By Gary Frasier

Frasier's Philosophy

As a young college student, more years ago than I like to admit, I remember driving between Denver and Fort Collins and seeing the wide-open spaces and open country of the rangelands of eastern Colorado. After college, I moved to the Phoenix, Arizona, area, where in the Salt River Valley, there were large cotton and alfalfa fields. Today, both of these places are covered with housing developments, suburban ranchettes, and freeways, moving people at high speed (unless it is rush hour when it all slows to a crawl).

How many of the people in these areas have a feeling for the land or care what is happening to it around them? I would suspect that very few ever think about the land and what it was like 50 years ago before the mass migrations to the areas. They want easy and close access to the large shopping centers and malls. They want the high-salary jobs in the cities and high-speed freeways so they can rush home from work and watch the "reality" shows on TV.

Some of these people see the remaining open spaces as a place to visit on vacations. They never think about what it takes to manage these areas. They get upset if there is some activity on the lands that affects their pleasure, such as cattle grazing in a meadow. There are anglers who want access to all streams and large catchable fish, yet they never think of the management of the watershed that provides the water for the stream. There are hunters who want large trophy animals yet are not concerned about what it takes to manage the resource. There are people who want the land returned to a "pristine" wilderness as it was before the advent of the European settlers.

What has happened? We have a changed landscape. It can never revert back to the past. We still have some open spaces, but they are looked at with a different perspective.

Management of these areas today is quite different than management of the land in the past. Many of the open spaces are a mixture of private and public lands. No single entity has control of the areas. It requires people with different backgrounds and visions working together to develop plans that accommodate the new paradigm.

We are fortunate that we have a few people who are concerned about how we can manage these lands under the changing use perspective. These people are willing to compromise in a give-and-take atmosphere for the betterment of the land. They are wildlife managers, environmentalists, ranchers, rangeland management specialists, and even a few urbanites, all with a deep desire to manage the land resources in a sustainable manner for the present and future.

This issue of *Rangelands* presents a description of a few of the efforts at managing these changing landscapes. These efforts are just a start. Some of the approaches are working better than others. We are learning. No one has given up. This is the future of natural resource management. We must be the Trail Boss of the effort and show the way. ◆

Introduction: The Working Landscapes Special Issue

By Lynn Huntsinger and Nathan F. Sayre

Americans have long been preoccupied with the idea of nature as pristine and untouched by humans. Conceived as the opposite of—and refuge from—urban areas, this notion of nature overlooks the land in the middle, between city and wilderness. "Working landscapes" gives that place a name and a value by calling attention to the possibility—indeed, the necessity—of effective stewardship and conservation through active human presence and management.

There are several dimensions to this. "Working" means, first, that there is productive activity on the land—such as farming, ranching, or forestry. Ranchers, through the livestock they husband, produce high-quality food, leather, wool, and other livestock products from arid, nonarable places. The term "landscape," meanwhile, connotes a place we look on, and, it is hoped, enjoy looking on. A work of nature is implied, as opposed to a "cityscape," as is a certain expansiveness and, to an ecologist, a large, terrestrial scale. Third, at this scale, there are other things produced by and from the land in a sort of joint production function: intangible things like scenery, tangible things like water, and myriad other things somewhere in between. Landscapes provide habitat for wildlife, sinks for pollutants, and reservoirs of meaning for human communities.

The term "working landscapes" thus carries the weight of a vast and diverse array of "ecosystem services" that humans both rely on and alter for better or worse. In this sense, it proposes as an ideal the synergistic combination of commodity production with the provision of public benefits of various kinds. How do we accomplish this both as a quality of life for us and as a legacy for future generations?

This article has been peer reviewed.

A significant portion of the western states are public lands managed by public agencies. It might be assumed that having 50% of California as public land or 90% of Nevada is enough—yet here we are proposing that private working landscapes are worthy of further public and private expense and effort to protect. However, private lands are ecologically different from public lands, as Colin Talbert, Richard Knight, and John Mitchell demonstrate in this issue. In addition, public and private lands are connected by the ranching enterprise, and conservation of private lands is therefore linked to the policies and decisions of public land managers, as revealed in Adriana Sulak and Lynn Huntsinger's article.

On rangelands, ranching is the key to conserving working landscapes. Ranchers throughout the West are besieged by low income from production and inflated real estate values—several of the articles herein discuss this problem. A working landscape requires a worker. Ranchers like to produce livestock products, but the ecosystem services they also produce are becoming valuable to today's society. How can this value be harnessed to support and motivate the worker and thereby support working landscapes? Conservation easements are one method, and two of the articles in this issue are devoted to the topic. Anthony Anella and John Wright lay out the many options that easements offer the rancher. Adena Rissman, Richard Reiner, and Adina Merenlender describe the way that easements are monitored and how the relationship with the easement holder can be a long-term, collaborative process.

The stewardship of ranchers, past and present, shapes the capacity of the land to produce livestock and ecosystem services. In California, recent research has demonstrated significant ecological values from grazing in addition to the obvious benefit of maintaining open, natural landscapes. The California Rangeland Coalition, described by Sheila Barry, Tracy

Schohr, and Karen Sweet, is an effort to build collaboration between environmental groups, ranchers, and agencies to protect working landscapes and support good land stewardship. Bill McDonald and the Malpai Borderlands Group (http://www.malpaiborderlandsgroup.org) made history when they developed a collaborative management program with agencies and ranchers and initiated a grass bank program in 1994. Since then, several grass banks have emerged in the West, as reported in *Rangelands* (27:24–28) by Stephanie Gripne in 2005. Courtney White and Craig Conley update us on the Valle Grande Grassbank, a creative and collaborative effort to conserve New Mexican working landscapes, and give us some things to ruminate on as we contemplate the future of grass bank programs.

The ability to respond to change is crucial as we look to the future of working landscapes. Carrie Kennedy and Mark Brunson examine the capacity for innovation in ranching communities and the factors that influence that capacity. The article illuminates how educational outreach and personal relationships (with other ranchers as well as agency personnel) can enhance ranch sustainability by influencing the outlook and information base of ranchers. In fact, ranchers have a long history of coping with changes in policy, environment, markets, science, and social attitudes. Nathan Sayre's article illustrates the rich history of rancher interactions with the land and describes the motives and outside influences that have affected those interactions in the Altar Valley of Arizona.

Finally, the phenomenon of a "working landscape" is nothing new. Native Americans were shaping western landscapes long before the arrival of European settlers. Unfortunately, their knowledge of western ecosystems and skill at managing them were long ignored and their practices suppressed. Lucy Diekman, Lee Panich, and Charles Striplen discuss Native American working landscapes in California and illustrate the importance of traditional knowledge and working with tribes. Many ranchers also feel that their knowledge and their practices are too often misunderstood and ignored. Can we build a science that respects the traditional and local knowledge that comes from working in and with a landscape?

Initially, many ranchers were reluctant to think that they might be in the business of producing ecosystem services as well as producing livestock. Today, the pendulum has swung in the other direction, with increasing identification of ecosystem services from ranchland, and research that shows us how to use livestock to create ecological benefits and minimize negative impacts. However, the identification of an ecosystem service does not create a market or a way to compensate or incentivize the production of the service by ranchers. Mechanisms need to be found to reward ranchers for good stewardship that provides public benefits, mechanisms that in turn help the rancher stay in business.

"Perpetuity," a stipulation on conservation easements, is an aspiration at best, but it makes some ranchers nervous. In theory, perpetuity assures public investors that the benefits they pay for through easement purchase or tax relief will be around for the long term. Other forms of investment in ranchers' land or practices cannot promise such long-term returns. Pressures for ranchers to sell land are powerful in many places—often those places with exceptionally high ecosystem service values. There are a variety of incentive programs for wildlife habitat enhancements and investments to improve management—but the likelihood that properties will someday be developed undermines these public investments. In the European Union, by contrast, agriculturalists are often well compensated for ecosystem services they produce. However, European agricultural producers are generally not free to develop their land or sell it for development. Will the American public demand a similar trade-off? In fact, conservation easements embody this public desire. Conservation easements work for donors and the public, in part, because they help solidify the tenure of the ranch.

There are many dimensions to working landscapes, and with this issue we have been able to explore only a few. Ideally, we would have articles by ranchers and agency managers; we would have talked more about land trusts and the important role they will play in the future, and we would have reported on some of the very impressive land trusts working in our own backyard, notably the pioneering and always interesting Marin Agricultural Land Trust (http://www.malt.org). In a recent survey conducted in California, rangeland landowners reported that they asked land trusts for advice as often as they did advisory agencies. We hope that some of you will contribute more articles about the diverse aspects of working landscapes to future issues of this journal.

Finally, there will always be room for change, innovation, and improvement in grazing management on working landscapes. As we learn more about ecosystems and how they work and as social and environmental needs change, there will also be a need for changes in management. Not every rancher is the steward we might desire, although a great proportion of them regularly demonstrate their commitment to the land and to doing the best they can despite all the obstacles. We face huge challenges when it comes to transitioning to the next generation of ranchers and making sure that ranchers can survive economically. But when it comes to conserving western landscapes and the cultures and environments that make the West unique, we must not "let the perfect be the enemy of the good." Management problems can be fixed, easement terms can be negotiated, regulations and incentives can be crafted, and other creative approaches to conservation can be found. There are plenty of options for improving and restoring working landscapes as long as they are not under asphalt.

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Private Ranchlands and Public Land Grazing in the Southern Rocky Mountains

Why the private land matters when we think about public lands grazing.

