

Displaced by agriculture, urban growth . . .

California wildlife faces uncertain future

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California supports one of the greatest diversities of terrestrial wildlife of any state. However, many wildlife species have been lost or have become imperiled since the mid-1800s. Much of this biodiversity loss has been due to habitat loss caused by the conversion of wildlands to agriculture, facilitated by numerous water projects. Although certain agricultural practices can benefit wildlife, continued population growth and urban sprawl are consuming much of California's agricultural land, threatening even these benefits.



B. Moose Peterson / WRP

Large-scale water development has had the most negative impact on wildlife including endangered species such as the San Joaquin kit fox.

Know that on the right hand of the Indies there is an island called California, very near to the Terrestrial Paradise.

— Garcia Ordonez de Montalvo, 1510

The historical abundance and diversity of the terrestrial wildlife of California are legend. Our 643 species of regularly occurring birds, mammals, reptiles, and amphibians comprise one of the greatest wildlife diversities of any state (table 1). California's wildlife diversity is due in large part to the state's remarkable climatic and physical diversity. Different ecologists have described 11, or 16, or 24 ecological zones, biogeographic provinces, or bioregions; this disagreement over partitioning our state only emphasizes its diversity. In a day in California, one can easily travel from alpine snow

to desert sands, from redwood forest to sagebrush plains. This physical and floristic diversity provides a corresponding diversity of habitats for wildlife.

The quest for wildlife riches including sea otters, beavers, and fur seals stimulated much of the exploration of California by Europeans. Before their relatively recent arrival, however, other people had been living throughout California for millennia. The first of these original Californians may have hastened the extinction of a suite of Pleistocene species such as the giant ground sloth, saber-toothed cat, horses and camels some 10,000 years ago. Nevertheless, native Californians long practiced "sustainable ecosystem management," which resulted in the great numbers of elk, grizzly bears, pronghorn, wolves, waterfowl, quail, and condors that early 19th century explorers described. Even the 70-year era of Spanish settlement along the central

and south coast beginning in 1769 was relatively benign for wildlife, if not for native people.

This changed radically and forever with the Gold Rush. In the mid-19th century, market hunting to feed the booming mining communities decimated the once-vast herds and flocks of game including elk, pronghorn, deer and waterfowl. Perhaps even more significant, the reduction in wildlife populations from market hunting was followed by extensive and long-term habitat loss from the development of agriculture, especially in the Central Valley, where wetlands were drained and crops were planted. Livestock numbers increased rapidly, removing forage, altering plant species composition (e.g., changing perennial grasslands to annual grasslands) and introducing diseases to wildlife such as mountain sheep. Predators including wolves and grizzly bears were exterminated.

The changes in California's wildlife in the second half of the 19th century rivaled those associated with the extinctions of Pleistocene megafauna. Although a rancher from the Miller and Lux Company protected the last handful of California's endemic subspecies of tule elk near Buttonwillow, Kern County, in the 1870s, no one saved California's last grizzly bear — it was killed in 1922 in Tulare County. The golden bear now graces our state only on our flag, or as a name for sports teams or towns such as Los Osos in San Luis Obispo County. The last pronghorn in the Central Valley were killed in the 1920s, although others held on in the remote northeast corner of the state. Much of California's remaining wildlife is in trouble (table 1). Nearly 8% of the terrestrial vertebrates are officially listed as threatened or endangered by state or federal governments, and many more are proposed for listing or defined as "sensitive" to actions of management agencies. Thus, 20th century conservation and management efforts necessarily address an incomplete assemblage of what was recently present in California.

Of any single factor, large-scale water development perhaps has had the most negative impact on California's wildlife. California's "developed" water, most of which is used for agriculture, causes direct habitat loss in two ways: by creating reservoirs and altering flow regimes, and by allowing wildlands to be converted to pasture and cropland in areas that see little rain. Affected wildlife range from San Joaquin kit fox to western yellow-billed cuckoos to blunt-nosed leopard lizards, all of which are classified as threatened or endangered. While conflicts between agriculture and biodiversity are most apparent in the Central Valley, they are not restricted to that region. For example, livestock grazing on public lands throughout higher elevations of California, which is subsidized by the government at below-market rates, has led to listing the willow flycatcher as threatened. Livestock grazing has reduced or eliminated from many Sierra meadows the riparian willows needed by these birds for nesting.

