Protecting Biodiversity on Grazed Grasslands in California

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Introduction

California annual grasslands are found in wide-open expanses, as well as interspersed in many of California's vegetation types. They are best represented in portions of the Great Central Valley, the Sierra and Cascade foothills, the Coast Range, and the Transverse Range. Annual grasslands represent a huge portion of the undeveloped California landscape supplying tens of millions of California residents with open space, clean water, recreation, beef and wool. They are also important contributors to California's biodiversity providing an ecosystem composed of plants and animals adapted to frequent fires, summer drought, little shade, and intense herbivory. Kuchler's (1964) map of the potential natural vegetation of the U.S. shows 5.35 million hectares of grassland in the Central Valley and surrounding foothill ranges, and an additional 3.87 million hectares with an oak overstory.

Early references to the composition of California grasslands are sketchy as best. The first accounts simply describe it as excellent pasture (Heady 1988). Most scientists concur, however, that a large percentage of the original upland valley grassland was composed of perennial grass species, especially purple needle grass (*Nassella pulchra*). Early writings

also indicate that the original grasslands were rich in native wildflowers that most likely occurred in the spaces between bunch grasses. In April 1868, John Muir wrote of the Santa Clara Valley, "the hills were so covered with flowers that they seem to be painted" (Adams and Muir 1948). On the same trip Muir referred to the Central Valley as a "garden of yellow Compositae" (Heady 1988).

Grasslands provide society many benefits. The most obvious products, such as meat, are easily valued in familiar currency. Other products, such as clean water, open space, and biodiversity, are more difficult to value monetarily. Yet it is these "environmental services" that are becoming important in the discussion regarding the future of our remaining grasslands.

Threats to grasslands

To date the greatest threat to grasslands is outright conversion to other land uses. Nearly all of the grasslands in our Central Valley were lost to cultivation near the turn of the century, and as of 1987 only 1% of the Valley grassland remained. The current large expanses of grassland almost exclusively reside in large private ranches in foothill regions and many of these ranches are now in the process of being subdivided. The reasons for the demise of these ranches include housing development, poor returns in the cattle market and subsequent conversion to other land uses such as vineyards. Some ranches are being broken up because California tax laws make ingenerational transfer prohibitively expensive.

The spread of non-native species also threatens the diversity of California grasslands as the abundance of these weeds has increased dramatically. The grasslands we observe today are only a shadow of their former selves, having been invaded by annual grasses from Europe and other Mediterranean climates. Some of theses species, such as wild oats and bromes, are so well established in today's grassland that they are considered naturalized. With careful management the percentage of these species can be decreased in favor of natives, but it is unlikely that they can ever be eradicated. Grasslands with the highest native species composition are now found in areas where annual grasses are least successful, such as vernal pools, serpentine soils, and rocky landscapes.

Most troublesome to biodiversity are newer weed arrivals such as star thistle (*Centaurea solstitialis*), medusa head (*Taeniatherum caputmedusae*) and goatgrass (*Aegilops triuncialis*). These species threaten to eliminate the remaining native species and because they are not desirable forage, livestock production is decreased. It is critical that we begin to make significant progress on stabilizing grassland weeds. If current trends continue it is entirely possible that conservationists could expend huge sums of money protecting ranches from development and still loose them to introduced weeds.

Biodiversity and livestock grazing

After painting such a bleak picture of the condition of California grasslands many people are surprised that our remaining grassland are so extensive and biologically diverse. To be inspired one need only to drive through our coastal and Sierran foothills during a wet spring to view the spectacular wildflower displays. In addition to wildflowers, there are

many animals that are specialized to life in grasslands. Some of those animals, such as black-tailed hare (*Lepus californicus*), Beechey ground squirrels (*Otospermophilus beecheyi),* and burrowing owls (*Athene cunicularia*) are visible to the casual viewer. Many others, such as San Joaquin kit foxes (*Vulpes macrotis*) and California tiger salamanders (*Ambystoma tigrinum ssp. Californiense*), are best viewed with a spotlight at night.

