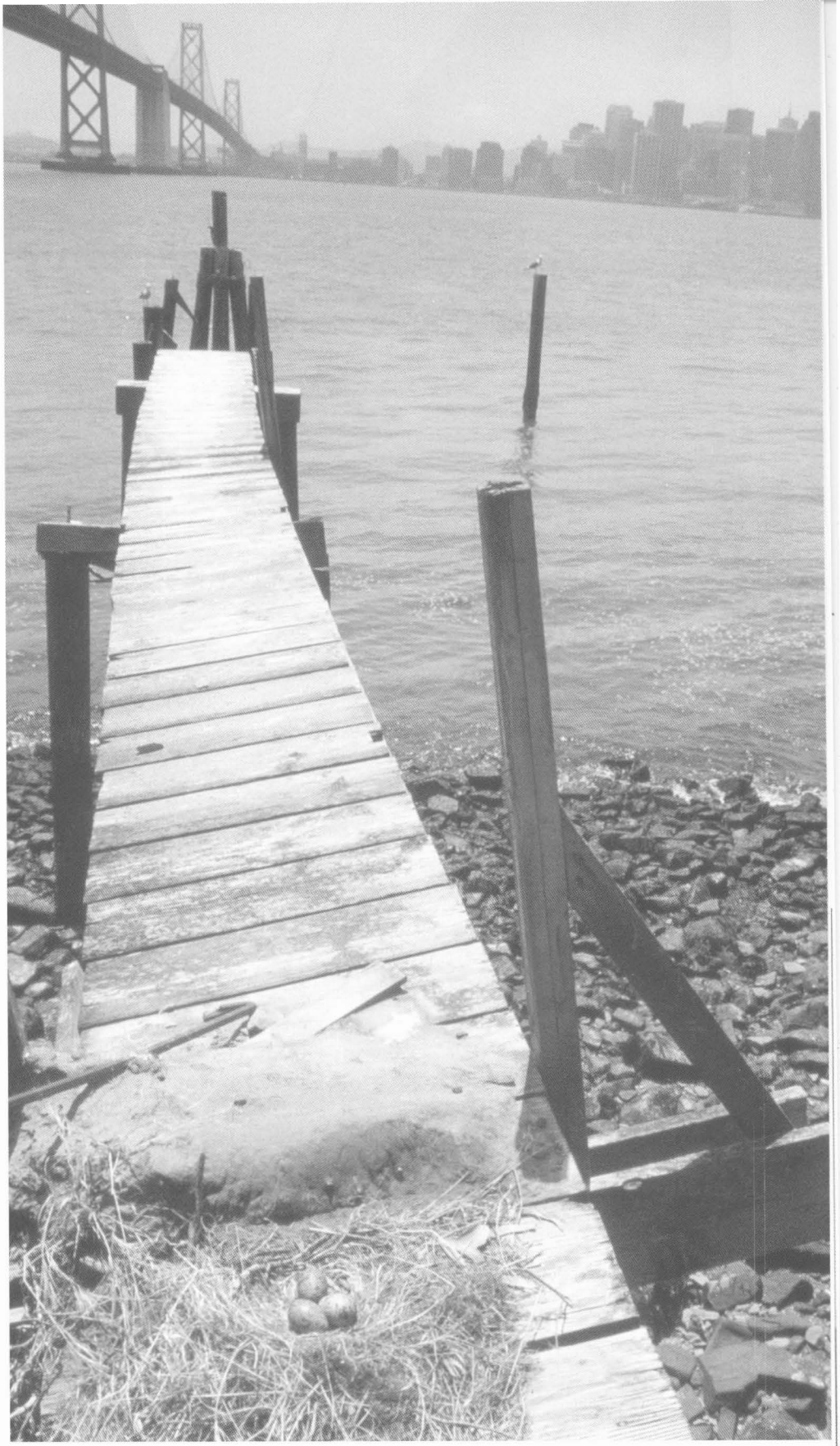
The problem is that California doesn't have strong enough legal tools to protect its state parks, said Goldstein, who worked for parks departments in New York City and State before coming to California. "The charter obligations to protect state land are much stronger in other states. People have to say 'We won't tolerate this,' if this is going to be turned around." ■

HIDDEN IN PLAIN SIGHT

The Treasure of Yerba Buena Island

MIKE WOOD

MIKE WOOD



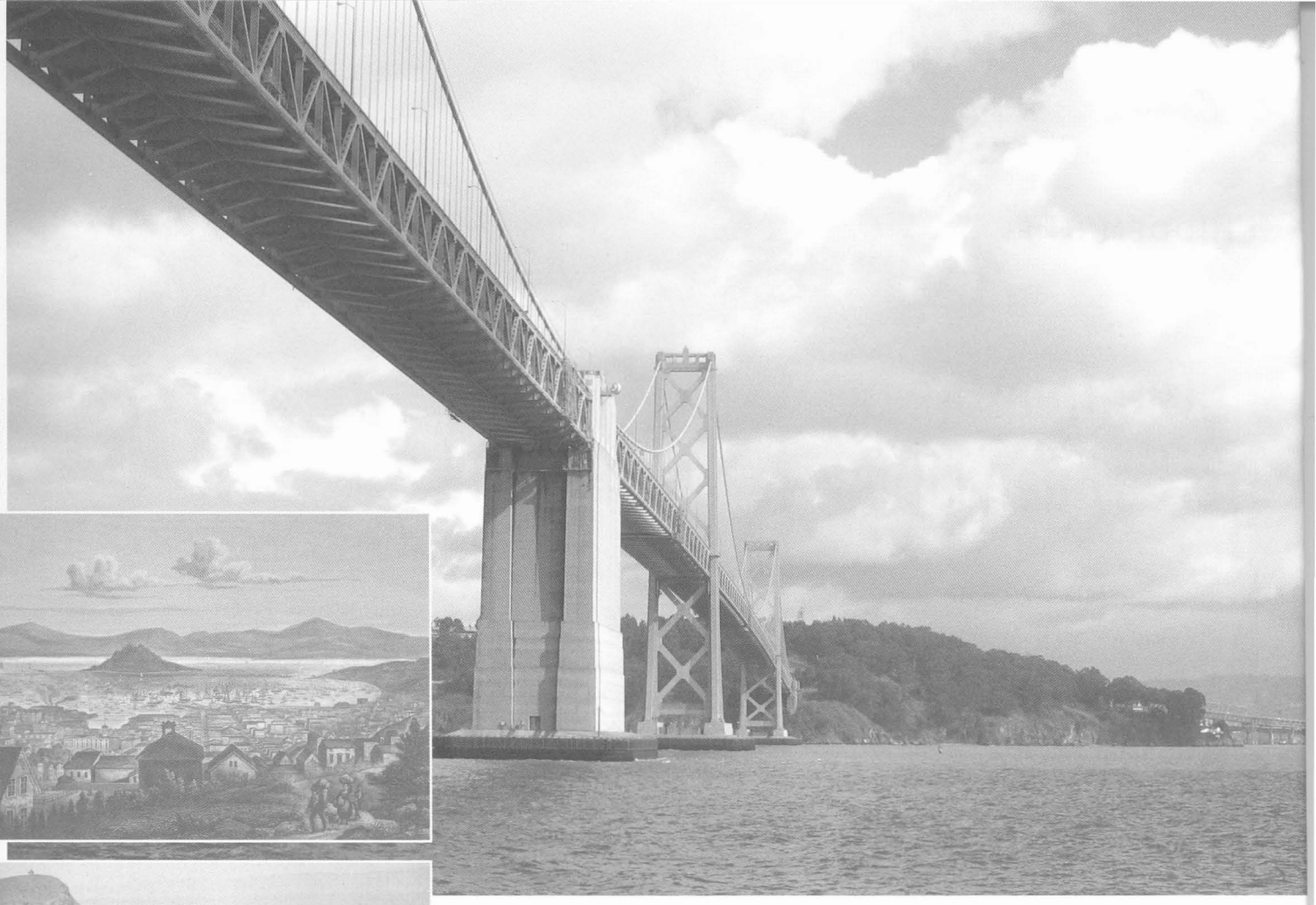
Western gulls usually nest on west-facing cliffs of Yerba Buena Island. Those sites must have been full, as one pair chose to nest on this dilapidated pier.

ALMOST EVERYONE WHO LIVES IN the San Francisco Bay Area has passed through Yerba Buena Island, but few have ever set foot on it. Hundreds of thousands of cars pass daily through the tunnel that runs through it, connecting the two spans of the San Francisco–Oakland Bay Bridge. As we cross the bridge we see taillights, headlights, city skylines, the bay's glittering waters, the tunnel lights. We pass through Yerba Buena Island without seeing it.

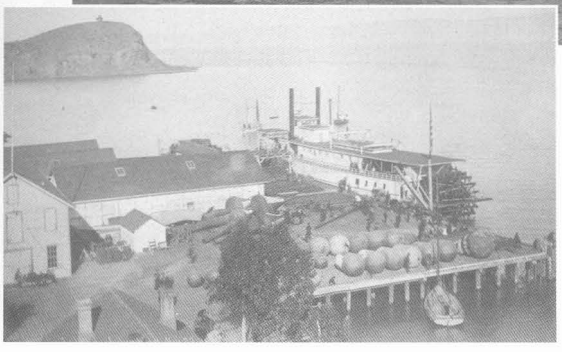
To be sure, this rocky bay island has been occupied by the military and virtually off-limits to the public since 1867. No "public access" signs show the way. Along with its man-made neighbor, Treasure Island, it will be turned over to the City and County of San Francisco within the next few years. But you can explore Yerba Buena now—and if you're interested in native plants, you will discover treasures.

I was once among those who had never given much thought to Yerba Buena Island. As a biological consultant surveying plant communities around the region, I often crossed the Bay Bridge on my way to other destinations. Out of the car window I caught glimpses of little more than invasive exotic plants, mainly eucalyptus trees and French broom, and with disdain turned my attention elsewhere. But in 1996 I was asked to conduct a botanical study of the island as part of the U.S. Navy's base-closure environmental study. To my surprise, I discovered remarkable remnants of the island's indigenous flora. Over the course of a two-year study, I became, and remain, obsessed with exploring these remnants, and with learning more about what I soon realized was the island's fascinating history.

If you can tune out the incessant roar of the traffic on the Bay Bridge, a visit to Yerba Buena



EILEEN ECKLUND



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Top: The San Francisco Bay Bridge leads through Yerba Buena Island.

Above: The island from San Francisco, by J. Meyer Hermann, c. 1854

Middle: Arbor Day, 1886, on Yerba Buena Island

Bottom: The Oakland Long Wharf seen from Goat (Yerba Buena) Island, October, 1886

Island can be a trip back in time. With a little imagination, it's not too difficult to picture the island as it once appeared: a grassy knoll covered with wildflowers, with oaks on its north side and fragrant sage scrub along the bluff tops. For optimal enjoyment, however, I strongly recommend exploring it as part of a group tour or work party (see sidebar p. 16).

A Rocky Past

UNLIKE TREASURE ISLAND, which was built for the 1939-40 Golden Gate International Exposition, Yerba Buena Island is a natural geologic feature. It's the southernmost of three major islands in San Francisco Bay—the others being Angel and Alcatraz—with about 150 acres of mostly steep terrain, reaching an elevation of 338 feet.

Until 8,000 to 10,000 years ago, this island was just another windswept hill, not unlike San Francisco's Bayview and Bernal Hills or Twin Peaks, but surrounded by an extensive grassy and marshy flood plain. There was, as yet, no bay, just meandering channels from the San Joaquin–Sacramento River Delta from the north and the Guadalupe River from the south. When the great continental ice sheets melted, the ocean level rose about 300 feet. Seawater rushed into the flood plains and the little hill became an island.

Until about the 1830s, the indigenous Huchiun used to set up a seasonal fishing camp on the northeastern shore, paddling through the marshes in tule canoes. Two Native American burial sites have been found on the island and in 1933, during construction of the Bay Bridge, a 250,000-year-old tusk of a woolly mammoth was discovered.

The early history of European-American occupation of the island is filled with contention; for many years even its name was a source of disagreement (see sidebar p.13). From 1835 until the U.S. Army assumed control in 1867, Yerba Buena Island was alternately occupied and abandoned by numerous individuals claiming ownership and with schemes to make use of it in one way or another. In 1835, American sea captain Gorham Nye was granted sole ownership by the Mexican government for services rendered. Nye permitted the merchant Nathan Spear to use the island, while retaining rights to cut wood for ship repair and, later, to graze goats to supply his

crews with fresh meat. For more than a dozen years the goats multiplied, until a herd of as many as 1,000 roamed free over the island, with predictable impacts on the native vegetation. This is likely when yerba buena, the native plant the island is now named for, was eradicated.

Later, several buildings were constructed, including a barn, stable, windmill, carpenter's shop, forge, and wharf. Oyster beds were farmed off the island's eastern side. Stone was quarried for building in San Francisco and for use as ballast in ships. A colonial cemetery with 98 graves on the island's northwestern tip was relocated to San Francisco (I haven't been able to find out where) in 1937, before the opening of the Golden Gate International Exposition, as its presence was deemed contrary to the fair's theme of optimism and recovery.

In February 1867, the Army, stationed at Fort Mason, sent a sergeant and ten privates under command of a commissioned officer to the island, ostensibly to stop a fight that threatened to lead to a duel. Having established its presence, however, the Army settled in. Although court challenges continued for decades, the period of private ownership of Yerba Buena Island was over.

The Military Era

A MILITARY POST AT YERBA BUENA Island was established in 1868 and served as a regular Army post until it was transferred to the Navy in 1898. The island's lighthouse was completed in 1875 and has been in continuous operation ever since. It is on the National Register of Historic Places, as are the Army's "Nimitz House" (Quarters One) and Torpedo Assembly Building.

In 1886, when California had its first Arbor Day, the Army began to plant trees. "Goat Island had become an offense and eyesore to those fated to journey daily from SF to Oakland," explained the *San Francisco Call*. Plantings were laid out in the pattern of a Maltese cross, "to remind us that we all have some cross to bear," said poet Joaquin Miller, an Arbor Day promoter. More trees were planted between 1900 and 1945. While most of those on the ridge and hilltop succumbed to harsh weather and fire, some planted at lower elevations are believed to survive to this day.

During World War I, up to 13,000 military personnel were stationed on the island, where the Navy had established a training facility. Crowded quarters contributed to a Spanish flu outbreak during the 1918 pandemic, and the island was quarantined. During World War II, the Navy processed up to 1,500 new recruits daily on the island. After World War II, the Coast Guard became the primary tenant on the island's eastern side, although the Navy continued to maintain apartment-style officers' quarters, as well as the Nimitz House and adjacent quarters, and the Torpedo Assembly Building.

