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UNIVERSITY OF CALIFORNIA

Transect

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A FEW WORDS FROM THE
DIRECTOR OF THE NRS

The UC Natural Reserve System and regional conservation planning

Poet Gary Snyder gave powerful expression to the essential need for a bioregional vision:

We must consciously fully accept and recognize that this [land] is where we live and grasp the fact that our descendants will be here for millennia to come. Then we must honor this land's great antiquity — its wildness — learn it — and work to hand it on to the children (of all beings) of the future with its biodiversity and health intact.

(Quoted in Timothy P. Duane, *Shaping the Sierra: Nature, Culture, and Conflict in the Changing West*, Berkeley: University of California Press, 1999, p. 435.)

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ANSEL ADAMS PHOTOGRAPHED THE COACHELLA VALLEY IN 1965, THE SAME YEAR THAT BOYD DEEP CANYON BECAME AN NRS RESERVE.

BIOREGIONAL PLANNING BLOOMS IN CALIFORNIA'S COACHELLA VALLEY

The California desert is a landscape of contrasts. Lush greens adorn some of the world's most famous golf courses, in contrast to the adjacent cactus-studded, sand-swept desert. As duffers test their swings against the champions, a fringe-toed lizard plunges headfirst into the sand.

The Coachella Valley stretches from Joshua Tree National Park to Mount San Jacinto National Monument. Wind funnels into the valley through the San Gorgonio Pass and sculpts a shifting ridge of sand on the valley floor. Steep rocky canyons tumble into the valley from ridgetops as high as 8,700 feet, the source of raw materials that make mountains into sand. Ridge to ridge, this ecosystem encompasses 24 distinct natural communities, 31 species of special concern, and a quarter of a million people.

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BIOREGIONAL PLANNING

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The contrasting worlds of the California desert are not easy neighbors. Issues of land use and conservation can be contentious. But there is a strong commitment to conservation efforts from diverse groups that are as different as the golfer and the lizard. For more than 20 years, scientists from the University of California have worked with developers and environmental groups to create credible, science-based plans to conserve the Coachella Valley. Far from any UC campus, these UC scientists work from the Philip L. Boyd Deep Canyon Desert Research Center, a 16,873-acre NRS reserve just outside Palm Desert.

Early conservation efforts pay off later

In a way, the University’s involvement with desert conservation began with Philip L. Boyd himself.

In the 1930s, Boyd came to Palm Springs for its curative climate, fell in love with the desert, and eventually became the city’s first mayor and a regent of the University of California. Boyd wanted to establish a place where people could come to learn more about the desert, and in the early 1950s, he set aside 40 acres near Palm Desert to showcase the natural features of California’s arid lands.

From that beginning, Boyd’s vision grew. He wanted to create a much larger natural reserve that stretched from the desert floor all the way up to the crest of the mountains. In



THE COACHELLA VALLEY FRINGE-TOED LIZARD IS FOUND ONLY IN THE VALLEY SURROUNDING PALM SPRINGS, CALIFORNIA. PHOTO BY ALEX GLAZER

1959, Boyd donated to the UC Riverside biology department nearly three sections in Deep Canyon, as well as funds to help purchase three adjoining sections for the establishment of a large desert research center. His gift astounded the young biologists he had hired to advise him, including Bill Mayhew, now professor emeritus at UC Riverside.

“I never would have imagined that

such a thing was possible,” Mayhew remembered. But Boyd knew this was not something that could be put off. Desert lands were being developed rapidly even in the 1950s, and what was not protected could be lost.

The Coachella Valley continued to grow. Conflicts between development and conservation began to emerge in the 1970s, culminating with the listing of the fringe-toed lizard under the state and federal Endangered Species Acts. The subsequent Habitat Conservation Plan incorporated research by UC scientists, including Mayhew, NRS founder Ken Norris, and Al Muth, current director of the Boyd Center. The plan outlined three areas that protected not only the wind-swept sands with existing populations of lizards, but also the source of the sand and those places through which sand would move over time. The UC scientists made it clear that habitats shift with storms and wind and time, and the plan would protect the processes that allow habitats to persist.

Although their work was done years before conservation biology was a recognized discipline, the scientific basis of the plan is still considered firm. Fifteen years after that plan was approved, Al Muth reflected on its accomplishments:

We have over 18,000 acres preserved, with a viable extent of natural populations and functioning processes to nourish the creation of new habitats. If it were not for scientific understanding of the larger system and exactly what processes are



ALLAN MUTH, WHO DIRECTS THE BOYD DEEP CANYON DESERT RESEARCH CENTER, HAS BEEN INVOLVED WITH REGIONAL PLANNING — AND THE COACHELLA VALLEY FRINGE-TOED LIZARD — SINCE THE EARLY 1980S. PHOTO BY VIC MUTH

necessary, we would have lost the sand sources and, eventually, lost the habitats and the species.

UC scientists advance multi-species planning

In 1986, the Habitat Conservation Plan was signed by all the city governments in the Coachella Valley, who oversaw its full implementation and its effectiveness. Development continued parallel with conservation.

By the mid-1990s, problems with endangered species were again becoming heated, this time in the western parts of Riverside County. The Stephens' kangaroo rat and the California gnatcatcher became lightning rods for debates over land use. It seemed as if more money was spent for litigation than for conservation, while disputes flared in the courts.

This was an expensive stalemate that the Coachella Valley cities wanted to avoid. They could foresee a time when species other than the fringe-toed lizard would be listed in the valley and would require additional Habitat Conservation Plans.

Hoping to streamline the planning process, the Coachella Valley Association of Governments proposed to develop a plan to conserve the habitats of multiple species before they became imperiled. The new plan would expand the extent of protected lands to include critical elements of a full range of Coachella Valley natural communities and to preserve the natural processes that create and maintain habitats. In exchange for comprehensive species protection, the cities would receive assurance that future listings would not impede development outside the expanded preserve.

Once again, UC scientists have been called on to help create a conservation plan. The planning process, a collaboration of federal, state, and local governments, developers, and environmental groups, succeeds on the strength of the science.

As part of the Science Advisory Panel of the Coachella Valley Multiple Species Conservation Plan, Al Muth contributes not only his considerable expertise, but also his long-term involvement with the desert and the people who live there.

