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California's Endangered Peoples and Endangered Ecosystems.

M. KAT ANDERSON

"On a global basis, human cultural diversity is associated with the remaining concentrations of biodiversity. Both cultural diversity and biological diversity are endangered. Modern cultures are undercutting traditional cultures, and modern knowledge is replacing traditional knowledge."

— E.O. Wilson¹

INTRODUCTION

One of California's greatest assets is that it harbors the richest plant diversity of any state in the continental United States. There are about 6,300 species, subspecies, and varieties of native plants.² Another great treasure is the cultural diversity of its Native American tribes. With over one hundred indigenous languages once spoken on California soils, the state can legitimately claim to be the most linguistically diverse place on the continent.³ California at the point of Euro-American contact was more densely populated than any area of equal size in North America.⁴ Despite these dense populations, early non-

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Indian settlers did not find a biologically impoverished land. On the contrary, they found a vast abundance and diversity of plants and animals. The immense herds of tule elk and pronghorn antelope in the Central Valley, for example, rivaled animal numbers in Africa's Serengeti.⁵

The fact that indigenous people have lived in California for at least 12,000 years with minimal negative impact on biodiversity in many cases suggests that contemporary society might learn from indigenous peoples' ability to coexist with the state's other denizens. In the intervening 225 years since Euro-American settlement, Western land uses such as logging, livestock grazing, mining, and housing developments have severely impacted and reduced this biological diversity. Loss of habitat, ecological degradation of streams, environmental pollution, and overexploitation of natural resources have combined to create a genuine peril for animal, plant, and ecosystem survival in California. Nearly one in three vertebrate species and one in ten of California's native plant species are in serious danger of extinction.⁶

It is no coincidence that the state's Native peoples are also endangered. Loss of traditional hunting and gathering sites, destruction of sacred places, extinction of Native languages, and erosion of traditional knowledge have combined to create a genuine peril for indigenous cultural survival in California.⁷ The decline of natural systems in the state is intimately tied with the diminishment of the Native cultural heritage. While botanists, wildlife biologists, ecologists, and environmentalists mourn the loss of genetic, species, and habitat diversity, little is said about the implications of this loss for indigenous cultures. We are not only losing native condors and clovers—but also the cultural wealth—the vast experience of Native cultures in how to use, manage, respect, *and* coexist with these other life-forms. This knowledge is in a real sense scientific knowledge.⁸

In the evaluation of what the extinction of species means to humanity, one needs to ask what it means to the Native cultures in whose territories the endangered plant or animal resides. What, for example, does the endangerment of the coho salmon mean to the Karuk people, the demise of pismo clam to the coastal Chumash, or the rare and endangered status of the Torrey pine to the Kumeyaay? The ethnobotanics and ethnozoologies of the tribes are in large part what give them their unique identity, their economic independence, and their spiritual relationship with the land. Songs, dances, and ceremonies

are frequently conducted to honor culturally significant plants and animals. The Yurok white deerskin dance, the Miwok bear dance, and the bird songs of the Cahuilla bird singers all demonstrate the depth of relationship between Native people and other life-forms.

Our rich natural heritage is also linked with the historical use and stewardship of vegetation by Native Americans. Through the introduction of time-tested horticultural techniques such as burning, tilling, weeding, and selective harvesting practices of different tribes, California's ecosystems were profoundly shaped by human influence over thousands of years without appreciably diminishing its variety of plant and animal life. This indelible human imprint is reflected in the aerial extent, structure, function, and composition of different ecosystems throughout California.⁹ Until recently, conservationists and resource managers have usually uncritically dismissed Native American gathering, use, and management of the environment simply as having little or no impact. And the claim is made that habitats rich in biodiversity must be kept as free as possible from human tinkering. As a rule, indigenous knowledge about the natural environment has not been valued by wildland managers and ecologists. Yet, ironically, Yosemite as well as other wildlands were deemed worthy of protection because they were maintained for centuries or millennia by the land management practices of Native peoples in ways that left them appearing pristine.¹⁰

This article explores the linkages between diversity of Native cultures and diversity of the biota in California and reveals how the diminishment of one adversely affects the other. The battle to preserve animals, plants, and ecosystems and the struggle to save Native cultures are deeply intertwined. The study of ancient land management systems can provide Western society with cultural models for successful, long-term human interventions in the natural environment. Land managers, policy-makers, and conservation biologists involved in protection of biodiversity are urged to consult and collaborate with Native people who retain the knowledge of how to coexist with this biodiversity over long periods of time.