By Colin B. Talbert, Richard L. Knight, and John E. Mitchell

Introduction

In the western United States, Euro-American settlement was concentrated on the most fertile, best-watered, and most desirable sites, while the unsettled mountains and deserts remained in the public domain. As a result, the public and private halves of the western landscape are not interchangeable for conservation purposes. Federal statutes require ranchers grazing livestock on federal lands to own sufficient private ranchland, known as "base ranch" or "commensurate" land, to sustain their livestock for part of each year.[1] If access to forage on public lands is curtailed, the economic viability of these ranching operations may be compromised, leading to an intensification of ranch operations on the private lands or conversion to exurban development.[2] Either of these outcomes could have important consequences for conservation at a regional scale.[3]

Residential development, once largely confined to urban fringes, is moving to rural areas at alarming rates. Already an estimated 25% of the private land in the conterminous 48 states has been converted to exurban densities (defined as 1–40 acres per housing unit), and the trend shows no sign of abating.[4] Since amenity values and recreational opportunities are thought to be driving much of this development in the West, the private lands bordering public lands are often the most at risk of being developed.[5]

Although the ramifications of widespread land use change from ranching to housing development are not fully understood, there is increasing concern about the lasting cultural, economic, and ecological effects.[6–8] Conversion of working ranches to residential development leads to an increase in the

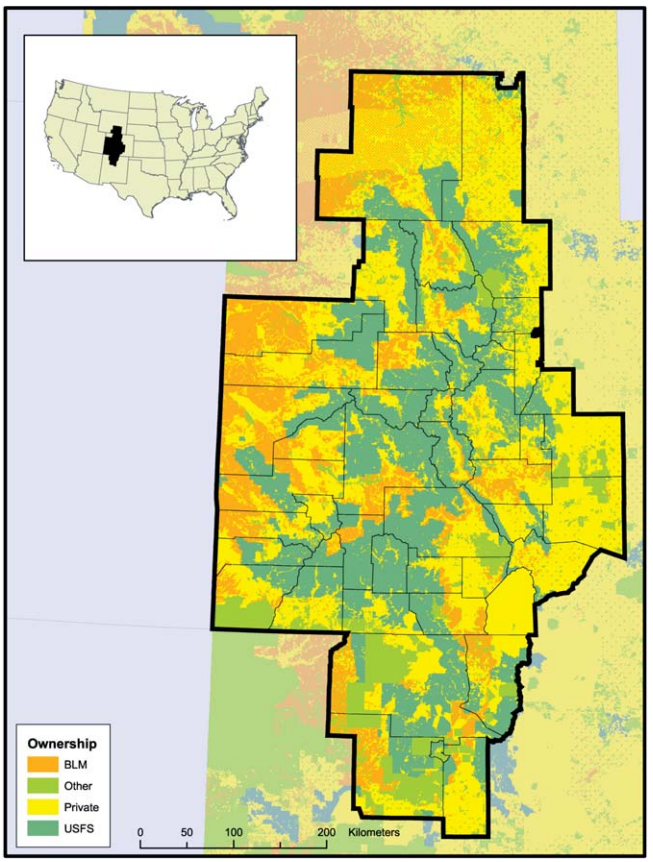

Figure 1. Land management within the study area.

This article has been peer reviewed.

Table 1. Characteristics of US Forest Service and Bureau of Land Management grazing allotments and associated privately owned base ranch properties

	Area (million acres)	Mean elevation (feet) (SD)	Mean slope (degrees) (SD)	Mean soil productivity (SD)*	Mean stream density (feet/acre) (SD)
Base ranch (1,456)	4.69	7,372 (981)	6.7 (4.3)	8.9 (3.1)	17.2 (10.3)
Allotment (2,217)	14.08	7,669 (1,270)	11.4 (6.2)	10.3 (2.9)	9.0 (7.4)

*Values range from 4, for the most productive soil, to 16, for the least productive soil.

number of houses and length of roads with corresponding consequences for the natural community.[9] Research indicates that such landscapes attract nonnative, human-adapted species at the expense of specialist species and that they are avoided by predators.[10–12] Data from the National Resources Inventory (http://www.nrcs.usda.gov/technical/NRI) have shown that exurban developments and urban expansion rarely, if ever, revert back to agricultural uses; thus, the ecological changes due to this land use conversion are likely to remain on the landscape. The impacts of these changes may be magnified, moreover, by the spatial distribution of private lands. Yet virtually no empirical data exist as to the biological value of these lands. The purpose of our study was to inform the public lands grazing discussion by quantitatively comparing the biological values of private ranchlands with those on public grazing lands.

Study Methods

Our study area included 48 counties that roughly comprise the southern Rocky Mountains of Colorado, southern Wyoming, and northern New Mexico (Fig. 1). This semiarid region is characterized by high-elevation mountain ranges separated by lower-elevation valleys. Mapping the private portion of public land ranches was accomplished by using publicly available county assessor records to identify large parcels owned by federal grazing permit holders. Federal grazing leases were mapped using digital data from US Forest Service (USFS) and Bureau of Land Management (BLM) field offices. Although there is uncertainty with both of these estimates of public and private lands, they represent a best available and likely conservative estimate of the actual lands of interest for our comparison.

Physical and ecological landscape traits relevant to the biological productivity and conservation value of these lands were identified from available GIS data sets. Average elevation, slope, predicted soil productivity, and stream density were calculated for both the private and the public grazing lands. Additionally, for the portion of the study area within Colorado, lands important for biological conservation, as identified by the Colorado Natural Heritage Program (CNHP), were mapped.

Results

Our study identified 4,693,000 acres of private land owned by ranchers with federal grazing permits (Table 1). These private lands were associated with federal grazing leases totaling 14,085,000 acres. The base ranch properties averaged 600 feet lower in elevation and 4.7 degrees shallower slope than their associated public lands, and average stream density on private lands was nearly twice that of the public lands. In addition, soil productivity was higher on the private lands compared to the public lands. Lastly, in Colorado the proportional area of CNHP potential conservation areas was greater on private lands than on public lands (Fig. 2).

Since our region is characterized by its blend of private and public lands, the spatial distribution of private ranchlands might be an indicator of their regional conservation value. We compared the share of private ranchlands in 1) all private land in the study area and 2) private land within 0.6 miles (1

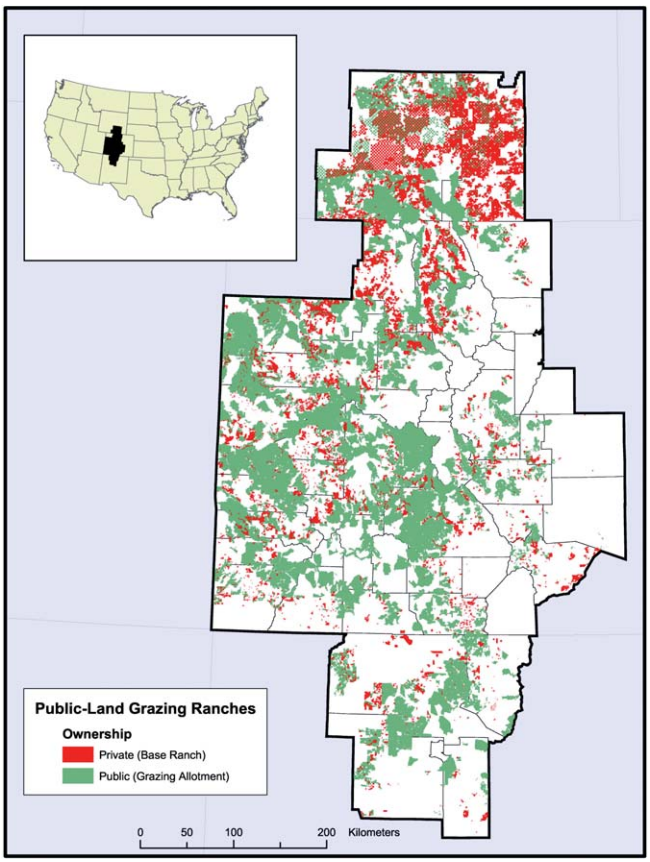

Figure 2. Base ranches with associated US Forest Service and Bureau of Land Management grazing allotments in the southern Rockies.

km) of public land grazing allotments. The 4,693,000 acres of private grazing lands represents 21% of the 21,489,000 acres of private land in our study area. But if we just look at the private land within 0.6 miles of the public land grazing allotments, the proportion of private grazing lands increases to 43%. This finding indicates that working ranchlands provide a land use buffer around our public lands.

Conservation Implications

Our study provides an accounting of differences in public and private land attributes; however, interpreting the absolute importance of differences at a regional level is beyond its scope. Nonetheless, if crucial areas for conservation in the American West tend to be on private lands, then our results indicate that base ranch properties may be important conservation targets.

The viewpoint that all livestock grazing is damaging to ecosystem health is being replaced by a better understanding of the way climate, grazing, soils, and other factors interact to shape rangeland environments.[13,14] The use of livestock as a stewardship tool blending conservation with viable ranching on western rangelands is exemplified by the efforts of organizations such as the Malpai Borderlands Group, the Quivira Coalition, The Nature Conservancy, and other nongovernmental organizations. In light of the physical and biological limits of the public lands, conservation plans that do not incorporate private lands are only half a loaf.

In the public land grazing controversy one unanswered question persists: will the continued use of public land grazing keep the associated commensurate lands out of development? It has been argued that once the market value of land reaches some point, ranch owners will sell regardless of the availability of forage on public lands.[15] Research gauging ranch owner reaction to changes in federal grazing policy indicates a more complex story.[16,17] Public land ranchers exhibit diverse motivations for staying in ranching and differing perceived abilities to maintain their operations without public forage.[18] Ironically, many ranchers persist in the rangeland livestock business, despite its marginal economic returns, for the same reason that new westerners buy 35-acre ranchettes, that is, for the lifestyle.[16,18,19]

Simplifying the grazing debate to a choice between livestock on the public land or condos on the private lands ignores the complex socioeconomic heterogeneity of ranching in the West. Still, one important driver in the decision to retain ranching operations seems to be the continued availability of affordable public forage. It has been estimated that the 21,000 ranch families having approximately 30,000 grazing leases on BLM and USFS lands own about 107,000,000 acres of private land.[18] The essence of this public–private policy dilemma can be posed in the form of a question. Is it a fair bargain if more than a hundred million acres of ecologically rich Western private lands are kept open and productive (the private half of the bargain), knowing that in order to accomplish this approximately 85% of federal lands are being grazed at some time of the year (the public half)? No one is exactly sure of how much the public values ranching. The value might be higher if they knew that by promoting policy that maintains large tracts of natural ecosystems on private ranches, they are helping keep the West open and out of development, now the second-leading cause for the decline of federally threatened and endangered species.[20]

Conservation easements in which development rights are retired in perpetuity while allowing for continued use of ranches as working landscapes are an emerging strategy for conservation on private lands. As evidence that stock producers often stay in the business in order to maintain a rural way of life, we note that 7 Colorado grazing associations have formed land trusts that presently have more than 1 million acres of private ranchlands in easements.[21] The effectiveness of easements for conservation is still being assessed, but their utilization is increasing because of the pressing need to include private land in conservation strategies. Regardless, the potential for increased use of conservation easements on base ranch properties remains high, given that only an estimated 7% of federal grazing permit holders have currently implemented them on their base ranch properties.[22] If reductions in public land grazing accelerates the selling of base ranch properties before land trusts have time to coordinate the purchase of development rights, this opportunity to realize permanent protection on these lands could be lost.

