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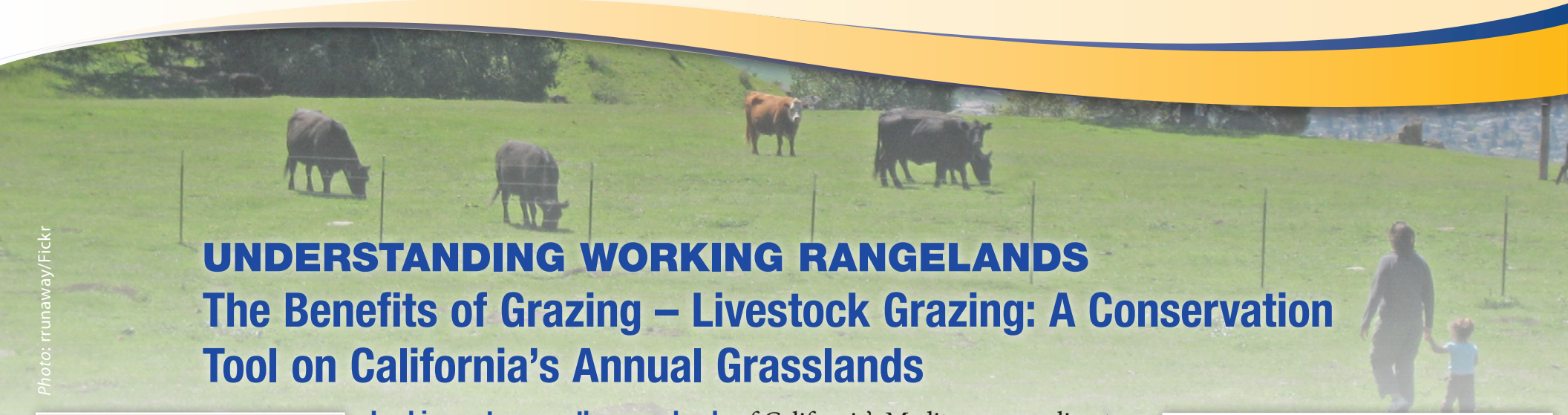

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UNDERSTANDING WORKING RANGELANDS

The Benefits of Grazing – Livestock Grazing: A Conservation Tool on California's Annual Grasslands

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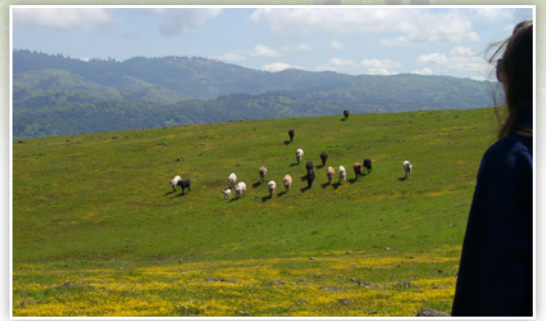
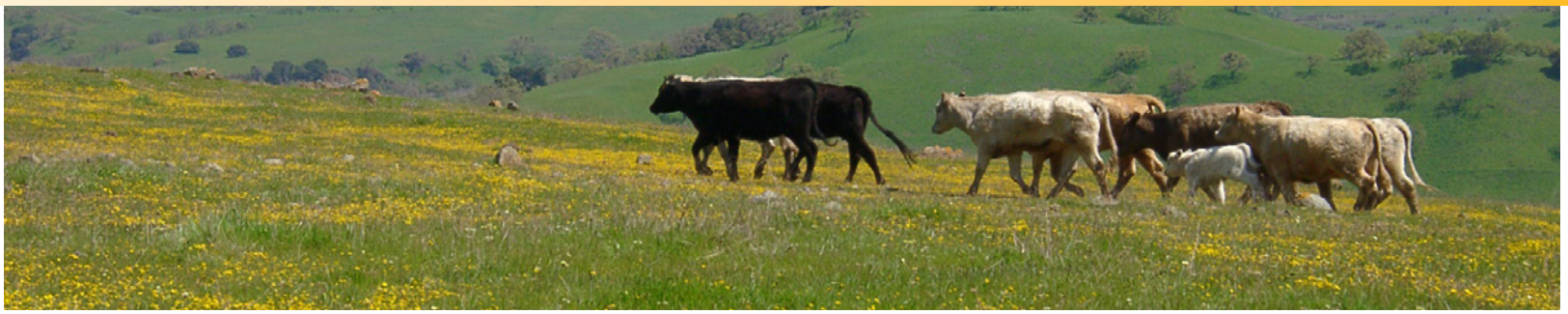
Looking out across the grasslands of California's Mediterranean climate zone, most of the plants you see are non-native annuals brought here from Europe and Asia. These include grasses, such as wild oats (*Avena* spp.) and soft chess (*Bromus hordeaceus mollis*) as well as forbs such as filarees (*Erodium* spp.) and black mustard (*Brassica nigra*). When left unmanaged, these non-native grasses and forbs can grow profusely in normal and above-normal precipitation years, degrading habitat conditions for some native plants and animals and increasing the risks of wildfire and pest plant infestations. California's Mediterranean-type grasslands are recognized among the world's "hot spots" of native biodiversity, despite being generally dominated by non-native species (Bartolome et al. 2014). An appreciation of this paradox and how it came to be can help conservation biologists, environmental regulators, agency managers, recreationists, and ranchers communicate more clearly about how to best manage California rangelands for the purposes of conservation.