Muth's work at Deep Canyon goes back twenty years to the earliest conservation plan for the fringe-toed lizard. Such long-term commitment to regional planning and implementation is rare in agencies and governments, whose personnel are often tied to election cycles. Natural changes in the desert move in cycles of decades and centuries, and they may go unnoticed by the short-term observer. The presence of the Boyd Center and its resident scientists provides a deeper understanding of local environmental conditions and a more informed basis for predicting the consequences of planning decisions.



THE PHILIP L. BOYD DEEP CANYON DESERT RESEARCH CENTER.

The Coachella Valley Multiple Species Conservation Plan is a work in progress. The final outline of its proposed preserve is still evolving. But the success of the fringe-toed lizard conservation plan provides reason for optimism.

“Among groups with such divergent needs and goals, it is easy to not get along,” says Palm Desert mayor Buford Crites. “You have to start with common ground, not compromise. Science provides common ground. The debate becomes based on data, rather than on feelings.”

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BIOREGIONAL PLANNING

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Water-wise development comes to the desert

Muth has represented the scientific basis of conservation in other planning efforts in the Coachella Valley. When international developer Lowe Enterprises began plans for a golf and residential resort at the mouth of Deep Canyon, Muth was thrown into the dual role of science advisor and neighbor. The proposed development was to be built adjacent to both the Boyd Center and the Living Desert, the botanical showcase that Philip Boyd had begun a half-century earlier.

Concern focused on the ecological integrity of the desert landscape. This was not the wind-swept sand of fringe-toed lizards, but a rocky alluvial fan spilling down from the hills, a rugged garden of palo verde, ocotillo, and creosote bush. The alluvial fan connects mountains to valley, a connection that is central to the natural landscape.

Golf is central to the economic landscape of the Coachella Valley. The area has nearly 100 golf courses, most of them expanses of grass and palms kept stunningly green with water pumped from underground or the distant Colorado River. Millions of gallons are pumped to keep the desert green. Yet Ted Lennon, the force behind Lowe Enterprises's plans, had another vision in mind.

Lennon, like others in this story, has lived in the Coachella Valley for much of his life and loves the desert. He envisioned a resort that celebrated the desert, a rock garden of native plants, and minimal use of water.



ECO-MINDED DEVELOPER TED LENNON ADDRESSES THE CALIFORNIA BIODIVERSITY COUNCIL AT THE RESERVE IN PALM DESERT. PHOTO BY ALEX GLAZER

Working closely with Muth and others from the Living Desert, Lennon's resort has been built with great effort to maintain not only native plants, but also natural pathways, wildlife corridors, and open vistas across the rocky landscape. Multimillion-dollar homes meet strict codes in order to keep their profile low and their intrusion minimal. Thousands of native plants that were removed to make way for development were potted and replanted in gardens that merge into the natural landscape. Palo verde, not palms, dot the fairways. Homes blend into the native rock and cactus. Lennon's development, called The Reserve, has become a showcase of environmental design and has influenced the direction of similar projects around the world.

NRS continues a vital role in bioregional planning

Muth and other UC scientists maintain close ties with their neighbor as they oversee the implementation of conservation-minded plans that took years to develop. In contrast to out-of-town expert panels that disband before plans are put into place, resident NRS scientists at Deep Canyon maintain a long-term commitment to planning and implementation.

Such long-term conservation planning as this in the Coachella Valley has expanded the role of scientists in the community. Long-term studies conducted at NRS reserves lead to a deep understanding of local environmental conditions, which in turn provides a credible basis for predicting consequences of local actions. Through their knowledge of and commitment to a place, NRS scientists provide common ground for community land-use planning. Mayor Crites explains it this way:

We need people who know science and have an ability to perform in public forums. Facts by themselves don't convince people. It is how those facts are delivered, by whom, and with what credentials. The Deep Canyon staff have been there for a long time, while agency scientists come and go. We know when we deal with them that we are talking to people from our desert. There is no way to overestimate this value.

— MLH

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WATER IN THE CARPINTERIA SALT MARSH ORIGINATES IN THE SANTA YNEZ MOUNTAINS AND FLOWS THROUGH AGRICULTURAL LAND, URBAN AND INDUSTRIAL AREAS, AND RAILROAD RIGHT-OF-WAY TO THE MARSH AND ON TO THE PACIFIC OCEAN. ILLUSTRATION BY MARGARET L. HERRING

LEGACY OF STEWARDSHIP FLOURISHES AT URBAN RESERVE — AND BEYOND

Professor Leal Mertes likes to bring visitors to the Ash Avenue amphitheater. She says:

From here, you can see the whole watershed, from the mountains to the ocean, compressed into view. You can see all the layers, from the national forest, the agricultural land, the city, the railroad, down to the marsh and out to the ocean.

You can see the integration of all the uses in the watershed; all the decisions that are made in the watershed. The marsh receives everything that we do upstream.

This is where I take people to show them what it means to live in this landscape.

Mertes is faculty manager of Carpinteria Salt Marsh Reserve. The Ash Avenue amphitheater is a small semicircle of stone benches overlooking the marsh from the city's new nature park. This park, and the lessons visible from it, are the result of years of collaborative work by many people and of the vision of one scientist — Wayne Ferren.

Ferren is executive director at UC Santa Barbara's Museum of Systematics and Ecology. For fourteen years, he also served as manager of the Carpinteria Salt Marsh Reserve. His research interest is in estuarine plants, but his scientific expertise spans botany, ecology, geology, and natural resource management. He understands better than most what it means to live in this landscape. He is an articulate and formidable champion of land stewardship and an artist in restoration ecology. The marsh at Carpinteria has been his canvas.