Research from grassland sites as varied as South Africa and our mid-west indicate that grasslands are dynamic systems influenced by natural disturbance regimes (Collins 1985, McNaughton 1994). Among the best-understood disturbance regimes effecting grasslands are fire and grazing. Both of these natural disturbances are patchy, reduce the standing biomass of vegetation, and occur on varying scales. Each temporarily effects the balance between organisms competing for space, light, water, and nutrients. Research in mixed-grass prairie (Scott and Barber 1987) shows that if grasslands are subjected to moderate levels of multiple disturbances they contain greater biodiversity (Figure 1). In other words, grasslands that are protected from fire and grazing eventually lose species.

Examples of grasslands being degraded by the removal of grazing and fire are numerous both in the literature and in practice. In a study of a rare population of the Sonoma spine flower (*Chorizananthe valida*), Liam and Sherman 1992, found that the population dramatically declined when protected from livestock. On the other hand, it appears clear that grasslands that are periodically grazed and burned have fewer weed species and greater abundance of natives (Kan 1998).

The fact that properly managed livestock grazing and biodiversity can be mutually compatible is significant. Livestock grazing not only becomes another tool that can be used against the threat of weed species, it adds an important strategy for conserving large grassland landscapes.

The Jepson Prairie Experience

Jepsen Prairie, located 12 miles south of Dixon, California, is an outstanding example of native Central Valley grassland. It is an especially diverse landscape of purple needlegrass (*Nassella pulchra*) grassland and vernal pool communities. At last count the Preserve had 212 species of plants belonging to 45 families. The preserve is habitat for many extremely rare plants and is one of only two known locations for Solano grass (*Tuctoria mucronata*). It is also home to many rare and interesting animals, such as the California tiger salamander, and the only known population of delta green ground beetle (*Elaphrus viridis*). The Nature Conservancy recognized the importance of Jepsen and purchased it in December 1980.

Management of the Prairie has been controversial from the time of its initial purchase by TNC. The Prairie had a long history of agricultural use. The Hamilton family had operated a sheep operation there for over 100 years. When TNC contemplated removing sheep, the family quickly pointed that they saw no need for change since the native species we were most interested in protecting still existed under their long-term livestock management. Yet some people in the environmentalist community argued that TNC was

advocating grazing because of political pressure from the locals and a desire for rent income. Tempers flared, emotional letters were written, and the agricultural and conservation communities were further distanced.

TNC temporally eased the friction caused by livestock on the Prairie by excluding a portion of the Preserve from sheep. This area, known as the Docent Pasture, became the focus for public visitation and included a self guided nature trail. TNC also began to engage the University of California in grazing research, and in 1987 funded a study to investigate further the effect of grazing and fire on the Prairie grasslands. Over a period of about 5 years it became clear to all involved with the Prairie that without fire and grazing the Docent Pasture was being invaded by weeds, and that biodiversity was indeed decreasing. The nature trail beame infested with yellow star thistle, prickly lettuce (*Lactuca serriola*), and medusa head. The beautiful spring wildflower displays that still occurred on the sheep-grazed pastures were no longer found on the "protected" land.

Research at U.C. lead by John Menke and later by Kevin Rice and their students began to shed light on the mechanisms that caused a decline in biodiversity in the Docent Pasture. A major factor was competition with the introduced annual grasses and especially the effect of the buildup of annual grass mulch. Without grazing and fire the leftover standing production of previous years' grass production was left matted on the ground, leaving the native California species an environment where germination conditions were poor. Even worse, weed species were encouraged by these conditions.

Weeds quickly became the common focus of both biodiversity and livestock interests at the Prairie, and therefore formed the foundation of a management plan. The plan was developed in a team atmosphere with input from a broad group of stakeholders including The Nature Conservancy, U.C. Davis, Solano County Farmlands and Open Space Foundation, Hamilton Brothers Livestock, U.S.F.S. Pacific Southwest Research Station, California Department of Fish and Game, and the Jepson Prairie Docents. Such a broad base of involvement led to a very holistic set of planning goals and a greater appreciation from all involved as to the complexities of managing the prairie.

The plan focuses on biodiversity objectives while recognizing the need to keep the sheep operation as profitable as possible. It lays out a clear set of objectives, a grazing and burning schedule for each pasture, and a monitoring protocol. The plan recognizes the need for flexible grazing schedules as weather patterns change and different weeds wax and wane. One of the first actions under the plan was to reduce grazing to increase the fuel load in a pasture infested by medusa head, and then to burn the pasture in the early spring. Oren Pollak and Tamara Kahn of TNC studied the effect of the fire and found a 100% reduction of medusa head in the first year. By the 3rd year the weed had regained some ground, but was still reduced to below the pre-burn levels (Kan 1998).