Construction began on the Bay Bridge in 1933. The extensive grading, boring of the traffic tunnel, and construction of the perimeter roads is very evident in aerial photos from the late 1930s. With all the human activity during the past 170 years, it's a wonder that any of the island's native vegetation survived.

Botanical Treasures

TO THE BEST OF MY KNOWLEDGE, Yerba Buena Island's flora was never properly documented by the early botanists of this region. So by a splendid set of circumstances, I was given the opportunity to perform what appears to be the first floristic study of the island. I was delighted to find that despite its long history of human disturbance, abuse, and neglect, the island still supports several excellent examples of some of the San Francisco Peninsula's original native plant associations.

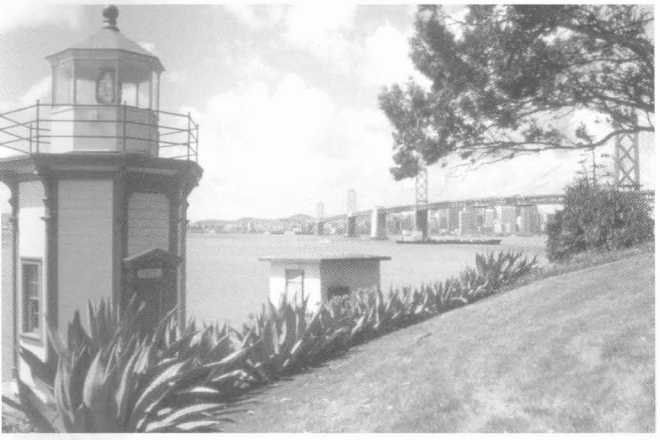
Of special interest are stands of coast live oak woodland, northern (Franciscan) coastal scrub, needlegrass grassland, a shoreline stand of arroyo willows, and robust populations of other native plant species. (For a list of both the common and scientific names of all the plants mentioned in this article, see www.coastandocean.org.) Spring through summer is the best time to see lupines, dune gilia, blue dicks, fiesta flower, seaside woolly sunflower, and phacelia in bloom. Don't expect, however, the spectacular spring wildflower display that some of our grasslands are known for; here the bloom is more subtle. Winter, when the ferns are at their most lush, is my favorite time to visit.

Once you're on the island, you soon see that there's more to the flora than eucalyptus and broom. Along Treasure Island Road on the west side is a splendid stand of wind-pruned coast live oaks. They look to be little more than shrubs but actually form a 15-foot-tall umbrella beneath which one can easily walk. Although thick with poison oak, this stand supports a high diversity of native herbs, including California figwort, manroot, Pacific pea, stinging phacelia, and fiesta flower—the latter so named because it was used to make garlands worn by young girls during festivals in the Mission District, where it once grew in abundance. Yerba Buena Island is now the only

Other Times, Other Names

YERBA BUENA ISLAND HAS had many names since Europeans and Americans first arrived in the Bay Area. In 1775 the explorer Juan Manuel de Ayala named it Isla de las Alcatraces (Pelican Island). It was mistakenly renamed Yerba Buena Island in 1826 by the English cartographer Captain Frederick W. Beechey, when he apparently misinterpreted the Spanish maps and applied Ayala's name to the rock we know as Alcatraz. The name Yerba Buena (like that of the original settlement that became San Francisco) comes from the fragrant mint *Satureja douglasii*, which reportedly covered the island's slopes. In the mid-1800s, when Gorham Nye raised goats there, Yerba Buena Island became known locally as Goat Island, and in 1895 that name was officially adopted by the U.S. Geographic Board. Under pressure from the Native Daughters of the Golden West, its name was officially changed back to Yerba Buena in 1931. Unofficial names have included Wood Island—named for the wood, presumably coast live oak *(Quercus agrifolia)*, that was cut and supplied to sailing vessels, Sea Bird Island, Spear's Island, and Treasure Island, for the rumors of treasure buried there.

MIKE WOOD



The lighthouse, built in 1875, is on Coast Guard property and not open to the public.

place it can be found in San Francisco County.

Stepping out of the oak canopy, you find yourself at the top of a very steep dropoff to the rocky shoreline below and again among thick stands of poison oak—but with a spectacular view of San Francisco. Here you are in an untrammeled stand of coastal scrub, composed of the fragrant gray foliage of California sagebrush, sticky monkeyflower, coyote brush, yellow bush lupine, common phacelia, California broom, and pearly everlasting. On loose sand, which is found in many pockets on the western slopes of the island, grow scattered dune plants such as mock heather, beach-bur, and dune gilia, the rarest botanical gem on the island, which has clusters of small, bright blue-violet flowers. The 1958 *Flora of San Francisco* describes it as "one of San Francisco's most attractive flowering plants."

Survey the steep bluff faces, if you dare, and you'll see bouquets of seaside woolly sunflower, which seem to always be in bloom; bluff lettuce; California polypody fern, in dense patches that are curiously out of place here in full sun, above the high-tide line on otherwise barren rock; coffee fern; goldback fern; and more yellow bush lupine. During the summer, western gulls nest on these bluffs. At their base, just above the splash zone and adhered to bare rock, large-flowered sand-spurry grows.

A Sheltered Beach

AS YOU HEAD NORTHWARD ON Treasure Island Road toward the gates to Treasure Island, you'll come to Clipper Cove on the east side of the narrow isthmus that connects the two islands. Named for Pan American Airways' China Clippers, this crescent of soft white sand was a terminus for the legendary seaplanes' route to Asia and the Pacific Islands from 1939 to 1944.

Clipper Cove might be one of the Bay Area's best-kept beach secrets. Lying at the base of the island's steep north-facing slope and protected from the prevailing winds by thickly vegetated hillsides, it feels more like southern California than the middle of frigid San Francisco Bay. Steps lead from a small bluff-top park to the beach, which continues into the water as shallow, sandy bottom.

On the rock outcrops just above the beach, you can see some of the same scrub bluff plants found on the west side. At the east end of the shoreline, your way will be blocked at high tide by a thick grove of shrubs growing out over the water. You might easily mistake them for tropical mangroves, especially when you see the barnacles on their stems, but you're looking at a stand of arroyo willow, fed from freshwater seeping out of the base of the hill. Further upslope, just above the willows, is a stand of giant horsetails, the only one on the island. Even further upslope, the island's largest and oldest coast live oak trees grow among non-native eucalyptus trees, invasive cape ivy and Algerian ivy, as well as such native vines as California blackberry and Pacific pea.

These seemingly overgrown, steep, sandy slopes harbor a secret hidden beneath all that eucalyptus and ivy: dense stands of wood fern and western sword fern, western brackenfern, and maidenhair fern. Here I also found some of the largest toyons I've ever seen, as well as scattered California hazelnut, oso berry, and even the peculiar-looking Dutchman's pipevine, whose flowers do indeed resemble a meerschaum pipe. Count yourself lucky if you see them, however; the blossoms are short-lived and infrequent.

If you continue clockwise around the island, you will come upon an open, grassy slope uphill of the intersection of Macalla and Treasure Island Roads, where the old cemetery was. Although this area is regularly mowed and is dominated by non-native grasses and eucalyptus, you can still find abundant fiesta flower. At the small children's playground, just above the former cemetery site, you'll also see a clump of tremendous California buckeyes. Look for these trees in full bloom in May and June.

Continue above Clipper Cove on Macalla Road toward the east end of the I-80 tunnel. Most of this area is either landscaped or quite overgrown by non-natives, although it still supports a respectable diversity of native plants. From the westbound I-80 off-ramp just before the tunnel, you can see a steep slope covered with planted pines. The understory here is a solid stand of California polypody fern. Further upslope is a hodgepodge of native species among the French broom and eucalyptus, including coast live oak, toyon, Dutchman's pipevine, and many others.

From the off-ramp, continuing clockwise on Hillcrest Road, the view is mostly blocked by a stand of eucalyptus trees that extends from the lighthouse gate to the western span of the Bay Bridge. All of this southwestern corner of the

island, including the lighthouse, belongs to the U.S. Coast Guard and is off limits to the public. (Hillcrest Road is open, however, allowing visitors to circle the island.) A team of botanists from the San Francisco chapter of the California Native Plant Society (CNPS), including myself, was granted permission to conduct surveys here before access was restricted after September 2001. Among the things we found were small patches of dune gilia and the bright red-flowered cobwebby thistle persisting beneath the canopy of eucalyptus, although dominated by non-native grasses. Downslope, out from under the eucalyptus, are scrubby patches of oaks and toyon and stands of sage scrub. These stands are dwarfed by the thin soils and the hot, dry southwestern exposure, and remind me of vegetation I explored as a boy in San Diego County.

Most exciting, however, is an extensive stand of native perennial bunchgrasses, dominated by foothill needlegrass. This stand is perhaps the most dense, most diverse, and least disturbed of this habitat's three remaining locations in San Francisco. Other native grassland and scrub species growing here include wavyleaf soap plant, a sea of the deep blue blossoms of blue dicks, coffee fern, purple needlegrass, Coast Range melic grass, blue wildrye, yarrow, and coyote mint. We look forward to continuing our surveys of the restricted area this spring, having recently obtained permission from the Coast Guard.

The native plant associations still found on Yerba Buena Island are remarkable for many reasons. For me, they afford a glimpse back in time to what the indigenous flora might have looked like before the introduction of goats, the building of roads and bridges, and the planting of exotic trees and shrubs. Parts of these native plant communities are remarkably intact. More significantly, several plant taxa found on Yerba Buena Island occur in only very limited numbers in San Francisco, or not at all, making them a

Plants of Yerba Buena Island

See these plants and more in color at www.coastandocean.org.

Pearly everlasting

LOUIS-M. LANDRY

California hazelnut

ABE DOHERTY

Blue dicks

BONTERRA CONSULTING

Dune gilia

DOREEN SMITH

Toyon

BONTERRA CONSULTING

Purple needlegrass

CAROL WITHAM

Sticky monkey flower

BONTERRA CONSULTING

Fiesta flower

CHRISTOPHER CHRISTIE

California polypody fern

STEVE TYRON

Cobwebby thistle

MATT BELOW

Arroyo willow

BONTERRA CONSULTING

California figwort

CHRIS WAGNER

Visiting Yerba Buena Island

EXCEPT FOR THE SOUTHERN ONE-THIRD, which is under the Coast Guard's jurisdiction, most of Yerba Buena Island is open to the public. It is not, however, a good place to explore on your own. Parking is scarce, the narrow and windy streets can be dangerous to walk along, there are few sidewalks, and the lighting is very poor at night. Steep cliffs, eroding bluffs, and plentiful poison oak pose additional dangers. It's also difficult to find and appreciate the island's native habitats without a guide—and if you do find them, it can be easy to damage them without realizing it. We strongly recommend that you join a field trip or work party.

The California Native Plant Society offers occasional tours of the island's native habitats, guided by Mike Wood (see www.cnps-yerbabuena.org/calendar.html). The next one is scheduled for April 29, 10 a.m.–1:30 p.m. There is no charge, but group size is limited to 15, and reservations are required. For a hands-on approach, get out and pull some weeds with a work party organized by Nature in the City (www.natureinthecity.org)—you'll be helping to save these little slices of the past for future generations. The work parties take place quarterly and volunteers weed for about two hours.

You can drive onto the island, but parking is difficult and getting back on the bridge, with its never-ending stream of traffic, can be harrowing. You can also take San Francisco Muni's 108-Treasure Island bus line, which departs from the Transbay Terminal approximately every 20 minutes during the day and makes two stops on Yerba Buena Island, at Hillcrest Road and Macalla Road.

potential source of seeds or cuttings for habitat restoration efforts by San Francisco's Natural Areas Program or the Golden Gate National Recreation Area's projects in the Presidio.

To date, assisted by members of the California Native Plant Society, I have recorded 108 native plant taxa from 38 families on Yerba Buena Island; another 155 non-native plant taxa have naturalized there. All told, I have tallied 263 plant species belonging to 67 families on the island.

Change Is Coming

TODAY, THE NAVY STILL OWNS THE PART of Yerba Buena Island not under Coast Guard jurisdiction, as well as all of Treasure Island, but is in the process of turning both over to the City and County of San Francisco for redevelopment. The land is now managed by the Treasure Island Development Authority (TIDA) under a long-term lease. More than 3,000 people now live on the two islands, and some commercial tenants, nonprofit organizations, schools, and other community services are located there.

Development plans for Yerba Buena Island call for tearing down the Navy's old housing and building new housing in its place. Because some of the oak woodlands are within the housing area, it is important that the demolition and reconstruction plans include protection measures for the native vegetation. Historic buildings will be preserved, and a wellness center with a small hotel is planned for the southwest side. The rest of the island will be set aside for parks, recreation, and preservation of natural habitat.

It is encouraging that TIDA's sustainability plan calls for identifying, protecting, and restoring Yerba Buena Island's existing natural habitat and wildlife, and that the San Francisco Board of Supervisors has instructed TIDA to create a habitat management plan for the island. The devil, of course, will be in the details. If you want to become involved in helping to shape the future of these islands, you might attend some TIDA meetings, which are open to the public (schedules and agendas are available at www.sfgov.org/site/treasureisland).

While Yerba Buena's botanical treasures face threats from invasive weeds and other pressures, there are people working to preserve and restore them. Nature in the City (www.natureinthecity.org), a group dedicated to ecological conservation, restoration, and stewardship of the Franciscan bioregion's natural habitats, organizes volunteer work parties on the island. Residents of the two islands form the core of these parties, but anyone is welcome (see sidebar). In June 2006, more than 50 staff members of San Francisco's Department of the Environment, which is very supportive of the restoration work, pitched in to help haul out ice plant, ivy, French broom, fennel, and other invasive weeds at four sites on the island. If you would like to help with bird counts and other wildlife inventories on Yerba Buena Island, contact Noreen Weeden at the Golden Gate Audubon Society (nwweden@comcast.net).

The acquisition of Yerba Buena Island by the City of San Francisco offers a rare opportunity to preserve natural resources that have been virtually hidden away at the heart of a large metropolitan area. If development there is sensitive to these little niches of remaining habitat, both residents and visitors will be able to enjoy the unique sense of place they provide long into the future. ■

Mike Wood runs a small environmental consulting firm in Walnut Creek and performs biological surveys and impact analyses throughout California. A board member of the Yerba Buena chapter of the California Native Plant Society since 1994, he writes the regular feature "Focus on Rarities" for the chapter newsletter.

WHAT'S KILLING SEA OTTERS?

ANNE CANRIGHT

PHOTOS THIS PAGE: DEBORAH GABRIS, MARINE MAMMAL CENTER

These two otters are being nursed back to health at the Marine Mammal Center in the Marin Headlands.

SOME 18 YEARS AGO, I went to visit an old friend who was several months pregnant. She was giving me a tour of her new house, and when we arrived on the screened-in back porch she made a curious request: "Would you mind very much cleaning the cat's litter box for me?" I surely gave her a look, and she explained: "My doctor told me under no circumstances was I to clean it out myself because of a disease that can spread to human embryos. So I'm relying on family and friends to do the job."

