More than six years ago, Dr. Thomas Parker, a biology professor at San Francisco State University, walked at the southern tip of San Francisco Bay with his colleague John Callaway from the University of San Francisco. As team members on a major project to help restore the area’s damaged plant life, the two skirted several salty ponds near the foot of the Dumbarton Bridge and excitedly discussed the best techniques for the task. They wore black rubber hip boots to protect themselves from the deep tidal mud, and periodically jammed long poles of PVC pipe called “pins” into the soft, salty ground. Parker and Callaway returned every few weeks to check the pins and record how much new sediment had accumulated. Earlier that year (2006), engineers had deliberately breached the levee that for decades had kept Bay water from inundating the ponds. The tide could then wash in and out of the marsh each day and deposit layer upon layer of sediment. This tidal action, in turn, would eventually create a thick-enough zone to support salt-resistant plant life and to form the basis of a healthy and newly restored ecosystem.
Based on Parker’s work, scientists now have important insights on how to restore the plant ecology in both chaparral and wetland environments.

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Chaparral in the Santa Lucia Mts, *Arctostaphylos glauca, A. glandulosa* and *Adenostoma fasciculatum* as visual dominants in photo.

Above:
Corte Madera Marsh, with Christina Yunker (left), and Stephanie Bishop (both graduate students in the Parker lab).
Both photos by V.T. Parker

Right: *Distichlis spicata* (salt grass) found in wetlands.
Photo by David Hoffman
After about three years, enough sediment had been deposited in the marsh to support plant species such as *Salicornia pacifica* (pickle weed) and *Distichlis spicata* (salt grass). “In 2006 the levee was opened,” says Parker, “in 2008 it was filled, and by 2009 plants had finally invaded.” Today, after several more years, Parker and Callaway can confirm that their work successfully contributed to recreating a wetland ecosystem—an ecosystem that not only sustains native plant species, but supports birds, fish, and other animals, as well. Although beneficial and satisfying, this project was just one of Parker’s and just a small portion of his work to protect and conserve wetlands, chaparral, and other California ecosystems.

Parker’s passion for plants and animals started in childhood. “I grew up in an area where we had a wild creek, and I fell in love with catching animals all the time,” he recalls. His love for biology and other sciences stuck with him throughout school, college, and into professional life and is a leading reason why he works toward ecosystem preservation. His favorite job description is fieldwork. “I like actually physically going into the field, being outside.”

Parker earned his doctoral degree in ecology at the University of California Santa Barbara. By the time he graduated college, he was already on track for a dream job by his definition. He accepted a position at Rider College in Lawrenceville, New Jersey, and became involved with wetlands for the first time. Since 1980, he has been a faculty member in the biology department at SF State. Parker has dedicated most of his research time to studying the conservation and restoration of wetlands, chaparral, and California’s other native environments. He has published three books and over a 100 articles on conservational biology, with more in press.

When imagining “wetlands,” some people picture filthy, foul-smelling, bug-infested lowlands that— for all they know—serve no purpose. While wetlands do have their share of insects and offensive odors, they are, in fact, among our planet’s most crucial environments. Parker understands in great detail the importance of wetlands and for the past 30 years has researched ways to preserve what little...
remains of these altered ecosystems. Wetlands are home to a large variety of fauna and flora, many of which are on endangered species lists. Wetlands also recharge groundwater, produce fresh oxygen, help prevent flooding, and even filter toxins from drinking water. Humans depend on wetlands for these and other reasons, says Parker. However, in an attempt to reclaim land for agriculture and development, Californians have destroyed an alarming 90 percent of their marshes, swamps and tidal flats.

Wetlands face another destructive threat: inundation based on rising global temperatures. In the past century, increasing greenhouse gas emissions have affected global climates, causing polar ice caps to melt and sea levels to rise all over the world. Wetlands everywhere, not just those in the San Francisco Bay Area, will become inundated and eventually, will become part of the ocean itself. Once distinct ecosystems will then cease to exist.

Using satellite images and maps generated by oceanographers, Parker has estimated rising sea levels and projected likely impacts on wetlands. “Historically,” Parker says, “sea level has only risen about one millimeter per year, but that has accelerated since humans have started adding carbon dioxide. We are up to around three millimeters a year.” Although this amount is still less than the thickness of a shoestring, predictions show significant accumulations and a worsening of the phenomenon during the last half of this century.

In order to survive, wetland plants will literally have to stay above the deepening water. Plants have been doing this for 5000 years, says Parker, but at the rate of just one millimeter per year. If the rise in sea level continues to accelerate at its current rate, ecosystem disruption will be inevitable.