Federal grazing permits were implemented as a means of limiting rampant overgrazing of a communal resource and providing for improved individual stewardship of our public rangelands.[23] While past degradation of the public lands by livestock undoubtedly occurred under this system,[24] removal of livestock today will not necessarily ensure a return to previous ecological conditions. Instead of unilaterally eliminating livestock from federal land, conservationists might have more success working collaboratively with agency personnel and ranchers to make federal grazing more ecologically sustainable. As with many things of great import, Wendell Berry[25] captured the tension—and the answer—between our rural and urban public and private and public lands when he wrote,

> *The most tragic conflict in the history of conservation is that between environmentalists and the farmers and ranchers. It is tragic because it is unnecessary. There is no irresolvable conflict here, but the conflict that exists can be resolved only on the basis of a common understanding of good practice. Here again we need to study and foster working models: farms and ranches that are knowledgeably striving to bring economic practice into line with ecological reality, and local food economies in which consumers conscientiously support the best land stewardship.*

Clearly, there is good work to be done by all.

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References

1. Rowley, W. D. 1985. U.S. Forest Service grazing and rangelands: A history. College Station, TX: Texas A&M University Press, 270 p.
2. Sullins, M. J., D. T. Theobald, J. R. Jones, and L. M. Burgess. 2002. Lay of the land: ranch land and ranching. *In*: R. L. Knight, W. C. Gilgert, and E. Marston [eds.]. Ranching west of the 100th meridian: Culture, ecology, and economics. Washington, DC: Island Press. p 25–32.
3. Weeks, W. W. 2002. Cloudy sky over the range: whose home and why it matters. *In*: R. L. Knight, W. C. Gilgert, and E. Marston [eds.]. Ranching west of the 100th meridian: Culture, ecology, and economics. Washington, DC: Island Press. p 219–231.
4. Brown, D. G., K. M. Johnson, T. R. Loveland, and D. M. Theobald. 2005. Rural land-use trends in the conterminous United States, 1950–2000. *Ecological Applications* 15:1851–1863.
5. Hansen, A. J., R. Rasker, B. Maxwell, J. J. Rotella, J. D. Johnson, A. Wright Parmenter, U. Langner, W. B. Cohen, R. L. Lawrence, and M. R. V. Kraska. 2002. Ecological causes and consequences of demographic change in the New West. *BioScience* 52:151–162.
6. Huntsinger, L., and P. Hopkinson. 1996. Sustaining rangeland landscapes: a social and ecological process. *Journal of Range Management* 49:167–173.
7. Knight, R. L., W. C. Gilgert, and E. Marston [eds.]. 2002. Ranching west of the 100th meridian: Culture, ecology, and economics. Washington, DC: Island Press.
8. Sayre, N. F. 2005. Working wilderness: The Malpai Borderlands Group and the future of the western range. Tucson, AZ: Rio Nuevo Publishers. 144 p.
9. Mitchell, J. E., R. L. Knight, and R. J. Camp. 2002. Landscape attributes of subdivided ranches. *Rangelands* 24:3–9.
10. Odell, E., and R. L. Knight. 2001. Songbird and medium-sized mammal communities associated with exurban development in Pitkin County, Colorado. *Conservation Biology* 15:1143–1150.
11. Maestas, J. D., R. L. Knight, and W. C. Gilgert. 2003. Biodiversity across a rural land-use gradient. *Conservation Biology* 17:1425–1434.
12. Hansen, A. J., R. L. Knight, J. Marzluff, S. Powell, K. Brown, P. H. Gude, and K. Jones. 2005. Effect of exurban development on biodiversity: patterns, mechanisms, and research needs. *Ecological Applications* 15:151–168.
13. Knight, R. L. 2002. The ecology of ranching. *In*: R. L. Knight, W. C. Gilgert, and E. Marston [eds.]. Ranching west of the 100th meridian: Culture, ecology, and economics. Washington, DC: Island Press. p 123–144.
14. Sayre, N. F. 2001. The new ranch handbook: A guide to restoring western rangelands. Santa Fe, NM: Quivira Coalition.
15. Wuerthner, G., and M. Matteson. 2002. Welfare ranching: The subsidized destruction of the American West. San Francisco, CA: Foundations for Deep Ecology.
16. Starrs, P. F. 1998. Let the cowboy ride: Cattle ranching in the American West. Baltimore, MD: John Hopkins University Press. 356 p.
17. Rowe, H. I., E. T. Bartlett, and L. E. Swanson. 2001. Ranching motivations in two Colorado counties. *Journal of Range Management* 54:314–321.
18. Gentner, B. J., and J. A. Tanaka. 2002. Classifying federal public land grazing permittees. *Journal of Range Management* 55:2–11.
19. Liffmann, R., L. Huntsinger, and L. Forero. 2000. To ranch or not to ranch: home on the urban range? *Journal Range Management* 53:362–370.
20. Czech, B., P. R. Krausman, and P. K. Devers. 2000. Economic associations among causes of species endangerment in the United States. *BioScience* 50:593–601.
21. Knight, R. L. 2007. Bridging the great divide: reconnecting rural and urban communities in the New West. *In*: L. Pritchett, R. L. Knight, and J. Lee [eds.]. Home land: Ranching and a West that works. Boulder, CO: Johnson Press. p 13–25.
22. Steinbach, M. S. 2004. Evaluating the consequences of public land grazing permit buyout program, permit reductions, and increased fees on land ownership and open space in Western states [dissertation]. Missoula, MT: University of Montana. 251 p.
23. Mitchell, J. E., P. F. Folliott, and M. Patton-Mallory. 2005. Back to the future: Forest Service rangeland research and management. *Rangelands* 27:19–28.
24. Olberding, S. D., J. E. Mitchell, and M. M. Moore. 2005. "Doing the best we could with what we had": USFS range research in the Southwest. *Rangelands* 27:29–36.
25. Berry, W. 2001. The whole horse. *In*: E. T. Freyfogle [ed.]. The new agrarianism. Washington, DC: Island Press. p 63–79.

Public Land Grazing in California: Untapped Conservation Potential for Private Lands?

Working landscapes may be linked to public lands.

By Adriana Sulak and Lynn Huntsinger

The growing interest in conservation of working landscapes and the attention paid to ranchland protection reflects a growing recognition of the environmental values of production landscapes, dissatisfaction with what sometimes appears to be gridlocked, under-funded public lands management, and decreasing public funding for fee title acquisition. Yet productive private rangelands are often linked to public land leases. In this research, we examined the relationship between the accessibility and management of these leases and ranch sustainability in 2 areas of California. Findings suggest that an overlooked tool for the conservation of working landscapes is the use of public land grazing for stabilizing livestock operations. Public land grazing could be the glue holding many ranching communities together in the face of strong pressures to convert private rangeland to more intensive uses.

California: The West's Shared Future?

There are now over 36 million people living in California, and in 2000 those 30 or so million people were living at a density of 217 people per square mile—this is orders of magnitude more densely settled than any other western state.[1] Additionally, consider that California is half publicly owned overall and that 63% of California's rangelands are privately owned.[2] This equals intense pressure for residential and commercial land uses, and over the past decade California has lost tens of thousands of rangeland acres per year.[2] California's iconic livestock industry and bucolic rangelands are at a crossroads.

This article has been peer reviewed.

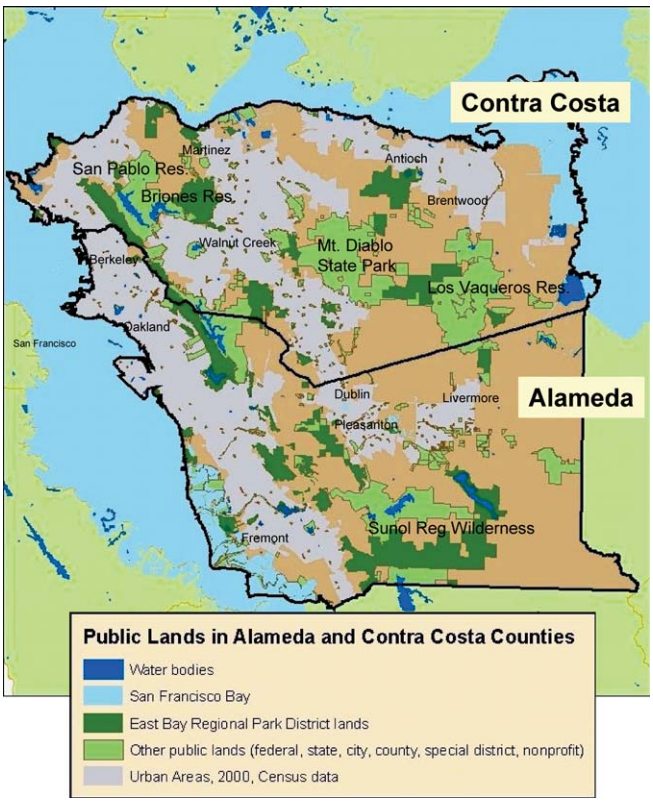

Figure 1. Case study area in the San Fransisco Bay Area.

Ranchers all across the West face serious challenges including heirship issues, increasing property taxes, worsening industry economics, losses of infrastructure, increasing conflicts with urban neighbors, fragmentation and development

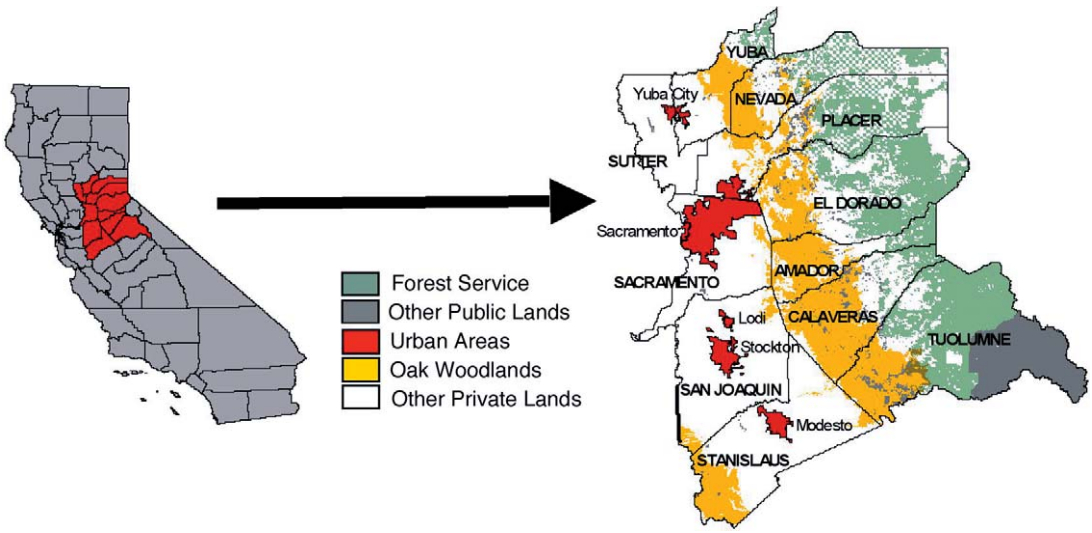

Figure 2. Case study area in the west central Sierra Nevada.

of grazing lands, and an unstable forage base.[3–13] Results from this study show that the stability of public land grazing is important to the sustainability of environmentally important private western rangelands.