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LEGACY OF STEWARDSHIP

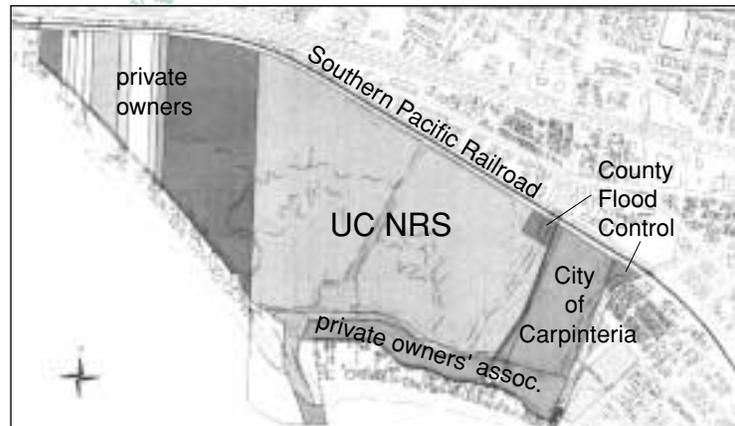
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A marsh changes over time

The marsh has attracted people for a long time. The first Spanish explorers found a bustling community of Chumash boat builders living there; they named the site *carpinteria*, “the carpenter’s shop.” Native Californians, who have inhabited the area for over 9,000 years, were eventually displaced from their home by European settlers. Roads were cut across the upper estuary and agriculture developed on the hillslopes. Channeled streambeds drained and segmented the wetlands, and a seawall permanently opened the estuary to the sea as urban development squeezed into the margins of the marsh.

A remnant of a once-larger wetland, the Carpinteria Salt Marsh has a natural tendency to fill with sediment. A century of urban and agricultural development has greatly accelerated the process. Located 20 miles down the coast from the UC Santa Barbara campus, the 230-acre marsh is an important refuge for estuarine plants and animals. Today Carpinteria Salt Marsh provides one of the few protected habitats for the endangered Belding’s savannah sparrow (*Passerculus sandwichensis beldingi*), clapper rails (*Rallus longirostris*), and several imperiled wetland plants. It also provides a nursery for halibut and other marine fish.

The marsh at Carpinteria had been used occasionally by classes from UCSB when Ken Norris, professor of Natural History at UC Santa Cruz and a founder of the NRS, identified it as a potential reserve during the 1960s. Even then, its value was recognized as one of the few remaining salt marshes in Southern California, and the homeowners surrounding the estuary



THIS SIMPLE MAP REVEALS THE PATTERN OF OWNERSHIP IN CARPINTERIA SALT MARSH AND THE CENTRAL LOCATION OF THE NRS'S RESERVE IN RELATIONSHIP TO NUMEROUS PRIVATE AND PUBLIC OWNERS. ILLUSTRATION BY MARGARET L. HERRING

supported the idea of protecting the marsh. In 1977, a consortium of homeowners sold 120 acres to the University to create a natural reserve.

A community embraces stewardship

Now seventeen landowners and numerous agencies share an interest in Carpinteria Salt Marsh. The marsh as a whole encompasses lands owned by Santa Barbara County, the City of Carpinteria, the Land Trust for Santa Barbara County, homeowners' associations, the University of California, Union Pacific Railroad, and private individuals. Agencies with a vested interest range from the California Coastal Commission and Department of Fish and Game to Vector Control and the U.S. Fish and Wildlife Service.

From the beginning, Ferren realized that managing a reserve embedded in such a patchwork of jurisdictions was going to call for equal measures of politics and science. He recalled that, at about the same time that he became manager of the marsh, the City of Carpinteria launched a program to revitalize its waterfront. A group of stakeholders from the region met to discuss the fate of the marsh, particularly a parcel at the end of Ash Avenue slated for condominiums.

“Before you knew it,” says Ferren with a laugh, “we had an ad hoc group with no authority fighting a developer over plans for private property!”

That challenge was not the only one Ferren undertook as manager. Working with the ad hoc committee, which included representatives from a state senator’s office and the county board of supervisors, Ferren waded into the maelstrom of state and local politics to help secure funding to create a comprehensive management plan for Carpinteria Salt Marsh. Armed with the first comprehensive botanical and historical survey of the marsh, which he had completed several years earlier, Ferren presented a compelling vision of the marsh as an ecological whole. His survey, and the research that followed on its heels, described an ecosystem of interrelated systems and elements. To preserve the marsh, it would have to be managed with all those systems in mind.

A plan is drafted for the ecosystem

After a century of fragmentation, ownership of the marsh had become a jigsaw puzzle of thirty-five separate parcels. The Carpinteria Salt Marsh management plan brought all pieces of the marsh back together as one whole ecosystem. The plan would integrate activities of all

the landowners and agencies under a single, coordinated, ecosystem-based, management plan administered by the NRS Carpinteria Salt Marsh Reserve.

Begun in the late eighties, the Carpinteria Salt Marsh Management Plan was ten years in the making. It now serves as the basis of interagency and community planning. And, despite the passage of time, many of the same people who were involved in the early stages of the plan's creation are still involved. (The plan, which won an Award of Merit from the California Chapter of the American Planning Association, can be viewed through the NRS website: <http://nrs.ucop.edu/CSMR_Management_Plan/Web_Pages/CSMR-Title.html>.)

"The success of the management plan and the projects that followed," says Ferren, "rests on the fact that most of the same people have been involved from the beginning. They have shared a similar vision and a similar passion for fourteen years."

The first ad hoc committee became the city's marsh-park steering committee and has evolved into the executive committee of the management council, which oversees the implementation of the plan's twenty management programs.

The Ash Avenue site is restored

Among the initiatives is a series of restoration projects to be phased in over many years. The first restoration was the 8-acre Ash Avenue site. Already buried under tons of dumped fill dirt and destined for condominium development, the site presented an opportunity to design a restoration that would recapture the structure and function of upper estuary habitats. The challenge was significant: restoration of the Ash Avenue site would require removal of 27,000 cubic yards of old fill, sculpting of natural channels and dunes, reintroduction of native plants, and

creation of an interpretive nature park for the city. The price tag: \$5 million.

The draft management plan provided a mechanism for all the partners in the marsh to discuss the project openly. The final plan was approved by participants the year that ground was broken for the restoration project. There were discussions and some conflicts over costs, parking, a building, trails, restoration goals, and maintenance of the new park.

"It was not a path without thorns," recalls Mertes. But, she adds, "first and foremost, what we had was a wonderful reserve. So the City of Carpinteria said, 'We want this as part of our community.'"

In 1997, construction started on the Ash Avenue project. The grand opening of the park, including installation of interpretive signs, was held in September 2001.

