

Monitoring Natural Resources on Rangeland Conservation Easements

Who's minding the easement?

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Introduction

Conservation easements are quickly becoming one of the most popular tools for conserving working landscapes in the United States.¹ Easements held by local and state land trusts increased from 2.5 million acres in 2000 to 6.2 million acres as of 2005 with many on western rangelands.² Recent scrutiny of conservation easements by the media, Congress, and the Internal Revenue Service has increased the focus on how conservation easements should be monitored to ensure that they are protecting natural resources over time.^{3,4} Conservation easements are land use agreements individually negotiated by a

landowner and a nonprofit land trust or government agency in which a landowner agrees to restrictions on land use, often in exchange for a direct payment or tax reduction. The land trust or agency then becomes the holder of the easement. Conservation easements have a variety of purposes, and many share the goal of protecting natural resources from development and degradation.

Monitoring has been much studied and discussed as it relates to rangeland management on public land,⁵ but here we focus on monitoring for land trust conservation efforts on private lands, an expanding and new area for rangeland management. Land trusts usually conduct annual "compliance" monitoring of the conservation easements they hold. Compliance monitoring of easement properties is monitoring to see if the easement is being stewarded as agreed in the terms

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Left to right: Plant monitoring transect in blue oak woodlands; monitoring a conservation easement; Mount Shasta; a blue oak; yellow star-tulip, *Calochortus monophyllus*; and cow-calf pair on Dye Creek Preserve in foothills.

and objectives of the easement. However, some organizations are going beyond this to documenting abundance, composition, and long-term changes in plants, animals, or water resources on easement properties. This additional monitoring of natural resources, sometimes called ecological monitoring, can provide important information on ecological status and trends and can be part of an assessment of the effectiveness of easements as a conservation strategy. It can be done if it is stipulated in the easement or if the landowner gives permission and can even be a collaborative effort. Landowners may benefit from monitoring and research on their ranches through better understanding of changes in plant communities and forage over time and through building relationships with nonprofit organizations that can bring resources and funding to land management issues such as invasive species control.

We were interested in learning what types of compliance and “beyond compliance” natural resource monitoring occurs on rangelands with conservation easements. Since compliance monitoring is based on the terms of the easement, we collected data on easement stipulations for ranch properties. We then interviewed land trust staff and natural resource professionals involved in monitoring easements to find out what types of natural resource monitoring they do. We focused on California easements created by The Nature Conservancy (TNC), the largest nonprofit easement holder in the United States. The primary mission of TNC is the protection of biodiversity.

We were also interested in asking what lessons can be learned about natural resource monitoring from a 2-year “beyond compliance” monitoring effort on conservation easements in the Lassen foothills of northern California. We rely on this example of easement monitoring to provide recommendations for sampling native and invasive plant composition.

Compliance Monitoring

Most ranch easements in California restrict subdivision, building, mining, and conversion to intensive agriculture. Some allow for a few additional homesites, outbuildings, and roads. Monitoring compliance with these restrictions typically requires annual visits by a land trust or government representative who observes the property and may meet with the landowner. TNC uses compliance monitoring report forms that contain a comprehensive set of questions covering land use, infrastructure changes, recent natural catastrophic events, and management problems. Photo monitoring is also included. In California, monitoring reports are uploaded onto an internal Web-based reporting and tracking system called ConservationTrack®. Reports archived there are TNC’s business records and, in the event of a violation, may be drawn on to support any needed legal action. This also provides TNC staff easy access to the easement document, baseline report and an orientation narrative in preparation for property visits.

Many California rangeland easements contain additional requirements relating to ranching. For instance, in our survey of 110 of TNC’s easements in California, we found that about 50 easements permit grazing, mostly in oak woodland and annual grasslands. Of these, about half include minimum limits on residual dry matter (RDM), or the amount of herbage left behind at the end of the grazing season. About one-third of surveyed easements with grazing have seasonal use restrictions, and about one-third have some type of restrictions on grazing in riparian or other sensitive areas. Very few easements restrict the number of animals or forage used on a property. Grazing management plans linked to conservation easements existed for only a handful of properties.

It is important to note that there is considerable variation in the way easements are written and monitored among easement holders. Even within TNC, there are many differences in easement terms from easement to easement. In the next stage of our research, we plan to examine the terms and monitoring of easements held by a variety of nonprofit and government organizations to examine an even greater diversity of objectives, easement terms, and approaches to monitoring.