The use of public lands and private lands by livestock operations has been common since the first public land management agencies were established. Most Americans are aware that public land grazing occurs on federal lands but many do not realize that it is found on other types of public lands as well—city, town, utility, and local parklands. Using livestock grazing for vegetation management is accepted and defended by many government agencies, and land trusts, as an integral part of land management. It can be used for fire fuel reduction, restoring native plants, promoting biodiversity, and enhancing wildlife habitat, including habitat for special status species.[14–16]

Nevertheless, despite much research documenting the benefits of grazing for conservation goals, there are widespread negative perceptions of public land grazing due to historical mismanagement, controversial politics, a shift in public lands goals to emphasizing "pristine nature," and conflicts with recreation and wildlife management. Whatever the reason, livestock grazing on public lands has declined in recent decades.[17]

Two Different but Similar Californias

Our research was conducted in 2 study areas within California: the San Francisco Bay Area's eastern counties and the western foothills of the Sierra Nevada mountain range (Figs. 1 and 2). Among the cities and sprawling housing developments of the San Francisco area and stretching east toward the Central Valley, there is a stalwart ranching community in Alameda and Contra Costa counties using local regional park, utility, and city open space land grazing leases. The more rural but speedily growing central Sierra foothills are home to many ranchers who have long practiced a transhumance system of grazing, using the foothills in the winter and US Forest Service (USFS) montane meadows in the summer.

Public land lessees and permittees were identified from the rosters of 3 National Forests in the central Sierra and 3 local public agencies in the East Bay—the Tahoe, Eldorado, and Stanislaus forests in the central Sierra and the East Bay Regional Park District, the East Bay Municipal Utility District, and the San Francisco Public Utility Commission in Alameda and Contra Costa counties. In 2000 and 2001, 23 USFS permittees were interviewed about their use of public lands and the importance these public lands play in their operations. This was followed in 2005 and 2006 with similar interviews of 29 Bay Area lessees.

The Importance of Leasing

The amount of land a California rancher leases to complete the annual forage requirements for a herd of cows is substantial. For these groups, leasing is important in terms of acres used, forage supplied, and income generated—all from lands that are not owned or controlled by the operator. Obviously, all the ranches in the permittee/lessee groups had a public lease, as this was a requirement of the study. But what was surprising is that all but one of the central Sierra Forest Service permittees leased other lands in addition to their federal leases, and in the Bay Area, all of the cow/calf lessee operations except 2 used private leased lands in addition to their public lease. In the Bay Area group, there were 2 operations which were entirely stocker operations, and those were completely conducted on public leases.

On average, in the Bay Area group of lessees, those with private leases used an average of 4 different private leases per operation. One rancher estimated he used between 10 and 15 private leases each year. The central Sierra group also reported using multiple leases but used fewer, on average about 2.6 per operation. To emphasize this point further, we tallied up all the acreage used by the Bay Area participants and created an

average ranch. We found that about 80% of these operations' annual acres come from leased lands of some sort—about 30% private leased acres and 50% public leased acres. The public leases in particular are important in terms of ranch incomes. When asked, "What percentage of your ranch income is attributable to the use of your public lease?" USFS permittees and Alameda/Contra Costa lessees reported that the public lease contributed an average of 41% and 44% to their ranch income, respectively.

Reactions to Losses of Public Leases

To take the public–private connections a step further, ranchers in both groups were asked what they would do if they no longer had access to their public lease, using a format similar to that used by Rowe and Bartlett in Colorado.[9,10] If central Sierra participants lost their public leases entirely, about one-third of them said they would likely sell all or part of their ranch. The Bay Area lessees had an even more dramatic response—just over half of them said they would sell their land in response to a loss of public lease access. Considering the amount of land these groups own in their regions, loss of a public permit could cause very large changes in the local landscape. These hypothesized reactions are not specific to California—Bartlett and Rowe found similar reactions in their research in Colorado with USFS and Bureau of Land Management permittees.[9,10] One central Sierra permittee put his family's dilemma eloquently into words: "Public lease versus private lease? Where is the opportunity? What are the ramifications? How will we pass on this ranching operation to the next generation? These questions will be resolved over the next ten years—without public lands as an option the answers may be harder to come by for the next generation."

Role of Agency Decisions and Priorities

One major finding from the Bay Area was that since ranchers rely heavily on public leases, agency choices about who they lease to can shape the future of the livestock community. In contrast to USFS leases, Bay Area leasing agencies change lessees more often. They are not derived from early 20th-century grazing policies, and leases do not travel with specific base properties. As a result, guidelines used by these agencies for selecting permittees vary among agencies and over time. For a while, competitive bidding was attempted, but agency managers said that they discovered this did not always result in getting the best permittees. Instead, most Bay Area agencies look for lessees who are good to work with, have a record of stability, and are near the public lands for lease. Lessees, however, were often concerned that the leasing agencies were favoring large or small, new or long-term, local or outside operators. The more than 20 lessors had diverse methods for selecting lessees, and communication with the ranching community was sporadic and varied, with some of the smaller agencies lacking range management personnel or programs.

In the Sierra foothills, many permittees were using allotments that had been in the family for generations. However, different priorities for management were having an effect on the productivity of public and private forage. On public lands, fire suppression has led to an increase in buildup of woody vegetation, reducing the available forage. Fencing of riparian areas was the most common management activity on the public forests. On private summer rangelands, clearing brush to maintain forage production was the most common activity. One can foresee a divergence in landscape appearance and characteristics over time. On public and private leased lands, interestingly, lessees bore most of the cost of activities such as fencing and range improvement.

In both places, there was intense competition for the remaining private forage. Development is gobbling up rangelands in the foothills of the Bay and Sierra, and planning often diverts housing development away for cropland and toward "low value" but beautiful grazing lands. Speculative ownerships are often grazed for tax benefits and fuel reduction, but they are eventually developed and lost. Public lands play a crucial role in providing a stable forage supply.

Conclusions

If losses of public land grazing leases can have landscape-scale effects, then the reverse is true as well—public policies which promote the grazing of public land for vegetation management and conservation benefits are creating regionwide ranchland conservation benefits as well. One conservation benefit that cannot be ignored is the conservation of private rangelands linked to public lands (see Talbert et al, this issue). Public agencies could influence landscape stability and management beyond their borders by working together with lessees, and according to respondents, simple improvements in communication would go a long way. Miscommunication could be avoided by clarifying chains of command so that when lessees have a question or a problem, they know with whom to speak. Taking communication a step further and integrating lessees in management decisions could produce results on the land and foster more thorough compliance from lessees in management strategies—lessees talked of instances where they could have added to management discussions because of their extensive and day-to-day knowledge of the leases. Transparency on both sides is very important in these relationships.

For those interested in incentive-based private land conservation methods, this study also has important implications. California ranchers are clearly supporting herd sizes that are beyond the grazing capacity of their own property. This makes sense, as the number of cattle needed to support a viable operation has increased over time. A traditional conservation easement protects the productive capacity of only the private single ranch—it does not ensure that a public lease will continue to be available to allow the necessary herd size for the operation.

In the Malpai Borderlands Group conservation easement program, easement restrictions are linked to the continued availability of public land leases.[18] Easements are also linked

to other benefits for the rancher, including use of a grass bank. This model could be adapted in some ways based on this research. A nonprofit group could provide grazing on reserve lands in exchange for conservation initiatives on the private ranch, such as provision of certain types of wildlife habitat or the establishment of a conservation easement. Public agencies could link public leases to ranches with conservation easements or to those carrying out private land conservation actions.

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References

1. U.S. Census Bureau. 2007. State and county quickfacts. Data derived from Population Estimates, Census of Population and Housing, Small Area Income and Poverty Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report. Available at: http://quickfacts.census.gov/qfd/index.html. Accessed 1 February 2007.
2. California Department of Forestry and Fire Protection. 2003. The changing California: Forest and range 2003 assessment [assessment summary]. Sacramento, CA: State of California, The Resources Agency, Fire and Resource Assessment Program.
3. Anderson, M. A., S. C. Blank, T. Lamendola, and R. J. Sexton. 2002. California's cattle and beef industry at the crossroads. *California Agriculture* 56(5):152–156.
4. Hargreave, T. 1993. The impact of a federal grazing fee increase on land use in El Dorado County, California [thesis]. Berkeley, CA: University of California. 68 p.
5. Hart, J. F. 1991. Farming on the edge: Saving family farms in Marin County, California. Berkeley, CA: University of California Press. 174 p.
6. Huntsinger, L. and P. Hopkinson. 1996. Viewpoint: sustaining rangeland landscapes: a social and ecological process. *Journal of Range Management* 49(2):167–173.
7. Johnson, S. G. 1998. Oaks at the edge: land use change in the woodlands or the central Sierra Nevada, California [dissertation]. Berkeley, CA: University of California; 267 p.
8. Liffmann, R. H. and L. Huntsinger. 2000. To ranch or not to ranch: home on the urban range. *Journal of Range Management* 53:362–370.
9. Rowe, H. I., E. T. Bartlett, and L. E. Swanson, Jr. 2001. Ranching motivations in 2 Colorado counties. *Journal of Range Management* 54(4):314–321.
10. Rowe, H. I., M. Shinderman, and E. T. Bartlett. 2001. Change on the range. *Rangelands* 23(2):6–9.
11. Sulak, A., and L. Huntsinger. 2002. The importance of federal allotments to central Sierran oak woodland permittees: a first approximation. In: R. B. Standiford, D. McCreary, K. L. Purcell [tech. coords.]. Proceedings of the fifth symposium on oak woodlands: oaks in California's changing landscape. 22-25 October 2001; San Diego, CA. Gen. Tech. Rep. PSW-GTR-184. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 846 p.
12. Sulak, A., and L. Huntsinger. 2002b. Sierra Nevada grazing in transition: The role of Forest Service grazing in the foothill ranches of California. South Lake Tahoe, CA: Sierra Nevada Alliance, California Rangeland Trust, and California Cattlemen's Association. Available at: http://www.sierranevadaalliance.org/publications/Sierra%20Nevada%20Grazing.pdf. Accessed 1 May 2007.
13. Wacker, M. J., and N. M. Kelly. 2004. Ranchers vs. ranchettes in California's oak rangelands. *Rangelands* 26:17–22.
14. East Bay Municipal Utility District. 2001. East Bay Watershed Range Resource Management Plan. Prepared with assistance from La Cuesta Consulting and Merritt Smith Consulting.
15. Holecheck, J. L., T. T. Baker, J. C. Boren, and D. Galt. 2006. Grazing impacts on rangeland vegetation: what we have learned. *Rangelands* 28(1):7–13.
16. Nuzum, R. C. 2005. Using livestock grazing as a resources management tool in California. Concord, CA: Contra Costa Water District Watershed and Lands Department. July. Available at: http://www.ccwater.com/files/LivestockGrazingFinal72005.pdf. Accessed 1 May 2007.
17. Forero, L. 2002. Grass, grazers and tenure: A case study on the Shasta-Trinity National Forest [dissertation]. Berkeley, CA: University of California. 171 p.
18. Sayre, N. 2005. Working wilderness: The Malpai Borderlands Group and the future of the western range. Tucson, AZ: Rio Nuevo Publishers.

