Cows? In California? Rangelands and Livestock in the Golden State

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On the Ground

- Most of the livestock forage in California is produced in the Mediterranean climate zone, despite a long summer dry period.
- There are also cold desert steppe and warm desert zones, and montane range, and both fall- and spring-calving cattle herds.
- Leased land, public land, irrigated pasture, supplements, by-products, and feeds round out the annual forage calendar.
- The Mediterranean zone has been termed a "critically endangered eco-region" and a "global biodiversity hot spot."
- Grazing benefits some of our rarest rangeland species and finest landscapes, and diverse interest groups are cooperating to support ranching.

Keywords: annual grasslands, livestock production, prescribed grazing, diversity.

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Cows in Surprising Places: A California Round-Up Story

Setting out to conduct an interview for a research project, we met the rancher, our subject, outside a small ranchette in the foothill woodlands of the Sierra Nevada. There was not much time to communicate with him before we were simply assigned to our posts, stationed a few paces apart along a winding rural road, evidently to block or guide some creatures that were about to emerge from behind the house. Along with my students, a visitor from China was with us, and there is no telling how livestock are wrangled in the deserts of western China—she was looking for guidance, and looked kind of worried. In fact none of us knew what was going to transpire. Suddenly a group of cows and calves—about half a dozen—came trotting around the corner, gave us a skeptical look, and headed right for the loading chute. They knew the drill!

Afterwards, we found out that our "cattle boss" grazes his animals on more than 30 different leased bits and pieces of rangeland, including exurban backyards, moving them from one parcel to another as the grass runs out. He markets his grass-fed beef direct and in local grocery stores. Later we watched a sports utility vehicle drive on to the home ranch and pick up a beef purchase. The buyer seemed to enjoy the setting and the transaction as much as the product. This rancher is part of the fascinating, adaptive new generation that is pursuing rangeland production, and a decent living, in a transforming state. In this paper we offer an introduction to rangelands and livestock production in the "Golden State."

Hills of Gold and Green

California is known as the Golden State because of the Gold Rush, but also because the grasslands covering rolling hills and valleys around Sacramento and much of the state turn gold in late spring when the soil dries, and stay that way until late fall, when rainfall causes the annual grasses to germinate and grow. In the Mediterranean climate region of the state, deciduous and evergreen oaks, and patches of chaparral, reflect variations in soil, topography, and history (Figs. 1 and 2). Once actively managed by native Californians, in less than 300 years the California landscape has been "reengineered" by livestock grazing, cultivation, fire suppression, and the introduction of exotic species. The state has been referred to as a "critically endangered eco-region" because of habitat loss and conversion.[1] Ranch lands are increasingly important to diverse interest groups for habitat conservation. Rangeland managers strive to understand and work within this dynamic situation.

Grazing is California's most extensive land use. The state has more than 40 million ha of land, of which nearly 23 million ha can be considered rangeland.[2] Approximately 47% of these rangelands are owned by the federal government and another 12% by other public agencies. Three major livestock production zones can be defined based on climate: the Mediterranean zone, with cool, wet winters that support a fall–winter–spring growing season, and very dry summers; the cold desert zone, where elevations are greater than 1,000 m and sagebrush communities and pinyon–juniper woodlands are characteristic, and the growing season is late spring–sum-

Figure 1. The golden hills just east of the San Francisco Bay with oaks and chaparral.

mer; and the warm desert zone, where the Mojave and Sonoran deserts extend into the southeastern state, with warm temperatures year round and vegetation responding to periods of rainfall in any season (Figs. 2–4).

By some estimates more than 80% of the livestock forage is produced in the Mediterranean climate zone, from about 4.5 million ha of annual grass-dominated grasslands and 2.1 million ha of hardwood woodlands with an annual grassland understory[3,4] (Fig. 2). More than 80% of these lands are privately owned.[4] Highly variable rainfall means forage dry weight typically varies from 500 kg/ha to 3,000 kg/ha from year to year, but averages about 2,000 kg/ha. It is drier and warmer in the south; northern or higher-elevation areas are colder and wetter. The cold Pacific Ocean creates a cooler and moister climate near the coast. Heterogeneous soils, along with precipitation patterns, cause high spatial variation in forage production.