The disease is called toxoplasmosis, and it is a parasitic infection that may be found in more than 60 million Americans—one-fifth of the population. How do we get it? Typically by eating undercooked, infected meat of animals that serve as an intermediate host (pigs, sheep, and rabbits are a few of them), or by contact with cat feces. For the protozoa *Toxoplasma gondii,* cats are the definitive host—the only organism in which the parasite reproduces. If a cat eats a rodent that has been infected with *T. gondii,* the little parasite can celebrate, because it is home at last, able to do what it was meant to do and complete its life cycle. Eventually its eggs (called oocysts) are shed all at once and by the tens of millions, in cat feces.

Most humans never know they have the disease. Healthy people tend to be asymptomatic, although some may develop flu-like symptoms that quickly vanish. Those at risk for the more serious consequences of toxoplasmosis are babies *in utero* and people with compromised immune systems. When passed on congenitally, toxoplasmosis may result in blindness and mental retardation; in immunosuppressed victims, it can cause encephalitis and, ultimately, coma and death.

Recently, I reencountered toxoplasmosis—not in humans, but in sea otters *(Enhydra lutris).* While most infected humans go through

life blithely unaware of their predicament, sea otters are not necessarily so fortunate. In a study of freshly dead beach-cast sea otters collected from 1998 to 2001, toxoplasmosis was the primary cause of death in 17 percent of cases. In addition, researchers found that brain inflammation resulting from the infection led to a 3.7 times greater risk of death due to shark attack or boat strike.

It's all about the land-sea interface, full understanding of which will be vital not only for sea otters, but for the overall health of our nearshore marine environment.

But how can this be? Sea otters don't eat mutton or pork, or even rodents, and they aren't exposed to cat feces. Or are they?

It turns out they are. Or at least, to the microscopic *T. gondii* oocysts that are carried in the feces. The likely mode of transmission is freshwater runoff—not just along the California coast, but inland as well. Anywhere rain falls and washes into rivers that in turn flow into central California coastal waters, cats—domestic, feral, and wild (bobcats, mountain lions)—defecating outdoors contribute to serious disease in otters. Even indoor cats that use litter boxes are culprits, if their owners buy flushable litter for ease of use and send the feces into the sewers. Studies have found that urban centers along the coast, and points of heavy freshwater outflow such as the Salinas River, correlate strongly with high rates of infection in otters.

Scientists began to document toxoplasmosis as a killer of sea otters in 1998. The evidence they presented was so convincing that in September 2006, the California Legislature passed, and Governor Arnold Schwarzenegger signed, Assembly Bill 2485 in an effort to mitigate the problem (see sidebar). A major component of the bill, which took effect in January, calls for labels on cat litter packaging advising consumers that "encouraging your cat to use an indoor litter box, or properly disposing of outdoor cat feces, is beneficial to overall water quality."

Unsettling Trends

UNFORTUNATELY, TOXOPLASMOSIS IS only one hazard that sea otters face. Other protozoal parasites, tiny worms, fungi, persistent organic pollutants (POPs), pesticides, fishing pots, boats, and even marine algae also play deadly roles. Currently, deaths are outpacing births among southern sea otters, and researchers are trying to understand why.

A mother sea otter and pup float in Monterey Harbor. The pup's health is poor; its ribs are visible.

Their answers may determine whether we will be able to continue enjoying the presence of this lovable icon of the California coast.

As recently as the mid-17th century, an estimated 16,000 sea otters foraged and raised their young along the California coast. Hunting diminished their numbers so thoroughly that by the turn of the 20th century most experts believed the southern sea otter had been wiped out. But then, in the 1930s, a small colony of 50 or so individuals was discovered off Big Sur. In 1983, when the U.S. Geological Survey (USGS) began annual censuses, sea otters had expanded both their range and their number—to 1,277—with slow increases continuing into the early 1990s. Then growth slowed, and in some years counts showed a decline in number. Although the 2004 census recorded a population high of 2,825, by 2006 only 2,692 animals were counted. As Jim Curland of Defenders of Wildlife put it, "The population has flat-lined." The 2007 census will be pivotal: if numbers are down yet again, we'll be looking at a trend of shrinking population.

In 1977, southern sea otters were listed as threatened under the Endangered Species Act. At that time, a population of 2,650 was considered the threshold for removing them from the list. In 2003, however, the U.S. Fish and Wildlife Service released a revised otter recovery plan; the threshold was bumped up to 3,090, and a count of 8,400 was deemed necessary for the otter population to no longer be listed as "depleted" under the Marine Mammal Protection Act of 1972.

A particularly alarming trend is that a large number of adult females are dying. Dave Jessup, a veterinarian with the California Department of Fish and Game (DFG), observed, "The death of breeding females isn't new, but it seems to be increasing over the last five to 10 years—and that, of course, is the worst thing that can happen."

Overall demographics are worrisome as well. According to Andy Johnson of the Monterey Bay Aquarium (MBA) Sea Otter Research and Conservation program, in 2006 about 280 dead animals were salvaged statewide, a little more than 10 percent of the population. "Based on modeling," he said, "we figure that we're getting close to 50 percent of the animals that die every year. Some animals die at sea and don't come to shore, and we get very few of the animals in the Big Sur area." That means, he said, that "a full 20 percent of the population is expiring every year. And we're barely counting that many pups."

Knowledge gained from the carcass-salvage program is critical to the sea otter's chances for recovery. Those found on the beach are sent for analysis to the USGS National Wildlife Health Center in Santa Cruz, the DFG Marine Wildlife Veterinary Care and Research Center in Moss Landing, or the University of California at Davis (UCD), where necropsies are performed—more or less detailed, depending on how fresh the carcass is. More than 40 percent of deaths have been attributed to various infectious diseases, a rate that has remained relatively consistent for prime-aged adults since studies began in 1992. Jim Estes, a research scientist with the USGS, points out that although a high percentage of Alaskan sea otters also die of disease, "the thing that is distinguishing between the two is that there tends to be a much wider range of diseases here in California."

Multiple Killers

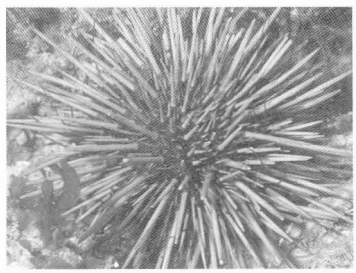
WHAT ARE THESE DISEASES? They're a nasty bunch, and although they exist in quite a number of other species—including, as we have seen for toxoplasmosis, in humans—they are highly pathogenic to otters. Estes ticks off the three biggest killers, parasites all: the tiny thorny-headed acanthocephelan worm and the single-celled protozoan parasites *Toxoplasma gondii* and *Sarcocystis neurona.*

Acanthocephalans account for about 14 percent of sea otter deaths. According to www.seaotterresearch.org (a website that brings together the research of DFG, USGS, UCD, MBA, and other scientific organizations), "In heavily infected otters, the worms burrow through the walls of the otters' intestines, set off a painful inflammation that ties the intestines in knots, and the otters die." Although the parasite's definitive host is a sea duck, the surf scoter, it finds intermediate hosts in sand crabs and spiny mole crabs, which otters—especially juveniles, who are still learning to forage—occasionally rely on as prey items.

Toxoplasma gondii, which causes lethal brain inflammation in otters, accounts for another 17 percent of otter deaths. Although potentially deadly, the parasite may not kill immediately. In one study, blood samples taken from both dead and living otters showed that 52 percent of 305 freshly dead animals and 38 percent of 257 live, healthy ones harbored the parasite. The fate of those healthy but infected otters is uncertain. Veterinarian Jessup said, "There are animals that appear to live with toxoplasmosis for a fairly long time, maybe into their old age, and as they

Help Sea Otters When Filing Your Taxes

TAXPAYERS HAVE AN opportunity this year to help fund research aimed at understanding what ails California sea otters and what might help their populations recover. AB 2485, by Assemblymembers Dave Jones (D-Sacramento) and John Laird (D-Santa Cruz), passed in 2006, created a tax check-off on the State's 2006 tax form to fund such research. For the check-off option to continue, at least $250,000 in donations must be received this year. It's simple to participate. When you prepare your State tax return, go to line 63 of Form 540 under Contributions: CA Sea Otter Fund. Enter the amount you wish to donate. If the State owes you money, what you contribute to the Sea Otter Fund will be deducted from your refund. If you owe State taxes, add the amount of your contribution to your payment to the State. For more information, see www.defenders.org/seaotter/taxday.html.



CHAD KING/MBNMS

Purple sea urchins (*Strongylocentrotus purpuratus*) are a favorite food of sea otters.

STEVE LONHART/MBNMS

JOSH PEDERSON/MBNMS

get sick with something else, then the toxo comes out and starts eating up their brain."

The last of the big three, *Sarcocystis neurona,* behaves similarly to *T. gondii* but relies on a different host: the Virginia opossum, another land-based animal, introduced into California only about 125 years ago. That means, Jessup said, that the opossum's hitchhiker is likely "entirely new ecologically and evolutionarily to sea otters." While wild cats have resided in California for millions of years (our state fossil is the "saber-toothed tiger"), and have no doubt served as hosts for *T. gondii* much of that time, the same is not true for *Sarcocystis.* As a result, said Jessup, "pretty much whenever [otters] get it, it becomes a very hot, fast, aggressive infection."

Sometimes a disease's virulence, or lack thereof, may be partly explained by coevolution. Does reduced genetic diversity add to otters' plight? Jim Estes explained that although California sea otters don't seem to be much less genetically diverse than Alaskan and Russian sea otters, "it could be that particular genes have been impacted in ways that are damaging to the animal. The one we're concerned about right now is the MHC [major histocompatibility] complex, which is the gene complex in all animals that is used to fight off disease. That's basically where our whole immune system centers." He referred to ongoing work at the National Marine Fisheries Service lab in Santa Cruz, where initial findings indicate that southern sea otters have "a very highly impoverished MHC complex."

Various other killer diseases are at work on California otters as well. Domoic acid, a neurotoxin produced when the diatom *Pseudonitzschia* blooms, contaminates the shellfish that many otters love to eat. The toxin can cause seizures and inflammation of the heart muscle leading to cardiac arrest, and is responsible for 13 percent of sea otter deaths. The fungus *Coccidioides immitis* causes what is known as San Joaquin Valley fever—in both humans and otters. Known to affect humans and animals who inhale fungal spores in dust from the dry interior valleys and deserts of the southwestern United States, its appearance in otter populations is puzzling.

Pesticides and persistent organic pollutants pose additional threats to otters in coastal California, especially in places like Monterey Bay and Morro Bay, which are relatively dirty environments. Pollutants from such sources as agricultural runoff, sewage plants, and boatyards, as well as DDT and PCBs that accumulated in coastal waters years ago, no doubt have deleterious effects. Although they are not occurring in levels that are acutely toxic, said Jessup, "we have to believe that they are not good for sea otters, probably not good for harbor seals, probably not good for people that eat or collect shellfish either recreationally or commercially. We can't say they are killing 'this many' sea otters, but they may be messing with their immune system, with their reproductive system, with various endocrine systems in the animal that make them more susceptible."

Sharks, boat strikes, and humans with guns remain big threats, of course. And there's also the sea otter's own inquisitiveness, which, when it leads an animal to investigate a lobster pot or Dungeness crab trap and become trapped itself, has dire consequences. Curiosity kills sea otters, but unlike the host of *T. gondii,* otters don't have nine lives.

Pinpointing the Problem

RESEARCHERS HAVE LEARNED A LOT about sea otter mortality over the past few decades from sea otter counts and beach-cast carcasses. They've also turned to live, free-ranging otters for information—a more costly and time-consuming, but equally essential, job.

Presently USGS and CDG researchers are tracking almost 100 animals in order to study lifestyle and well-being. When these animals are captured, both initially and at subsequent times through their lives, blood samples are taken and detailed health profiles logged. In this way, researchers can follow exposure to infectious disease, exposure to contaminants (body burdens), and immune functions. By implanting radio transmitters and time-depth recorders, they can

study such things as foraging strategies, prey selection, and range of travel. "And when they die," said Jim Estes of the USGS, "we are watching them, so we can pick them up very quickly and see what they died from." Eventually, Estes hopes that the instruments implanted in the animals will be recoverable even from those that drown in fishing pots, providing information about mortality that is currently unavailable. Researchers are also using these data to compare California otters with otter populations elsewhere that are doing better and see if there are significant differences.

Investigations don't stop with the otters themselves, however. At UC Davis, parasitologist Pat Conrad, a key player in identifying *Toxoplasma gondii*'s role in sea otter mortality, is leading an integrated study that will bring together terrestrial and marine ecologists, oceanographers, and epidemiologists to look at, in addition to otter ecology, the ecology of the parasite and its hosts (especially cats of all stripes) and land-runoff ecology. It's all about the land-sea interface, full understanding of which will be vital not only for sea otters, but for the overall health of our nearshore marine environment. As Andy Johnson of the Monterey Bay Aquarium said, "We're really just at the cusp of linking disease with either particular natural history activities, things that are occurring within the natural system, or things that are being introduced from the land, either by people or animals."

AB 2485, which mandates labeling of cat litter, will also assist this effort by creating a research program administered through the Coastal Conservancy to study, in part, sea otter mortality from non–point source pollution, such as freshwater runoff. Although many indicators point to runoff as the major source of land-based disease in otters, both Estes and Jessup suggest that more specific sources, or hot spots, will begin to be identifiable in the otters' range. "Both for urea [which stimulates the production of domoic acid] and for some of the persistent organic pollutants," said Jessup, "we have accumulating evidence in sea otters, in mussels, and in the grab samples taken by the state and regional water quality boards" that what were thought to be non–point source pollutants in fact have localized origins.

With a little more funding, Johnson said, researchers will begin getting refined answers to questions about why the otter population is struggling so. The more they learn, the more prepared scientists and conservationists will be to call for changes. "It's probably going to be some sort of restriction or legislation or other provision to limit or fix what we're dumping into the nearshore environment," he suggested. "And those fixes are probably going to be expensive. So you have to have real pinpoint information or nobody's going to buy it."

All of us can play a role in helping this research along (see sidebar). Indeed, we should. As Dave Jessup put it: "All of the causes of otter mortality have human health concerns. There are reasons to be concerned about their effects on other marine species. . . . Sea otter health, human health, and marine ecosystem health and diversity are together on these things. It's not simply that we need to do this [work] for sea otters. We need to do it because it's the right thing on a whole lot of fronts." ■

JOSH PEDERSON/MBNMS

COURTESY ARIEL DUEÑAS

Olive Ridley sea turtle in Michoacán

Encuentro Tortuguero at a Crossroads

AÍDA NAVARRO BARNETCHE

SEA TURTLES ARE AMONG THE MOST endangered marine animals inhabiting the coastal waters of the Californias. Their feeding areas range from Monterey Bay to San Diego Bay in California to the mangrove-fringed lagoons of Magdalena Bay in Baja California Sur, and along the island-studded coastline of Loreto Bay National Park in Mexico's Sea of Cortez. Turtle meat is a staple of many traditional feasts throughout communities in Baja California, and sea turtle eggs are considered a form of natural Viagra and are sold throughout the markets of Mexico.