Saving the Ranch: Fresh Eyes on Taxes, Development, and Conservation Easements

Conservation easements provide a surprising diversity of alternative strategies for maintaining the ranch.

By John B. Wright and Anthony Anella

At some time every ranch family must decide either to stay in agriculture or sell the ranch. This decision may be driven by family situation or priorities as well as by economic and other forces largely outside the family's control. There is a tipping point when the weight of economic and personal considerations decides the future of a property[1,2] (Fig. 1). That point is different in every case, and most families are used to thinking that they only have 2 choices—ranching or development. Although housing developments seem inevitable for rangelands in some urbanizing areas, most range managers like to see rangelands remain in sustainable management for agricultural production and natural resource values. What do we have to offer ranching families facing difficult choices? The answer can sometimes be found in partnership with conservation groups and agencies.

Land trusts and national conservation groups walk a delicate political and ethical line with agricultural landowners. While many praise ranchers for their range management and stewardship, others loudly write them off as destroyers of nature. What is lost in all this shouting is a plain fact—when ranchers go out of business, the land and its wildlife habitat, natural resources, open space, and history are lost to development. While conservation easements and the purchase of development rights are widely accepted tools for negotiating the middle ground—for saving the ranch—there are still leaps of faith to be made by people who should be natural allies. For-

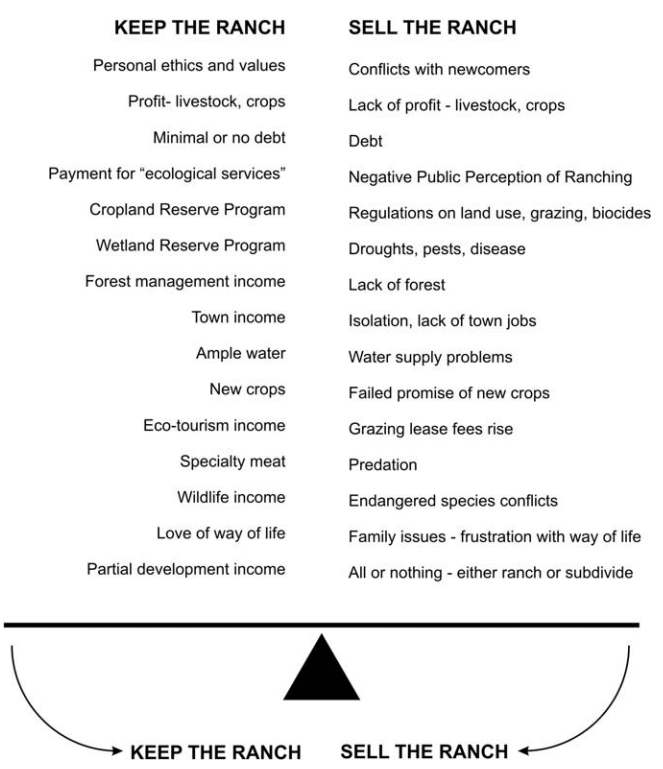

Figure 1. Many factors weigh in when a ranch family is faced with making a decision about the future of the ranch. Economics, environmental, social, and family issues all influence the decision and can tip the balance either way.

This article has been peer reviewed.

Table 1. Running the Numbers	
The following examples show how easement deductions come out.	
Example 1—without a conservation easement	
Adjusted gross income	$50,000
Itemized deductions	$0
Taxable income	$33,100
Net federal tax due	$4,210
Example 1—with a conservation easement, qualified ag owner, $500,000 value of conservation easement donation	
Adjusted gross income	$50,000
Itemized deduction	$50,000 (for 10 years in a row)
Taxable income	–$6,600
Net federal tax due	$0
Total federal income tax savings: $4,210 × 10 years = $42,100	
Example 2—using a $100,000 adjusted gross income and the same easement facts	
Total federal income tax savings: $13,890 × 5 years = $69,450	

tunately, programs are emerging that bring agriculturalists and conservation groups together based on respect for rural culture and customs, the ecosystem benefits of ranching, and private property rights.

Ranchers are familiar with Farm Bill incentives for conservation practices on the 525 million acres of rangelands in the United States. The Conservation Reserve Program of the Natural Resources Conservation Service (NRCS) has 32 million acres enrolled. The Wetland Reserve Program has 16 million acres under conservation easements that prohibit construction. The Environmental Quality Incentives Program, the Grassland Reserve Program, and the Federal Farm and Ranch Lands Protection Program are examples of other federal incentives for private rangeland conservation. Yet some operators are still unclear or suspicious about conservation easements. Rangeland managers working to conserve private rangelands need to know as much as possible about how conservation easements and other incentive programs work.

Landownership and Conservation Easements

In the landownership "bundle of rights," water rights, timber rights, and mineral rights can be separated from the title to land. Development rights—the right to subdivide and develop private property—can also be separated from the land title and sold, traded, or donated. The basic idea of a conservation easement is to voluntarily donate or sell some or all of your development rights to a nonprofit land trust selected by the landowner—forever. This keeps the land from being subdivided, mined, or developed in ways that reduce its productive capacity as rangeland. The rancher still owns the land, pays "ag" property taxes on it, ranches it, leaves it to the children and/or sells it for whatever price someone will pay. If the rancher doesn't own the mineral rights, he or she may still be able to receive tax benefits for an easement donation if there is little likelihood of commercial mineral development.

Land Trusts and Conservation Easements

The first land trust in America was founded in 1890 as the "Trustees of Reservations in Massachusetts." As of 2005, there were 1,667 local and statewide land trusts, a 32% increase since 2000. These groups have conserved over 12 million acres—the majority of it using voluntary conservation easements. The West contains 44% of the total and is showing the fastest growth in private land conservation. National conservation groups like the American Farmland Trust and The Nature Conservancy have worked with landowners to conserve another 25 million acres. Some land trusts are proagriculture, others are not. The Colorado Cattlemen's Association Agricultural Land Trust holds conservation easements on over 200,000 acres. The California Rangeland Trust has over 200,000 acres under easement, including the 80,000-acre Hearst Ranch. The combined actions of Malpai Borderlands Group (a rancher land trust), the Animas Foundation, and The Nature Conservancy have resulted in over 420,000 acres of rangeland easements along the New Mexico–Arizona border. The Montana Land Reliance has the largest tally with 700,000 acres of ranchland protected. With the understanding that conservation easements must be voluntary, the tool is supported by the National Cattlemen's Beef Association, the American Farmland Federation, and many stockgrowers groups.

Conservation Easements and Tax Incentives

A conservation easement is a voluntary, less-than-fee-simple legal interest in land that limits development to protect sig-

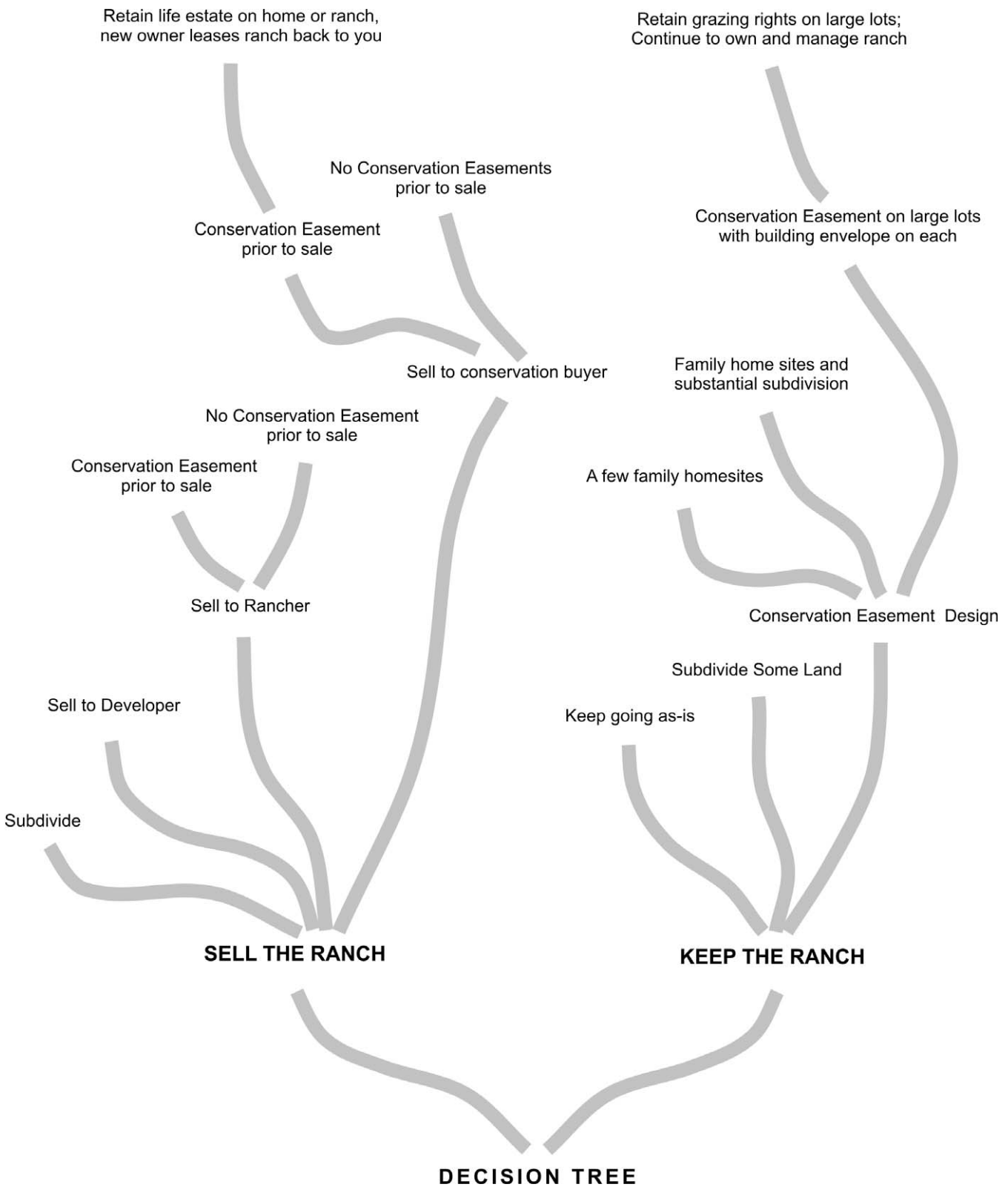

Figure 2. Today there are a lot of options for ranch families seeking to access the capital tied up in ranchland and/or to protect their ranchland for future generations. Conservation easements are a valuable tool and can be used in a number of different ways.

nificant agricultural, open space, ecological, historic, and/or recreational values. Unlike road or power-line easements, these deeds *prevent* certain land uses from happening.