The restoration created new marsh habitats where UC scientists have conducted many research projects and have successfully reestablished populations of endangered plants, including salt marsh bird's-beak (*Cordylanthus maritimus maritimus*) and salt marsh goldfields (*Lasthenia glabrata coulteri*).

The interpretive program includes a viewing and interpretive area, nature trails, and an amphitheater overlooking the larger marsh landscape. It has become a magnet for regional artists, as well as school groups and others seeking to understand this estuarine landscape.

The community of Carpinteria has embraced the new marsh park with an outpouring of volunteers and support. A legion of dedicated docents has led public tours of the park every Saturday for three years. From the park, visitors can view the marsh restoration and learn more about the research going on next door in the reserve.

"The nature park invites public access and provides a more relaxed attitude about the fenced-off reserve adjacent to the park," says Mertes.

Marsh research gets the spotlight

What goes on *within* the fenced-off reserve is also part of the management plan. Activities include University research, education, and public service programs, and many interagency

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THE NATURE PARK AT CARPINTERIA MARSH IS OPEN TO THE PUBLIC AND ATTRACTS MANY K-12 GROUPS. TOURS OF THE ADJACENT UNIVERSITY RESERVE ARE AVAILABLE THROUGH THE RESERVE DIRECTOR BY APPOINTMENT. PHOTO BY WAYNE FERREN

LEGACY OF STEWARDSHIP

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management programs. One inter-agency program outlined in the plan calls for integrated ecosystem monitoring.

Since Ferren's arrival, Carpinteria Salt Marsh has become one of Southern California's most intensively studied and best-understood marshes. Years of research there have established a broad base of understanding and a platform for long-term ecological research. Now that platform is becoming the foundation for a new series of global-scale projects that will put Carpinteria in the spotlight — and under the microscopes of scientists throughout the world.

The work that was done to prepare the management plan will be the foundation for new research with the Long Term Ecological Research (LTER) consortium of the National Science Foundation. Carpinteria is part of the new Santa Barbara Coastal LTER, one of twenty-four sites throughout North America established to measure ecological trends over time and across large distances. The Santa Barbara Coastal LTER is the first such site in California. Its focus is the semi-arid coastal

zone that includes coastal mountains, streams, salt marsh, and near-shore kelp forests — in other words, the full sweep of landscape visible from the Ash Avenue amphitheater.

In particular, LTER scientists will use the Carpinteria Salt Marsh to study the effects of land use on processing and transporting nutrients from the land to the sea. It is only because the marsh and parts of the upper watershed are protected that such long-term research can be undertaken with confidence.

The LTER work will be joined by another nationally significant research project. Carpinteria Salt Marsh has been slated to become one of several research sites for an EPA-funded wetland toxicity center. Andrew Brooks, the new manager at the Carpinteria Salt Marsh Reserve, is one of the principal investigators, heading a group of scientists from UC Santa Barbara and UC Davis to build on the work begun by his predecessor, Ferren.

Stewardship proves paramount

Overlooking the marsh at Ash Avenue, one begins to understand the complexity of managing an urban reserve. The effects of actions taken far upstream or

decades earlier can come trickling down through the watershed. Social and ecological goals sometimes conflict, and compromises must be made. That is part of living in this landscape.

Carpinteria Salt Marsh is one piece of a puzzle that University scientists, community leaders, governments, and agencies are putting back together to form an integrated, functioning landscape. Anything designed, from flood control to city parks to large research projects, must fit into a stewardship plan for the ecosystem. One important result of the management plan is that the Carpinteria Salt Marsh and Carpinteria Salt Marsh Reserve will be one and the same.

“Stewardship is our responsibility,” says Ferren of his role in the NRS. “We hold these lands in the public trust, and we must be good stewards. This can be accomplished in association with research, teaching, and public service, but stewardship is paramount to our mission.”

Ferren's clarity of mission has inspired an entire community to be better stewards of the land. The result is an ecosystem of integrated parts: political, social, and biological.

“What Carpinteria has accomplished is remarkable,” says Mertes. “And Wayne was the fulcrum.” — *MLH*

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INTERPRETIVE WALK AT CARPINTERIA SALT MARSH NATURE PARK.

Longtime NRS reserve director charts a new course

Wayne Ferren came to UC Santa Barbara in 1978, just as the University closed escrow on a parcel of salt marsh in Carpinteria. Wetland plants, particularly an estuarine spinach of the genus *Suaeda* (commonly known as sea-blite), had been the focus of Ferren's work at Rutgers when he was hired to curate the UCSB herbarium. When he arrived in Southern California, he found little was known about the area's wetland plants.

"We owned a marsh, and I wanted to know what was there," said Ferren. Curiosity led him to conduct the first comprehensive survey of botanical resources and the physical environment of Carpinteria Salt Marsh. In 1985, his 300-page work was published as *Carpinteria Salt Marsh: Environment, History, and Botanical Resources of a Southern California Estuary*. Two years later, Ferren became manager of Carpinteria Salt Marsh Reserve.

During this time, the herbarium merged with other museums on campus, and Ferren found himself principal museum scientist, curating collections of vascular plants, terrestrial vertebrates, fish, and crustaceans — as well as a growing collection of natural areas.

Under Ferren's leadership, the Museum of Systematics and Ecology took on the management of campus natural areas, including Stork Wetlands and the oak woodland of North Bluff above Goleta Slough. In addition, the museum manages the extensive Campus Lagoon, which also can be restored, thanks to \$250,000 in funding that Ferren secured.

Today the Museum of Systematics and Ecology encompasses collections as broad as its name implies. But it is about to lose its home. The Department of Ecology, Evolution, and Marine Biology is under renovation, and there is no space for the museum in the new plan.

"Faculty change, programs change, but collections grow," says Ferren. Yet the university made no provisions for the growing collections of this particular museum.

So, Ferren says, "It is time to end the long-term loan of my time to the NRS and finish what I came here to do." On June 30, 2001, he retired as director of the NRS's Carpinteria Salt Marsh Reserve to continue full-time as



WAYNE FERREN. PHOTO BY ALEX GLAZER

executive director of the Museum of Systematics and Ecology (MSE) and devote himself to creating the planning documents for the museum, including initiatives, academic and development plans, a master plan, a collections management plan, and an operations manual. He would like to build a new museum building, with a demonstration garden, a native plant site, and enough space for new discoveries and increasing knowledge.