Declines in sea turtle populations over the past decade are attributed primarily to the continuance of the ages-old custom of eating sea turtle meat and eggs, as well as to fishing practices that inadvertently trap turtles as by-catch. Conservationists have therefore focused turtle protection efforts on campaigns aimed at reducing the demand for sea turtle products, reducing by-catch and, most important, involving members of fishing communities directly in sea turtle conservation and education programs.

Over the past nine years, much of the community-building effort has been highlighted at the annual meeting of the *Grupo Tortuguero*, or Sea Turtle Conservation Network of the Californias, which takes place in January in the seaside village of Loreto on the Sea of Cortez. Here fishermen, students, researchers, conservationists, and citizens from local fishing communities come together to celebrate sea turtles, share experiences, and spread the turtle conservation message.

Among those present at the January 26–28 *Encuentro Tortuguero* was Jessica Torres, from Bahía de los Ángeles, who traveled 300 miles from her tiny fishing village on the Sea of Cortez with a group of fellow high school students, plus middle school and elementary school children, to present the results of their environmental education program. This is the first year that Bahía de los Ángeles has had a high school, and Jessica was a leader in the local group that struggled for years to get it. Her own high school education had been interrupted, so now she was completing it, at age 23, with plans to become an environmental lawyer. This career choice was inspired by her three-year involvement with Pronatura, an organization working for the creation of a marine protected area in Bahía de los Ángeles.

Leading the local student group *Jovenes Ambientalistas* (Young Environmentalists) *de Bahía de los Ángeles* for two years taught Jessica about the valuable natural resources of the Bahía. She also learned to create radio spots, write news articles, produce puppet shows, and develop other community-outreach projects focusing on environmental protection for the region. The students produced a play about sea turtles that they took to Guerrero Negro, Santa Rosalía, and Loreto, and are planning to show in other communities. Last year they were thrilled to share their achievements with their peers at the Loreto gathering—especially because when they began their activities, many of their neighbors were reluctant to help protect sea turtles for fear of angering local sea turtle poachers. This year, however, they didn't get to perform onstage, as the main auditorium was reserved for scientific presentations.

Since it started in 1999, attendance at the annual *Encuentro Tortuguero* at Loreto has grown sixfold, drawing sea turtle conservation-

ists from all over the Sea of Cortez region, Mexico, California, and as far away as Japan, Hawaii, and Indonesia. When I first attended the *Encuentro* three years ago, I saw what an important working ground it was, providing an arena for the representatives of sea turtle protection camps and fishing communities to share their accomplishments and difficulties, and to inspire each other. For those of us in nongovernmental organizations (NGOs) worldwide who directly support sea turtle conservation programs, this meeting provides firsthand information from those who work in the front line.

This year more than 300 people gathered in Loreto's auditorium, which is also the municipal gym, to listen to researchers talk about their work. Videos and community presentations were assigned to places in Loreto's central plaza, by the cathedral. There, in a relaxed atmosphere, people could easily approach each other to discuss and ask questions about their work. Simultaneously, the Third Annual Meeting of Children of the Californias for Sea Turtle Conservation was set up a few yards away from the auditorium. The young participants were mostly from Loreto and Bahía de los Ángeles, and under the enthusiastic lead of Graciela Tiburcio and Sergio Román, they engaged in arts-and-crafts workshops, theater, and other activities.

The increasing number of monitoring teams and communities wanting to show their results had led the meeting's organizers to conceive different strategies to give everyone a chance to speak up. Neither community groups nor children, however, had the opportunity to present their work in the auditorium, as they had done in the past, and many were disappointed by that.

On the main stage, researchers from *Instituto Politécnico Nacional* (the National Polytechnic Institute) in Mexico City discussed recent studies that showed a link between human leukemia and sea turtle consumption; researchers from *Centro de Investigaciones Biológicas del Noroeste* (the Center for Biological Research of the Northwest), in La Paz, presented work on the concentration of heavy metals in green sea turtles of the Pacific. Among the many other presenters were guests from Japan and Russia. Four workshops allowed participants to explore issues related to monitoring, data collection, and standardized methods for sea turtle research.

While scientific information is important for conservation, many meeting participants could not help but notice the disappointment of some community members who had traveled long distances with the expectation of an opportunity to present their work. At the debriefing session held at the end of the event, a number of them spoke of a need to reconsider the scope and goals of the *Encuentro*.

As happens with many successful projects, the *Encuentro Tortuguero* has come to a crossroads. The organizers are pondering: should they take advantage of the momentum and potential to turn it into a worldwide event where scientists and professionals can gather, or should the event go back to its origins and remain focused on people working on the front line? This is not an easy decision, especially now, when Loreto has been proposed as the venue for the 27th International Annual Symposium on Sea Turtle Conservation and Biology.

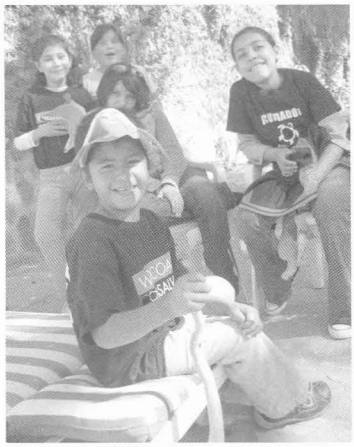
While hosting this international event can be an outstanding opportunity for Loreto and other communities in the region to meet scientists and receive international exposure, changing the scope and vision of the *Encuentro Tortuguero* brings the possibility of neglecting the very valuable local human capital that is the key component for preserving sea turtles and the coastal ecosystems they thrive in. ■

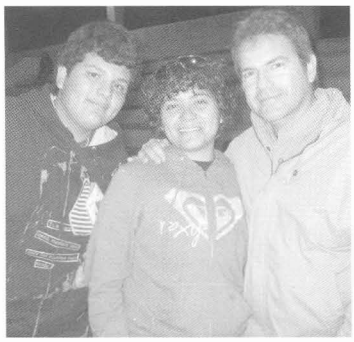
Aída Navarro Barnetche, wildlife conservation program manager for WiLDCOAST/COSTASALVAjE, coordinates community-based marine conservation and education programs throughout the Californias and Latin America.

Top: Children from Loreto

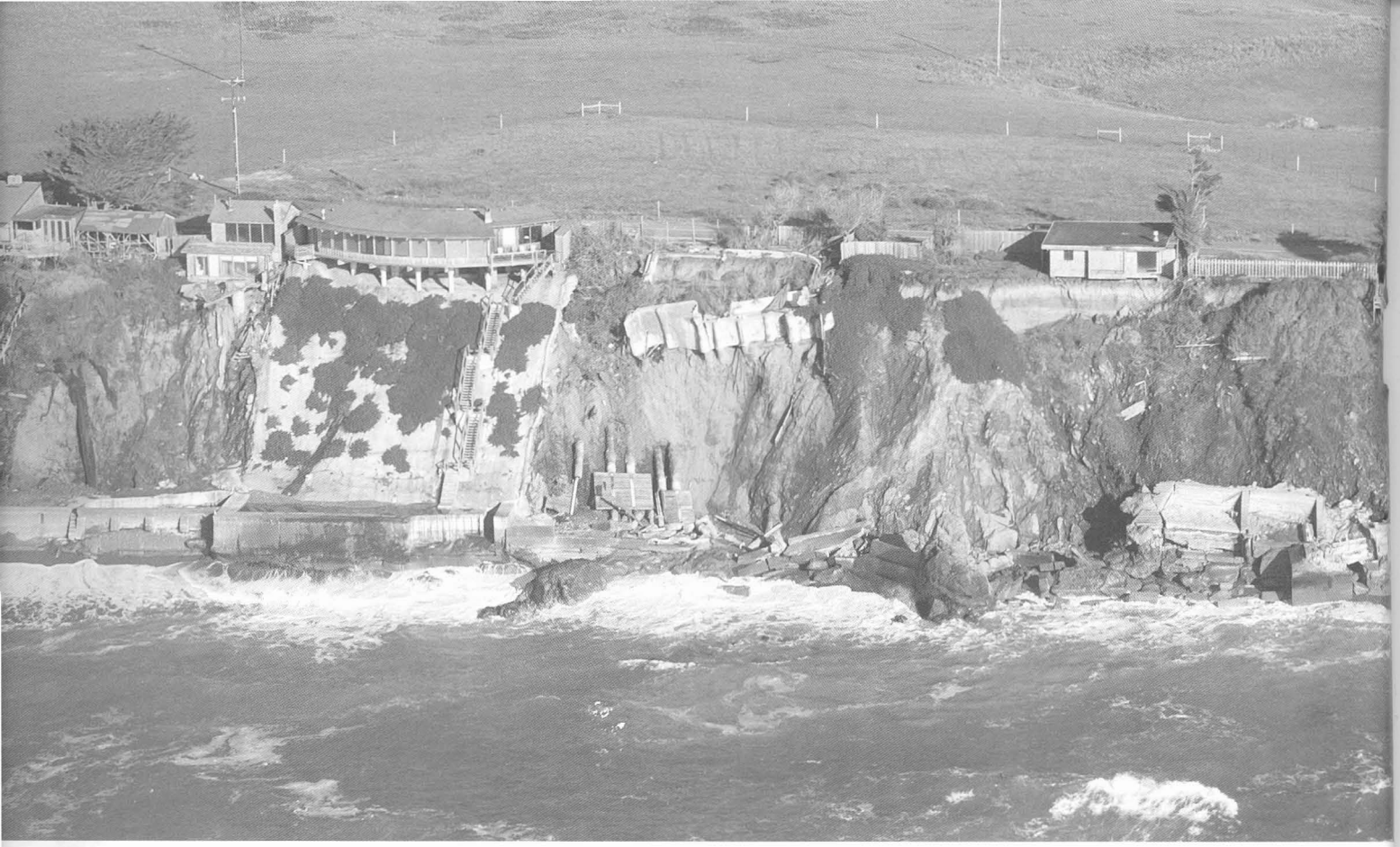
Middle: Jessica Torres (center) and Beto (left) from Bahía de los Ángeles, with Gustavo Danemann of ProNatura

Bottom: Members of Sinaloa group





PHOTOS THIS PAGE: AÍDA NAVARRO BARNETCHE



Is California Preparing for Sea-Level Rise?

THE ANSWER IS DISQUIETING

SUSANNE C. MOSER

"We basically have three choices: mitigation, adaptation, and suffering," said John Holdren, the president of the American Association for the Advancement of Science and an energy and climate expert at Harvard. "We're going to do some of each. The question is what the mix is going to be. The more mitigation we do, the less adaptation will be required and the less suffering there will be."

New York Times, January 30, 2007

CALIFORNIA COASTAL RECORDS PROJECT

Opposite page: At Gleason Beach, about five miles south of the Russian River in Sonoma County, several houses slid onto the beach during the 1998 El Niño. Remaining structures are at risk of following them.

LATE LAST YEAR, SUSANNE MOSER *completed a survey on how coastal managers in California are responding to accelerating sea-level rise. The survey was designed to assist the state in identifying what coastal communities need in order to adapt to impacts of global warming. She has been presenting the results to uneasy audiences ever since. This article is adapted from her talk at the Coastal Commission's Climate Change Workshop on December 14, 2006, in San Francisco.*

Let me begin by placing my study into the broader context of what is happening in California. In June 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05, in which he not only set stringent emission targets, but also asked for regular updates on the state of the science of climate change, how well California is meeting the emission reduction targets, and the status of "mitigation and adaptation plans to combat the [expected] impacts" from climate change. The study we conducted for the state on coastal managers' preparedness for climate change is a direct response to the last part of this request.

A year later, in the summer of 2006, California's Ocean Protection Council released its strategic plan. Several of its objectives and priority areas speak directly to the need for the state to begin preparing for climate change. These goals were reinforced in September 2006, when the governor and his colleagues in Oregon and Washington signed the West Coast Governors' Initiative on Ocean Health. In short, key leaders in the state recognize the need to slow down global warming and get ready for impacts we cannot avoid.

Clearly, much is at stake, and California's coastal managers already have a difficult task at hand. The state's 1,100 miles of open ocean coast, and another 1,000 miles of bay coastline, are major attractors for development, economic activity, tourism, and recreation. Managers are charged with meeting multiple and sometimes conflicting coastal management objectives, ranging from ensuring public safety to protecting natural habitats, to fostering a vibrant coastal economy. These goals will be increasingly difficult to achieve as the risks grow from the combined impacts of climate change.

According to the latest study conducted for California, sea level is projected to rise by about four to 28 inches over this century. As this occurs, we should expect species and habitat shifts (e.g., wetlands wanting to move inland but being hemmed in by development along the shore, a situation dubbed the "wetland squeeze"). In addition, experts expect changes in coastal storms (including possible changes in storm intensity, frequency, and tracks), increasing coastal erosion, more coastal flooding, and faster cliff retreat. Rainfall and runoff patterns are also expected to change. These changes are not just projections for the future; they are already apparent. For example, more precipitation is already coming as rain rather than as snow in the winter, and as it runs off sooner, coastal communities see both more flooding and longer dry periods with less water available in the summer. This pattern also affects water quality: a heavy storm after a long dry period leads to big runoff, which may be heavily polluted with contaminants from roads and fields; as it runs into coastal streams and the coastal ocean, water pollution problems become more serious. Scientists also expect a rise in coastal water temperatures, which likewise will affect water quality. Less oxygen in the water means less favorable conditions for all marine life that depends on oxygen, and so we may see more fish kills.

It should be noted that these are conservative estimates. The relatively modest sea-level rise projections mentioned above are based on the assumption that the ocean will rise gradually, as ice on land melts down slowly and warming ocean waters expand. But that does not account for more recent science, which says Greenland and West Antarctica may melt down much faster than we thought. Of course, if sea level will rise several times faster than we have witnessed in the past, the types of impacts described above—in some sense already familiar to coastal managers today—will become dramatically worse.

In our study, we examined whether coastal managers in California are aware of these projected changes, and what, if anything, they are doing to prepare their communities to deal with the risks and challenges associated with global warming. While the state has looked at basic adaptation options in various sectors before, ours is the first study to look at actual preparedness "on the ground." It delves into the questions of awareness, attitudes, capacity to use available

global warming information, and actions already taken to plan for climate change (or barriers to such action) in California coastal communities. The study was sponsored by the California Energy Commission and California Environmental Protection Agency through a grant to the California Climate Change Center.