LOSS OF BIOLOGICAL DIVERSITY IN CALIFORNIA

Some temperate habitats in California are being eliminated more rapidly than most tropical rain forests and stand to lose as great a proportion of their species.¹¹ The state with its diverse soils, topography, and climates harbors 25 percent of the biological diversity in the continental United States.¹² With the largest human population number of any state, more than 29 million people, there is less and less space for its 6,300 plant species, 30,000 insects, 63 freshwater fishes, 46 amphibians, 96 reptiles, 563 birds, and 190 mammals. Since the 1850s, at least twenty animal species and thirty-four plant species have become extinct.¹³ For example, the San Joaquin Valley tiger beetle, the Santa Barbara song sparrow, and the Los Angeles sunflower have vanished forever. California has the largest number of endangered species of any state in the continental United States.¹⁴

Scientists refer to this rich variety of species, from the tiny San Bruno elfin butterfly to the mammoth sequoia, as *biological diversity* or simply *biodiversity*. It can be defined at several levels of biological organization:

Biodiversity is the variety of life and its processes. It includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.¹⁵

This definition now includes the ecosystem—a community of species populations that inhabit a designated area and its abiotic environment. Among the most imperiled ecosystems are wetlands, alkali sink scrub, vernal pools, and Central Valley riparian forest (see Table 1).¹⁶ Scientists now recognize biodiversity as essential to humanity's future.¹⁷

Modern humans are the main perpetrators of the rapid, unnatural decline of species of plants and animals and whole ecosystems. Dwindling biodiversity is linked with contemporary land uses which cause degradation, fragmentation, and outright loss of habitat. Other significant reasons are overharvesting and rapid unnatural climate changes due to human activities.¹⁸ For more than two decades, researchers have been monitoring and compiling data relating to the abundance, fre-

quency of occurrence, and density of California's animal and plant species. Species that are in jeopardy are assigned to one of several categories: "endangered," "threatened," or "rare" and appear on either California and/or Federal Endangered Species lists. "Endangered" is the most serious category; it means that a species is "in danger of extinction throughout all or a significant portion of its range."¹⁹ Major legislation, the Endangered Species Act, was passed in 1973 to protect listed taxa from hunting, habitat exploitation, and other perils associated with humans.²⁰

ENDANGERED ECOSYSTEMS OF CALIFORNIA
Alkali sink scrub (99% destroyed)
Central Valley riparian forest (99% destroyed)
Grasslands (99% destroyed)
Needlegrass steppe (99.9% destroyed)
Redwood forests (85% old-growth destroyed)
Salt marshes (62% destroyed)
Southern coastal sage scrub (70-90% destroyed)
Vernal pools (90-95% destroyed)
Wetlands (91% destroyed)

Table 1

Taken from Endangered Ecosystems report, National Biological Service (Noss et al., 1995), and California Native Plant Society's Inventory (Skinner et al., 1994)

Why Is Biological Diversity Important?

Much has been written about the loss of plant and animal species and ecosystems in California and the deeper implications to humanity. Natural ecosystems provide the fundamen-

tal ecological services and evolutionary processes essential to life. Ecosystems regulate climate, purify water and air, and absorb wastes.²¹ Numerous authors have written about the value of open spaces and wildlands to the human psyche and spirit. Biologically diverse wildlands give humans the chance to interact in a deeper way with nature, provide places of solitude, and enable an unfettered existence that is uplifting and essential to human well-being. Largely unaltered environments offer opportunities for recreation through rafting, cross-country skiing, hiking, fishing, and hunting activities.²² Wildlands that contain biological diversity offer a plethora of potential products to meet the economic needs of modern society. From foods to fibers to medicines to construction materials, biologically diverse environments are a latent storehouse for novel uses of resources. Environmentalists and ecologists also claim that other life-forms have intrinsic worth and legal rights, and they argue for biospecies equality.²³

LOSS OF CULTURAL DIVERSITY OF TRIBAL PEOPLES IN CALIFORNIA

While increasing attention has been paid to preserving California's rare and endangered plant and animal species, there has been little concern for the preservation of indigenous cultures.²⁴ Although anthropologists systematically studied the lifeways of different groups since 1900, the common sentiment in academia was to record the last vestiges of indigenous cultures before they disappeared.²⁵ Environmentalists have often praised the land-use practices of Native Americans, but as environmental historian Stephen Fox points out, "Few conservationists dealt with actual living Indians, or listened to their problems in a white man's world, or helped them maintain the old ways of which conservationists spoke so reverently."²⁶ Anthropologist Alfred Kroeber has suggested that in precontact California there were probably more than five hundred small tribes or tribelets—denoting a group of people that act in unison, view themselves to be a unit, and are sovereign in a designated territory.²⁷ Some cultural groups such as the Yahi have become extinct and, with them, tremendous knowledge about our state's native plants and animals.²⁸ Despite their turbulent history, today California is endowed with a great vari-