The scattered oaks typical of the region's hardwood woodlands create a moister microclimate and litter that can increase production, influence species composition, improve forage quality, and extend the period of green forage. If trees are too dense, they may be thinned, but a canopy cover of 50% or less does not tend to suppress forage. There is much literature on overstory–understory relationships, afforestation, and factors influencing oak regeneration and recruitment, including grazing.[5,6]

Calving and lambing is usually in fall to minimize the disadvantages of the long (5 months or more) dry season of the Mediterranean climate and take advantage of the mild winters and high quality and quantity of spring growth, but spring and winter calving is not uncommon. Supplemental feeds, selling of calves, irrigated pasture, leased pastures, and stock movements north and to higher elevations help cope with unpredictability and the summer dry period. Transhumance to the Sierra Nevada and northern mountains for summer forage began in the mid-19th century, when booming mining towns created a demand for meat that brought hordes of stock into the state. Grazing on government and leased private land is

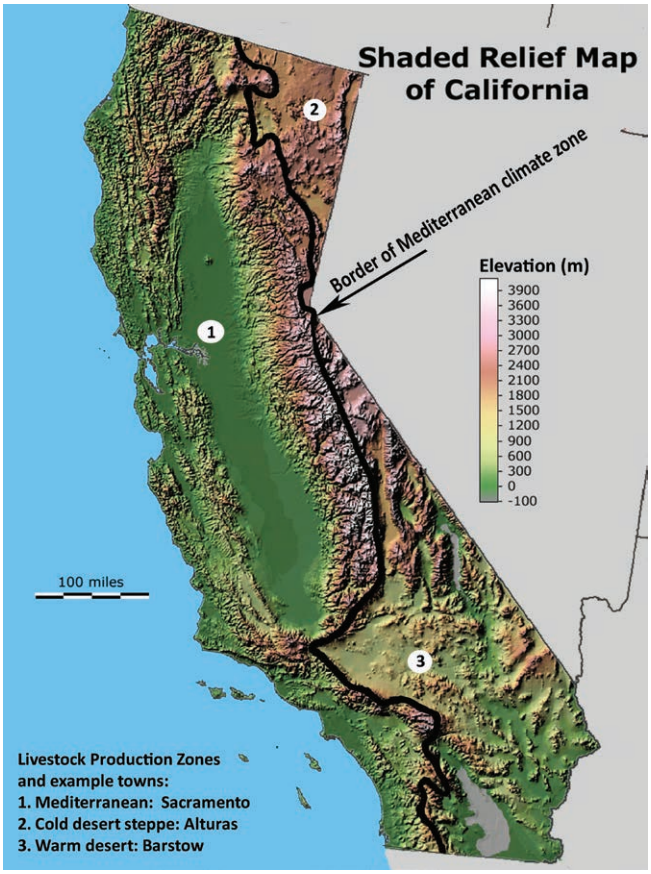

Figure 2. California relief map, modified from *The National Map.*[24]

common, with government land often around a third to half of the rangeland portfolio, though this is often comprised of a variety of nonfederal public ownerships.[7]

East of the Sierra and to the north, the cold desert steppe region extends from the Intermountain West into California, where livestock practices are more similar to those in Nevada (Figs. 2 and 4). Spring calving is common and more than 75% of the 2 million ha of sagebrush grasslands and pinyon–juniper woodlands are federally owned.[4] Summer grazing on Forest Service montane meadows and winter grazing on Bureau of Land Management (BLM) range complements private ground. In the warm desert region, the vast majority of the more than 9 million ha of desert range (Fig. 2) is federally owned,[4] and range is often grazed under BLM grazing permits using ephemeral forage, shrubs, and significant stands of native perennial grasses at higher elevations on suitable sites. In these two regions, dependence on federal lands for 7 months of grazing from spring through fall is common. Winters are classically spent on lowland meadow pastures or crop stubble with hay supplementation. On federal lands, grazing competes with management for recreation, wildlife conservation, water storage facilities, massive solar projects, and mining.