The responses we obtained reflect the state of awareness and preparedness in the second half of 2006. While I have done related research in nine other coastal states in the United States, this is the only study to my knowledge that looks at what local coastal managers think about adapting to climate change. In my opinion, these local managers are critical to understanding "real" preparedness, because they are the ones responsible for implementing coastal policies on the ground and thus are at the forefront of preparing for climate change impacts.

The AAA of Adaptation

IN OUR STUDY WE LOOKED AT THREE aspects of preparedness—the Triple A of Adaptation: awareness, analytical capacities, and action. First, are coastal managers at the local level—permit officers, planners, water managers, civic engineers—aware of and thinking about the risks associated with global warming? Do they know what climate change really means? Second, if they are aware, how do they use the information they have? Can they translate scientists' projections into something they can act on in their daily work, in the decisions they make? We call this managers' analytical capacity. And finally, are they already developing policies and taking action? Are managers taking this information—such as the fact that flooding will get worse, and flood levels higher—into account in long-term planning, in emergency plans?

In early 2006, we interviewed 17 federal, state, and regional officials—managers actively involved in coastal zone management in California, from agencies ranging from the Army Corps of Engineers to the Department of Boating and Waterways to the Coastal Commission. Based on what we learned, we developed a comprehensive survey and in the summer of 2006 sent it to 299 municipal and county coastal managers—people who do everything from issuing permits to managing stormwater flows, water quality, public works, and so on. About half the people responded, which is considered a fairly high response rate for a survey. We received responses from nine out of ten coastal cities and 90 percent of all coastal counties, so the results give a fairly good indication of what's going on. The 18-page survey sought answers to the following questions: What are your current challenges and how do you deal with them? What are your attitudes about global warming? How do you think global warming and related impacts such as sea-level rise might affect your local area? What have you done to prepare for those impacts to date? If no plans are in place, what are the barriers to beginning to prepare? And what would you need in order to act—more information, more training, or something else?

Awareness of and Attitudes toward Global Warming

TO LEARN HOW AWARE MANAGERS ARE of climate change, we asked if they agreed or disagreed with various statements. For example, "Global warming is already happening now." Over 90 percent responded that they "agreed" or "agreed strongly" with this statement. This answer reflects a very high level of awareness about this issue, a level I have not seen in other states.

As another way to gauge attitudes toward global warming, we asked: "What is your personal level of concern about global warming?" About 80 percent responded that they are "very concerned" or "concerned," again signaling an exceptionally high level of concern.

Next we asked: "What are your attitudes toward preparing for the impacts of global warming?" We found that the vast majority, over two-thirds of respondents, are ready to prepare for the most likely climate-change scenario based on the best available scientific information. A few percent of respondents said they are willing, in all of their decisions, to prepare for things getting worse; about a third said, "I want leadership from on top" or "I can't deal with this because I have too much else on my plate;" and approximately 15 percent stated that they would "rather wait to act until they get better information." Those unwilling to take action right now make up an important segment of the population, but overall we found that a significant majority of coastal managers in this state are very concerned *and* ready to act.

We then asked respondents how informed they felt about global warming. The vast majority said they are "moderately well" informed. When we probed a bit, we learned that people basically get their knowledge about global warming from the

news media—the papers and TV news. Very few said they are very well informed and very few admitted that they don't really know anything. So although we found that people are concerned and ready to act, their understanding of the issues is somewhat superficial.

Translating Science into Information for Decision-Making

UNDER THE SECOND A OF THE TRIPLE A of Adaptation, analytical capacity, we tried to find out whether managers were capable of translating technical information into "usable science" for decision-making. We began by asking whether they have the information they need, and what else they might need, to begin preparing for climate change impacts. In one question, for example, we gave several options: Do you want (1) short-term weather and seasonal climate forecasts, (2) regional climate change projections for the next few years, (3) information about what is most vulnerable or at risk in your community, or (4) locally specific projections of various climate change variables, such as changes in temperature, rainfall, and sea-level rise? What our study revealed is that for coastal managers, the most important type of information is the vulnerability assessment for their communities: people want to know what will be most at risk. By identifying what is most vulnerable, they get a better idea of what to do and what else they may need to secure their local area against possible impacts. Managers are very clear in saying, "I don't want generalized forecasts of warming for the globe. I want to know: Can I still meet my management objectives? How far back do I have to tell people they have to build? How does sea-level rise translate into a retreat rate?" As a result, I highly recommend that scientists and state agencies avoid the "loading dock" approach of providing local managers with more and more information in the form of reports and statistics. People need not just information; they need to know how to *use* that information. They also want to know what other communities have done.

In addition, respondents clearly stated that they want to know how climate changes and the effects these will have on the ocean translate into project-relevant timeframes—the sorts they deal with on a daily basis, encompassing five, 10, 25, 50, or at most, 75 years. With regard to flood zones, for example, they asked such questions as: Do we need to remap our flood zones? Can scientists project how flood zones may look different under higher sea-level scenarios? Right now the state is attempting to update flood-zone projections; however, this effort makes no attempt to project how flood zones may be altered as a result of climate change.

We then asked about the kinds of tools managers use now to process information. The answers to this question are important because they indicate managers' capacity to transform scientific information into something they can use in their decision-making. We learned that managers mostly use maps and GIS, and to a far lesser extent more sophisticated analytical or forecasting tools. The message here is that if we give people fancy models and projections that they don't know how to integrate into their daily decision-making, they will be less likely to use them effectively. Instead, the scientific community must translate technical data into practical information, presenting it in formats that are already commonly in use. For example, rather than providing a nice diagram of sea-level rise over the next 100 years, we must create regionally specific maps and GIS layers depicting more easily observed events such as flooding, beach erosion, and cliff retreat. This presents new challenges that scientists must tackle to link up climate-change information more directly with decision-making.

Solana Beach

CALIFORNIA COASTAL RECORDS PROJECT

Actions Taken and Barriers to Preparing for Climate Change

FOR THE LAST A OF THE TRIPLE A OF Adaptation, we asked what actions communities had already taken to prepare for climate-change impacts such as sea-level rise, or if they had not, what barriers prevented them from doing so. The responses were sobering: When asked if they had started to think about global warming in their management and planning efforts, only two counties, San Luis Obispo and Sonoma, replied that they have plans in place that consider the effect of climate change, and neither of these considers coastal impacts. Only one city, Berkeley, has such a plan.

Somewhat more encouraging is the fact that six cities and four counties are currently preparing such plans, some of which will look at what sea-level rise and global warming might mean to them locally.

More than two-thirds of the respondents said their communities had not begun planning for the impacts of climate change, and nearly 20 percent didn't know whether their communities had any such plans. In some instances, we found respondents from the same local government contradicting each other—a reflection of the all-too-common situation of different departments not knowing what the others do. A lot of things could be improved if people talked more with each other, but of course, that won't fix everything.

When we asked why individual communities had not yet begun planning for climate change, the responses were revealing. Fifty percent or more of local coastal managers mentioned five major barriers to action: insufficient local funds, insufficient staff resources, no financial assistance from either the state or the federal government, no legal mandate, and simply being overburdened: "We have too many things going on as it is."

An additional option on the survey was that "the science is still too uncertain," but that didn't figure highly in the responses.

The pressing coastal management challenges that currently occupy these managers include inland and nearshore water quality issues, inland flooding, species and habitat protection, coastal erosion, coastal flooding, public access, and saltwater intrusion. Because all of these will become more problematic with global warming, in some respects climate change will just be bringing more of the same. But because managers feel overburdened as it is, they can't even make the time to find out that climate change and sea-level rise won't bring something fundamentally new, different, or "extra," but instead worsen the problems they face daily now. And, as our survey revealed, coastal managers already feel they have too few resources to address the issues they currently face. In other words, they need help. Specifically, they need time, resources, and technical assistance to begin looking at the growing risks associated with climate change.

At the state level there are some agencies, including the Coastal Commission, that have considerable expertise on climate change and what it might mean for coastal areas, but the motivation to act on that expertise varies. Some agency experts are as yet unwilling to tackle the issue of climate change because they perceive it as politically charged; others simply don't know how. Although some experts, both in public agencies and in the state's research institutions, stand ready to develop the information that managers need, generally speaking the scientific expertise in the state is inadequately connected to those who need it most.

At the local level, most people put out one fire at a time—or keep one house at a time from

MAPS COURTESY BCDC

The outlined areas on these maps from the San Francisco Bay Conservation and Development Commission show regions that would be submerged by sea-level rise of one meter. At left is the Foster City and Redwood City region, at right is Oakland Airport.

falling off the cliff. Nothing in their agency mission or job description says they also need to look at climate change. They will only start dealing with global warming impacts once that becomes part of their job description, because then it will be part of their responsibilities and they will be accountable.

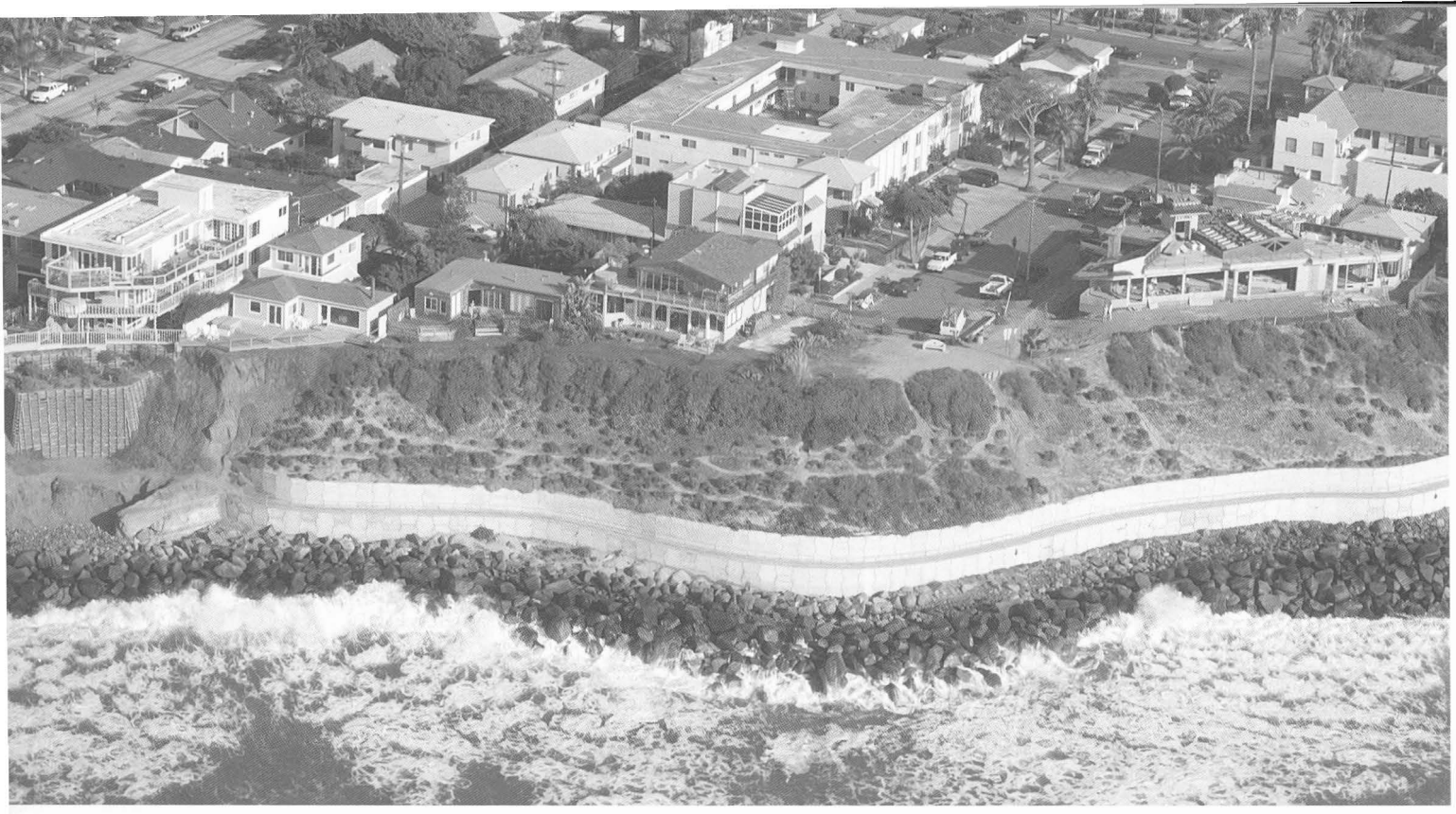
It is also important to realize that our results, though hardly encouraging, may still be too optimistic. About 50 percent of the people to whom we sent the questionnaire did not reply. I think that people who have something to tell, such as those who have begun to act on climate change, and those who are motivated to do an excellent job, are more likely to respond to such a survey, while those who have not yet taken action on global warming are less likely to do so. Thus the summary here is probably too rosy a picture of the overall situation in coastal California.

Given that the scientific projections of what's ahead are becoming ever more alarming, what can be done to help those who are in charge of decisions about our coast? I think the Coastal Commission has an important opportunity to take on a leadership role by instituting an official policy that makes climate change a central consideration in coastal development and management. Today, there are critical constraints on local coastal management that prevent best practices. As a first step, these should be addressed. In addition, the Commission could take a serious look at those communities that are willing to be the pioneers and take action. Developing response options with those ready to lead will be important, because those are the communities others will look to for answers later on.

Postcard to our Grandchildren

CLIMATE CHANGE WILL HAVE SIGNIFICANT impacts on a part of the California landscape that is vital to the state—ecologically, economically, and culturally. I was recently in New Orleans and saw with my own eyes the devastation inflicted by Hurricane Katrina. I can tell you that the time for preparation is now, not when the crisis is upon us. If you start thinking about making changes only after a catastrophe hits, it's too late.

People face many constraints that keep them from doing the best they can right now. Managers told us they want technical and financial assistance, as well as a legal mandate, or at least



CALIFORNIA COASTAL RECORDS PROJECT

Heavily armored shoreline at Del Mar Avenue, San Diego

an official policy. People want leadership. They need these things in the face of ongoing development pressures and the demands of special interests. They need specific information, but they also need help to use that information, and opportunities to exchange relevant experiences with colleagues.

California is a national leader in addressing greenhouse gas emissions—that is, in working to reduce the pace and magnitude of global warming. However, top state leadership is lagging behind in its readiness to address the unavoidable impacts of climate change. An important public conversation about adaptation is yet to be had. Some may view a discussion of adaptation as a form of capitulation, as giving up on mitigation, but that is outdated thinking. The impacts we are already seeing are taking place because of emissions we released into the atmosphere decades ago. They are, in a sense, a postcard from the past. What we do today should be viewed as a postcard we're sending our children and grandchildren, for delivery 30 years from now. No amount of mitigation today will diminish the impact of the heat-trapping gases we have already emitted. We have already committed ourselves to additional climate change, and will have to deal with those impacts. Adaptation, therefore, should be seen as a complementary necessity to mitigation. There is no way around it: we need to start a public dialogue that acknowledges these realities, and begin discussing how we will deal with these unavoidable impacts.