Cattle grazing in the Bay checkerspot butterfly habitat at Coyote Ridge, south of San Jose, California. *Photo: Sheila Barry*

Working rangelands are open space lands that are managed with livestock grazing and rancher stewardship. Their management contributes to a variety of ecosystem services including food production, clean water, weed control, wildlife habitat maintenance and creation, fire fuel reduction, carbon sequestration, pollination services, and open space conservation.



Livestock grazing is the most effective, efficient way to manage California's grasslands on a landscape scale, particularly when the land is being managed with conservation objectives in mind (Huntsinger et al. 2007). Livestock grazing is proving both a useful buffer against development (and, therefore, against loss or fragmentation of habitat) and a practical way to enhance native biodiversity (Bartolome et al. 2014). Grassland management, and specifically efforts to control the mass, height, and cover of non-native herbaceous vegetation, is essential for the maintenance of habitat for many of California's native plants and animals, including many that are listed as threatened and endangered. In addition, grassland management that incorporates livestock grazing can reduce the encroachment of shrubs and trees, the accompanying increases in wildfire fuel (Russell and McBride 2003), and the loss of open grassland habitat (Ford and Hayes 2007).

The story of how the grazing of livestock became a conservation tool for California's grasslands is a story of invasion, change, and management of that change.

Invasion: The Introduction of Non-Native Plants

Beginning in the late 1700s with the arrival of domestic livestock and growth of a ranching industry in California, non-native grasses and forbs (mostly from the Mediterranean Basin) spread throughout our coastal prairies, foothills, and valleys (Burcham 1957). Although some of the non-native plant species may have arrived a century or more earlier, brought ashore by seafaring explorers who carried livestock and feed in their ships, most of the non-native annual grasses and forbs were introduced by Franciscan missionaries. Wild oats and other plants with value as livestock forage may have been intentionally introduced, while plants like red brome (*Bromus madritensis* subsp. *rubens*) and ripgut brome (*Bromus diandrus*) were likely introduced by accident in weedy hay or packing material. Historical written reports of the introduction and expansion of non-native species are scarce, but bricks in Spanish missions provide some initial information about their appearance and spread. The presence of seeds from several non-native plants such as filaree, cheeseweed (*Malva parviflora*), and wall barley (*Hordeum murinum*) in the bricks used to construct the first Franciscan mission provide evidence that these non-native plants were present in California before European settlement began in 1769. The increasing number of non-native seeds appearing in bricks as more missions were built indicates that the vast majority of non-native species invaded and spread in the late 18th and early 19th centuries (Hendry 1931).

The Change: Non-Natives Displace Native Plants

Over the past 250 years or more, non-native plant species have become more abundant than natives across California's Mediterranean-type grasslands. Although the increasing dominance of non-natives and the accompanying decline in native grassland plants have been attributed to uncontrolled livestock grazing, several other factors have played important roles in the conversion, factors such as tillage for crops (and other soil tillage), fire suppression, the elimination of land management techniques historically used by indigenous peoples, climate change, and competition from non-native species. Some researchers have concluded that non-native, annual grasses are so competitively superior that they had the capacity to displace native grasses solely through competition and their greater rates of seed production (Heady 1977; Bartolome and Gemmill

1981; Murphy and Ehrlich 1989). Regardless of which factors were responsible for the decline of native-dominated grassland, today native species make up only a minor component of the grassland flora (less than 1% of standing grassland vegetation) in most regions of the state.