Livestock Production

In the Mediterranean climate zone, grazing using residue management is encouraged by public advisory agencies such

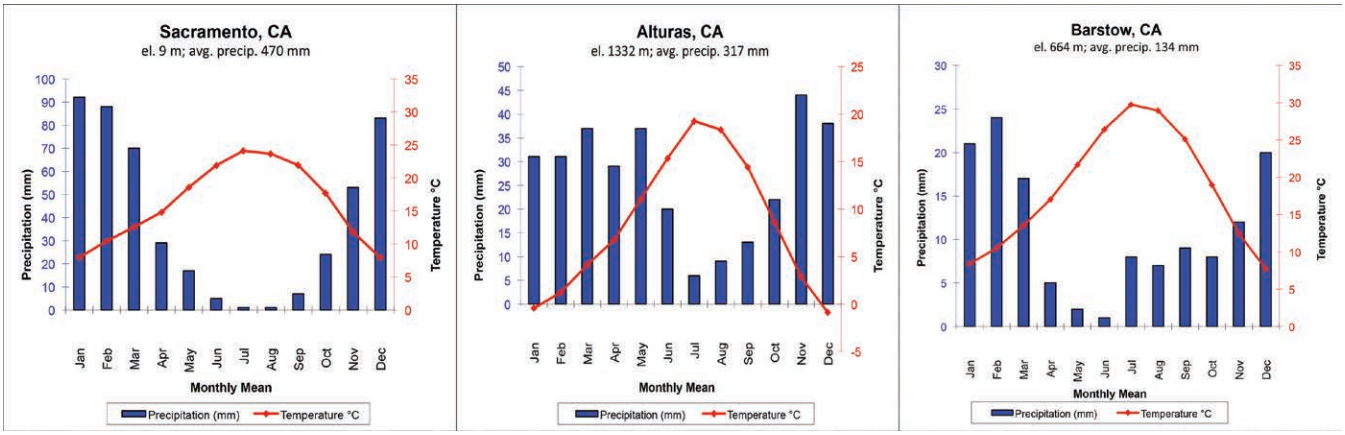

Figure 3. Climate graphs for towns typical of the three major livestock producing regions shown in Figure 2: Sacramento (Mediterranean), Alturas (cold desert steppe), and Barstow (warm desert). As you can see, in Sacramento temperatures are mild, even in February, and accompanied by rainfall that covers the hills in green grass and wildflowers.

as Cooperative Extension and the Natural Resources Conservation Service (NRCS); the goal is to leave behind a certain amount of ungrazed plant material, or residual dry matter at the end of the grazing season to protect the soils and encourage the growth of useful forage species by influencing germination conditions. Recommendations call for leaving 110–960 kg/ha depending on oak canopy cover and slope.[8] Management practices vary, including year-long, rotational, seasonal, and targeted grazing. Annual grasses germinate with fall rains, grow slowly through the cool wet winters, and increase in biomass and quality dramatically with warm temperatures in the spring, until the soil moisture runs out.

Livestock have been in California since 1769, with dramatic shifts in numbers through time. When markets driven by the 1849 Gold Rush collapsed with the departure of the miners, livestock populations boomed to 5 million sheep and 3 million beef cattle before drought and floods reduced the abandoned herds. Sheep numbers peaked for the last time during World War I at more than 3 million, and cattle in the 1970s at about 3 million.[9] There are typically around 2 million beef cattle outside of feedlots in the state in January including 730,000 beef cows and replacement heifers.[10] Spring-weaned calves that are not kept on the ranch are generally sold to other regions for additional grazing as stockers or to feedlots. Since feedlots are concentrated in the middle of the country, feeder calf prices tend to be suppressed by transportation costs.[11] Up to a million stockers graze in California, often purchased from other regions in the fall based on predicted rainfall, and grazed through the winter–spring growing period. Thousands of cattle are shipped from Hawaii to California each year for this purpose.

Although cattle are the most common type of livestock, Californians graze a variety of animals, including llamas, emus, range chickens, mules, donkeys, and, of course, horses (Fig. 5). California and Texas have the most sheep in the United States. In 2012, the state had 307,000 ewes, down from 770,000 in 1985.[12] The drop is attributed to low profits from competition with imported lamb, high labor costs, and a decline in lamb consumption. On rangelands, with wildlife protections, predators have increased, and with development, domestic dogs are a growing problem. Lambing is in late fall and spring.

About 140,000 goats resided in California in 2013, including 40,000 dairy animals.[12] Goats are used for meat, dairy, and vegetation management. Goats may be herded to control weeds and reduce fire hazard, often on steep hills where other brush control methods are expensive and difficult. Free-ranging pigs are rare, but the practice has undergone a recent revival for the gourmet market, with a few producers trying acorn-fed pigs.