Moreover, there is no way, given the increasing challenges we face from global warming, to avoid addressing some long-standing taboos: population growth and development pressures in the coastal zone, for example, which place more and more people and expensive structures in harm's way. Addressing this clash will raise uncomfortable questions about long-term retreat from the shoreline, private property rights, the role of government in protecting the public from risk, and so on. The onus is on the Coastal Commission and other agencies to take a strong leadership role in protecting California's precious coastal resources and environments, while maintaining a vibrant coastal economy. Some tough decisions will have to be made. Such leadership will likely be unpopular among vested interests in the near term, but it will pay off in the long term—even in the face of climate change—if it allows coastal California to remain a cultural and economic magnet. ■

Susanne C. Moser, a geographer at the Institute for the Study of Society and Environment, National Center for Atmospheric Research, in Boulder, Colorado, has been researching impacts of climate change for the past 15 years and seeking ways to help policy-makers and managers understand their choices and implement appropriate responses. From 1999 to 2003, she was a staff scientist at the Union of Concerned Scientists.

WHERE TO FIND MORE WATER

Our very best source has barely been tapped

DOROTHY GREEN

THE BIGGEST AND BEST SOURCE OF new water, the most cost-effective, cheapest, most readily available, and most secure method of supplying the Los Angeles area and the state with water to meet the needs of our growing population, is the water now wasted locally through inefficient use.

The California Constitution, Article X, Section 2, requires that all uses of the state's water be both reasonable and beneficial. It prohibits the waste and unreasonable use, method of use, or method of diversion of water. Thus the constitution, as well as common sense, require that we use our local water resources as efficiently as possible.

Efficiencies include: conservation, reclamation and reuse (which is considered a new water supply by some), conjunctive use of surface and ground water, watershed management that includes better utilization of stormwater, the development of a landscape ethic, and better management of our dams and spreading grounds. In these pages we focus on urban residential conservation, touching briefly on the others, which are described in my forthcoming book, *Managing Water: Avoiding Crisis in California*, from which this article is adapted.

Many studies have concluded that we can greatly reduce our dependence on imported water, and accommodate growth both within the region and statewide by fully implementing these efficiencies. Some are already being implemented, with outstanding results.

However, almost all efficiency programs are voluntary at this time. If we are to achieve the maximum possible savings, more carrots and some sticks will need to be added to the programs now available. Without the carrots provided by Los Angeles Metropolitan Water District (MWD), most of the smaller agencies in the Los Angeles area would be unlikely to take on any of the efficiency programs offered. When each agency is dependent on water sales for its income, they do not find it in their self-interest to spend money so as to have less product to sell.

Drought Was a Catalyst

MOST EFFORTS TO CONSERVE WATER in California were initiated as a result of the drought of 1987–92, which for the first time caused water shortages in both the agricultural and urban sectors. Until then there had always been some "surplus," as then defined, in the system—water was thought to be "wasted" if it flowed to the sea. Neither the Endangered Species Act nor the Clean Water Act's water quality standards were yet being implemented on a major scale.

Since that six-year drought, some cities and water districts in southern California have made water conservation a high priority by seeking to eliminate wasteful practices. To assist in this goal, urban water agencies throughout California joined with environmental groups and other water professionals to form the nonprofit California Urban Water Conservation Council (CUWCC). In 1991 they signed a memorandum of understanding that details 14 best management practices (BMPs) designed to conserve water. Each signatory promised to implement them. This Council acts as the conservation clearinghouse for the state and as a brain trust of sorts for the signatory agencies. It also works to identify additional BMPs and to quantify the

savings that can be obtained from each. Participation is voluntary. Some of the BMPs are system-wide, some are residential, industrial, or commercial.

Implementing these BMPs has already led to measurable successes. Despite a population increase of slightly over 35 percent (or nearly one million people) since 1970, current water use in the City of Los Angeles has grown by only seven percent, and per capita usage has been reduced by 15 percent. The entire MWD service territory now uses about the same amount of water it did 20 years ago, despite a comparable increase in population.

The daily water use per person is lower in Los Angeles than in other major cities in California. The rest of the state has a lot of catching up to do.

There is also great room for improvement in the industrial sector, as well as in agriculture, which consumes some 80 per cent of the state's developed water. MWD's experience in offering a subsidy to those industries that can become more efficient in their water use has been amazing. All the money set aside for this subsidy is immediately spoken for.

The CUWCC's Fourteen Best Management Practices

1. Water Survey Programs for Single-Family and Multi-Family Residential Customers
Identify the highest 20 percent of water users and provide them with incentives and/or alternative household appliances (toilets, showerheads) that will result in less water consumption.

2. Residential and Commercial Plumbing Retrofit
Offer ultra-low-flush toilets to homeowners to replace toilets that use more water. The state prohibits the sale of toilets using more than 1.6 gallons per flush. Therefore they are now required on all new construction in the state. A bill pending before the Legislature as this is written would require that toilets be replaced whenever a home is sold. This is now required in the cities of Los Angeles and Santa Monica. Toilet flushing accounts for more than 25 percent of all indoor water use.

3. System Water Audits, Leak Detection and Repair
Conduct an audit, at least once every three years, to compare the meters of the water suppliers to those of their customers to determine if there are leaks in the system. If repair is cost-effective, leaks are repaired.

4. Metering of All Old and New Connections and Institution of Commodity Rates
Meters are required on all new connections, and water bills must be based on volume of use. Meters must be installed by 2025 in urban areas that are not yet metered, such as Fresno, Sacramento, and Stockton.

5. Large Landscape Conservation Programs and Incentives
Identify and contact all irrigators of large landscapes (golf courses, greenbelts, common areas, schools, parks, cemeteries, and others) offering information on ways to irrigate more efficiently and on the use of native plants. Water agencies must also provide follow-up audits at least once every five years and provide multilingual training and necessary information. A state law now requires the use of drought-tolerant plants in large landscaped areas.

6. High-Efficiency Washing Machine Rebates
Support local, state, and federal legislation to improve the efficiency of washing machines, so as to save water, energy, and lessen the load on wastewater treatment plants. If an energy or water utility in the agency's territory offers a rebate for the purchase of such a machine, then the water agency must also provide one, unless the maximum rebate offered by the others is less than $50. Washing machines account for approximately 25 percent of all water used indoors.

7. Public Information
Promote water conservation through public speaking, through the media, by inserting educational material into water bills, and by informing customers on their water bills of their use in gallons-per-day. Coordinate with other government agencies, industry, and public interest groups in promoting water awareness.

8. School Education
Work with school districts in the water supplier's service area to provide educational material and instructional assistance to promote water awareness.

9. Commercial and Industrial Conservation
Identify and contact the top 10 percent of industrial and commercial customers, offering audits and incentives sufficient to achieve implementation of water-saving practices. Provide follow-up audits at least once every five years.

10. Wholesale Agency Assistance
Wholesale water agencies must provide local assistance to the smaller retail agencies.

11. Conservation Pricing
Provide incentives to customers to reduce average use. This may involve an inverted rate structure. When more than a set amount of water is used, the rate goes up for the next increment of water used. More could be charged during the summer dry season when water is not as available.

12. Conservation Coordinator
Designate a water conservation coordinator responsible for preparing the conservation plan, managing its implementation, and evaluating the results.

13. Water Wasting Prohibition
Prohibit gutter flooding, sales of automatic water softeners, single-pass cooling systems in new connections, nonrecirculating systems in all new conveyor car wash and commercial laundry systems, and nonrecycling decorative water fountains.

14. Toilet Replacement
When homes are sold, require replacement of old inefficient toilets that use anywhere from 3.5 to 7.0 gallons per flush with 1.6-gallon flush toilets called ultra-low-flush toilets. Toilets with 1.3-gallon flush are now available.

Water agencies may adapt the recommended practices to their particular needs, as long as their program is as effective. All members of the CUWCC are required to submit a progress report to the Council's website once every two years. The results of these filings are available for all to see.

In 2004 the Legislature authorized the creation of a Landscape Task Force, which has reenforced the need to reduce water use, improve irrigation efficiency, encourage the use of plants with low water requirements, and use conservation rate structures to send appropriate pricing signals.

The CUWCC requires wholesale agencies to comply with only seven BMPs: system water audits, leak detection and repair, public information programs, school education programs, conservation pricing, local agency assistance, and a conservation coordinator. The requirement to provide local agency assistance is taken quite seriously by most of the wholesale agencies. Their support results in the sum total of what conservation programs exist in much of the Los Angeles area outside of a few progressive cities.

The Council is exploring additional BMPs for both residential and commercial uses. Some of these have already been adopted by local jurisdictions. Oceanside, for example, has mandated that all new homes be built with hot water circulation systems to save the water that is run when the tap is turned on to get hot water.

Adding Up the Savings

HOW MUCH WATER WILL THE LOS Angeles area need in the future and how much "new" water can be found by implementing best management practices and other conservation measures? Estimates vary widely and depend in large part on who is estimating.

Satellite-linked Irrigation

THE IRVINE RANCH WATER DISTRICT IN Orange County has installed a programmable computer-operated irrigation controller (also called an ET controller) in 114 homes. These controllers are programmed to match the evapotranspiration (ET) of plants growing in the front and back yards of each home. They are connected by radio to the state weather station that signals relative humidity and precipitation. With both ET and the weather plugged in, the irrigation system can be programmed to provide the optimum amount of water required for healthy landscaping. Residents were also given soil moisture probes, and taught to understand the system.

The water district monitored the impact of the system on urban dry-weather runoff. Grouping 300 homes in five sets, each sharing a storm drain, the district looked at volume of runoff and of nutrients, herbicides, pesticides, and bacteria in the runoff.

One group of 114 homeowners received educational materials and had the irrigation controller installed; a second group only received the educational materials.Participants in these two groups were either self-selected (by indicating an interest in conserving water), or randomly selected through letter solicitations and a door-to-door campaign. The other three groups were controls. The typical savings was 10 percent of total household use and a 50 percent reduction in dry-weather runoff, with no increase in runoff pollution. Large landscapes saved even more. Education alone produced a six percent savings. And the landscaping is healthier because it is not over-watered. (See www.irwd.com/Conservation/index.php.)

A study by California Urban Water Agencies (CUWA), completed in 2004, echoed its 2001 study, *Urban Water Conservation Potential*, which took a cursory look at some of the BMPs and concluded that for the South Coast region—essentially the MWD service territory—cost-effective net savings by 2020 could be only 581,000 acre-feet a year (AFY). Statewide, CUWA estimated a potential 972,000 AFY. Yet even by this conservative estimate, the figures add up to the equivalent of MWD's "paper water"—the amount contracted but not delivered from the State Water Project. CUWA represents the 10 largest urban water agencies in the state.

The Association of California Water Agencies (ACWA), the big association of all water agencies that is even more conservative than CUWA, foresees grave water shortages and in 2005 released a plan, *No Time to Waste: A Blueprint for California Water*. It supports the construction of additional surface and groundwater storage and conveyance, relaxing of the Endangered Species Act and other regulatory constraints, and expedited water transfers as well as conservation, reuse, and regional planning.

A far more optimistic estimate of potential savings through increased efficiency is offered by the Pacific Institute for Studies in Development, Environment and Security, which has published several studies and reports on water issues. Its 2003 analysis, *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, suggests that vast quantities of water can be made available for other uses by replacing old technologies and practices with those that permit us to accomplish the desired goals with less water.

If used efficiently, this conserved water could meet the indoor residential needs of 17 million people annually. Savings could more than double if all reasonable potential conservation could be captured. A third of the residential water used indoors can be saved today, cost-effectively, with existing technology.

If water use in California becomes as efficient as readily available technology permits, total urban use could drop by 33 percent, from 7 million acre feet (MAF) to around 4.7 MAF, the Pacific Institute found. Reductions in residential use outdoors, more difficult to measure, could easily produce cost-effective savings of at least 32.5 percent relatively quickly with improved management and available irrigation technology. Using computerized irrigation controllers could save 10 percent immediately, and as much as 50 percent could be saved with changes in landscape materials.

Saving water also saves other resources. By reducing the energy needed to heat water for bathing or for washing machines, and by reducing the flow to wastewater treatment plants and therefore the amount of wastewater that needs treatment, both water and energy can be saved. With outdoor conservation, water quality from reduced urban runoff is improved, and there is less runoff.

The state has never had a serious discussion of demand management; many economically viable conservation options have been overlooked.

A Creative Approach

TO ENCOURAGE PROPERTY OWNERS TO switch to water-saving showerheads and toilets, some water agencies, led by the Los Angeles Department of Water and Power, turned to community-based nonprofit organizations for help. Mothers of East Los Angeles was one of the first to participate, and it established the methodology.

The organization contacts property owners in the neighborhood, distributes and installs new toilets free of charge, collects the old wasteful ones, and turns them in to the water agency, which pays $15 to $35 for each. This program has proved effective in reducing water use while also creating jobs and income for the participating groups. The money earned by the organization's volunteers is plowed back into the community in the form of college scholarships or to help fund extras at local high schools or other programs.

Other organizations that have participated in this program include the Asian American Drug Abuse Program and Korean Youth and Community Center in Los Angeles, and Calvary Baptist Homes, Inc. in the San Fernando Valley, as well as some high schools. Some of these groups' members have been trained to install the new toilets. Pleased with the results, the department plans to invite community organizations to help install other water-saving devices.

Rebates Work

THE TWO LARGEST WATER SUPPLY agencies in the Los Angeles area are the Metropolitan Water District of Southern California (MWD) and Los Angeles Department of Water and Power (DWP). Because of their dominance, their programs deserve a special look.

MWD serves about half the state's population. As the importer and distributor of water from the Colorado River and the State Water Project, and the de facto water planning agency for most of southern California, whatever MWD does has great significance. It sets the pace in many ways for all of southern California, by means of various incentive programs. These programs rely on carrots; MWD has no sticks.

MWD's Conservation Credits Program offers a rebate of $154 for each acre-foot saved. A rebate of $250 per acre-foot is available for groundwater recovery programs, reuse, and for desalination of ocean water. Since 1990, installation of water-saving home appliances has been encouraged with rebates to its member agencies: $80 for a dual-flush-model toilet and $60 for high-efficiency washing machines. Possible expansion of the rebate program to other efficiency devices, including irrigation controllers, is being considered. More than 2 million toilets, 93,062 washing machines, and almost 3 million showerheads have been installed.

A competitive grant program for commercial, industrial, and institutional retrofits has proved extremely popular. MWD has also unbundled its rate structure, instituting a tiered rate system to encourage the development of local resources.