The voluntary donation of a conservation easement in perpetuity to a 501(c)(3) nonprofit organization (land trust) or a unit of government is a tax-deductible charitable gift under

Table 2. Conservation Development Scenarios	
Scenario 1	
Entire ranch, including 7 lots and ranch headquarters, is placed under a conservation easement. 32,000 acres.	
Before value ($150/acre)	$4,800,000
After value ($75/acre)	$2,400,000
Easement value	$2,400,000
Sale price of lots ($400/acre)	$2,000,000
Scenario 2	
Ranch, excluding lots (5,000 acres) and ranch headquarters (5,000 acres), is placed under a conservation easement. 32,000 acres – 10,000 acres = 22,000 acres.	
Before value (22,000 acres)	$3,300,000
After value (22,000 acres)	$1,650,000
Easement value	$1,650,000
Less enhancement (10,000 acres)	($500,000)
Easement value	$1,150,000
Sale price of lots ($500/acre*)	$2,500,000
*Value of lots increases to $500/acre because of potential tax benefit to buyer who would donate a conservation easement on their land.	
Scenario 3	
Ranch and 7 lots (excluding ranch headquarters [5,000 acres]) are placed under a conservation easement. 32,000 acres – 5,000 acres = 27,000 acres.	
Before value (27,000 acres)	$4,050,000
After value (27,000 acres)	$2,025,000
Easement value	$2,025,000
Less enhancement (5,000 acres)	($250,000)
Easement value	$1,775,000
Sale price of lots ($400/acre)	$2,000,000
Scenario 4	
Only 7 lots (5,000 acres) and view shed (5,000 acres) are placed under a conservation easement. Total: 10,000 acres.	
Before value (10,000 acres)	$1,500,000
After value (10,000 acres)	$750,000
Easement value	$750,000
Less enhancement (22,000 acres)	($1,100,000)
Easement value	($350,000)
Sale price of lots ($300/acre*)	$1,500,000
*Value of lots decreases to $300/acre because of less land being protected.	
In this scenario the easement donation ends up having no value due to the enhancement of the value of the part of the ranch that is not placed under the easement.	

Table 2. (continued)	
Scenario 5	
Only the view shed (5,000 acres) is placed under a conservation easement.	
32,000 acres – 5,000 acres = 27,000 acres.	
Before value (5,000 acres)	$750,000
After value (5,000 acres)	$375,000
Easement value	$375,000
Less enhancement (27,000 acres)	($1,350,000)
Easement value	($975,000)
Sale price of lots ($300/acre*)	$1,500,000
*Value of lots decreases to $300/acre because of less land being protected.	
In this scenario, the easement donation also ends up having no value because of the enhancement of the value of the part of the ranch that is not placed under the easement.	

Section 170(h) of the Internal Revenue Service (IRS) codes. The value of the easement gift is appraised using a "before and after" method. The land's value for development before the easement is compared to its value afterward—the difference is the value of the easement donation. An easement does not "freeze" the value of the land—the rancher can always sell it for whatever price someone is willing to pay, but the new owner must honor the terms of the easement. The Pension Protection Act of 2006 greatly expanded the federal income tax benefits for easement donations. For *qualifying* ranchers and farmers (earning more than half their income from agriculture), an individual owner can deduct the value of the donation up to 100% of their adjusted gross income (AGI) over a 16-year period. Tax savings depend on the value of the easement and the rancher's AGI. Corporate ag owners can deduct up to 100% of their taxable income for 16 years. For nonqualifying owners, those earning a smaller proportion of their income from agriculture, the deduction drops to a maximum of 50% of their AGI. These existing incentives apply until December 31, 2007, unless they are renewed. As with any tax matter, professional financial and legal advice should always be sought before proceeding. For updated information check the Web site of America's top easement tax specialist at http://www.stevesmall.com.

As the donor's income and the easement's value rise, tax savings typically increase (Table 1). Nonqualifying landowners (earning less than half their income from agriculture) usually receive lower benefits. Some states also have an income tax credit available for easement donations that further sweetens the pot.

Conservation easements can also be sold by the rancher if a nonprofit group or agency the rancher respects has the funds. States such as California, Colorado, and Florida have annual funding for this, others do not. The Federal Farm and Ranch Lands Protection Program of the NRCS can provide part of the cash with the remainder coming from other sources such as a land trust, lottery proceeds, sales tax, or open space bond issue. In all cases, income from the sale is taxed as a capital gain.

At present, estate tax benefits may be substantial for easement donations. In 2007 and 2008, estates of $2 million or less are exempt with the remainder taxed at a rate as high as 46%. In 2009, the exemption rises to $3.5 million. In 2010, the IRS gets nothing. After that, federal estate taxes vanish unless Congress puts them back on the books.

Property taxes are typically unaffected by a conservation easement. Land that was taxed as "agriculture" before the easement will remain in that category.

The Rancher's Choices

If you are a rancher, the best way to maintain control of your destiny is to be clear about your goals and understand all your options. The rancher must ask some tough questions: If the children inherited the ranch today, what would the tax bill be? How would it be paid? Who will manage the ranch after the rancher is gone? What does the rancher want the ranch to look like 100 years from now? The answers to these questions are personal and private. They are between the rancher and ranch family but there are now allies in agricultural organizations and land trusts that can help ranchers achieve their goals.

The "decision tree" (Fig. 2) illustrates how conservation easements create options for ranch families in meeting a wide range of financial and personal needs. For example, if a rancher chooses to sell the ranch, there are many options. Each involves individual values. If the rancher is interested primarily in getting as much money out of the land as possible, the ranch can be subdivided into as many lots as possible or sold to a conventional developer. A conventional developer can also subdivide the ranch for you. If, instead, the rancher prefers to see the land stay a ranch and to stay in ranching forever, a conservation easement can be placed on it—and

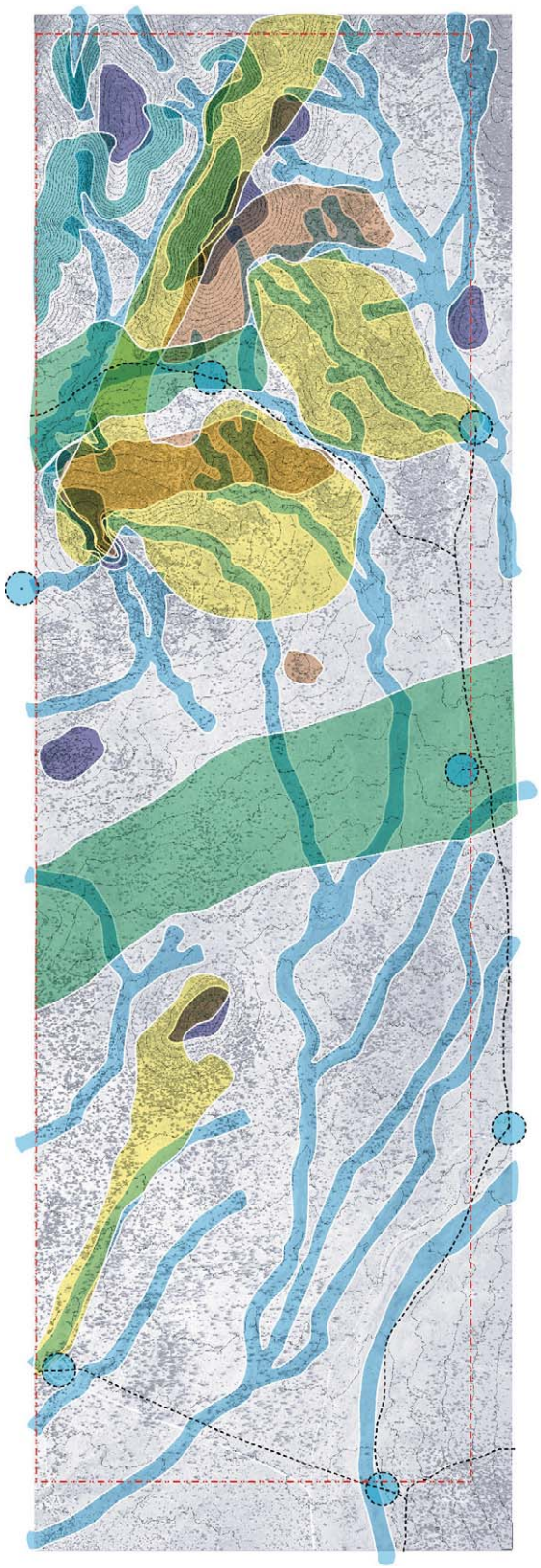

Figure 3. If part of the ranch is going to be developed or subdivided, mapping of resources should be used to plan building sites, lot lines, and roads for minimum impact on things like waterways, view shed, and wildlife habitat.

then the land can be sold to another rancher or "conservation buyer" who is interested in the beauty of the place. If the ranch is sold with no conservation easement on it—even to another rancher—there is a risk that the land will be subdivided in the future. The most obvious disadvantage of selling the ranch is losing control of the land.

If the rancher chooses to keep the ranch, there are several choices. Some ranchland can be subdivided—based on either the conventional or the conservation development pattern. If the rancher needs to raise some money or get some money out of the land but does not want to see the land heavily subdivided, a conservation easement can be placed on the land while the rancher retains limited development rights. These limited development rights can range from a few family homesites to multiple large lots with designated building envelopes where the rancher retains the grazing rights. Various hybrids of development can be designed to meet financial goals while protecting and retaining rancher control over ranch management.

Conservation easements and conservation development work because they put the market to work for the ranchers by capturing the value of conservation in the real estate market as a commodity. In addition to the "commodity production" value and recreational (eg, hunting) value, land has a conservation value. *This is true whether a rancher chooses to develop all, part, or none of the ranch*. For example, if the rancher decides to keep the ranch just like it is, the ranch still has a built-in development value. Population pressure will only increase this value. Usually, unless you develop your land, you will not be able to capture this value. The one exception is a conservation easement.

All this can be confusing for ranchers who are used to valuing land on the basis of its capacity to produce cattle. It can also be confusing for the developer who is used to seeing land only as a marketable commodity. In addition to the "commodity-production" and "residential" value, land has a "conservation" value. But how is this conservation value appraised? How can ranchers capitalize on it? How can land developers factor it into their projects? And how can conservation easement design help create this value while protecting the land? Capitalizing on this value starts by looking at the land.