One point that should not be overlooked from our experience managing Jepson Prairie is the importance of working with local knowledge. From the Hamiltons we learned management tricks it would have taken years to learn on our own. Specifically their local knowledge regarding the diets and behavior of sheep proved invaluable. They knew from

years of experience at the Prairie which season sheep would select specific weeds. Rip-gut brome (*Bromus diandrus*), for example, would have to be targeted early in the year since sheep rarely eat it after its 3-leaf stage. The Hamiltons also understood sheep behavior. When we became concerned that sheep would impact rare plants in vernal pools, we learned that sheep really do not like to get their feet wet. They would avoid vernal pools if we waited until the pools were full of water before putting the sheep out.

A workable plan also needed to consider sheep/public interactions. Having sheep in the pastures during high visitation periods proved to be problematic. We had weathered several wildflower seasons of fiery letters, condemning both the sheep and The Nature Conservancy's management of the Preserve. A solution was found by considering the need to concentrate and rotate livestock during the spring season. Working with the Hamiltons we developed a spring schedule that assigned wildflower-viewing pastures to be grazed from Monday through Thursday. Sheep were then concentrated on a back pasture during the high visitation weekends.

The Jepson Prairie experience convinced TNC that working closely with livestock operators could be to the advantage of both. Our view of the livestock producer thus changed from that of resource consumer to that of a resource steward.

Landscape Scale Conservation Strategies on Grazed Grasslands

TNC recently completed an analysis that indicates that the remaining grasslands in California's Coast Ranges, Central Valley, and Sierra Foothill regions are mostly on

large, privately owned ranches. It is becoming increasingly clear that saving grassland biodiversity will require protecting large private ranches from being broken up and sold off to subdivisions or other land uses. The need to work on a very large scale is especially evident when one considers the conservation of large native mammals such as elk and mountain lions.

The Nature Conservancy has developed a systematic approach to identifying and protecting threatened natural communities. In the case of grasslands, the first step is a recognizance level study that identifies portfolios of high quality grasslands that if protected could preserve the natural community into the future. At least 3 examples of sufficient size are selected for the portfolio. Once the properties are identified, a team of scientists and planners identify the major ecological systems, land tenure, and connectivity to other large protected areas. They then determine a minimum project size to assure the continued management of fire and grazing.

After identifying the treats to a portfolio site, the team attempts to isolate the sources of those threats. Most threats have more than one source. For example, if the threat is subdivision, one source might be due to a landowners financial debt with no ability to reap income except from the highly volatile and cyclic livestock market. A second threat might be related to intergenerational transfer taxes. An effective conservation solution must then be a strategy that helps a landowner reduce debt and one that allows transfer of the land to their children.

One of the most promising conservation tools being used today by TNC and others is the purchase of conservation real-estate easements from private landowners. The purchase of easements enables a conservation group to identify, value, and purchase certain rights to a property. These rights are permanently removed from the property deed. For example, the right to subdivide a property, or the right to convert the property to intensive cropping, can be striped from a property deed. Conservation easements are promising in that they can be written to address specific threats unique to a property, while allowing the owner to continue income-producing activities such as ranching and hunting.

Conclusion

It is evident that the long term interests of organizations concerned with protecting biodiversity and those making a living raising livestock are not mutually exclusive. The Nature Conservancy has successfully owned and held conservation easements on livestock grazed grasslands for nearly 20 years. In 1999, TNC will purchase conservation easements on over 100 square miles of grazed grasslands.

TNC is working to help new land trusts become established. In 1997, TNC donated Jepson Prairie Preserve to the Solano County Farmlands and Open Space Foundation along with a stewardship endowment to fund ongoing management. One of the most promising new organizations is California Cattleman's Association Rangeland Trust. Ranchers are realizing that the purchase of conservation easements is a way of placing monitory value on the environmental services their properties provide to society. Perhaps most important, the recognition of the value of these environmental services can form the

catalysis for "environmentalists " and ranchers to creatively work together to protect large ranching landscapes in perpetuity. Long live the great wide open.