Managing Change: How Grazing Benefits California's Grasslands

The non-native annual grasses and forbs that dominate much of the state's grasslands can produce huge amounts of biomass each year. In a normal rainfall year, many of California's annual grasslands will produce more than 2 tons of grass per acre. Unless this biomass is reduced by fire, grazing, or mowing, it can accumulate for a year or more until it decays. Non-native annuals such as Italian rye grass (*Festuca perennis*) and ripgut brome can produce a thick layer of thatch or mulch. This thatch eliminates growing space for native plants as well as habitat for some native animals. Many of the benefits to grasslands from grazing occur when livestock manage the changed grassland by consuming non-native annual plants. One cow (1 *animal unit*) will consume approximately 27 pounds (dry weight) of forage per day, or almost 5 tons of forage per year.

In addition to eating the non-native plants, livestock can also benefit grasslands by trampling the plants and making trails. Many of our grasslands are also susceptible to invasion by woody plants. While trees and shrubs do provide habitat for many species, it is important to maintain sufficient grasslands because of the many species that depend on them for habitat. Livestock trampling can limit the invasion of shrubs, thus maintaining a grassland and its associated species and reducing potential fuel for wildfires.

Specific Benefits (Ecosystem Services) of Grazing

Ecosystem services are the benefits to environmental and human health that derive from nature and managing nature. Some examples of ecosystem services that result from grazing in the San Francisco Bay Area are described in the following paragraphs.

Reducing Fuel for Fires

Ungrazed grasslands pose a greater fire risk than grazed grasslands for two main reasons (Russell and McBride 2003). First, non-native grassland plants produce high levels of fine fuels, which are very flammable. Wildfire can move through stands of these plants very rapidly and carry fire to woody fuels. Second, the shrubs that invade ungrazed lands burn hotter and longer than grass in grazed grasslands. The removal of grazing has increased shrub cover in grasslands, causing "a general increase in fire hazard within the open spaces of the San Francisco Bay Area" (Russell and McBride 2003). Livestock grazing can play the beneficial role otherwise allotted to prescribed fire or wildfire, managing vegetation where fire is inappropriate and livestock grazing does not conflict with other resource management objectives. Grazing reduces fire fuels as the animals consume shrubs and non-native grasses and trample plants with their hooves (Nader et al. 2007). Grazing at conventional levels also alters wildfire behavior, although it does not significantly reduce the risk of fire ignition and spread (Stechman 1983).

Reducing Impacts of Nitrogen Deposition

Nitrogen from automobile exhaust and other atmospheric sources has been associated with the increased presence of non-native grasses in some Bay Area grasslands, and the consequent threat to native species. Grasses can store excess nitrogen and grazing cattle will select grasses over wildflowers. By consuming grasses, grazing livestock can help reduce the accumulation of nitrogen in grasslands and increase opportunities for native wildflowers to grow. The reintroduction of cattle grazing has allowed native plant and animal populations to recover in grasslands that had been threatened by atmospheric nitrogen deposition (Weiss 1999).

Maintaining Habitat for Grassland Birds

Grassland birds require a grassland environment for breeding and foraging. Livestock grazing has been found effective for maintaining habitat for grassland birds such as the grasshopper sparrow (*Ammodramus savannarum*) and savannah sparrow

Bay checkerspot butterfly, Coyote Ridge, Santa Clara County, California. *Photo: KQED Quest/Flickr*

(*Passerculus sandwichensis*). Two coastal sites in Sonoma County were compared: one that was grazed (Jenner Headlands Preserve) and one that was not grazed (Sonoma Coast State Park). The grazed site had more grassland birds overall as well as more species of grassland birds. This difference is thought to relate to the greater abundance of shrubs and thatch, which do not provide the types of habitat that some grassland birds need, on the ungrazed site (DiGaudio 2010). In a study of valley grassland and oak woodland matrix, grassland birds responded to grassland size and surrounding land uses as well as smaller-scale grazing effects (Rao et al. 2008). Larger patches of open grassland support a more species-rich, abundant grassland bird community.