Ranchers and Land Use Change

More than three-fourths of ranchers in the Mediterranean region live on their land and manage it themselves. On average, they have owned their properties for 39 years. In 2005, 25% of hardwood rangeland ranchers reported that the majority of household income came from ranching. About 22% cited off-ranch wages as a major income source, and another 22% earned most of their income from other forms of self-employment, including investments, pensions, and the like. Livestock producers may earn income through marketing oak trees as firewood and selling access to their land for hunting, but most work off-ranch to support their property.[13]

For the most part, California ranchers are enthusiastic about the amenities produced from the management of their properties, and aware that society values them, but at the same time, the ability to make a good income from livestock production is essential. Most ranchers acknowledge that "income maximization" in the conventional sense is not their goal. Instead, a financially sustainable operation that maximizes landowner autonomy in decision-making, provides a good place to raise a family, allows enjoyment of the natural environment, and is based on work with animals is more important. As in much of the West, land prices are consistently above those that can be justified by commercial production

Figure 4. Grazing land in Mediterranean zone annual grassland in southern California (top: R. Wenk), creosote bush range in the warm desert's Mojave (middle: J. Bartolome), and sagebrush on cold desert steppe in eastern California (bottom: L. Huntsinger).

value, reflecting the strong market for developable real estate, but also substantial landowner consumption of nonmarket benefits from the land.[14]

Figure 5. Though most rangeland livestock in California are cattle or sheep, llamas, emus, and even acorn-fed pigs are part of the scene. Shown are north coast oak woodlands.

Rangeland Ecosystem Services

Efforts to conserve and enhance rangeland ecosystem services in California are emerging at two scales: landscape and pasture, with a constellation of policies, practices, and research for each.[15] The "wide open spaces" of ranch landscapes are important aesthetically, and many other ecosystem services depend upon the extensive and undeveloped land. At the pasture scale, a number of studies have shown that livestock grazing has become a valuable tool for conserving native species. Programs that motivate landowners to manage for the joint production of livestock, and increased and multiple ecosystem services, can be a powerful approach to ecosystem conservation at both scales.

At the landscape scale, zoning is weak in response to the financial power of development interests. For many ranchers land appreciation is a long-term financial asset, planned for retirement and inheritance. Cash-short ranchers sell land to raise capital. Ranchers strongly defend their right to market their land as they see fit. The constant attrition and fragmentation of the resource base undercuts the long-term sustainability of ranching. There is strong competition for available grazing leases, augmented by the administrative withdrawal of millions of acres of federal lands from grazing, and the continued decline in numbers of stock allowed on federal lands. A study in the Sierra Nevada foothills showed that transhumant ranchers using Forest Service range are more affected by land use change than ranchers not practicing transhumance. Most have owned their land for a long time by US standards: 63% of transhumant foothill oak woodland ranchers reported that their families have owned their ranch for more than 100 years.[16] Loss of a permit to graze in the mountains can make associated private lands more vulnerable to development due to the reduction in the ranch's forage supply.

Conservation easements are a response to fragmentation and are now the most widely used private sector land conservation method in the United States. The 2010 Land Trust

Alliance survey reports that the amount of California land under conservation easements has increased by 34% since 2005, and doubled since 2000.[i] In exchange for tax benefits or outright payment, a landowner voluntarily agrees to a permanent deed restriction on the property title that prohibits development. Easements allow ranchers to continue ranching, while extracting some of the capital value of the land by voluntarily donating or selling the right to develop. Surveys of range and forest landowners in 2005 and 2008 found that approximately 6% had a conservation easement.[9,13] The California Rangeland Trust was spawned in 1998 by the community of ranchers active in conservation, and holds easements on more than 100,000 ha throughout the state, with nearly twice as much additional land on a waiting list for funding.[17] Other very active groups supporting working landscapes are The Nature Conservancy and the Central Coast Rangeland Coalition.

At the pasture scale, the role of grazing and rangelands in the production of ecosystem services that support biodiversity is now recognized.[15] In the San Francisco Bay region, half of the available habitat for the endangered California tiger salamander (*Ambystoma californiense*) is provided by stock ponds and improved with grazing.[15] Examples of other species that benefit from grazing are endangered bay checkerspot butterflies (*Euphydryas editha bayensis*), burrowing owls (*Athene cunicularia*), kit fox (*Vulpes macrotis mutica*), kangaroo rats (*Dipodomys stephensi*), wildflowers, and a host of rare flora and fauna associated with vernal pools.[15] In some cases grazing exclusion has caused the species being "protected" to leave or disappear. In a more complex case, more than half of the foothill habitat for the rare California black rail (*Lateralllus jamaicensis*) comes from leaky irrigation works associated with ranching, yet grazing must be carefully managed during the breeding season.[18] Trade-offs do occur: grazing reduced methane emissions from oak woodland seeps and springs, but was associated with a decline in insect species richness.[19]