How do we know what's left?

Experimentation and the formulation of inferences are the twin essentials of the scientific method. Nevertheless, observational studies form the majority of today's [wildlife] investigations.

—J.R. Skalski and D.S. Robson, 1992

The wildlife that provided food, fur, or fear to explorers and early settlers were those most frequently discussed in their journals. Little mention was made of the majority of wildlife species of less immediate utilitarian interest. Several scientists in the first part of the 20th century conducted extensive fieldwork describing and documenting the status of our native wildlife. Most notable were Joseph Grinnell and his colleagues at the Museum of Vertebrate Zoology, endowed at UC Berkeley by Annie Alexander, a member of a wealthy agricultural family in Hawaii.

While California has changed enormously in the last half century, little is known about the current status of most of our wildlife species. In contrast to other states such as Illinois, California has no systematic or institutional biological survey. There is no central organizer of information on current distribution and abundance of all our wildlife. There are few recent empirical data on distribution and

abundance of birds and mammals, and there seems little will or budget at any level of government to generate them. Several programs of the California Department of Fish and Game (CDFG) attempt to address this need for information. One of these, the California Natural Diversity Data Base (NDDDB), keeps records on the state's animal and plant species with special conservation needs but is heavily weighted toward plants. The NDDDB has records on only 37% of our regularly occurring terrestrial vertebrates.

Our knowledge of amphibians and reptiles is especially poor, although scientists have become aware that they are disappearing from many areas of California as well as the rest of the world. A recent assessment of the conservation status of California's reptiles and amphibians (Jennings and Hayes 1994) recommends that an additional 48 out of a total 120 species be offered some official protection (table 1). Mark Twain's jumping frogs are now so rare in Calaveras County — and most of the rest of the state — that the frog-jumping contests that attract tourists now use the bullfrog, which is native to the eastern states.

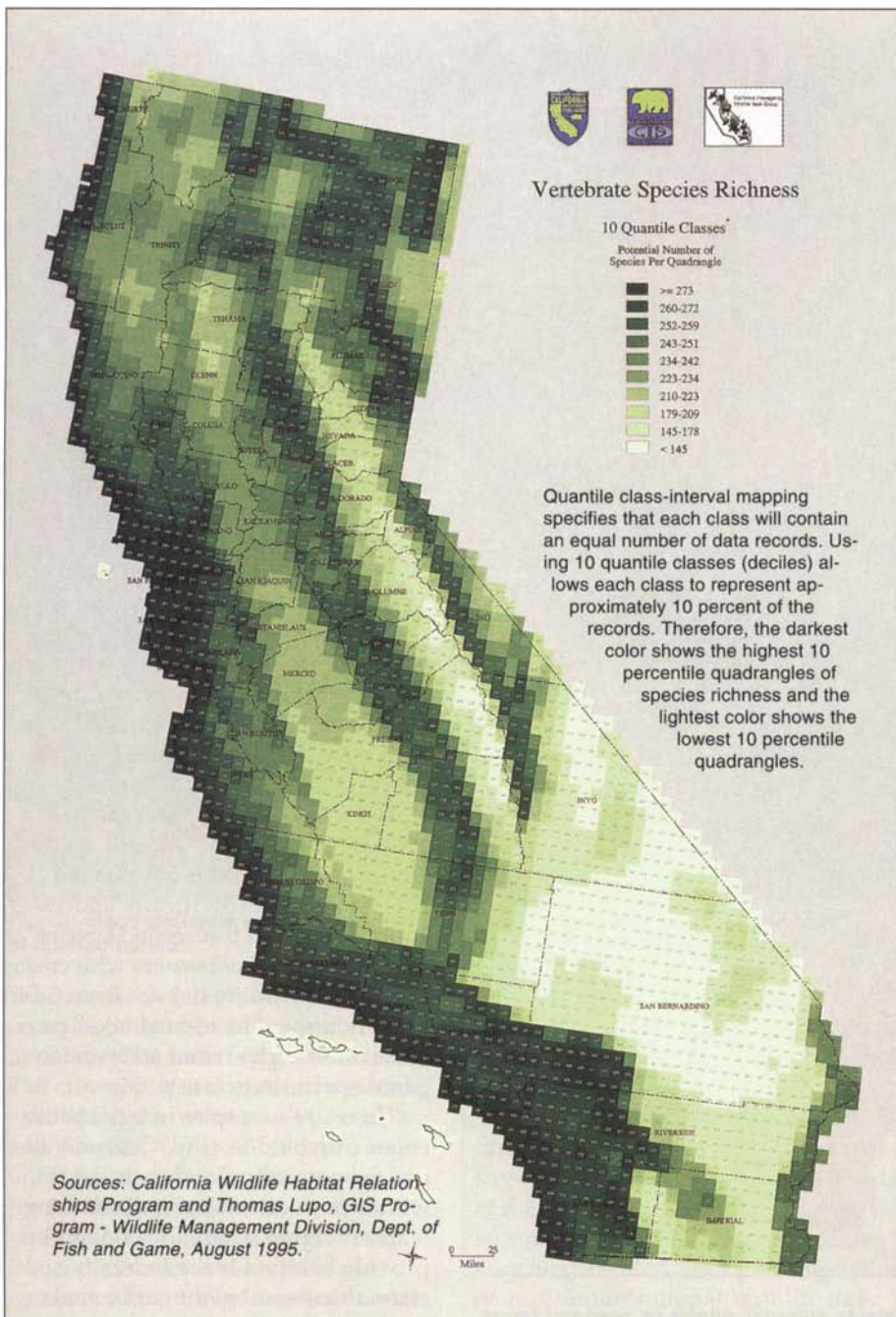
The CDFG also administers the California Wildlife Habitat Relationships (CWHHR) System, which predicts the occurrence of terrestrial vertebrates based on various ecological cri-

