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Loss of Cherished Places -- Casualties of Climate Change: Identity and Livelihood in California's Central Valley

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Casualties of Climate Change: Identity and Livelihood in California's Central Valley

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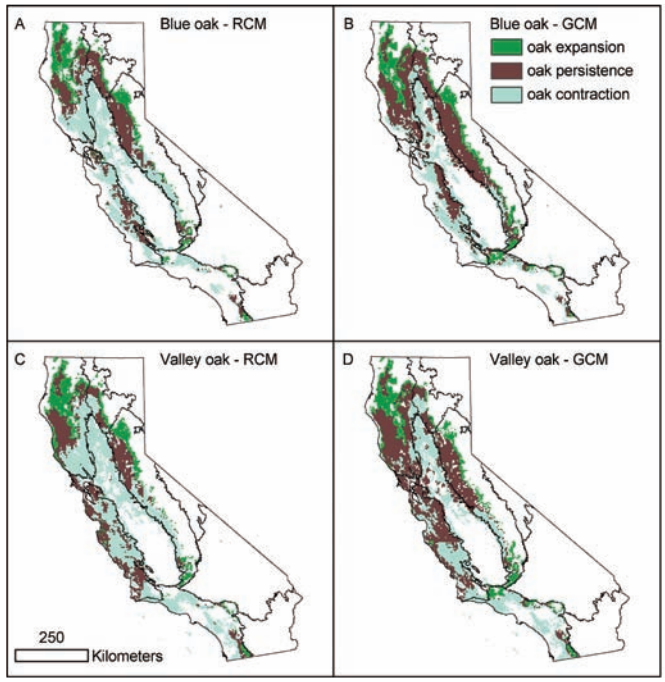
Oakdale, California, is a small city of eighteen thousand people in the vast flatlands of California's Central Valley. Its economy is mostly agricultural—almond and peach orchards, dairies, and row crops; and it is the kickoff point for the spring rodeo circuit. Like many Central Valley towns, its parks and riverbanks are also dotted with majestic oaks. As tall as a hundred feet, with trunks wider than the span of a man's arms and branches spreading to a crown 150 feet wide, valley oaks (*Quercus lobata*) frequently provide what appears to be the Central Valley's only topography. Blue oaks (*Quercus douglasii*) shade streets and riverbanks with their distinctive blue-tinged foliage. Though much of their habitat has been destroyed by the plow, remnant oaks are still seen in some fields, where tractor furrows detour around them, presumably because the farmers have been unable to bring themselves to destroy such beautiful specimens.

On a hot day in the Central Valley, when the air is still and every living thing seems to be seeking either shade or air-conditioning, it is easy to imagine Oakdale's founders choosing a town site beneath the spreading oaks, and gratefully making the town their namesake. City fathers of a later era, like those in many other California cities named for oaks (Oakland, Thousand Oaks, Live Oak, and Paso Robles, to name only a few), made the image of an oak the city's official seal.

Above: Oaks dot a foothill behind almond orchards outside Oakdale. Photo by Virginia Matzek

But the oaks' days in Oakdale may be numbered. A team of University of California, Santa Cruz, scientists recently reported that climate change threatens the continued persistence of blue oak and valley oak in the Central Valley.[1] The researchers mapped several factors expected to limit the distribution of the two oak species, including soil characteristics and climate variables like temperature and summer rainfall. Then, using a fine-scale regional model, they applied future climate scenarios to predict how the mapped variables would change. They found that by the end of this century, the total area suitable for blue and valley oaks in California is likely to shrink by more than 40 percent.

The trees can survive in the Central Valley because its deep clayey soils hold just enough water for them to survive the hot, dry summers. With climate change, though, even hotter and drier summers are on the horizon, and the area range of the two species is expected to shift almost entirely out of the Central Valley, toward moister coastal regions. In the future, valley oaks may be nearly absent from the Central Valley, and Oakdale could be oak-free—along with the towns of Oak Grove, Fair Oaks, and Live Oak.



Homeless Species, Nameless Places

California oaks are already under threat from a number of directions: by disease[2]; by land-use change[3]; and, in the case of valley oak and blue oak, by a puzzling failure to produce new seedlings and saplings.[4] On top of these stress factors, a rapidly shifting habitat is not good news, especially for a species that disperses slowly (an acorn is much less mobile than, say, a coyote). In California, urbanization and agriculture are also certain to throw up significant barriers to the migration of oak woodlands to moister areas of the state. Because these manmade barriers were not included in the U.C. Santa Cruz map analysis, the shrinkage in total oak range will certainly be more than 40 percent.