MWD has been working with others to establish a uniform and simpler water-use efficiency survey program and is researching better ways to automate sprinkler irrigation programs, especially for large landscaped areas managed by professional gardeners. Training programs have been established and model drought-tolerant gardens have been built by some of its member agencies. MWD has also mounted a major Heritage Garden and California Friendly Garden program, with a huge website to promote native plants for home gardeners. It has persuaded some nurseries to stock natives, and is providing other learning opportunities, for home gardeners and especially for landscape professionals. MWD's other conservation goals and programs are spelled out in its Regional Urban Water Management Plan.

The Los Angeles DWP helped to develop the CUWCC's 14 BMPs and is committed to implementing all of them. As a result, residents of the City of Los Angeles had installed 1.24 million ultra-low-flush toilets by 2005. The Department has started a program to install such toilets free of charge. Free shower heads are available for the asking. This program teaches the public that they can save money on their water bill without sacrificing the usefulness of their appliances. As a result, despite increases in population, water use has remained stable.

LA DWP offers rebates of $150 for the purchase of high-efficiency washing machines, in addition to the $35 rebate offered by MWD. As of 2005, 32,000 washing machine rebates had been issued, reducing annual water use by as much as 5,200 gallons per machine (a total of 82 acre-feet saved per year). In addition, Southern California Edison has been offering rebates of $50 to $100 per machine because they also save energy. This year, these machines have become the state standard.

Reusing Wastewater

LA DWP IS ALSO COMMITTED to reusing its wastewater. In 1990, the City Council adopted a goal to recycle 40 percent of its wastewater by 2010. The Integrated Resource Planning Process, underway as this is being written, presents three alternative ways to meet the city's future water needs. Reuse goals outlined in the EIR range from 42,000 acre-feet a year to as much as 79,900 acre-feet a year. The East Valley Project, which is built and ready to go, is designed to recharge 10,000 acre-feet of reclaimed water a year, increasing to 35,000 acre-feet by 2020.

A conservative estimate made by the California Urban Water Agencies is that a million acre-feet of water can be saved statewide.

The City has adopted a landscape ordinance, more stringent than the state's, that applies to large landscaped areas or those installed by a developer, and offers training. It has adopted an inverted rate structure, increasing the cost per unit of water used beyond an established base line. The City further increases the cost of those additional units in the summertime to discourage waste and profligacy.

A graywater ordinance, adopted in 1994, permits the use of wastewater from showers, sinks, and washing machines for irrigation if distributed through an underground irrigation system. DWP makes loans available to help cover the costs of installing efficiencies, including loans to other city departments. It is studying the cost/benefits of further efficiency improvements, including the possible installation of computer-driven irrigation controllers connected to the

state's weather station. A technical assistance program for commercial and industrial water users offers a subsidy of $315 per acre-foot saved, and has been saving about a million acre-feet per year.

Because of its water savings, the department is now using less energy than it did before the five-year drought to pump water over mountain ranges and to its end use. Less wastewater needs to be treated, and less polluted urban runoff flows into streams and the ocean.

Per-capita water use peaked during the 1980s at over 180 gallons per capita per day (pcd). During the drought of the early 1990s, it fell to 145 gallons pcd, and has stabilized in 2005 at 155 pcd.

Daily water use per person is lower in Los Angeles than in other major cities in California. The rest of the state has a lot of catching up to do.

THE EFFECTIVENESS OF MANY KINDS of conservation is difficult if not impossible to measure. About a third of the water agencies in the Los Angeles area are doing little if anything to implement the BMPs they have already agreed to implement. Many others have not even signed on to the list of BMPs.

The Pacific Institute has reached the conclusion that, statewide, about 33 percent of the urban water now used indoors could be saved cost-effectively with existing technologies. There is the potential of saving an additional 10 percent of water used outdoors with irrigation controllers that reduce over-watering, and much more could be saved with the adoption of a landscape ethic that involves planting California natives and California-friendly landscape materials.

New Statewide Water Group

THE CALIFORNIA WATER IMPACT NETWORK, the only statewide nonprofit organization working solely on water issues, has adopted "16 Principles for a Sustainable Water Future" and is seeking endorsements. Its website (www.c-win.org) is designed to serve as an organizing tool and network for all the people and groups around the state that are interested in water issues. It is step one toward developing the political will needed to make the changes that are so necessary.

A conservative estimate, made by the California Urban Water Agencies, is that a million acre-feet of water can be saved statewide. That's "new" water—the most available, least expensive, most reliable source for the state's future needs. The measures described or mentioned in these pages are only a fraction of what is beginning to be done.

There is enough water for our growing population, for agriculture, and for restoring ecosystems decimated by water transfers. We are that inefficient. We can have it all. We just need the political will to make it happen. ■

Dorothy Green, a water activist for decades in Los Angeles, is among the founders of the California Water Impact Network. This article has been adapted from her forthcoming book, Managing Water, Avoiding Crisis in California, *which will be published in autumn this year by the University of California Press.*

On-line Resources

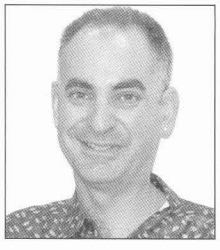
California Urban Water Conservation Council: www.cuwcc.org
Landscape Task Force: www.cuwcc.org/ab2717_landscape_task_force.lasso
Association of California Water Agencies: www.acwa.com
California Urban Water Agencies: www.cuwa.org
Pacific Institute: www.pacinst.org
Metropolitan Water District of Southern California: www.mwdh2o.com
California Friendly Garden Guide: www.bewaterwise.com
California Water Impact Network: www.c-win.org

Do Unto Others

In this issue of *Coast and Ocean* Anne Canright describes the current plight of the southern sea otter. It would be hard to find a more charismatic creature that has come closer to extinction than the sea otter. Like many California children, my daughter (now 13) used to fall asleep clutching the stuffed toy otter I got for her at the Monterey Bay Aquarium.

The otter's recovery in California began when the U.S. Fish and Wildlife Service declared the species threatened and began recovery efforts in 1977. For a while the otter bounced back, although never as fast as the northern population in Alaska did. The otter's recovery has stalled during the last decade, and the burning scientific question is why, and what to do about it?

Although many things contribute to otter mortality, it seems increasingly clear that otters are having a hard time because of the pollution we allow into the ocean. In particular, disproportionate numbers are dying from infection by *Toxoplasma gondii,* a parasite endemic to humans and cats. They also seem to be getting infected by *Sarcocystis neurona,* another bug that doesn't hurt most of us but does hurt otters.



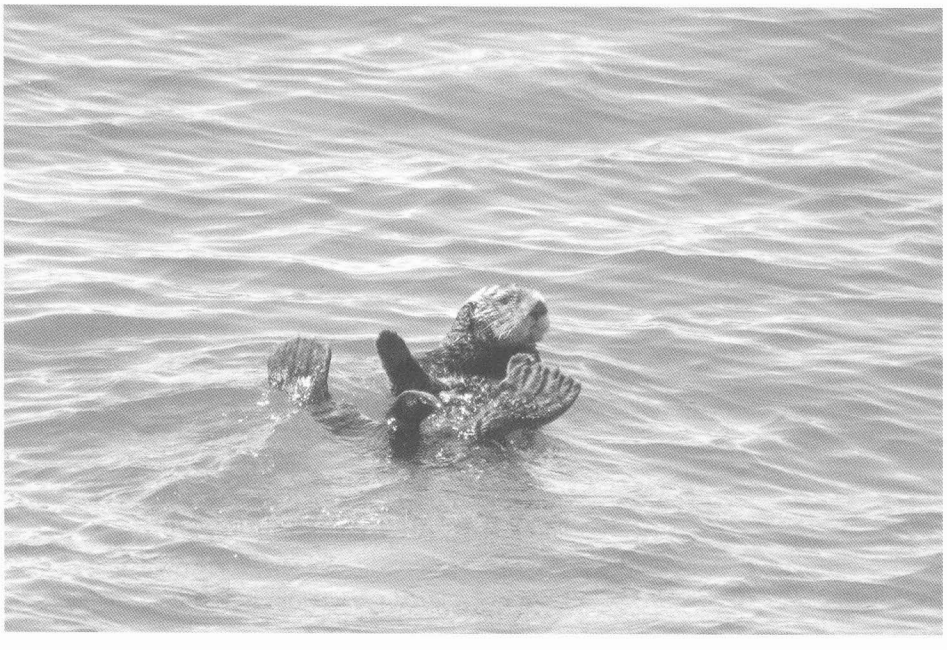
How do these bugs get into the ocean? Cat feces are likely the major route for *T. gondii,* particularly from outdoor cats or cats whose owners flush litter down the toilet. Other problems include untreated or partially treated sewage drained into the ocean by the people who live along the Central Coast, agricultural and urban runoff, and stormwater. The fact is that 30 years after the passage of the Clean Water Act, we persist in treating the ocean as a giant sewage sump. If the sea otters organized themselves and routinely dumped truckloads of otter poop on our front lawns, we would be agitated and demand redress. Somehow it doesn't occur to us that we should treat them the way we would like to be treated.

The idea that we should do unto others as we would have them do unto us, rigorously applied to the environment, would solve many, if not most, of our ecological dilemmas. If we treated our oceans as if they were our front yards instead of someplace far away, they would be in much better shape than they are. We have established the principle that humans need clean water and waste removal, but we haven't managed to apply this to all the other creatures that live on Earth with us.

Respect for the environment has been on my mind since I attended a two-day workshop with many of the leading otter researchers in California. Just as they are closing in on the things killing the otters, their funding (mostly federal) is declining. Hopefully the Coastal Conservancy and the Ocean Protection Council will be able to step in and keep this critical research and monitoring going. Scientists hope to establish definitively what is going wrong for otters, and how we can remedy the situation.

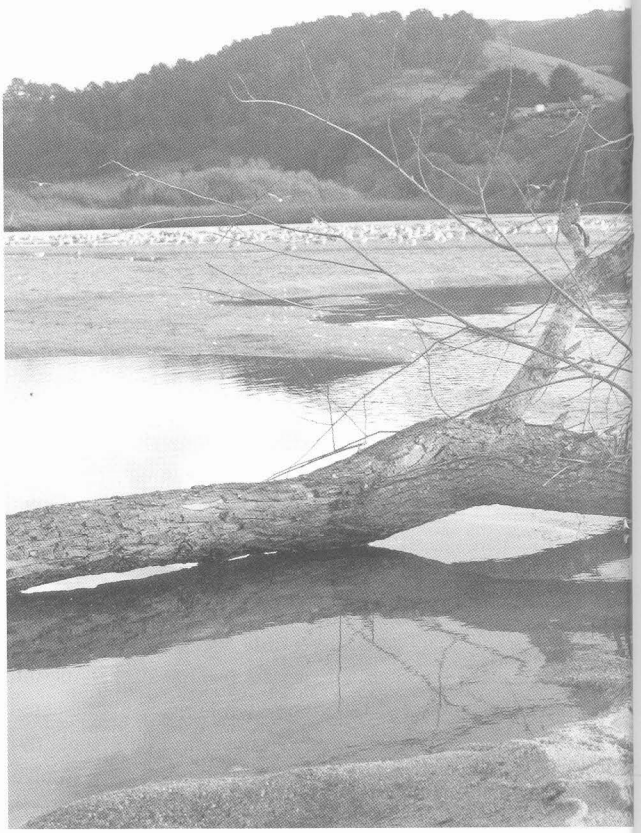
Of course, we don't need 100 percent certainty to take action. In fact, all we really need is to think of the ocean as the otter's home, and ask ourselves how we would feel (and how healthy we would be) if our homes were continuously bombarded by trash, feces, chemicals, and other dangerous things. Extending this thinking to the otters would quickly change human behavior, and allow the otters to continue their ancient and graceful way of life.

Sam Schuchat is the executive officer of the Coastal Conservancy.



JOSH PEDERSON/MBNMS

Carmel River Lagoon



COASTAL CONSERVANCY NEWS

RECENT CONSERVANCY ACTIONS

At its meeting on January 18 in San Diego, the Coastal Conservancy supported 16 projects along California's coast and around San Francisco Bay by approving a total $9.6 million in funding. The Conservancy's support for these projects is leveraging almost $8 million from federal and local governments and private organizations.

Among the statewide projects funded in January is $4.2 million for data collection, research, monitoring, and other actions to improve California's management of marine fish habitats and populations. The funding will help implement the Marine Life Protection Act and Marine Life Management Act, as specified in the Ocean Protection Council/Department of Fish and Game joint work plan, and will include grants to the Department of Fish and Game and the Pacific Coast Marine Fisheries Commission.

The Conservancy also granted $90,000 to the Monterey Bay Aquarium Research Institute to prepare a study of existing state expenditures and identify funding gaps for California coastal and ocean restoration programs and projects.

Among other projects approved in January are:

Making San Diego's Beaches More Accessible

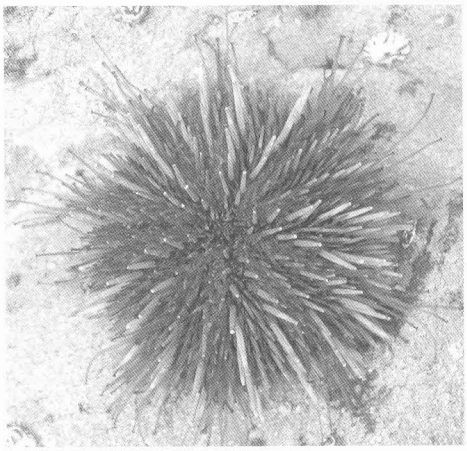
Wheelchair riders will soon be able to explore more beaches in San Diego County on their own, using motorized beach wheelchairs equipped with balloon tires. Coronado and Oceanside city beaches and Silver Strand State Beach will each provide three power beach wheelchairs that can be used at no cost by people with impaired mobility. They will join the four San Diego city beaches—Mission, South Mission, Ocean, and La Jolla Shores—that already provide wheelchairs through the City's Beach Access Program, developed with the assistance of Accessible San Diego, a group that provides information on accessibility to seniors and travelers with disabilities.

Accessible San Diego will use $313,000 approved by the Conservancy to buy both power and manual wheelchairs for the three beaches, train city staff to operate them, and publicize the program to both residents and visitors. Motorized beach wheelchairs allow their users to move around independently, while manual beach wheelchairs must be pushed by another person but can also be used in the water. After the first year, city staff will take over the program.

Accessible San Diego will also help staff at each location assess the accessibility of parking, paths, restroom facilities, and signage, and will work with local companies to design improved equipment for beach accessibility. If the programs at these beaches are successful, the group will work to establish similar programs at other beaches in San Diego County and beyond.