TABLE 1. California's regularly occurring terrestrial vertebrates (totals in parentheses), by legal status

Status	Amphibians (45)	Reptiles (75)	Birds (341)	Mammals (181)	Total (643)	Percent of Total
FE	2	2	8	9	21	3.3
FT	0	8	14	6	28	4.4
CE	2	3	16	5	26	4.0
CT	6	5	5	8	24	3.7
FP	19	22	28	44	113	17.6
CP	23	21	10	9	63	9.8
FS	8	2	4	4	20	3.1
BS	2	4	1	5	12	1.9
CS	19	18	61	45	143	22.2
HA	1	0	51	32	84	13.1

FE = Endangered under the federal Endangered Species Act.
 FT = Threatened under the federal Endangered Species Act.
 CE = Endangered under the California Endangered Species Act.
 CT = Threatened under the California Endangered Species Act.
 FP = Proposed for listing as threatened or endangered under the federal Endangered Species Act.
 CP = Proposed for listing as threatened or endangered under the California Endangered Species Act.
 FS = Listed as "Sensitive" by the USDA Forest Service.
 BS = Listed as "Sensitive" by the USDI Bureau of Land Management.
 CS = Listed as "Sensitive" by the California Department of Fish and Game.
 HA = Listed as a harvest species by the California Department of Fish and Game.

Totals may be lower than reported elsewhere because of difference in definition of "terrestrial" and "regularly occurring" species. Source: California Wildlife Habitat Relationships System.



The Wildlife Habitats Relationships System contains summer, winter or yearlong range information for 646 vertebrate species in a total of 833 separate digital maps. There are 2831 USGS 7.5-minute quadrangles in California, each covering approximately 59 square miles. The data shown was produced by intersecting the 1995 version of the range maps with the quadrangle grid and dividing the results into classes based on the number of species which may occur in each quadrangle.

teria. The purpose of the CWHR System is to make the process of assessing wildlife status more efficient by producing new tools for professional wildlife biologists. By mapping the predicted distributions of all California's wildlife one can gain perspective on which regions of the state support the greatest wildlife diversity. Models have been developed for the

distributions and abundances of all 643 wildlife species under the direction of the California Interagency Wildlife Task Group (CIWTG). These models incorporate the opinions of recognized experts for each species. The CIWTG includes technical representatives from each state and federal agency with an interest in California's wildlife as well as from universities

and utilities. The CIWTG is a technical advisory body for the California Biodiversity Executive Council.

The CWHR System can assist in understanding the effects of habitat changes on terrestrial wildlife. For example, converting a valley-foothill riparian habitat to cropland is predicted to create or improve habitat for 49 species, but to decrease or eliminate habitat for 195. The next step, empirically testing the predictions of the CWHR system by surveying the species in question, will be an ongoing process. Periodically, experts should review wildlife survey results and recommend needed changes to the wildlife-habitat models. Monitoring the status of all wildlife is the only way society will know what is left, and most importantly, what is about to disappear forever.