ety of indigenous cultures. I have defined this rich cultural diversity of tribal peoples as:

the variety of cultural groups that have descended from tribelets found living in different geographic regions of California at the point of Euro-American contact. These indigenous groups have lived in the same area for centuries or millennia, generating a long-term history with the land. Cultural diversity includes the variety of indigenous languages, social structures, material cultures, religious customs, and land management practices, and the cultural evolutionary processes that keep these cultures functioning, yet ever changing and adapting.

Native American tribes have endured major threats to their cultural survival for over two hundred years. These harmful events include the obliteration of California Indian populations, the taking of Indian lands, the loss of the right to self-determination and immersion into the dominant culture without time to adapt, or the granting of equal rights. California Indian numbers plummeted from more than 300,000 in 1769, the date of the establishment of the first Spanish mission, to 30,000 by 1860. A mix of introduced diseases, starvation, and outright homicide caused this decline.²⁹

As Euro-American settlers multiplied in California, forces of change grew steadily and affected all aspects of the traditional indigenous culture and lifeways. Most tribes were forced to move into white settlements, and the best lands were preempted by non-Indians and used for agriculture, stock ranging, mining, or lumbering purposes. The new owners were many times not willing to allow local Indians to "trespass" for gathering purposes. Tribes throughout California painfully witnessed the reduction in the variety and abundance of the regional flora as exploitive land uses practiced by Anglo settlers degraded their traditional lands.³⁰

At the point of Euro-American contact California had one of the densest populations in North America. Yet today it has one of the smallest Indian land bases, consisting mainly of small rancherias of under one hundred acres. Between 1851 and 1852 the United States government negotiated eighteen treaties involving about 25,000 California Indians. In each of the treaties the tribes were acknowledged as sovereign nations and the Indians were promised provisions, cattle, and extensive

tracts of valuable land to be set apart for reservations. In June 1852 the United States Senate, meeting in secret session, rejected the California treaties, and the vast reservations proposed were never created.³¹

Whites were bent on dissolving the differences of Native Americans and that meant getting rid of "Indianness." The choices for Native Americans were to perish or become "civilized." Being civilized meant dressing in European fashion, practicing Western religion, learning English and forgetting one's own language, laboring at Western jobs, and attending Western schools. Even if California Indians tried to fit into the mold of Western culture, numerous laws and regulations were passed in the nineteenth and early twentieth centuries at the city, county, state, and federal levels that violated their human rights. For example, a California Indian in 1850 could not vote, testify against a white person in court, possess guns, gain citizenship, or have the right to a fair trial when accused of a crime.³²

These persistent efforts to eliminate Native cultures in California have met with swift results—over half of the languages in California are extinct, and at least another dozen languages are imperiled with one to several speakers left.³³ Most tribes are forced to gather and hunt on public or private lands to continue their traditions. Plant populations are often not accessible or available in sufficient quantities. Many cultures are losing the struggle to keep their traditions alive as old gathering sites are paved, fenced, bulldozed, or sprayed with herbicides. Native American sacred sites are constantly in jeopardy with proposed developments. Threatened sites include Mt. Palomar, Mt. Shasta, Mt. Pinos, and Pincushion Mountain in the Sierra Nevada.

Despite their losses, most tribes have maintained a distinct ethnic identity. Today there are more than 70,000 California Indians. Many of the tribes regulate their business and conduct fundraising efforts through formal tribal councils. Some tribes have Indian-owned and -operated cultural museums. Intra- and intertribal gatherings occur up and down California annually and are known variously as acorn festivals, Indian days, big times, and powwows. The present activities and lore of the tribes have grown out of a blending of ancient plant knowledge and a sustained interest in their cultural heritage.