His vision for the museum is as far-reaching as the one he held — and fulfilled — for Carpinteria Salt Marsh. He says:

I have accomplished what I set out to do at the marsh. There is now a management plan, a nature park, restorations begun, and global-scale scientific research underway. It is a good time for someone new to take on new challenges there. And it is the perfect time for me to come back to the museum, because it desperately needs attention.

— MLH

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ESTUARINE HEALTH INDICATOR TURNS OUT — TO BE A FLUKE

flake: \ˈflük\ *n.* 1. a parasitic flatworm; 2. an unexpected event

In an unseen world within Carpinteria Salt Marsh, NRS researchers contemplate the ecological order and uncover a story of domination, unwilling accomplices, and mind control. It is the world of parasites.

Marine biologist Kevin Lafferty and colleagues from UC Santa Barbara are unraveling a surprising relationship between predator, prey, and parasite that affects the ecological order of California salt marshes.

The drama revolves around a tiny fluke, the trematode *Euhaplorchis californiensis*. The fluke, one of 17 species of trematodes in Carpinteria Salt Marsh, begins life in the gut of shorebirds. Cached inside bird droppings, fluke eggs are scattered across the mud flats. There, they are gobbled up by algae-grazing horn snails. Once inside the snail, the eggs hatch, and the resulting fluke offspring begin castrating their host.

The castrated horn snail serves the parasitic flukes like a eunuch in the emperor's court. Having no need to expend energy on mating and reproduction, infested snails continue to graze on algae and sustain their uninvited lodgers. The flukes live and grow to reproduce a second time, this time producing free-swimming larvae. These so-called cercarial larvae are released into the marsh's open water like a fleet of tiny tadpoles on a mission.

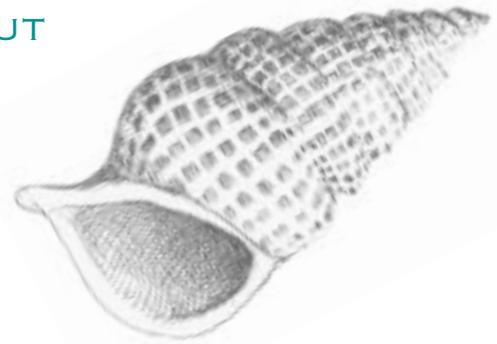
Their mission: to locate a second intermediate host, the California killifish. This time around, the larval flukes are not eaten by their host. They seek out killifish and attach themselves to the fish's gills. From there, they work their way to its brain. Once attached to the fish's brain, the parasites engineer a surprising means of passage back to their final hosts, the birds.

Killifish with flukes on the brain are easy to spot. They flail to the surface of the water and flash their silver bellies, announcing their presence to patrolling shorebirds. Lafferty's studies have found that parasite-infested killifish are 10 to 30 times more likely to be caught by birds. Once ingested in their final host, the flukes begin their cycle again.

The transmogrification of the trematode's life is only part of what interests Lafferty. For more than a decade, he and other UC scientists have studied the implications of such parasitism on larger ecological processes in salt marshes along the Pacific North American coast from Washington to Baja. Carpinteria Salt Marsh is their primary study site.

The researchers have found that trematodes are widespread, largely due to the fact that their mobility increases with each of their subsequent hosts. And hitchhiking in the guts of birds, trematodes are capable of traveling great distances and may be among the most widely distributed of known estuarine invertebrate species.

Trematode larvae are the most abundant zooplankton in the Carpinteria Salt Marsh, according to Lafferty. More than 40 percent of the horn snails are infected by trematodes. In studies that compare the feeding habits of snails, Lafferty found that infected snails grew more slowly, required more space to feed, and did not reproduce. So, without trematodes, the snail population in



PORTRAIT OF A FORMER TREMATODE HOST: THE EMPTY SHELL ONCE INHABITED BY A CALIFORNIA HORN SNAIL. ILLUSTRATION BY MARGARET L. HERRING

Carpinteria would nearly double. This would put twice the grazing pressure on existing algae beds. Food and shelter available for other grazers would be limited, which could ripple changes through the food chain. Trophic structure within the marsh community would be turned on its head.

The presence of trematodes affects bird populations, too. Some energy is syphoned off by the flukes during their residence in a bird's gut. But this energy loss may be more than compensated for by the energy saved by the birds when they feast on fish that seem to advertise themselves like flashing neon signs. Research by UC scientists at Carpinteria suggests that by making prey up to 30 times more available to birds, the trematodes may greatly improve conditions for shorebird populations in the marsh.

Because trematodes need several hosts to complete their life cycle, a degraded marsh may not support many of these parasites. Therefore, Lafferty and colleagues are beginning to use trematodes as indicators of estuarine health. In new research at Carpinteria, researchers found that degraded areas of the marsh located outside of the NRS's reserve supported relatively few trematodes. But following restoration, the flukes returned to the marsh in concentrations comparable to levels within the reserve.

— MLH

NRS RESERVES JOIN BROAD NATURAL AREA PARTNERSHIP TO HELP DEFINE A BIOREGIONAL IDENTITY

The first two features in this *Transect* issue offered examples of developers and city leaders, in both desert and coastal communities, who found reward in ecosystem planning and management by working within the rhythms of the native landscape. In these settings, much of the involvement of NRS scientists has been to help repair past damage and guide future development.

This third feature presents a somewhat different story. The Putah-Cache bioregion of the northern Coast Ranges encompasses nearly 2,500 square miles west of Sacramento. It extends to the uppermost reaches of Putah and Cache Creeks, and follows their courses into the Central Valley. Three NRS reserves – McLaughlin, Quail Ridge, and Stebbins Cold Canyon – are strung like pearls along the Putah Creek watershed. A fourth NRS reserve, Jepson Prairie, is located southwest of the bioregion and receives water from the Putah-Cache diversion system.

“The watershed provides a unifying concept for the public, a way to visualize their part in a larger, interconnected system,” says Joyce Gutstein, acting director of the Public Service Research Program at UC Davis. “The reserves play a real role in this larger engagement with the public.”