Prior to climate change, those who loved oaks (or any other endangered plant or animal) could establish parks and nature reserves for them. Sadly, climate change will play a cruel joke on these plans, too. The same climate model that signals trouble for Central Valley oaks also shows that half of California's current oak preserves will no longer be suitable as habitat by 2100.

The oak story—rising temperatures and altered ranges—has been echoed in numerous scientific reports on other species: Mexican butterflies[5]; Eastern U.S. trees[6]; Pacific Northwest Chinook salmon[7]; European birds[8]; and Argentine ants.[9] Several of these analyses describe species running out of places to live. Either suitable climate will no longer overlap protected areas and the species cannot move to new homes fast enough or there is simply nowhere else to go. For example, on the island of Hawaii, native birds thrive in cool, high-elevation forests because they can escape mosquitoes carrying deadly avian malaria. If Earth's temperature rises two degrees Celsius, mosquitoes will breed at higher elevations, and Hawai'i will run out of mountaintop refuges.[10]

More symbolically, Oakdale is also not the only place that could lose the basis for its name. Al Gore has referred to Glacier National Park, which has seen its glaciers shrink in area by one-third since 1850, as the Park Formerly Known as Glacier.[11] Likewise, Gulf Islands National Seashore could lose 40 percent of its namesake islands, as storm intensity increases and sea levels rise.[12] And Joshua trees are expected to entirely vanish from Joshua Tree National Park.[13]

Just as suburban sprawl has turned hills and dales and forests and glens into housing tracts called Hillsdale or Forest Glen, climate change will make memorials out of many of our place names.

Identity and Livelihood

What will it mean to Oakdale, and to Central Valley towns like it, to lose their oak trees? An anachronistic town name might not matter much in the long run, especially since no one these days expects much in ecological terms from a place named the Valley Oak Shopping Center. Because oaks are long-lived, and some established individual trees will likely persist for decades despite climate change, Central Valley towns will probably be spared the sudden fate of cities from New Haven to Minneapolis when Dutch elm disease laid waste to their street trees. The disappearance of oaks may be subtle and slow, outpaced by rapid urbanization and other forces of change. And, of course, the inhabitants of Oakdale—unlike their Native American predecessors, the Miwok, whose diet was based around the acorn—don't *use* oaks for much. Shade, yes; firewood, sometimes; beauty, undeniably; but other species may replace all these functions.

Oakdale and other towns in the Central Valley will be less able, though, to ignore some of the other profound

Above: Maps showing expected shifts in the range of blue oak and valley oak in California due to climate change. Effects are more dramatic in the regional model (RCM) than the global model (GCM), but in both cases the Central Valley becomes almost devoid of the two species by the end of the century. Map images copyright 2005, National Academy of Sciences.

impacts of climate disruption. Models that consider critical ecological processes suggest that Oakdale stands to lose considerably more than just the tree on the town logo. Indeed, the same warming trends that threaten the persistence of oaks may hit the people of the Central Valley squarely in the pocketbook, disrupting livelihoods that are dependent on cool temperatures and a stable supply of meltwater from the Sierra Nevada range.

The term "ecosystem services" describes the way that the natural functioning of intact ecosystems provides valuable free services that we would otherwise have to pay for. Everyone is familiar with the idea that we can extract *goods* from natural ecosystems: timber, food, fiber, clean water, etc. But intact ecosystems also provide *services* like pest control, pollination, erosion control, and nutrient cycling. For example, when bats eat mosquitoes, they offset some of our need to spray pesticides on wetlands or pay for medical treatment of mosquito-borne diseases. These offset costs can be measured, indicating how expensive species extinction or habitat degradation can be.

For Central Valley agricultural towns like Oakdale, the principal ecosystem service loss may come in the form of a diminished Sierra Nevada snowpack. In California, most precipitation falls in the winter, and a complex system of reservoirs and aqueducts collects, stores, and distributes it for summer usage. Some reservoirs are kept partly empty in winter to capture overflowing storm waters and prevent flooding at lower elevations; in summer, they are allowed to fill to capacity as they receive melting snow, storing the maximum amount of water for irrigation and drinking. Historically, these two goals—flood control and water storage—could be met simultaneously. As the climate warms and the snowpack melts earlier, they will increasingly be at odds with each other.