Currently, handfuls of individuals of both sexes and of all ages still gather plants and hunt in different tribes. Plant and

animal uses that had been relinquished have regained importance among certain families in recent years. Sons and daughters, and grandsons and granddaughters, demonstrate veneration for their forebears as they keep the traditions alive. Mushrooms are highly esteemed, picked and added to gravies, spaghetti, and other modern foods. Sourberries, yerba buena leaves, and labrador plants are made into a refreshing drink, while elderberries are used in pies and jellies. Different kinds of pine nuts are kept on hand for afternoon snacks for children and visitors. Big bowls of acorn mush lie in modern refrigerators. Clovers, sour docks, and miner's lettuce form salad greens and the bulbs of wild onions, yampahs, lilies, blue dicks, and sanicles are relished. Medicines such as yarrow, madrone, incense cedar, bearroot, and angelica treat various ailments. Weavers' hands still sort, debark, split, trim, soak, and dye branches, stems, roots, and rhizomes of various shrubs, trees, ferns, and sedges to be woven into beautiful baskets. The healing aroma of smoldering wild sage, sweet grass, prostrate juniper, or wormwood drifts through the air during sweats and other ceremonies. Salmon and eel are still caught in Northern California rivers. The continuance of traditions is remarkable given the great obstacles Native Americans have had to face.³⁴

Most of the tribes in California have an insignificant land base or none at all, and therefore they are forced to gather on public lands. The loss of habitat for culturally significant plants such as wetlands, overflow channels of streams, and black oak-ponderosa pine mixed conifer forest is extensive. Newly formed organizations such as the California Indian Basketweaver's Association (CIBA) have expressed these and other gathering concerns of its members from different tribes. Former gathering sites rich in memories, human energy, and culturally significant plants are now blacktops, widened roads, rangelands, or private homes.

Why Is Cultural Diversity Important?

Charles Lindbergh, in living among the indigenous peoples of Asia and Africa, realized that Western civilization had much to learn from Native lifestyles. Visiting the Agta and Tasaday of the Philippines and the Masai of Africa led Lindbergh to conclude: "I become more and more doubtful that the superiority

in science and technology of European man is leading him to a better life than that achieved by other peoples."³⁵

Where cultural traditions of Native people remain in California they are of inestimable value. Preserving tribal cultural diversity ensures future generations with a wide range of knowledge, experiences, and tools needed for solving problems and meeting goals.³⁶ For example, in parts of the world the knowledge of indigenous people has considerable modern value for us in managing and conserving *in situ* genetic resources.³⁷ Many of California's wildlands were greatly affected by indigenous management. The thousands of years of observation, experience, and purposeful trial and learning undertaken by different tribes to manage their homelands without major environmental degradation can serve as analogs in experimenting with alternative wildland management strategies. Contemporary tribal cultures are still conducting some of these historical practices, and these techniques may aid in restoring endangered ecosystems and species, enhancing the productivity and biodiversity of wildlands, and maintaining culturally significant plant resources for the perpetuation of indigenous cultural traditions. Westerners' true concern for cultural preservation of indigenous groups should extend beyond justification for cultural protection for its value and expertise to humanity; it should also involve the valuation of cultural diversity for its own sake. The conservation movement has already reached this stage with regard to the preservation of plant and animal species.³⁸

LOSS OF BIODIVERSITY AND THE DIMINISHMENT OF NATIVE CULTURES

Another avenue within which to analyze the total consequences of biodiversity losses is with respect to their effects on the health and well-being of indigenous cultures. There are at least five ways in which the loss of biodiversity adversely affects indigenous cultures. The disappearance of species and shrinkage of ecosystems undermines the ethnic identity, economic independence, health, religious freedoms, and traditional ecological knowledge of each Native culture affected.

Loss of Ethnic Identity

Loss of biodiversity means loss of ethnic identity. Each indigenous culture relies upon a unique flora and fauna characteristic of its tribal territory. The great variety in the flora manifested itself in the different house types, assortment of foods, medicines, weaponry, and basketry material of each culture. Today these differences mark the distinctness of contemporary cultures. For example, the Karuk of northwestern California gather the tillers of bear lily (*Xerophyllum tenax*) under ponderosa pines for overlay designs in their baskets and the Southern Sierra Miwok gather young redbud (*Cercis occidentalis*) shoots for the red designs in their baskets.³⁹ Plants and animals are still gathered or traded and used in ceremonies, dances, meals, medicines, and tools; and they have a major role in shaping, defining, and maintaining the cultural ethnicity of different tribes.

The pismo clam (*Tivela stultorum*) was harvested judiciously by the Chumash along the central California coast for centuries for food and used in the making of musical instruments. The clam was overharvested by commercial diggers, and in recent years there has been a disastrous decline in the intertidal populations of these clams.⁴⁰ Recent Chumash collecting trips to Morro Bay and Pismo Beach have been futile. The desert tortoise is on both state and federal threatened species lists. It has suffered severe population losses due to habitat degradation, disease, and overcollecting.⁴¹ Yet when the tortoise was properly harvested by desert peoples such as the Paiute and Chemehuevi for its meat and its shells used in rituals by the Cahuilla, Cupeño, Luiseño, and Diegueño, it flourished.⁴²

Affinity and choice for specific animals and plants grow out of linkages to places. The steadfastness with which a plant or an animal is interwoven into the cultures gives the culture a continuity with its past. It is the long-term association with place and the plants and animals that inhabit that place which translates into tangible, distinct tribal ethnicity. Relocation of Native peoples to reservations outside of their tribal territories all worked against the maintenance of tribal ethnicity.