Gutstein and others at UC Davis are working toward public engagement on a bioregional scale. The Putah-Cache bioregion is a place where scientists, artists, residents, and community leaders are carving out a unique identity that is based on people and their relationship to the land. The effort is referred to as the Putah-Cache Bioregion Project and integrates many different groups, activities, and landscapes in this diverse region. The NRS reserves, along with the scientists and educators working there, are central to the developing bioregional community.

It is no small miracle that in this fast-growing part of California, such a large area of land can be considered for conservation planning. Although the Putah-Cache watershed is home to over 100,000 people and accessible to millions more, most residents live in the eastern lowlands, around such cities as Davis, Winters, and Woodland. Meanwhile, much of the bioregion’s western uplands are in public ownership and still relatively sparsely populated.

A few years ago, local residents and land managers began looking for a way to preserve the natural beauty and ecological function of this upland area before problems of conversion and development became severe. Led by Ray Krauss, former environmental manager of the Homestake Mining Company, they formed the Blue Ridge/Berryessa Natural Area Conservation Partnership to chart an ecologically sustainable course for the half-million acres of coastal mountains. NRS scientists and managers have been an integral part in this partnership since the beginning.

Together with the University, the partnership includes state



WITH THREE RESERVES IN THE PUTAH-CACHE BIOREGION AND ONE RESERVE JUST SOUTHWEST OF IT, THE UC NATURAL RESERVE SYSTEM IS AN ENTHUSIASTIC PARTICIPANT IN THE BRBNA PARTNERSHIP.

and federal agencies, three county governments, several non-profit groups, private landowners, and community groups (see sidebar on page 13 for a list of primary participants). Initially, the partnership’s efforts were organized around the closure of the Homestake gold mine and the conversion of the mine site to an expanded environmental field station operated by the UC Natural Reserve System. The Donald and Sylvia McLaughlin

Natural Reserve, established in 1992, will span 7,000 acres and is surrounded by 75,000 acres of public land accessible for research use. Research at McLaughlin Reserve is supported by long-term data collected from a wide array of environmental monitoring by Homestake scientists during their long tenure at the site. Organizers from Homestake and

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elsewhere began to see this NRS site as a primary research resource within a potentially much larger Blue Ridge/Berryessa Natural Area managed cooperatively with public and private landowners.

The value of the area for research and teaching is unsurpassed. The area is vast, spanning parts of three counties. Straddling the ancient contact between the rocks of the continental and Pacific tectonic plates, the area's geology supports a diverse assemblage of ecological communities. There one can find serpentine chaparral, native grasslands, and a variety of oak woodlands. Wildlife abounds, including tule elk, mountain lions, golden and bald eagles. Lakes and reservoirs, including Lake Berryessa, provide a variety of aquatic habitats for research and teaching.

And creating the link between upland and lowland, both physically and symbolically, Putah and Cache Creeks course through the area on their way to the Sacramento Valley. The watershed is a metaphor that connects people, one to another.

It is the relationship of people to the bioregional landscape that most interests Rob Thayer, professor of Landscape Architecture at UC Davis.

"The study of landscape architecture depends on real sites, just like the study of medicine depends on real people," says Thayer.

Thayer has taken his students to the Homestake gold mine at McLaughlin to explore how ideas of technology and nature collide in the landscape. He emphasizes that McLaughlin is central to the Blue Ridge/Berryessa Natural Area. "If you were to cut out this territory from a map, it would balance on the McLaughlin Reserve," says Thayer.

His observation is layered with meaning. To Thayer, landscapes are layer cakes of meaning, physically, biologically, and culturally. One way to explore some of those layers is with a geographic information system (GIS). With help from a Packard Foundation grant, Thayer and his UC Davis as-

sociates have begun to map the attributes of the entire Blue Ridge/Berryessa region to identify areas with particular social, aesthetic, or biological value. Their work will identify not only critical wildlife habitats and botanic areas, but also important human landscapes where people can find recreation, solitude, and natural beauty.

Located within a two-hour drive from either Sacramento or San Francisco, the loosely defined Blue Ridge/Berryessa Natural Area is accessible to millions of urban visitors. One of the challenges of the partnership is to design a conservation framework for the natural area that can accommodate visitors and still maintain the natural qualities that make it attractive and functional for human and natural communities.

Through the partnership, much of this natural area and its wild inhabitants would be voluntarily and cooperatively managed by participating private landowners and public land managers for the enjoyment of future generations. As lofty as the proposal may seem, the work of the partnership has already begun to build a shared commitment and sense of place. The partners meet monthly to discuss ongoing management within the region. The meetings mix ranchers with ecologists, developers with restorationists.

Conservation planning by such a diverse group and for such a large area is accomplished incrementally, according to Susan Harrison, professor of environmental policy at UC Davis. She represents the Davis-administered NRS reserves in the Blue Ridge/Berryessa partnership. "You can't underestimate the value of hashing out problems face-to-face, rather than through the anonymity of faxes and memos," says Harrison.

Putting a human face on issues of land management is just one aspect of the sense of place shared within the Putah-Cache bioregion. For nearly a decade, this landscape has been the inspiration for an eclectic group of writers, artists, and scientists interested in the overlap of nature and culture. Part of what has emerged is UC Davis's Nature and