Promoting Food and Nectar for Butterflies

Some butterflies require small native forbs for larval food and nectar. These forbs are less abundant where non-native annual grasses and forbs dominate, and cattle grazing helps increase native forb populations because the cattle prefer the non-natives as forage. By consuming the non-native plants, cattle let the butterfly-supporting native forbs grow. Grazing has indirectly increased populations of four Bay Area butterfly species that are federally endangered or threatened, including San Bruno elfin butterfly (*Callophrys mossii bayensis*), Mission blue butterfly (*Icaricia icarioides missionensis*), Callippe silverspot butterfly (*Speyeria callippe callippe*), and the Bay checkerspot (*Euphydryas editha bayensis*) (US Fish and Wildlife Service 2009).

Maintaining Habitat for Small Mammals

Small mammals such as the California ground squirrel (*Otospermophilus beecheyi*) and the San Joaquin kit fox (*Vulpes macrotis mutica*) avoid areas with heavy thatch from non-native plants. They prefer grazed grasslands, where they can more easily see their prey and avoid being preyed upon by larger mammals such as coyotes. Grazing by cattle has been identified as the most feasible and economical strategy to manage habitat at the landscape scale for the San Joaquin kit fox, an endangered species that lives in Central Valley and Bay Area grasslands (Constable et al. 2009).

Maintaining Habitat for Amphibians

Native amphibians also struggle when there is too much vegetation in their aquatic habitat.

California red-legged frog. The California red-legged frog (*Rana draytonii*) needs breeding sites (ponds and streams) with a mix of open surface water and vegetated cover (Hayes and Jennings 1988). Vegetation allows these frogs to hide from predators such as bullfrogs and provides a place where they can attach their eggs; however, too much vegetation will shade pools, cooling the water and discouraging breeding. Cattle grazing around at least parts of frog breeding ponds can help maintain a mix of open water and vegetative cover. During the dry season, the frogs seek refuge in damp holes, crack, piles of litter, brambles of low shrubs, and small mammal burrows. While researchers have tracked the frogs traversing most terrain and vegetation, they may have difficulty moving if the vegetation close to the ground around their breeding waters is too dense and tall (Ford et al. 2013).

California tiger salamander. Managed livestock grazing is thought to benefit the habitat for California tiger salamander (*Ambystoma californiense*). Some Bay Area populations of these salamanders depend on ground squirrel burrows for refuge sites. Livestock grazing keeps vegetation low, making the grasslands

California tiger salamander. *Photo: Adam Clause/USFWS*

more suitable for California ground squirrels (USFWS 2003). Salamanders that inhabit vernal pools may also benefit from grazing. These ephemeral pools are wet only during the winter-spring rainy season, and too much vegetation in and around their edges can cause drying pools to lose depth too quickly. Because it reduces this vegetation, grazing can keep the pools wet longer, giving salamander larvae more time to grow up (USFWS 2004).

Creating Opportunities for Native Plants

Grazing of non-native vegetation is essential to creating opportunities for many native grassland plants. For example, there is only a single remaining natural population of the federally endangered Sonoma spineflower (*Chorizanthe valida*), and it declined dramatically after livestock were removed from its habitat area (Davis and Sherman 1992). Similarly, populations of the federally endangered Contra Costa goldfields (*Lasthenia conjugans*) and Santa Cruz tarplant (*Holocarpha macradenia*) plummeted and died out when grazing was removed from their habitats (USFWS 2005; Hayes 1998).

Conclusions

With the arrival of the Spanish missionaries, California's grasslands changed dramatically. They became dominated by non-native annual plants, mostly from the grasslands of the Mediterranean Basin. Despite the general replacement of native plants by these non-natives, enough native species have survived to prompt global recognition of our grasslands as hot spots of biodiversity. Because livestock grazing (primarily by cattle) can effectively reduce the biomass, height, and thatch accumulation produced by non-native annual plants, it has become an essential tool for managing California's grasslands. Grazing has been shown to benefit California's annual grasslands in many ways—by reducing the risk of a catastrophic wildfire, maintaining and enhancing habitat for many native grassland plants and animals, and maintaining the open character of our iconic grasslands and oak savannas. Grazing can be managed to target specific habitats, pest plants, fire hazards, and encroaching shrubs. Ranchers should be encouraged to continue their sustainable livestock production practices and their long history of good stewardship. In addition, they should be compensated for implementing other conservation services on rangelands. Nonetheless, potential and real impacts of grazing are recognized (such as historical damage to riparian areas). A good grazing management plan should be developed and followed to minimize such impacts while maximizing the benefits described in this publication.

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