Loss of Economic Independence

Loss of biodiversity affects tribal economic independence. While many Native cultures have been forced to assimilate into

the dominant culture and take up Western employment, some individuals within tribes still make a predominant portion of their incomes from the land. For example, the native economy in the past and present for the Karuk, Yurok, and other northwestern tribes is built around the river and fishing. Over millennia, the technologies, timing of harvest, and length of harvest were refined to ensure a future abundance of fish populations. Fish weirs were constructed across streams which could effectively exhaust salmon and steelhead runs, yet cultural rules and rituals prohibited the waste or overcollection of fish resources.⁴³ The coho or silver salmon is about to be listed as endangered by the U.S. Fish and Wildlife Service. This is another devastating blow to Native economies. Commercial fishing by whites, damming of rivers, and damage to the spawning grounds from timber and mining operations have depleted the salmon.

Loss of Health

The degradation of land and water through pesticide spraying, toxic waste contamination, and sewage input directly bears on the health of Native people. There are increasing incidences of cancer, miscarriages, and other health problems associated with the gathering, processing, and ingesting of plants. Plant gathering is a highly tactile endeavor, and often Indian weavers utilize their mouths in the splitting of plant material for basketry. Frequently plants that are targeted for pesticide spraying are the very ones that are important to Native American tribes for teas, basketry, medicines, and foods.⁴⁴

As California Indians were forced to assimilate into the dominant culture, they lost their lands, and their subsequent dietary changes were abrupt and drastic. Wheat flour substituted for flour made from pounded native seeds, while potatoes replaced the native tubers, bulbs, and corms. The ancient cooking techniques of baking, boiling, and roasting were often replaced with frying. Today in California's Native American population, health problems are frequently linked to inadequate nutrition. Particularly prevalent are heart disease and diabetes. In 1987, the age-adjusted diabetes mellitus mortality rate for the Indian Health Service in California was 20.8 per 100,000 people, compared with the overall U.S. rate of 9 per 100,000.⁴⁵ Recent studies conducted in Australia and the

Southwest have demonstrated that traditional foods such as acorn (*Quercus* spp.), tepary beans (*Phaseolus acutifolius*), and mesquite pods (*Prosopis velutina*) help maintain the health and longevity of indigenous peoples in arid environments. Traditional desert foods have soluble fibers and complex carbohydrates which may slow carbohydrate digestion and lower blood sugar levels. These studies demonstrate the long-term involvement of Native peoples with the land, and promote the idea of the specialized adaptation of the Native people to their native flora. Western diets, on the other hand, are high in carbohydrates and fats and low in soluble and insoluble fiber and may contribute to obesity, diabetes, and other health problems when the traditional foods are no longer available or abandoned for other reasons.⁴⁶ Ethnobotanist Gary Nabhan suggests that a return to traditional diets might help indigenous people of the Southwestern deserts combat diabetes.⁴⁷ The findings from these studies may be highly pertinent to Native people in California who also customarily relied on the acorns of various oaks to make up a substantial portion of their diets.

Loss of Religious Freedoms

Loss of biodiversity means loss of religious freedoms to California Indians. For instance, the endangered status of the California condor (*Gymnogyps californianus*) and the bald eagle (*Haliaeetus leucocephalus*) due to habitat loss, shooting, pesticides, and lead poisoning has made it difficult for tribes to acquire feathers so central to religious dress and ceremony.⁴⁸ Both the condor and the bald eagle are highly revered by many different tribes. They appear in legends and historically were integral to various ceremonial traditions. There is no evidence that the historical harvesting of feathers and/or the taking of birds for ceremonies contributed to a decline in bird populations.⁴⁹ Sacred areas that are the places spoken of in human creation stories and are loaded with numinous meaning to different tribes have become increasingly threatened by roads, logging, ski lifts, and other developments.