Sustainable Sea Urchin Harvesting

In a time when so many commercial fisheries are in trouble, San Diego's sea urchin fishermen are taking steps to help their still-healthy sea urchin populations stay that way. The San Diego Sea Urchin Project aims to move the fishery toward long-term conservation and sustainability through better collection and sharing of data, and improved fishery management. The project is being developed by the San Diego Watermen's Association, a fishery harvesting cooperative that includes the area's leading commercial sea urchin divers, with the help of $114,120 of California Ocean Protection Council funding approved by the Conservancy.



STEVE LONHART/MBNMS

Sea urchin

The association will recruit and train urchin fishermen to collect data about the areas in which they fish and share it with academic collaborators and government fishery managers. The data will be used to create a stock assessment for the fishery, which will help managers, scientists, and fishermen to create cooperative harvest strategies that help conserve urchin populations. The group will also conduct meetings between divers, fish processors, scientists, and resource managers to develop proposals for a sea urchin fishery management plan for the San Diego area.

One of the primary goals of the project is to develop a collaborative, community-based system of fishery management, grounded in accurate scientific assessment of the state of the sea urchin populations. Using this system, the association hopes to change the fishing environment from one of competition, where it is not in an individual diver's interest to leave sea urchins behind in order to mature, to one of cooperative conservation, where fishermen jointly decide to delay harvesting to increase sea urchin yields and quality.

Another element of the project aims to improve product quality and distribution—including developing a steady supply of live sea urchins for market—so that fishermen can get higher prices more consistently, rather than having to rely on selling large quantities. After the project is completed, the association will use the information to develop a business plan for the fishery.

CYNTHIA HOLMSKY, BIG SUR LAND TRUST

CAMBRIA COMMUNITY SERVICES DISTRICT

The first of the new California Coastal Trail emblems were installed along the bluff trail of Fiscalini Ranch Preserve, near Cambria, by ranch manager Ben Boer.

Progress toward Carmel River Parkway

The Big Sur Land Trust will purchase 8.1 acres from two private owners for the proposed Carmel River Parkway with the help of $3.5 million approved by the Conservancy. Of the total, $2.5 million is a three-year loan, $1 million is a grant.

The Parkway Plan, developed by the land trust in 2005 with community input, envisions a connected network of protected lands and waters reaching 18.5 miles upstream from the lagoon at the river mouth to San Clemente Dam. The Plan also calls for restoring 264 acres of floodplain habitat and 6.4 miles of the Carmel River, improving five wildlife corridors, removing invasive species, and planting native plants.

The three-acre Quail property, on the river's south side, will link Valley Greens Drive and Palo Corona Regional Park along a two-mile utility road that will become part of the Parkway trail. A two-bedroom house on the Quail property, currently used by the Santa Lucia Conservancy as office and visitor center, will become an educational center. A small parking lot will provide for Parkway users and visitors to the center. The 5.1-acre Howe property, on the river's north side, about 1.5 miles from its mouth, will be used as a staging area, with parking, equestrian facilities, and trailheads for both the Parkway and Palo Corona Regional Park. The access road to this property is a critical connection between Rios Road and the river.

The Parkway Plan focuses on first developing the mid-valley stretch of the parkway, then eventually extending it into Los Padres National Forest. (See more on plans for this region in the next issue of *Coast & Ocean.*)

A "Green" Center for Environmental Education

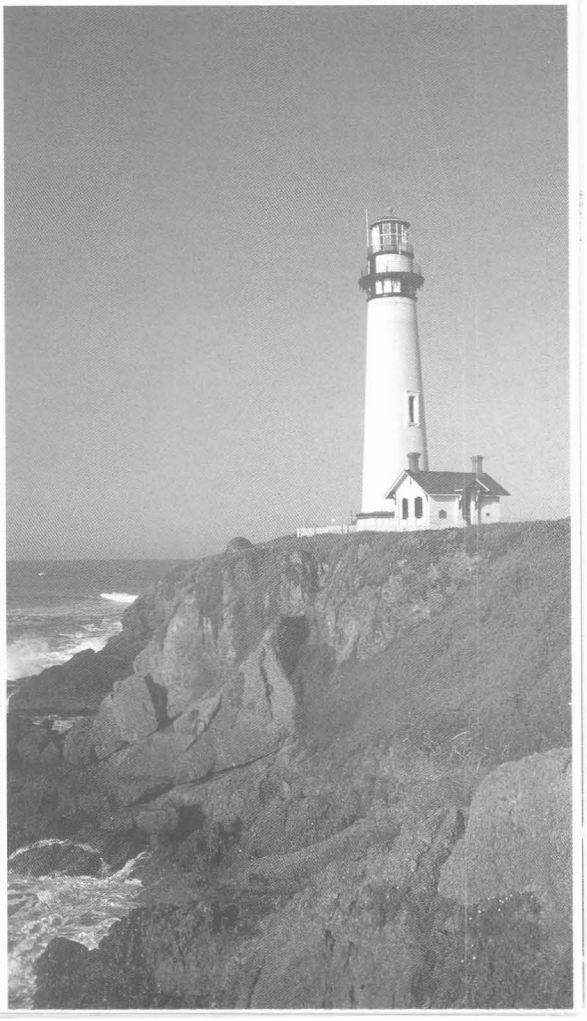
Salmon Creek School, on Salmon Creek in Sonoma County near Occidental, has 420 pupils in kindergarten through the eighth grade, and is known for the excellence of its environmental education program. Children watch and monitor the creek from an observation deck, grow native plants in a greenhouse and nursery, and participate in activities that include recycling and composting programs and an annual harvest celebration.

Soon the school will get a new "green" environmental learning center that is expected to become a model of sustainable design, meeting the rigorous criteria of the Leadership in Energy and Environmental Design (LEED) program. The 6,150-square-foot, single-story structure will be built with nontoxic, resource-efficient materials and will be heated by a passive solar energy system backed up by an under-floor hydronic heating system. It will include a photovoltaic electrical generation system and a rainwater collection system. The new center, which will highlight the diverse ecosystems within the school's 67 acres, will include classrooms, an auditorium, a cafeteria, and habitat gardens.

Students from other schools in Sonoma County are expected to participate in Salmon Creek School's environmental education program after the new center is built. High school and university students, teachers, and community organizations will be invited to visit.

The Conservancy approved $750,000 to the Harmony Union School District to help build the center. Earlier, the Conservancy helped to build an outdoor classroom at the school.

Pigeon Point Historic Light Station State Park will use $305,000 allocated by the Coastal Conservancy to California State Parks in January to relocate and expand the station's parking lot, install a public restroom, construct trails overlooking the ocean, and create a scenic gateway for the lighthouse and neighboring parklands.



ROBERT BUELTEMAN, COURTESY POST

LETTERS

Editor:

Just finished reading your article "The Rush to Build Desalting Plants." I was curious about this statement: "If all the plants now proposed are built, they could supply an estimated seven per cent of the state's urban water use."

I wondered about your sources for this information. Not to put anyone on the defensive. I just wanted to know because it could actually change my opinion on the subject. I am currently a proponent of desal plants co-located with power stations. It appears to be a good idea since the ocean is an almost limitless source of water and once-through cooling is on the way out. However, if the large amount of power required only produces a sliver of our demand, I may have to adjust my thinking.

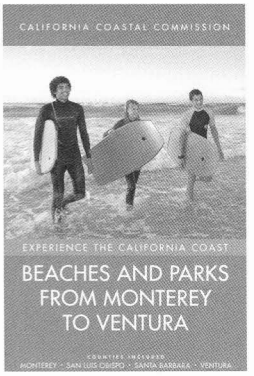
Nicole Apel,
Business Development/Proposal Manager,
Weston Solutions, Inc., Carlsbad

The Pacific Institute report cited in the article estimated that if these plants were built, they could supply a maximum of six percent of California's current urban demand, based on the 8.9 million acre-feet reported for 2002 by the Department of Water Resources. Some other experts speaking on the issue projected seven percent, so I used the more optimistic figure. Since the article appeared, some ocean desal plant proposals have been dropped. Projections for future demand are highly variable, as the article by Dorothy Green in this issue indicates.

—Ed.

BOOKS

NEW COASTAL GUIDE



Beaches and Parks from Monterey to Ventura (Experience the California Coast 2), *by the California Coastal Commission. University of California Press, Berkeley, 2007. 320 pp., 362 color illustrations, 10 line illustrations, 46 maps, $24.95 (paper).*

The second in the Coastal Commission's new series of coastal guidebooks by Steve Scholl is an irresistible invitation to explore some of the most wondrous natural places along the shore. Turn the pages and you'll want to set forth.

The 6" by 9" volume includes descriptions of more than 310 beaches, parks, campgrounds, nature preserves, natural history museums, outdoor recreation sites, and lots more. You'll get guidance to the Monterey Bay Aquarium, Hearst Castle, and other famous places, but also be introduced to a charming Western spadefoot toad (p. 213) and a colorful, intelligent California market squid (p. 287), as well as some of the condors Kip Evans encountered (see below) and other coastal animals and plants.

—RG

In Memory of Mary Travis

IN EARLY JANUARY the Coastal Conservancy sadly said goodbye to Project Manager Mary Travis, who died after a long battle with cancer. For over six years she managed Central Coast projects, uplifting the spirits of her colleagues with her delightful (and sometimes wicked) sense of humor.

Mary was a champion of birds and fishes, frequently boarding pre-dawn flights to Santa Barbara to help restore creeks for native steelhead trout. Whether acquiring 10,000 acres for parkland in Big Sur or restoring habitat for the rhinoceros auklet on Año Nuevo Island, she worked with skill, persistence, and devotion.

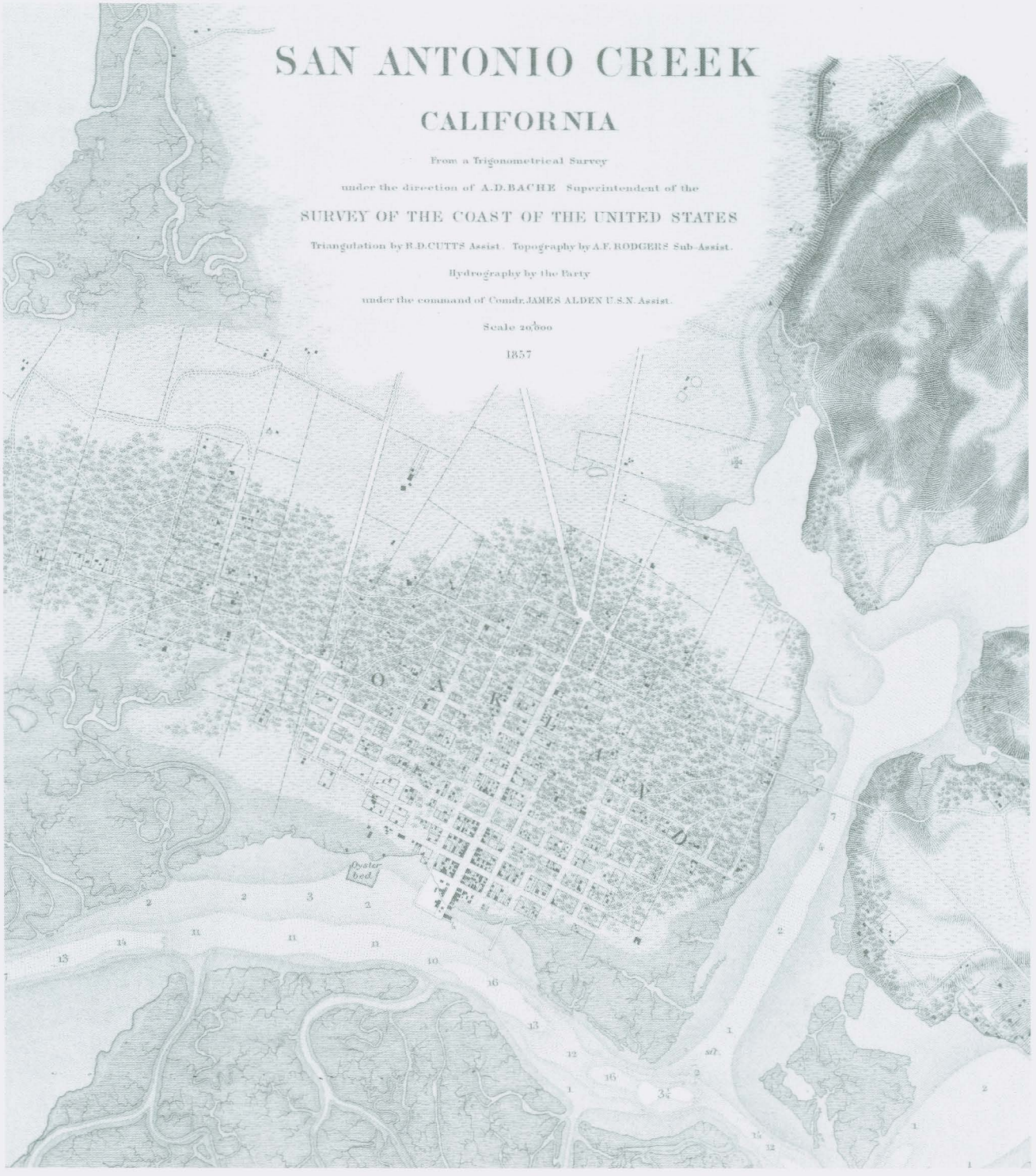
Mary was a graduate of the University of California, Santa Cruz, and received a master's degree in geography from San Francisco State University, for which she wrote a thesis on the natural history of Oakland's Lake Merritt estuary. She was an avid hiker and a longtime member of the California Native Plant Society.

Mary left behind her husband, Rich, her cat, Figs, and many friends at the Conservancy and the Coastal Commission, where she began her career in conservation as one of the authors of the *California Coastal Resource Guide*. Those who knew and loved her will miss her purple socks, her sympathetic ear, and her light, cheerful laugh.

A memorial bench will be placed by Mission Creek in Santa Barbara (see p. 1).

KIP EVANS

Kip Evans, a professional photographer, reports: "I was driving south on Highway 1 in Big Sur, south of Nepenthe [the blufftop restaurant], when I came around a curve and—lo and behold! Two large condors were standing on the guardrail. I stopped. A photography student who was with me and I walked toward them very slowly. They didn't move. Then we saw six more sitting on the bluff below the highway! We watched in amazement for 45 minutes as they took off every few minutes for quick flights down the bluff and over the ocean. The juvenile condors were a real kick to watch as they played delightfully in the early morning sun. I've waited most of my life to see a condor."



NATIONAL ARCHIVES

Historical geographer John Cloud is researching the history of the U.S. Coast and Geodetic Survey for its successor, the National Oceanic and Atmospheric Administration (NOAA). This chart, found in the National Archives, is a provisional edition of one published in the Coast Survey annual report for 1857. Among other things, it demonstrates that East Coast oysters were already being cultivated at the Oakland bayfront.

Look for John Cloud's article on George Davidson and the mapping of the California coast soon in *Coast & Ocean*.

Coastal Conservancy

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