“We have lots of sediment in [San Francisco] Bay,” Parker says, and this means that here, at least, “wetlands will be able to keep up for the first 20 or 30 years without a problem.” After this however, plant growth will be unable to keep up with the rising waters and the ecosystem faces decimation. These changes are not directly affecting society directly right now, he says In the future, however, if we ignore the issue, humans will begin to experience consequences such as flooding, species loss, and ground water salinization.

Odd as it sounds, one of Parker’s former graduate students, Stephanie Bishop, worked on a wetlands project in the middle of the SF State campus. In the green houses behind Thornton Hall, Bishop set up 55 different “artificial wetlands.” These have “tides” of different intervals and salinities, and they allowed her to investigate Bay-Delta ecology in a semi-realistic but experimental way. Bishop examined the interaction between tidal submersion and salinity on two salt marsh species, Salicornia pacifica (pickle weed) and Distichlis spicata (salt grass). The state of California’s Cal Fed Fund financed
him to believe that animals might be instrumental to the survival of many native plant species in chaparral areas.

To test his theory, he and his research team set up an intricate experiment: They placed a sample of native fruits on the ground during the night and monitored where their seeds ended up the next day. They had cleverly coated each fruit with a bright fluorescent paint; this allowed them to track the seeds’ relocation. While checking the site the following morning, Parker and his team found the tracks and trails of rodents that had eaten the fruit the previous night. These trails led to spots where the rodents buried the seeds in the ground as a future food source.

“We were able to find about 50 seeds,” he says, and “the ones buried below an inch are able to survive after a fire.” Parker estimates that such buried seeds account for over half the seed banks in a chaparral area. This experiment validated his hypothesis that animals form a vital link in the survival of many native plants after seasonal fires.

Along with his work on wetlands, Parker devotes a major portion of his research time to a higher, drier ecosystem—California’s chaparral environment. Again, he studies how to protect and restore its plant life. Natural wild fires, which routinely occur during California’s hot summer months, play a significant role in the plant ecology of chaparral areas, Parker says. These regions of dry forests, drought tolerant shrubs, and seasonal grasslands are common along California’s southern and central coasts, in the coastal ranges, and in the inland foothills.

Parker developed an interesting hypothesis about chaparral ecology after observing some specific plant responses following a wild fire. “Two-thirds of [chaparral] plants are killed by fire,” he explains, “and they completely depend on their seeds coming up from the soil to reestablish their population.” Parker noticed that many of the seeds were buried in clusters rather than scattered singly. This led him to believe that animals might be instrumental to the survival of many native plant species in chaparral areas.

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Parker feels that a critical first step to saving native chaparral plants is to help the seed-burying animals. Based on Parker’s work, scientists now have important insights on how to restore the plant ecology in both chaparral and wetland environments.

State budget cuts have left many California colleges and universities with research shortfalls and their investigators scrambling for any sort of funding for research. The only way to get new financing is from grants, Parker says, and these are “incredibly difficult” to obtain. Parker’s research on wetland and chaparral environments will progress, he is certain, but considerably more slowly than anticipated. Other agencies and conservation organizations have helped to restore California’s ecosystems by removing invasive plant and animal species. These methods, however, fail to prevent the ongoing destruction of land. Educational institutions need to continue their basic research, Parker is convinced, so they can continue to gather evidence on ways to stop the ecosystems’ actual destruction, not merely to fix the land after damage has occurred.

Recently, Parker was invited to meet with a regional scientific review panel to discuss the conservation of wetlands. The panel is examining ways to preserve the Bay Delta, while still permitting people to remove some water for agricultural, industrial, and development applications. “It’s not as easy as it sounds” to solve the wetlands puzzle, Parker says. However, he is content to devote the necessary time and research to finding solutions because he loves to learn and values the satisfaction of answering life’s newest curiosities.

To prevent the destruction of California’s coastal environment, scientists must continue to collect field data samples and record sea level changes. With these, they can ascertain clues on the future fate of wetlands. As of now, Parker says, predictions are that wetlands will be self-sustaining for another 100 years. What about after that, however? Wetlands are found on every continent and ultimately, affect everyone on earth, directly or indirectly. Collaborating on projects is crucial, and so is communicating findings so that everyone may benefit in the long run. Parker will continue to compete for grants and other funding and although they are hard to land, he will likely succeed because he has received many grants in the past. These will then allow him to continue gathering data and sharing his results and interpretations. “With more money,” he says, “our team will be able to afford new technologies and [bring on] more people that will help to save all types of environments.”

Left: *Salicornia pacifica* (pickle weed) found in wetlands. Photo by Ron Vanderhoff

Above: *Arctostaphylos andersonii* seedlings arising from a rodent cache (about 37 individuals); Bonny Doon Natural Research Reserve. Photo by V.T. Parker