Loss of Traditional Ecological Knowledge

As plants, animals, and ecosystems disappear, so too will the vast diversity of approaches to use, conservation, and percep-

tion of the natural world that are embedded within each unique Native culture. The perpetuation of indigenous customs and ready access to valuable resources are factors that are inextricably linked.⁵⁰

Many of the ecosystems that are in jeopardy contain important cultural resources. For example, sedge, a basketry material highly valued by numerous tribes, occurs in endangered riparian forests along central California rivers. Both the habitat and the plant have degraded in quality and dwindled in size because of dams, livestock grazing, channelization of streams, reclamation, introduction of exotics, and loss of water quality.⁵¹ It is not so simple to substitute one material for another such as the replacement of palm fiber or "rafiá" for sedge (*Carex* spp) rhizomes for basketry material. While the former material can be picked up in the local hobby shop, the traditional harvesting of real sedge rhizomes requires intimate knowledge of the plant's reproductive biology and growth patterns in relation to soil type, river flooding patterns, and other ecological associations—all specific to a place.

If local, indigenous knowledge about different ecosystem types is to flourish, the plants, animals, and ecosystems of interest have to be available, accessible, and in prime condition. Today there are many examples where this is not the case. The five million acres of wetlands in California have been reduced by 91 percent through diking, draining, and filling in for agriculture, housing, or other purposes.⁵² This puts a tremendous hardship on weavers trying to continue basketry traditions since a large portion of the plants they use are gathered from wetlands such as rushes (*Juncus* spp) and tules (*Scirpus* spp). Perennial grasslands once covered one-fifth of California. Today with agriculture, urban development, and introduction of exotics only .1 percent of those remain.⁵³ Cultural resources that come from grasslands today which are exceedingly difficult to find in the proper quantity and quality include deergrass (*Muhlenbergia rigens*) for basketry, bearroot (*Anemopsis californica*) for medicine, and saltgrass (*Distichlis spicata*) for food.

LOSS OF CULTURAL DIVERSITY AND THE DIMINISHMENT OF BIOLOGICAL DIVERSITY

One quarter of the United States' biodiversity was in the custody of California Indians who for thousands of years followed age-old land management and land-use practices. Their homelands are associated with centers of species and ecosystem diversity, and in many instances local people have played an important role in maintaining this biodiversity.⁵⁴ Loss of animal and plant diversity in California's wildlands is equated with habitat loss, fragmentation, and the degradation of biological resources from modern land uses. Seldom are the root causes equated with the absence of former indigenous interactions. Unfortunately, most scientists still do not see the link between loss of cultures and the subsequent loss of knowledge about how to manage for plant and animal diversity.⁵⁵ Therefore, terminology, legislation, policies, management, and research for preservation of cultures and preservation of flora and fauna remain largely on separate tracks.

Loss of Cultural Interactions that Benefit Rare and Endangered Plants

Certain plants integral to traditional indigenous cultures are now on rare and endangered species lists assembled by the California Native Plant Society and the U.S. Fish and Wildlife Service. Such plants as the kaweah brodiaea (*Brodiaea insignis*) were harvested for their edible corms by the Wukchumni Yokuts⁵⁶ and the Torrey pine (*Pinus torreyana* ssp. *torreyana*) nuts were gathered by the Kumeyaay for food.⁵⁷

Many of these plants were gathered in great quantities, without contributing to their depletion. Former harvesting strategies and management practices for these species may have maintained and/or expanded populations, while removal of Native Americans from their homeland, causing the discontinuation of these practices, may have contributed to species decline. For example, showy Indian clover (*Trifolium amoenum*) or *kali*, was gathered in the San Francisco Bay Area and eaten raw by the Coast Miwok.⁵⁸ It was presumed extinct until it was recently rediscovered by senior scientist Peter Connors of Bodega Marine Laboratory. While the cause of the decline of the clover is due to modern factors such as urbanization and

agriculture, cultural knowledge may be useful in its restoration and management. Different species of clovers were fired periodically to enhance leaf and seed production by the Wukchumni Yokuts, Pomo, the North Fork Mono, and other tribes.⁵⁹

The Kumeyaay ate the seeds of the Torrey pine, or *ehwiiw* (meaning pine nut in the Kumeyaay language), raw or roasted, flavoring seed porridges and pinole—a potpourri of different dry seed meals. Encroached by urban development, this pine is endangered in a portion of its range. According to plant ecologist Jim Barry, pine regeneration was sparse at Torrey Pines State Reserve, with the exception of a 1972 wildfire which promoted the development of many seedlings. Fire is an important ecological factor in perpetuation of the species and past human-set fires perhaps played a key role. Anthropologist Florence Shippek has documented Kumeyaay firing of areas containing Torrey pine groves and the planting of pines to enhance their populations.⁶⁰ In restoring fire cycles to these and other rare conifers, knowledge of how Indians changed the frequency and intensity of fires may be integral to successful modern wildland management of these species.