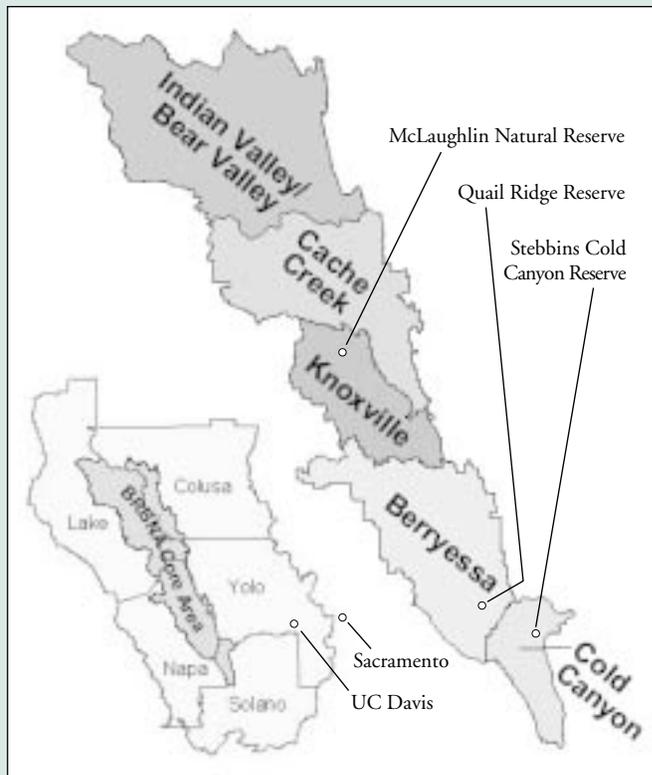


IN 1992, RAY KRAUSS AND ENVIRONMENTALIST SYLVIA MCLAUGHLIN DEDICATED A NEW NRS SITE — THE DONALD AND SYLVIA MCLAUGHLIN NATURAL RESERVE. KRAUSS, FORMERLY ENVIRONMENTAL MANAGER OF THE HOMESTAKE GOLD MINE, ONE OF THE U.S.'S MOST PRODUCTIVE, INNOVATIVE MINES, HAS IN RECENT YEARS PROVIDED LEADERSHIP FOR THE BRBNA CONSERVATION PARTNERSHIP. PHOTO BY SUSAN GEE RUMSEY

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About the Blue Ridge/Berryessa Natural Area Conservation Partnership

The simple maps that appear below show the general boundaries of the loosely defined, 500,000-acre Blue Ridge/Berryessa Natural Area (BRBNA), how it lies within its five participating counties of Solano, Napa, Yolo, Lake, and Colusa, and how it is sectioned into its own five districts. The region, geographically defined by Lake Berryessa and the Blue Ridge, is characterized not only by a wealth of diverse natural attributes, but also by rich historical, cultural, and recreational resources attractive to both local residents and visitors from larger urban communities in the San Francisco Bay Area and Sacramento. A combination of extensive public-land ownership and large private holdings (mostly used for ranching and agriculture) has kept the area significantly undeveloped — and that circumstance now makes regional conservation efforts by the BRBNA partnership all the more practicable. The BRBNA conservation partnership is stepping into a valuable opportunity to affect open-space planning and to reduce unbridled piecemeal development — whether residential, industrial, or recreational — or at least direct it toward other areas already fragmented.



BRBNA Primary Participants

Organized in 1998, the BRBNA membership now consists of over 130 agencies, organizations, and individuals, with approximately 30 to 40 of these actively participating in monthly meetings.

Federal agencies

U.S. Bureau of Land Management
U.S. Bureau of Reclamation

State agencies

CA Coastal Conservancy
CA Department of Fish and Game
CA Department of Parks

County government

Lake Co. Community Development Dept.
Napa Co. Planning Dept.
Napa Co. Resource Conservation District
Yolo Co. Community Development Dept.

University of California

UC Davis Putah-Cache Bioregion Project
UC Natural Reserve System

Private landowners

Gamble Ranch
Guenoc Ranch
Homestake Mining Company
Livermore Ranch
Morgan Valley Ranch
Todd Ranch

Nonprofit groups

American Land Conservancy
The Conservation Fund
Lake Co. Land Trust
Quail Ridge Wilderness Conservancy
The Land Trust of Napa Co.
The Nature Conservancy
Trust for Public Lands
The Wilderness Coalition
Yolo Co. Land Trust

NRS RESERVES

Continued from page 12

Culture program, an undergraduate degree program led by fisheries professor Peter Moyle and English professor David Robertson.

“This is part of an effort to create greater awareness of the local region of which UC Davis is part,” says Moyle. “The faculty and students work to generate an interest in the upper watershed in those of us who live out on the plains, and vice versa.”

The NRS reserves provide an important focus for students in the Nature and Culture program. There students find places of scientific, artistic, and personal discovery. Close to campus, both the Stebbins Cold Canyon and Quail Ridge Reserves offer students nearby places to learn about the natural world. Farther afield, the McLaughlin Reserve is used for a two-week intensive field course where observations are integrated into an emerging bioregional identity.

“The NRS reserves have been focal points for getting people together,” says Moyle, “mixing students and faculty, artists and scientists, kids and grownups, hill people and valley people.”

In addition, the Putah-Cache bioregion sponsors an annual program to place several writers and artists in residence in the bioregion. Their residency culminates in a festival that celebrates nature and culture on the reserves and at other sites throughout the watershed.

An important way for people to visualize their place in the landscape is to understand the places held by other creatures. In this way, Joyce Gutstein has developed an educational outreach program called “Return of the Salmon,” a collaborative project sponsored by the U.S. Environmental Protection Agency (EPA). This project, which focuses on issues of public trust in Putah Creek, uses the NRS reserves and other natural sites

along Putah Creek as the learning context for school classes.

“Stebbins is a wonderful place for people to explore,” says Gutstein. “It is close to town and open to the public. It is a place where university research from restricted sites, such as Quail Ridge, can become research-based learning for school groups and the public.”

Another initiative dedicated to increasing people’s knowledge and stewardship of Putah Creek is the development of a Putah Discovery Corridor, of which Stebbins Cold Canyon Reserve is a key site. Here again, the NRS reserves exemplify the University’s missions of research, teaching, and outreach.

Over thirty years ago, UC Santa Cruz professor and NRS founder Ken Norris envisioned a collection of natural reserves that would be used by students and researchers in every discipline.

“The specific educational value of the NRS will always be unpredictable,” said Norris. “There will be botanists, geologists, entomologists, naturalists, and scientists from many other disciplines as well; writers, photographers, and poets should also feel free to apply.”