Projecting climate change impacts on water is difficult, because attempts must not only account for the uncertainty around future climate scenarios, but also the complexity of surface and groundwater hydrology and a byzantine system of water rights.[14] Scientists are confident that more precipitation will fall as rain and less as snow, and that warm rainstorms will begin falling in winter, melting the snowpack earlier than usual. The greater the flooding risk from these warm storms, the more space needs to be left in reservoirs as flood insurance, which will create water scarcity during the summers. This scarcity is predicted at the same time that agricultural and municipal users must accommodate an increasing population and hotter irrigation seasons.

Decreases in snowpack and resulting water flows will hurt a community like Oakdale in more ways than one. After agriculture, tourism is the town's second-biggest industry. River rafting and water sports are an important component of summer revenues, and skiers driving toward Badger Pass and Dodge Ridge provide a major source of winter income. One projection of climate-change impacts on the California ski industry has predicted that by the end of this century at the latest, the ski season will be shorter by two to three months and open three to four weeks later, potentially missing the lucrative Christmas holiday season.[15]

Regardless of what happens to water, warmer temperatures alone also have potential to hurt the economy. For example, milk is the most important agricultural commodity in Stanislaus County, where Oakdale sits, with a value of about half a billion dollars annually.[16] Studies indicate that for every degree rise above thirty-two degrees centigrade, a Holstein cow's daily milk output declines by more than a liter. Assuming that measurable declines in production start at 25 degrees centigrade and that statewide trends are typical, local dairies should expect to see a 7 to 22 percent decrease in milk output in the coming century.

Oakdale's almonds, peaches, and apricots also need cold weather. Like many other orchard crops, they require a certain number of winter "chilling hours"—prolonged periods when the temperature drops below forty-five degrees Fahrenheit and the trees go dormant—in order to blossom and set fruit in the spring. At present, the Central Valley's mild climate is sufficiently chilled by winter fog to meet this requirement. But climate projections suggest that by the end of the century, Central Valley orchards may experience as little as five hundred hours of winter chill, a figure at or below the required threshold for many lucrative tree crops.[17]

Responding to Climate Change

Oakdale is pretty typical of rural Central Valley towns, and about a million other Californians live in places like it. In fact, what makes Oakdale a good example of the impact of climate change is not its uniqueness but its ordinariness. What happens to Oakdale will, in large part, happen to other places, too.

But it is also essential to point out that the impacts predicted here are by no means inevitabilities. For one thing, although all of the models agree that warming will continue in the Central Valley, they differ in their predictions about the speed and magnitude of climate change. More important, the predictions presume that we do nothing to plan for them.

In addition to weaning society off fossil fuels, our best defense against climate change may be a good offense. This

will mean taking a hard look at the places that we design, manage, and protect, from drinking water reservoirs to nature reserves, to see if they will meet the test of climate change. Some strategies that will be necessary are:

Providing migration corridors by purchasing land outright or buying conservation easements and making sure escape routes for species are not entirely blocked by dense housing projects.

Implementing restoration projects for degraded agricultural lands in suitable climate zones to provide new habitat for species pushed out by climate change.

Designing buildings and systems that can cope with warmer, drier climate trends with efficiency and innovation (drip irrigation, solar-power-cooled dairies, low-chill varieties of orchard crops, etc.).

Incorporating into public planning—and public discourse—an understanding of how climate change will affect ecosystem services, the natural life-support system that economies and human well-being depend on.

Another hopeful sign is that many organizations have stopped waiting for guidance and started providing it. The Nature Conservancy, for one, has initiated fine-scale ecological studies in New Mexico to identify conservation sites expected to be most vulnerable to climate change. And in California it has acquired forestlands in the Garcia River area to be used to sequester atmospheric carbon dioxide.

Government is also getting involved. In California several agencies are now required to report on climate change impacts, and a bill currently in the state legislature would require climate change and greenhouse gas impacts to be considered in feasibility studies for water resources. And at the federal level, the EPA has released a report to Congress that identifies "adaptation strategies" for vulnerable ecosystems.[18] One proven strategy it mentions is to reduce other forms of stress on ecosystems (such as pollution) to enhance the ability of species to adapt to climate stress. The EPA report even offered the optimistic note that climate change may lead federal agencies to cooperate in unprecedented ways, with many side benefits.

We have seen that the urgency of climate change is encouraging partnerships between scientists and policymakers to plan for, mitigate, reduce, and cope with the effects of climate change. It might not be enough to keep the oaks in Oakdale, but perhaps it can help the people who remain once they are gone.

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