Humboldt County wyethia (*Wyethia longicaulis*) or *bish'non* in the Yuki language has rare status, yet formerly it was an important plant in the pharmacopoeia and food repertoire of the Wailaki, Yuki, Little Lake Pomo, and Yokia Pomo tribes. According to V.K. Chesnut in his book *Plants Used by the Indians of Mendocino County California*, "The plant often completely covers whole acres of valley land in Round Valley, and is common everywhere in grassy openings in forests." Chesnut recorded multiple uses: The young leaves and stems were edible greens, the seeds made a pinole, and the resinous woody root was an emetic, a wash for sore eyes, and a poultice for sores and burns.⁶¹ Today North Fork Mono elders recall that mules ears or "sunflowers" (*Wyethia* species) found in the Sierra foothills were formerly burned to maintain seed production, and this may have also been an indigenous practice for the Humboldt County wyethia.⁶²

Pringle's yampah (*Perideridia pringlei*) is classified as rare, and yet at one time its tubers were dug in great quantities by the Kawaiisu, providing an important starch and protein source to their diet.⁶³ Digging these tubers with a digging stick may have aerated the soil, increasing its moisture-holding capacity, and preparing the seedbed, thus heightening seed

germination rates. This genus is known for its tuberous roots, a combination of root and stem tissue. It is feasible that tuberous root fragments were left behind in the tillage process, and this stem/root section formed a plant replacement. Additionally, different types of Indian potatoes were burned including some of the more common yampahs by the Chuckchansi Yokuts.⁶⁴

Loss of Ecosystem Diversity

Ecosystem diversity was also enhanced through the maintenance of ecosystems that would disappear in the absence of human influence including coastal prairies, dry montane meadows, and mixed conifer forests where black oak and ponderosa pine predominate. For example, Native Americans prolonged the life of dry meadows through periodic burning. Setting fires in the ecotone areas surrounding the meadows decreased the more wet-tolerant lodgepole pine and other conifers from encroaching into meadow areas, thus maintaining and perhaps in some cases enlarging meadow areas.⁶⁵ Recurrent changes in water level along streams, essential to freshwater marshes, were not obstructed. In fact, gathering large quantities of freshwater marsh resources acted as a form of hand clearing of vegetation that might alter moisture and soil conditions if allowed to accumulate. This detritus could hasten the "filling in" of the marsh, triggering succession: a new array of plant species to colonize. Native Americans also periodically burned tule marsh areas to recycle the nutrients from decomposing matter, facilitate human access, and enhance waterfowl habitat.⁶⁶ Black oak (*Quercus kelloggii*) and ponderosa pine (*Pinus ponderosa*) stands are a subtype in the mixed conifer forests of the Sierra Nevada. Kilgore and Taylor, in their 1979 fire history studies, concluded that natural ignitions alone were not adequate to account for the observed historic fire frequency in mixed conifer forests and suggested that Indians burned these areas.⁶⁷ Black oak areas were burned in the fall by Native Americans for at least six cultural purposes: to reduce acorn insect pests, facilitate acorn collection, promote native grasses, increase mushroom production, keep structure of the woodlands open to prevent catastrophic fires, and to encourage the growth of young sprouts for the making of material cultural items.⁶⁸ With almost a century of fire suppression and the absence of indigenous burning, this ecosystem

subtype is being lost to a more homogenous landscape of white fir and incense cedar.⁶⁹ Land managers are now realizing that some lands require an active management stance to maintain ecosystem integrity. For example, if fire-dependent or early successional plant species are not managed through prescribed burns, they may be outcompeted by other plant species.

Loss of Patchy Environments

Native peoples played a major role in the maintenance and enhancement of biological diversity by introducing disturbances that promoted mosaics of patches found within different landscapes in California. While openings are “naturally” created through windfalls, lightning fires, avalanches, and other disturbances, Native Americans maintained additional patches through direct cultural intervention. Areas that have been protected from Native American horticultural practices often contain impoverished floras and faunas.