Residual Dry Matter

Minimum RDM level measured at the end of the growing and grazing season was the most common rangeland term in the easements we surveyed. There was considerable variation in monitoring approaches and easement terms related to minimum RDM levels. In the TNC easements we examined, minimum RDM levels were mostly between 600 and 1,000 pounds per acre, depending on site characteristics. Minimum RDM level was usually provided either as an average across the property or as an average for each pasture. Burned areas, bedrock, areas around water troughs and salt licks, and other bare areas were typically excluded from the RDM estimate. Where easements included RDM restrictions, visual estimates or plot clippings are usually completed in the fall as part of an annual compliance monitoring visit.

Interviews suggested that rangeland standards such as minimum RDM may be particularly important when public funds are used to purchase easements or support tax reductions because this provides a quantitative measure of range condition and can help ensure that public trust benefits are being protected. The easement monitors we interviewed generally agreed that RDM is appealing because it is a well-established quantitative metric but expressed that RDM alone cannot reflect rangeland condition because it does not incorporate species composition or other factors. One land trust staff person responsible for easement monitoring told us that minimum “RDM restrictions are not necessary when things are in compliance, but on properties where there might be some problems, it’s extremely important.”

Only 1 easement in our survey contained a maximum RDM level. It was included in the easement to protect vernal pools and native annual forbs from high levels of nonnative annual grasses. Vernal pools are temporary pools formed

on claypan soils in winter and spring, and they are home to diverse endemic plants and animals. In some areas, grazing removal has been shown to result in more nonnative grasses that outcompete short-statured endemic plants and alter the hydrologic regime. Pools then dry out faster than they would with grazing, harming aquatic animals.⁶

Effectiveness and Resource Trend Monitoring Beyond Compliance

In addition to compliance monitoring, land trust or government easement holders may want to know how the resources that easements were created to protect are changing over time. Most land trust staff said they did not have the time or money to extend monitoring beyond easement compliance. We found that quantitative resource monitoring beyond compliance was executed only in cases where a large grant, endowment, or mitigation fund allows for significant monitoring of large properties.

In the few easements with extensive resource monitoring, multiyear quantitative projects have targeted plant diversity; oak woodland structure; animal communities such as birds, bats, and mesocarnivores; and water quality. Some monitoring is designed to evaluate expected effects of grazing, timber harvest, or recreation.

Some qualitative resource monitoring occurs during annual compliance monitoring visits on many of the easements we surveyed. In these cases, experienced field professionals make observations related to property condition, soil erosion, invasive plants and animals, or wildlife abundance and also note resource management problems of concern to the landowner. One staff person told us that in addition to compliance, he observes “whether something is experiencing difficulties that have little to do with the active control of the owner.” For instance, California red-legged frogs (a threatened species) appear to be declining because of an increase in bullfrogs and other nonnative predators that may have nothing to do with landowner management. “For the monitoring, we walk a couple of miles of stream, and write down if we see any Louisiana swamp crayfish, bullfrogs, or red-legged frogs.”

Photo monitoring to track vegetation changes over time is another common method of resource monitoring employed during annual compliance monitoring visits and is required by TNC. In addition, the TNC compliance monitoring form calls on monitors to record observed property changes and resource issues that need attention, even if these stewardship issues are not easement violations. The monitor can then work with the landowner to find resources to address management concerns, such as removal of invasive plants, implementation of prescribed burning, or funding for seasonal flooding of cropland for waterfowl.

Monitoring is easier if the property has a thorough Easement Documentation Report (EDR). The EDR is created when an easement is established and provides an important baseline for the condition of the property. TNC’s policy is to prepare an EDR for every easement they do. The Internal



One of 5 monitored conservation easements with Mount Lassen in the background.

Revenue Service requires that every nonprofit prepare them for easements for which an income tax deduction is taken. EDRs that include extensive property photographs, vegetation community maps, observations of rare species, and land use histories provide a significant value for understanding future resource change on easement properties.