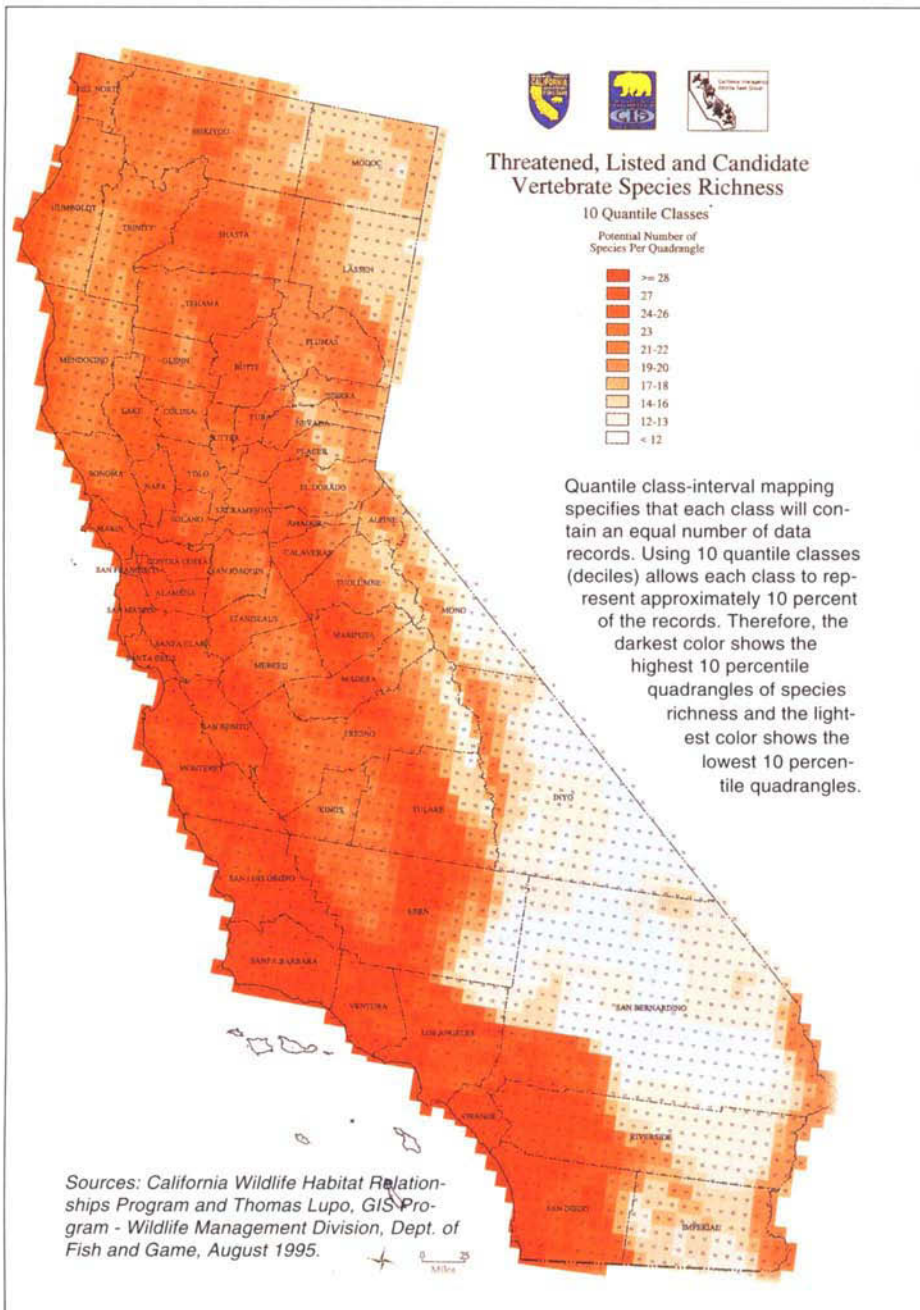
The CWHR System is also the basis for the GAP analysis project for California. This national program is a first step in systematically determining which species are not yet protected in reserves. Ecological preserves, such as the University's Natural Reserve System as well as state and federal parks and refuges, are essential for the long-term survival of many species.