Literature Cited

Adams, A. J. Muir. 1948. Yosemite and the Sierra Nevada. Houghton Mifflin, Boston. 130 p.

Collins, L.C. & S. C. Barber, 1985. Effect of disturbance on diversity in mixed-grass prairie. Dr W Junk Publishers. Vegetatio 64, 87-94.

Davis, L.H. & R.J. Sherman, 1992. Ecological study of the rare *Chorizizanthe Valida* (Polygonaceae) at Point Reyes National Seashore, California. Madrono, Vol 39, No.4 pp 271-280.

Heady H.F, 1988. Valley Grassland. In: Barbour and Major, Terrestrial Vegetation of California. California Native Plant Society.

Kan, T. 1998. The Nature Conservancy's approach to weed control. Fremontia, California Native Plant Society. Vol. 26, No.4. pp44-48.

Kuchler, H., 1964. Potential natural vegetation of the conterminous United States. Amer. George. Soc. Spec. Pub. 36.

McNaughton. S.J. 1994. Biodiversity and function of grazing ecosystems, in *Biodiversity and ecosystem Function* (Schulze, E-D & Mooney, H.A. eds), Springer-Verlag. pp 361-405.

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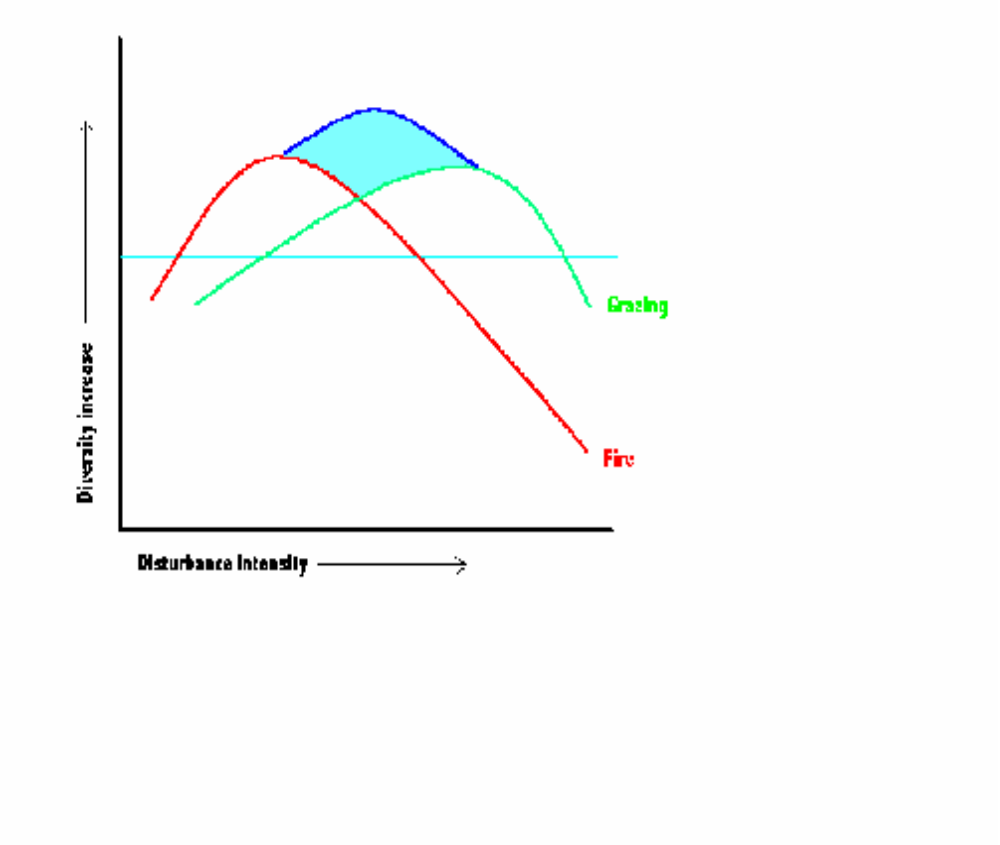

Figure 1. A generalized model showing the relationship between disturbance and diverstiy in grasslands. The area that is shaded represents the increase in diversity when both grazing and fire are represented on the landscape.