Sieve Mapping and Conservation Development

Sieve mapping is a design process that allows the rancher to capture the conservation value of the land and put it to work for the benefit of the ranch. Maps are made of prime soils, wildlife habitat, water features, historic sites, scenic views, and other important conservation priorities. These maps are overlaid into a composite of conservation priorities, and the land that "falls through the sieve" is the land that is most appropriate for development. It is important to note that this is also the land whose value is most enhanced by what is protected. Figure 3 illustrates this composite. Sieve mapping

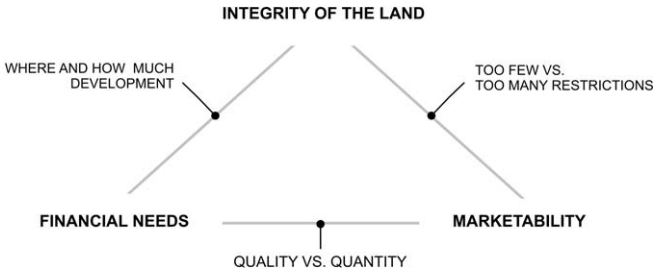

Figure 4. Conservation development offers a compromise to the rancher and the buyer. The amount and type of development should consider the financial needs of the family, the marketability of the product, and the integrity of the land.

works because buyers prefer land that is adjacent to protected open space and are willing to pay a premium for it. This insight is the basis for identifying and then capitalizing on the economic value of land conservation in the marketplace.

Conservation development is based on the long-term creation of real property value premised on land protection as a value-adding principle that appreciates over time. The crux of conservation development is balancing land development with land protection. This balance has to do not only with where development is appropriate (as determined through sieve mapping) but also with how much development is reasonable. Only the landowning ranch family can decide how much development achieves the family's goals. Figure 4 illustrates the factors that influence this balance.

The Montosa Ranch Project

The Montosa Ranch, located near Magdalena, New Mexico, is co-owned and managed by B.W. and Billie Cox (Photo 1). Because their wealth is tied up in land, the owners needed to get some equity out of the place. They first considered developing 2,000 acres into 20- to 40-acre lots but rejected the idea—too many neighbors. B.W. explained his emotional attachment to the land: "I consider myself to be the luckiest person in the world to be able to live and work in God's creation on the Montosa Ranch. I want the ranch to be protected so that it looks like this for the next 50 generations and beyond. I want the land left as it is. I don't want to see the kind of subdivisions that are being developed around Datil on this land. I want other people to see that nature can be managed for the future, and that it doesn't have to be abused."

Still, when the idea of a conservation easement was presented to B.W., he was hesitant. The word "perpetuity" scared him. "I don't have all the answers for the best way to manage the ranch for the future," B.W. said at the time, "but I want to keep my options open. Forever is a long time. I don't want to be cursed by future generations for a wrongheaded decision I may make today."

B.W. and Billie's financial partner was also reluctant to consider a conservation easement. It sounded like "tree hugging" to him. However, the ranch's attorney, John Garrett, was open to the idea. "Why be against it," John asked, "if it can satisfy your financial goals and do some greater good?"

Photo 1. Pasture fences and Tres Montosas Mountain, Montosa Ranch, New Mexico. Photo by Edward Ranney.

Two critical questions emerged: How do you maximize the market value of a limited number of lots without also providing open space amenities to the lot buyers? And how do you develop those lots in a way that will not adversely affect the ranch?

To help the owners make an informed decision, the financial and tax implications of several different scenarios were analyzed (Table 2). Using hypothetical numbers, the scenarios were based on the following assumptions:

1) Total area of ranch: 32,000 deeded acres
2) Total area of 7 lots to be sold: 5,000 deeded acres
3) Total area of view shed as seen from lots: 5,000 deeded acres
4) Total area of ranch headquarters: 5,000 deeded acres
5) *Before* value of ranch, unencumbered by easement: $150/acre
6) *After* value of ranch, easement encumbering all of ranch: $75/acre
7) Value of lots, if lots and entire ranch are under easement: $400/acre
8) Value of lots, if entire ranch but not lots are under easement: $500/acre
   (Note: value increases because of potential tax benefit to buyer.)
9) Value of lots, if only lots and view shed are under easement: $300/acre
   (Note: value decreases because less land is being protected.)
10) Enhancement of portion of ranch not under easement: $50/acre

In the end, the owners decided on scenario 3: to place most of the ranch—27,000 of the 32,000 deeded acres—under a conservation easement. The sale price of the lots under the easement is less than the example of scenario 2, but the conservation easement prevents further subdivision. The land trust holding the easement bears the expense for enforcing its terms instead of the ranch owners. And by keeping the

ranch headquarters out of the easement, the ranch owners have hedged their bets for future land sales.

The Montosa Ranch Project is about capturing the conservation value of the land for the benefit of the ranch owners. The project protected thousands of acres of private land that will continue to be ranched. It establishes a powerful model for others to consider.

Conclusion

Conservation easements and conservation development honor one of America's great strengths: private property rights. They support the stewardship of ranchers while allowing them to capitalize on this contribution. The approach creates income possibilities through limited development and allows a family to pay off debt while preserving the integrity of the land. Conservation easements are one of the last best chances for ranchers to maintain their way of life.

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References

1. Anella, A., and J. B. Wright. 2004. Saving the ranch: Conservation easement design in the American West. Washington, DC: Island Press. 176 p.
2. Liffmann, R., L. Huntsinger, and L. Forero. 2000. To ranch or not to ranch: home on the urban range? *Journal of Range Management* 53(4)362–370.

Monitoring Natural Resources on Rangeland Conservation Easements

Who's minding the easement?

By Adena R. Rissman, Richard Reiner, and Adina M. Merenlender

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 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.

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

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

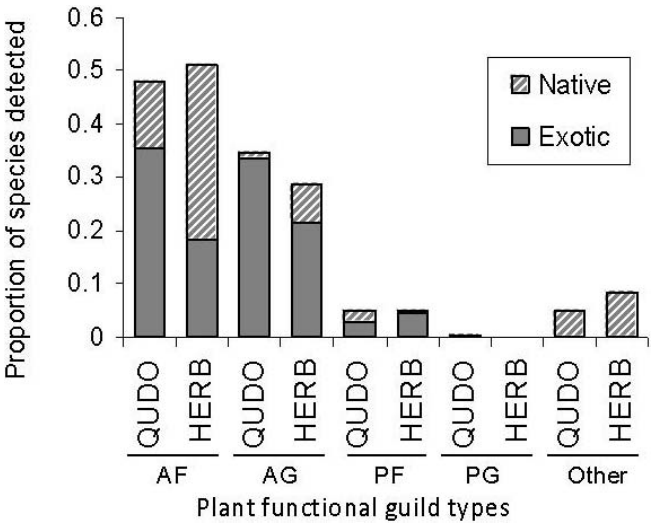

Figure 1. Average relative cover of functional guilds for the 61 blue oak–dominated plots (QUDO) and 14 herbaceous plots (HERB) sampled in 2006. Plant types, grouped into functional guilds, are AF = annual forb, AG = annual grass, PF = perennial forb, PG = perennial grass, other = ferns and shrubs.[7]

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 star-thistle (*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 star-thistle 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 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.

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

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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References

1. Anella, A., and J. B. Wright. 2004. Saving the ranch: Conservation easement design in the American West. Washington, DC: Island Press. 176 p.
2. Land Trust Alliance. 2006. 2005 Land Trust Alliance census. Washington, DC: Land Trust Alliance. Available at: http://www.lta.org/census. Accessed 30 January 2007.
3. Merenlender, A. M., L. Huntsinger, G. Guthey, and S. K. Fairfax. 2004. Land trusts and conservation easements: who is conserving what for whom? *Conservation Biology* 18:65–75.
4. Rissman, A. R., L. Lozier, T. Comendant, P. Kareiva, J. M. Kiesecker, M. R. Shaw, and A. M. Merenlender. 2007. Conservation easements: biodiversity protection and private use. *Conservation Biology* (in press).
5. National Research Council. 1994. Rangeland health: New methods to classify, inventory, and monitor rangeland. Washington, DC: National Academy Press. 180 p.
6. Marty, J. T. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. *Conservation Biology* 19(5):1626–1632.
7. The Nature Conservancy. 2006. Lassen foothills. Available at: http://www.nature.org/wherewework/northamerica/states/california/preserves. Accessed 10 January 2007.
8. Rissman, A. R., S. E. Reed, C. Hughes, and R. Reiner. 2006. Monitoring understory composition of blue oak woodlands on conservation easements. Sixth Symposium on Oak Woodlands, California's Oaks: Today's Challenges, Tomorrow's Opportunities; 9–12 October 2006; Rohnert Park, CA.
9. McCreary, D. D. 2001. Regnerating rangeland oaks in California. Oakland, CA: University of California, Division of Agricultural and Natural Resources Publication 21601. 62 p.
10. Jackson, R. D., and J. W. Bartolome. 2002. A state-transition approach to understanding nonequilibrium plant community dynamics in Californian grasslands. *Plant Ecology* 162:49–65.
11. Heise, K. L., and A. M. Merenlender. 2002. Monitoring a half-century of change in a hardwood rangeland. *Journal of Range Management* 55:412–419.

Grassbank 2.0

Building on what we have learned from the Valle Grande Grassbank.

By Courtney White and Craig Conley

A Grassbank is defined as a physical place, as well as a voluntary collaborative process, where *forage* is exchanged for one or more tangible *conservation benefits* on neighboring or associated lands. Grassbanks are one of the innovative initiatives spawned by efforts to conserve working landscapes.[1]

In 1997, author and conservationist Bill deBuys had a question on his mind: could cattle, curlews, prescribed fire, ranchers, environmentalists, and the US Forest Service all get along together?

To find out, Bill assembled the Valle Grande Grassbank, located on a 36,000-acre allotment of national forest land on Rowe Mesa, 25 miles east of Santa Fe, New Mexico. In assembling it, he set three goals for the Grassbank:

- To improve the ecological health of public grazing lands for the benefit of all creatures dependent on them;
- To strengthen the economic and environmental foundation of northern New Mexico's ranching tradition, which is arguably the oldest in the nation;
- To show that ranchers, conservationists, and agency personnel can work together for the good of the land and the people who depend on it.[2]

Inspired by a pilot Grassbank on the privately-owned Gray Ranch in southwestern New Mexico (the term "Grassbank" was coined by rancher and poet Drum Hadley), Bill convinced the Conservation Fund, a national environmental organization, to purchase 240 acres of deeded land on top of Rowe Mesa. The property came with a year-round federal grazing permit but no cattle.

This article has been peer reviewed.