How do we conserve what's left?

If there is to be a varied and interesting fauna for future generations to know, then management of the land must extend beyond basic human needs to the basic requirements of the fauna. Our lack of knowledge is the overriding deterrent to this type of management, but not the only one, and education of the public will have to follow the much-needed research.

— R.R. and J.W. Graber, 1963

A fundamental problem in conserving California's wildlife is deciding who pays for the necessary programs. While wildlife is "owned" by all citizens, historically, wildlife management has been funded through sales of licenses and tags for taking game species. Hunters and trappers have legitimately expected game funds to go to programs supporting those species, and thus "deer and ducks" have prospered relative to nongame wildlife. Nongovernmental organizations such



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as Ducks Unlimited, The California Waterfowl Association, and The Nature Conservancy have been major forces in maintaining or improving wildlife habitat in the Central Valley. Such groups function entirely on the donations of interested citizens. But who should pay for maintaining habitat for the blunt-nosed leopard lizards — people who buy licenses to hunt game, the farmer who wants to grow

cotton on land that supports the lizards, or the public at large? What if the public at large is already paying for the farmer's water? Similar questions are being asked about wildlife species throughout the state.

Historically scientists have identified few cases in which agricultural development has enhanced wildlife diversity. Perhaps the best one can say is that relatively little opportunity now

exists for additional habitat losses to agriculture. Most of the land in California that is suitable for agriculture has already been converted, and most of the water suitable for "development" is already being used.

Today the greatest new threats to wildlife and their habitats in California come from continued human population growth and urban sprawl, making any wildlife-habitat values provided by agricultural lands more important. There have been attempts to manage agricultural lands in ways that benefit wildlife. For example, wildlife management on private lands in California is being encouraged by state programs that let landowners benefit from fee hunting. Such programs are based on the premise that economic incentives will motivate more private landowners to improve habitat for game species, much of which will benefit nongame wildlife as well.

The "Safe Harbor" program being initiated by the U.S. Fish and Wildlife Service, CDFG, and the American Farmland Trust specifically addresses endangered and threatened species. It would protect landowners who create or enhance wildlife habitat from future liability under "incidental take" provisions of the federal and state endangered species acts (see p. 35).

There are examples of agriculture enhancing biodiversity. Central Valley rice farmers who flood their fields in winter provide habitat for wintering waterfowl (see p. 58). Rice fields also provide habitat for the federally and state-threatened giant garter snake. Greater sandhill cranes winter on agricultural fields in the Central Valley, and Swainson's hawks forage above them. However, as land is cultivated more intensively and crops harvested more effectively, less is left for wildlife.

Where do we go from here?

The most unfortunate aspect of man's domination of the land is not that he changes the environment but that he changes it so widely so quickly.

— R.R. and J.W. Graber, 1963

Fifty years ago Aldo Leopold (1945) foresaw two choices for agriculture:



Jack Kelly Clark

Human-made wetlands on farmland, like those shown here, help mitigate the loss of riparian habitat.

“The farm is a food-factory and the criterion of its success is saleable products,” or “The farm is a place to live. The criterion of success is a harmonious balance between plants, animals and people.” Thirty-three years later, in his review of agriculture and wildlife for the President’s Council on Environmental Quality, George V. Burger, a farmer and wildlife manager, noted that “pressures of economics and a hungry world may deny most farmers the latter choice”; consequently, “agriculture-wildlife conflicts can only intensify.” It is clear that Burger’s prediction has come to pass for many California farmers.

On a small scale, restoration of diverse wildlife habitat in agricultural areas in California may be technically possible. For example, efforts to replace the bare dirt typically found in noncultivated areas such as roadsides and along canals, berms and ditch banks with native perennial grasses, shrubs and trees should be expanded. Research into which wildlife species benefit from such practices, the eco-

nomie costs to landowners, and landscape-level issues such as connecting areas of extant habitat should be conducted.

On a large scale, however, such efforts are limited; they will never restore the millions of acres of wetlands and grasslands lost to intensive agriculture. In the future, some wildlife may be protected through designation of additional National Wildlife Refuges in key areas. However, this strategy can not substitute for sound stewardship of private lands, in which land owners, supported by enabling research, act in concert with the view expressed in Aldo Leopold’s “Land Ethic” (Leopold 1949):

A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.

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For further reading

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