In many ways, the NRS reserves within the Putah-Cache bioregion embody that vision. These are places where people can discover nature, culture, and themselves. The influence of scientists and artists working on the reserves extends beyond UC borders, as they become neighbors, teachers, and leaders in a bioregional community. — *MLH*

For more information about UC Davis-administered NRS reserves in the Putah-Cache bioregion and the BRBNA, contact:

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Serpentine Haiku

- I.
Under the walnut tree
A rattlesnake crawls away
From serpentine talk.
 - II.
Serpentine, ophiolite
Make no difference to snakes
Even if they slither.
 - III.
Black trunked blue oaks
Avoid ultramafic serpentine:
Tree osteoporosis.
 - IV.
Red and green serpentine
Keep out alien invaders —
Except ORVs.
 - V.
Prickly dry goat grass
Sinister invader from Greece:
We will rip you out!
 - VI.
Serpentine ghost pine:
You are not as indifferent
As you lead us to think.
 - VII.
White flowered tarweed:
Are you a star thistle refuge
Or just indifferent?
 - VIII.
Are monkey flowers proud
Of their endemic status
Or grow, regardless?
 - IX.
Serpentine sunflower!
Helianthus exilis!
Glory in exile!
 - X.
In serpentine seeps
Among hardened tire ruts:
Frogs, snails, and sunflowers!
 - XI.
Beady-eyes turtle:
I am amazed to find you
Living among seeps.
 - XII.
Turning over rocks
In a serpentine trickle
I find ancient stoneflies!
 - XIII.
Tiny purple vineweed
I am sorry I stepped on you:
Life is hard enough.
- Peter Moyle

A FEW WORDS

Continued from page 1

This issue of *Transect* provides three illustrations of the importance of the NRS and the work of its scientists in contributing to the realization of this bioregional vision in communities far from UC campuses.

First, in the Coachella Valley, scientists from the Boyd Deep Canyon Desert Research Center have helped craft a series of habitat conservation plans in one of the fastest-growing areas in California.

Working with desert city governments, developers, and agencies, Deep Canyon director Al Muth has brought a lifetime of scientific study to the planning table. Long-term research by Muth and other NRS scientists has identified how wind, water, rock, and sand work together to sustain the ever-shifting landscape of the California desert. Muth's involvement in regional planning guides new development in the desert to preserve not only native plants and animals, but also the natural landscape corridors and sources of sand that are essential to maintaining native ecosystems.

A second example of how NRS reserves extend the reach of the University is found along the southern California coast, at the Carpinteria Salt Marsh, where long-term scientific research provides the foundation for a long-term, far-reaching plan for ecosystem management and restoration.

When the NRS's Carpinteria Salt Marsh Reserve was established a quarter century ago, the remnant wetland was already surrounded by seaside development and industry. The reserve director, Wayne Ferren, initiated a comprehensive ecological study to understand the estuary and its function in the larger landscape that extended

from mountains to ocean. In parallel, Ferren became central in the complex political landscape of this urban reserve, where dozens of owners and interests have a stake in the ecosystem. Ferren's scientific understanding of the watershed and his deep commitment to the marsh have resulted in a multimillion-dollar restoration of marsh habitats, a new marsh park for the city, and a commitment from the National Science Foundation for long-term research at the marsh.

By working within the rhythms of the native landscape, developers and city leaders in both coastal and desert communities have found economic reward in ecosystem planning and management. Part of the involvement of NRS scientists has been to help guide future development and repair damage from the past.

The third example represents a somewhat different story. The Blue Ridge/Berryessa area of the northern Coast Ranges is still relatively sparsely populated. Much of the half-million acres here is in public ownership, including three NRS reserves (McLaughlin, Quail Ridge, and Stebbins Cold Canyon). Four years ago, local residents and land managers began looking for a way to preserve the natural beauty and ecological function of this large area before problems of conversion and development became severe. They formed the Blue Ridge/Berryessa Natural Area Conservation Partnership to chart an ecologically sustainable course for the region.

NRS scientists and managers have become an integral part in this partnership. They have mapped the attributes of the entire region to help identify areas with particular social, aesthetic, or biological value in order to guide future land use and protection. And they meet monthly with agency and landowner partners to work on the

small, incremental steps that will collectively become a meaningful bioregional plan.

These are but three of the many examples across the state where NRS reserves are important partners in regional management and conservation. Their influence extends beyond their borders, as neighbors, teachers, and leaders.

— Alexander N. Glazer
Director, Natural Reserve System

Editor's note: Alex Glazer was elected this spring to the National Academy of Sciences (NAS). Election to NAS membership, which recognizes distinguished and continuing achievements in original research, is considered one of the highest honors that can be accorded a U.S. scientist or engineer. Glazer has been on the UC faculty since 1964 and, in addition to directing the NRS since January 1998, is professor of the graduate school in UC Berkeley's Department of Molecular and Cell Biology. He studies macromolecular complexes, fundamental mechanisms of light-harvesting in photosynthesis, and the design and applications of fluorescent probes. Glazer became a fellow of the American Academy of Arts and Sciences in 1996 and of the California Academy of Sciences in 1999. The NAS, whose active members now number 1,874, is a private organization of scientists and engineers dedicated to the furtherance of science and its use for the general welfare.



ALEXANDER N. GLAZER.
PHOTO BY KATHLEEN JAY

GOING BEYOND “NORMAL”

At the NRS, we watched the September 11th terrorist attacks with horror and grief. In the aftermath, as world events continue to unfold in frightening ways, we are grateful for our lives and our work.

One idea that returns to us in this terrible time with renewed significance is our founding mission:

To contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California.

Conceived in the early sixties, this mission statement serves to remind us that, although our wildlands are all geographically situated within the boundaries of a single U.S. state, much of the research and teaching conducted at our sites has far-reaching implications for all humankind. Scientists and instructors who work at NRS reserves often discover the truth of the *inverse* of that fine old maxim, “Think globally, act locally” — for local actions can likewise lead to global thinking.

Furthermore, over nearly four decades, the NRS has hosted hundreds of thousands of students, teachers, and scientists — not only from across the United States, but also from around the world.

Overseeing 34 reserves that encompass 130,000+ acres and attract nearly 28,000 users annually is a big job — and we are as eager as anyone to find our way back to “normal.”

How ironic it is, then, to remember that the natural world and so many of its resources — such as air and water — on which all humankind depends for continued existence do not recognize national and cultural boundaries. The conflicts of our species — one species of many on the planet — only further degrade an environment shared by all.

One day, in one way or another, our differences with our fellow human beings will be settled. Our small world keeps getting smaller — and so it is worth bearing in mind and heart that, when that time of social equilibrium eventually comes, the importance of understanding and wisely managing the Earth and its natural systems will be no less than it is now. — SGR

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