Native Americans placed emphasis upon encouraging many sun-loving plants in various plant community types. Grassy clearings were created, maintained, or expanded within chaparral, oak woodlands, and forests resulting in diverse tracts of plants in varying successional states. For example, deergrass openings were created in chaparral and lower mixed conifer forests for basketry material. Edible seed plants such as chia (*Salvia columbariae*), mule ears (*Wyethia* species), and tarweeds (*Madia* species) were maintained within the grassy understories of open coniferous forests, chaparral, and oak woodlands.⁷⁰ Previous studies have shown that seral stages harbor the most diverse and abundant array of plant resources useful to Native people. According to a study by Spies and Franklin, plant species’ richness in coniferous forests of the Pacific Northwest after fire or clear-cutting attains their peak values within a few years and then declines within thirty to forty years as the tree canopies shut out most of the light to the forest floor.⁷¹

REKINDLING INDIAN-LAND RELATIONSHIPS

The efforts of conservation biologists and restorationists in restoring species to viable population numbers and preserving or restoring ecosystems revolves around captive breeding of animals; propagation, cultivation and outplanting of plants;

establishing and managing reserves; and restoring functioning habitat. Yet an often overlooked but important component for preserving biodiversity is the folk scientific knowledge of Native people. This not only includes the application of Native knowledge to wildland management, but also preserving the long-term ecological associations between Native people and wildland environments. The *in situ* conservation of Native people-land relationships is a complement to other strategies to preserve biodiversity.

There are a number of ways that former territorial lands can be opened up and Indian-land relationships revitalized. Some of the possible innovative land management arrangements and restoration efforts that reveal the beginnings of a concerted commitment to the conservation of indigenous cultures are listed below.

1. Many botanic gardens and arboreta are already involved in the conservation of rare taxa through their propagation and cultivation.⁷² They can begin to establish relationships with Native American groups of the region and grow culturally important plants that are rare and endangered, either from a strict biological standpoint or from a cultural standpoint. These plants could be reestablished on traditional gathering sites, both on public lands and tribal lands. For example, the Desert Botanic Garden in Phoenix and Navajo Nation community members have joined together in efforts to restore the Navajo sedge (*Carex specuicola*) on tribal lands.⁷³
2. Natural history museums can reorient their exhibits to portray "wild" California as an inhabited land with a lengthy and rich Native American land use and land management history. Cultural museums can slant their exhibits to represent more accurately the continuity of Native American cultures as living, vibrant communities rather than just focusing on the past. They can begin to invite guest Native American curators to plan exhibits and have a major voice in interpreting their own history. Additionally, museums such as the Grace Hudson Museum and the Oakland Museum have begun to initiate symposiums, bringing together Native Americans, government officials, and the general pub-

- lic to educate people that Native cultures are not extinct or static.
3. Public agencies are beginning to rethink their role. Since the creation of national and state public agency charters, their role was passive—to allow Indians to gather plants through a permit process or without a permit. Recently agencies have begun to take a more active role by becoming advocates of maintaining, tending, and encouraging growth of plants important to Indian people. This involves surveying the resources, recording their conditions and numbers, matching this with indigenous needs, and reintroducing Native American horticultural techniques such as fire to enhance cultural resources.
 4. A major step toward encouraging Indian cultures would be through agreements to maintain traditional gathering sites. Policies could be developed that address forest and range management practices to assure the availability and preservation of cultural resources. This is not passive permission of access, but rather active integration of the management of traditional plant resources for Native Americans as a component of public lands management programs. Native American gathering sites would have land-use status equal to that of other land-use categories. In other words, this category would have its own research and management funding within each of the agencies that administer our public lands.
 5. The Society for Ecological Restoration (SER) has recognized that indigenous peoples need to be part of any serious efforts at restoring and preserving ecosystems. At the last SER international meeting, The Indigenous Peoples' Restoration Network (IPRN) was formed and is supported by the Society for Ecological Restoration. The mission statement of IPRN reads as follows:

The IPRN has two related central goals: to use the tools of ecological restoration to enhance the survival of indigenous peoples and cultures, and to incorporate the knowledge of these cultures into emerging models of ecosystem management. The IPRN aims to establish a mutually beneficial working relationship with traditional indigenous tribal and

community groups needing technical and financial assistance for land restoration, and to encourage the empowerment of grassroots community activities and leaders in local efforts to implement their own vision of sovereignty and ecological restoration within their unique cultural, social, economic, and spiritual traditions.⁷⁴

CONCLUSIONS

The extermination of biodiversity in California is happening simultaneously with the loss of Native cultural traditions. Some of this biodiversity has been maintained through centuries of land stewardship and the horticultural management of indigenous people. Today, conservation efforts are focused upon preserving islands of "pristine" vegetation, without recognizing that what these lands have been to a considerable extent were determined by what our forbears were, by how they chose to treat these places. Their cultures and systems of knowledge are as valuable as the plants, animals, and ecosystems that their knowledge and values were designed to protect and enhance. Restoration of California's plants, animals, and ecosystems is intimately tied to restoration of Native cultures.

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