Adaptive Management

Our survey highlighted a variety of approaches to providing flexibility for adaptive range management. Some easements made exceptions to RDM guidelines for extreme weather and drought conditions. One easement allowed for the grazing restrictions portion of the easement to be amended every 25 years in accordance with advances in science, technology, and global climate change. Most easements require that if RDM guidelines are not met, the landowner and easement holder should consult on grazing levels for the following year. This consultation provides the flexibility needed to make grazing decisions based on local conditions and to adaptively manage. Consultation with the landowner on managing invasive weeds is another common stipulation of rangeland easements we surveyed.

Monitoring Rangeland Plant Communities: Lassen Foothills Case Study

In the Lassen foothills of northern California, we monitored conservation easements to provide information on persistence of biological diversity and abundance of native and invasive species. To date, TNC has acquired easements on over 80,000 acres of private ranchlands in this region to protect exceptional examples of blue oak woodlands (*Quercus douglasii*) and vernal pool grasslands. This is being done while preserving the landscape in privately owned cattle ranches.⁷ Easement monitoring involves both annual compliance monitoring including RDM estimates as well as a significant resource monitoring effort conducted by TNC staff, the University of California, Berkeley, and Point Reyes Bird Observatory

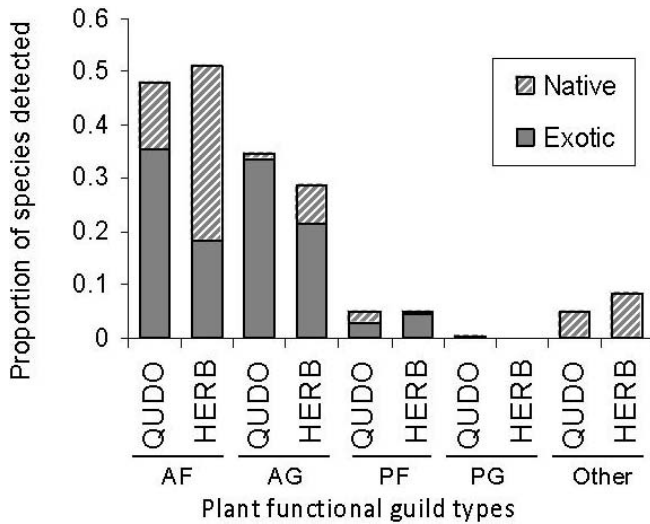


Figure 1. Average relative cover of functional guilds for the 61 blue oak-dominated plots (QUDO) and 14 herbaceous plots (HERB) sampled in 2006. Plant types, grouped into functional guilds, are AF = annual forb, AG = annual grass, PF = perennial forb, PG = perennial grass, other = ferns and shrubs.⁷

Conservation Science. This effort, conducted on easement properties with landowner cooperation, is designed to produce detailed vegetation maps, document the status of understory plant communities, inventory breeding birds, record blue oak woodland canopy structure, and examine grazing impacts. We focus here on our work on understory vegetation monitoring of blue oak woodlands and interspersed grasslands on the conservation easements.⁸

Our primary objective was to characterize the vegetation of 5 conservation easements (ranches A–E) in the Lassen foothills region in order to provide a baseline for future change. These properties were typically blue oak woodlands, grasslands, and shrublands. We compared indices of species diversity, including native and nonnative functional guilds; abundance of 2 invasive species, medusahead (*Taeniatherum caput-medusae*) and yellow star-thistle (*Centaurea solstitialis*); and the presence or absence of native blue oak (*Q. douglasii*) seedlings on easement properties. Blue oak regeneration is variable throughout the state and is of concern in some areas. A comparison across easements can provide a greater understanding of the relative contribution of each property to protecting native plant diversity and help set priorities for land management, including invasive species control by TNC in cooperation with landowners. We also compared field methods and assessed sampling error and used this information to develop recommendations for monitoring strategies for detecting patterns in species composition and change over time.

We established 73 plots of 10-m radius on the 5 ranches, measured species composition with the point-intercept method for 81 locations per plot, and compiled a full species list for each plot in 2005 and 2006. These included plots inside and outside the oak canopy.



Herbaceous plot (HERB).

Results

Like most California oak woodlands, the properties we surveyed were dominated by nonnative annual grasses and forbs but still contained considerable richness of native species, particularly native annual forbs. We found significant differences in the relative cover of native and nonnative annual grasses and annual forbs among easement properties, with an average of 43 species per plot. We compared native and nonnative species for 5 general plant types (Fig. 1) in blue oak woodland and grassland/herbaceous plots. Relative cover of native plants was significantly higher in herbaceous plots (50%) than in plots with blue oak canopy (21%).