One way to conserve the pasture and landscape is to increase ranch profits. Labelling programs are not well developed, although consumer interest is on the increase. Nongovernmental certification programs play a growing role in informing consumers of the ecosystem services associated with buying various products or brands. There are markets for some ecosystem services provided directly by livestock. Goat companies may charge $1,300/ha to graze for control of fire hazard and invasive weeds. On some public lands, lease costs are reduced for habitat improvement, but on the other hand, detailed and highly constraining grazing prescriptions may be required by the lessor.[20]

More than two-thirds of ranchers surveyed in California were receptive to the idea of being rewarded monetarily "to improve the quantity and/or quality of environmental benefits that their land provides to society," even though many were unfamiliar with the specific term "ecosystem services." The duration of their commitment, and the payment amount, were important factors in rancher willingness to participate in such payment for ecosystem services programs, with preference for shorter contracts and higher payments.[21] The kind of entity that would offer the payments was important to prospective sellers, with nonprofit organizations or private firms strongly preferred over state and federal agencies with regulatory or administrative authority over ranchers.

Federal cost-share programs, a form of payment for ecosystem services including habitat and environmental quality improvements, include the Wildlife Habitat Incentives Program (WHIP), Environmental Quality Incentives Program (EQIP), Conservation Security Program (CSP), and Grassland Reserve Program (GRP). In 2012, EQIP paid $117 million, CSP paid $8 million, GRP paid $0.3 million, and WHIP paid $0.6 million for conservation projects on California farms and ranches. In addition, the US Department of Agriculture NRCS spent $42.6 million on technical assistance in California in 2012.[9] The NRCS spent another $5.4 million on conservation practices in California between 2005 and 2009, including brush management, prescribed grazing, and upland wildlife habitat.[22]

Provision of wildlife habitat was the service that ranchers in California would prefer to market or be rewarded for producing, and they already report such management, but there was considerable willingness to restore native plants, improve water quality, and increase carbon storage.[13, 21] Ranchers were slightly less interested in increasing oak numbers, perhaps because most are familiar with the difficulties involved and may feel too many oaks will interfere with forage production.[21] Increasing woody plants is one possible way to increase carbon storage but it increases water consumption and fire risk. A research project known as "The Marin Carbon Project"[ii] has had success increasing rates of carbon sequestration for years on Mediterranean zone grasslands after a one-time 13-mm compost application.[23]

For landowners, many of the nonmarket ecosystem services they seek from their land, like natural beauty and rural life, can be satisfied with a small property.[14] On the other hand, commercial values from livestock production and other natural resource products increase with property size. Combining these two "valuations" is the basis of the "working landscapes" effort in California to encourage joint production of commercial and noncommercial ecosystem goods and services in order to create sustainable rangeland enterprises.

Conclusions: The California Rangeland Resolution and Conservation Coalition

California has the fourth largest cattle inventory in the United States. Grazing occurs on diverse rangelands with a unique flora. The many synergistic opportunities to enhance

[i] http://www.landtrustalliance.org/land-trusts/land-trust-census

[ii] http://www.marincarbonproject.org

and maintain wildlife habitat and other ecosystem services of all sorts, conserve beautiful landscapes, and produce food have led to notable collaborative efforts. In 2005, a variety of agricultural organizations, environmental groups, and federal, state, and local land management agencies drafted and signed the California Rangeland Resolution[7] and initiated the California Rangeland Conservation Coalition. The resolution states that private rangelands "and the species that rely on these habitats, largely persist today due to the positive and experienced grazing and other land stewardship practices of the ranchers that have owned and managed these lands and are committed to a healthy future for their working landscapes."[iii] The resolution has now been signed by over 100 groups, and others continue to sign on regularly. Every year hundreds of livestock producers, environmentalists, researchers, and agency personnel gather for a symposium on California rangeland conservation—and the audience grows every year. The coalition has created a map of high-priority areas for wildlife and plant conservation in the state, defining rangeland areas that should be protected from development.[iv] Obviously people from all walks of life think California's working landscapes are a treasure we owe to future generations.

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[iii] http://www.carangeland.org/images/10-07_Rangeland_Resolution.pdf
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