We also documented the presence of specific weed species, including medusahead (*T. caput-medusae*) and yellow starthistle (*C. solstitialis*), to help landowners develop prescribed fire and grazing management programs. These 2 invasive plants are a management concern because they provide poor forage for livestock and outcompete native plants. We found medusahead in 64% of plots, ranging from 31% of plots on ranch A to 100% of plots on ranch E. We found yellow starthistle on 9% of plots, ranging from no plots on ranch E to 25% of plots on ranch B.

Lack of regeneration of blue oaks is another potential threat to the sustainability of oak woodlands in the region. Blue oak seedlings were found in 69% of all plots. For blue oak woodland plots, we found significant differences in the presence of blue oak seedlings among properties, indicating that either management or site characteristics are influencing regeneration. Previous research has indicated that livestock grazing, invasive species, wildlife, weather, and fire may all play a role in oak regeneration and recruitment.⁹ Long-term livestock exclosures have been installed on 5 easement properties to sort out the potential impact of livestock grazing management.

We found that point-intercept surveys were not adequate to document the species community present in our plots, and therefore full species composition lists for each plot were necessary. We found an average 55% overlap in the species found

at each plot between 2005 and 2006. We also found that the date of sampling in 2005 and 2006 influenced the overlap in species composition between years for several of our plots. Annual species in particular vary in detectability, depending on the time of year.

Vegetation Monitoring Recommendations

Vegetation measurements that can be repeated over the long term provide an important baseline, and early investment in this type of data is necessary to evaluate the impacts of changes to the resource in the future. Permanent plot markers should be considered to improve the accuracy of future vegetation measurements, and allowances for unobtrusive permanent plot markers could become a standard part of conservation easements that aim to protect plant diversity. California oak woodlands and many other rangeland ecosystems have high variability from year to year, and changes in plant composition and dominant species can occur over several years.^{10,11} The design of a monitoring program must therefore anticipate high variability at small spatial scales as well as the possibility of dramatic shifts in vegetation composition. Monitoring at multiple scales should incorporate field data on plant composition as well as larger-scale vegetation community change that can be derived from aerial photos or satellite imagery.

Combining the point-intercept method with an inventory of all plants in a plot provides an efficient quantitative estimate of relative cover and a complete species list that is more likely to capture rare species. Ideally, long-term monitoring data would be paired with research examining the likely causes of resource change due to weather patterns and climate, plant invasions, grazing management, and fire patterns and with research on effective management interventions to maintain rangeland productivity and native plant richness and abundance. We also recognize the need for monitoring across spatial scales and multiple species assemblages, including documenting field conditions through permanent plots, large-scale vegetation change through aerial photography or satellite imagery, and pairing plant and avian diversity monitoring.

Conclusions

Consistent compliance monitoring serves a critical role not only in protecting society's interests by tracking easement violations but also in providing an opportunity for resource stewardship and observation beyond compliance. TNC's recent standardization of their monitoring report and the creation of a Web page for monitors in California are positive developments for organizing and streamlining compliance monitoring.

We found a high level of variability in rangeland easement terms and monitoring approaches even within 1 organization. Residual dry matter guidelines in annual grasslands and oak woodlands were the most common rangeland measure in the grazing easements we surveyed. RDM can provide important information to the ranch manager but is



Blue oak, *Quercus douglasii*, woodland plot (QUDO).

not an indicator for all resource goals. If RDM is desired as a metric for range management, additional efforts should be made to standardize RDM monitoring protocols and the way RDM is incorporated into easement terms. One central challenge for natural resource management on private land with conservation easements is to create terms clear enough to prevent resource degradation over the long term but flexible enough to allow for adaptive resource management with changing conditions and rancher needs. We found opportunities for easement flexibility through a variety of mechanisms.

Where measuring resource change is important to knowing whether the easement is achieving its objectives, there is a need for additional funding for quantitative resource monitoring at multiple scales. In our future work with a variety of easement holders, we expect to find even greater variability in monitoring approaches and rangeland easement terms from organizations with different missions, funding availability, scientific capacity, and local contexts working with landowners with diverse and varying objectives for management and reasons for having an easement.

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