The Valle Grande Grassbank is located 25 miles east of Santa Fe, New Mexico. Map Courtesy USDA Rural Development.

Instead of buying cattle, Bill proposed to offer the grass of the Valle Grande allotment as a "bank" to national forest permittees around the region in exchange for restoration work on their home ground—principally forest thinning and prescribed fire.

The ecological problem was a now familiar one: too many trees. "In a detailed study of a 250,000-acre area in northern New Mexico," Bill wrote in a summary of the Grassbank's goals, "ecologist Craig Allen found that between 1935 and 1981 tree and shrub encroachment had reduced the grassy component of the area's ecological mosaic by 55%."

"Consider the dynamics," Bill continued. "A fixed number of cows (and an increasing population of elk) must draw sub-

One of the goals for the Valle Grande Grassbank is to restore fire to the forest ecosystem.

sistence from a grass resource that is declining faster than one percent per year. The cattle necessarily use remaining grasslands heavily and crowd into riparian areas."

To Bill, and many others, restoring grassland and forest diversity and productivity means restoring fire to its natural role. Too often, however, necessary prescriptive treatments caused hardship for the local permittees and sometimes resulted in outright conflict. For many environmentalists, the solution was simple: end public lands ranching.

Bill searched for another way. "Let it be noted that the simple removal of cattle from public lands," he wrote, "as urged by a substantial number of environmentalists, will not restore environmental diversity and health, for it will not bring the keystone process of fire back into the landscape."

But a Grassbank could. That's because the Valle Grande Grassbank could take cattle from forest allotments around the region for two to three years so that restoration work could take place in the absence of any potential conflict. This work had a social benefit as well.

"In the case of northern New Mexico, we believe that the best hope for ecologically sound, fire-wise stewardship of public land lies within the ranching community," Bill wrote. "If ranchers, working with environmentalists, become advocates for prescribed burns, wildfires, and related treatments, political leaders and public agencies will respond accordingly—to the lasting benefit of the land."

In Practice

The partners in the Valle Grande Grassbank included the Northern New Mexico Stockmans' Association, the Forest Service, and the New Mexico State Cooperative Extension Service. Funding for the operation of the Grassbank, which included a full-time ranch manager, was provided by the Forest Service, the EPA (through the New Mexico Environment Department), the Conservation Fund, and private foundations.

In the first 6 full seasons of operation, the Valle Grande Grassbank took over 2,000 head of cattle from 9 separate grazing associations across 2 national forests in northern New Mexico. Conservation projects included:

- Prescribed fire: 5,590 acres
- Hand thinning ponderosa or mixed conifer forest: 4,020 acres
- Brush/Tree removal: 550 acres
- Riparian fencing: 5 miles
- Road improvements: 25 miles
- Trail improvements: 35 miles
- Association herder: 2 seasons
- Water developments: 6
- Wetland/Playa projects: 4
- Rest: equivalent of 14.5 years

In addition to the conservation benefits, the Grassbank was viewed as mostly positive by the ranchers who participated. Summarizing a survey he conducted for The Quivira Coalition in 2004, Armando Nieto wrote:

The work of the [Valle Grande] Grassbank continues to be viewed in a positive light, but it is a light that is also somewhat one-dimensional: nearly all respondents value it exclusively for the rest from grazing pressure that it confers on cooperating allotments. Concerns of distance and of lack of FS follow-through with promised projects on the home allotment further threaten to make it a less desirable option for northern New Mexico grazing permittees.[3]

In other words, after 6 years of progress, shortcomings in the model began to manifest themselves.

First, the modest conservation gains came to an end during the final 3 grazing seasons (2004–2006) when NO restoration work was completed on the "home" allotments of permittees. This occurred for a variety of reasons, including drought, National Environmental Policy Act hurdles, and budgetary tensions within the Forest Service. But it exposed a weakness in the model: relying on an overworked, understaffed federal agency for the conservation "half" of the Grassbank quid pro quo could be risky.

Second, the funding ran out. The Grassbank's $160,000 budget was entirely grant-funded and when the grants dried up, as they did at the end of 2006, so did the project. This raised a big question: how can Grassbanks "pay" for themselves? It became clear to us that relying on the fickle and increasingly competitive world of federal grants and private philanthropy is not an economically sustainable strategy.

Third, the long distances traveled by permittees to get to the Grassbank became increasingly problematic as transportation costs rose over time (participants paid their own way to the Grassbank). A number of permittees, in fact, dropped out for this reason.

In the fall of 2006, 2 years after The Quivira Coalition took over the Valle Grande project, all of these challenges came together. Some were resolved relatively easily, such as reorienting the Grassbank to serve local permittees, but others proved more difficult to crack, such as the funding conundrum.

In fact, the Grassbank has been shut down temporarily as we create a new business model that addresses these chal-

The Quivira Coalition herd on Rowe Mesa in New Mexico.

lenges. We still believe that the quid pro quo at the heart of the Grassbank is critical, as are the original goals of the project, but like an early version of computer software, their implementation needs an upgrade.

Bill deBuys anticipated this development when he wrote:

Our goal is to be consistently and continually adaptive. If the land is changing, so must we. Our fundamental challenge is shared equally by both the conservation and ranching communities: how to respond to the constant dynamism of the lands upon which we all depend.

New Vision

In May 2006, a small group of Grassbank operators, including the Heart Mountain Grassbank, located north of Cody, Wyoming, and the Matador Ranch, located near Malta, Montana (both owned and operated by The Nature Conservancy), met to discuss how to operate a Grassbank sustainably. All three are struggling with the same challenge: how to use Grassbanks to produce long-term conservation in an economically efficient way that also benefits ranchers.

The 3 Grassbanks represent a range of ownership types: the Valle Grande Grassbank is completely managed on public land for public land permittees; Heart Mountain and the Matador are a mix of public and private land participants. In comparing the strengths and weaknesses of each, the group came to the following consensus on 9 conditions for success which provide a useful framework for evaluating new Grassbank opportunities and for modifying existing programs:

1) Producing Conservation is the Primary Objective of a Grassbank.

To accomplish this goal meaningfully, conservation objectives should be anchored with a long-term (20-year) conservation plan that is scientifically/ecologically based. The old model—if you build it they will come—is an unsteady foundation for pursuing a Grassbank. For example, at its creation, the Valle Grande Grassbank had a clear vision for very specific conservation projects as well as the financial backing to make them happen. As projects were completed, however, the energy to replace old projects with new ones waned, especially as bureaucratic and budgetary obstacles were encountered.

Additionally, many of the restoration projects on the home allotments are "one shot" conservation treatments that are not part of long-range plans. Moreover, producing conservation doesn't stop with the treatment but must include the long-term management of those initial benefits or they will be lost over time. Returning livestock to the same management regime that contributed to the environmental concern in the first place, for instance, doesn't give participants, or the public, much of a return in the long run.

2) A Grassbank Must Provide a Meaningful Benefit to Participating Ranchers.

A tangible conservation benefit provided by a Grassbank might not mean much in the long run if the rancher goes out of business. Therefore, a Grassbank has to assist a rancher in accomplishing his or her goals—whether ecological or economic. This could include removing a bureaucratic obstacle on public land, or providing financial stability on adjacent private lands, or simply be a new "tool" in the toolbox. In any case, a Grassbank needs to help people stay on the land.

3) Although a Grassbank Is Not a Traditional Business, It Has to Have a Basis in Financial Reality.

As one of the Board members of The Quivira Coalition said when we first took over management of the Grassbank: "It has all the costs of a ranch and no income!" Grassbanks need to have business plans that produce revenue to support them.

For example, on their private lands, the Matador and Heart Mountain Grassbanks can charge for grazing and then provide discounts to participants for achieving specific conservation goals. These include: prairie dog habitat protection, watershed restoration, weed control, and no sod-busting, among other activities.

Although the Valle Grande Grassbank, as a public lands project, can't charge for grazing, we can derive revenue from running our own livestock. Therefore, our 5-year business plan has most of the operations of the ranch funded by approximately half the capacity of the allotment, with the other half being reinvested in conservation—either by bringing livestock to the Grassbank in the traditional model or by investing in treatments on our allotment or on associated allotments.

Regardless of whether it is a private or public lands Grassbank, at the end of the year the books have to balance or you're out of business. At the same time, conservation transactions have to result in a positive benefit for all parties. Preferably those benefits are leveraged and long-term.

4) To Work Well, a Grassbank Must Have the Cooperation of All Parties Involved.

Commitment to the goals of a Grassbank as a community resource is critical to creating long-term benefits. Valuing and respecting the interests of all parties involved is also important. The Grassbank manager has to respect the long-term interests of the participating rancher(s) and the rancher(s) has to respect the long-term mission of the Grassbank manager.

What happens on the ground is only part of the exchange. Long-term success can only be the result of growing, learning, and changing with the land and people who live on or near the Grassbank.

5) A Grassbank Is a Conservation Investment.

To be of most value, a Grassbank should be either embedded in, or adjacent to, a landscape that has long-term conservation values. If an area is destined for residential subdivision in the near term, for instance, it probably does not make a lot of sense to invest in this type of long-term landscape scale conservation.

6) A Critical Feature of a Grassbank Is Flexibility.

If a Grassbank doesn't need to operate every year, can you shut the operation down, run it as a ranch or something else that keeps the operation economically viable? Flexibility means more choices—when Grassbanks have other intrinsic values, such as wildlife, plant conservation, or recreation, more choices are available to Grassbank managers.

Likewise, it might not be necessary to destock a participating "home" allotment in order to implement a particular conservation treatment. Putting more management on the home ground in the form of range riders, for instance, might be a more cost-effective alternative to bringing the cattle to the Grassbank. When this alternative can be leveraged by an activity on the Grassbank, by a grant, or other income, we describe this approach as "taking the Grassbank to the cattle."

7) The Relationship Between the Grassbank and Participating Ranchers Must Build Long-term Capacity and Not Simply Provide a Short-term Stopgap.

Sometimes, Grassbanks are considered by observers to be "drought relief" or safety valves if something goes wrong on a district or in a particular landscape. This is akin to the practice of "swing" allotments on Forest Service land. However, although providing drought relief is sometimes a necessary and valuable function, it is generally not a primary objective of a Grassbank if it does not produce long-term benefits.

One way to encourage long-term capacity-building is to promote leadership. When Grassbanks create more effective relationships and communication among participants, they are much more likely to succeed. For example, if cows are dropped off at the beginning of the grazing season and picked up at the end without much involvement by the rancher in between, you are probably not building relationships that will be sustained over time. Also, if a Grassbank can provide access to expertise for ranchers, through an education and outreach program, and that expertise is actually utilized, you are more likely to see changes in management. A major collateral consequence of the Matador Ranch Grassbank was the creation of the Ranchers Stewardship Alliance in 2006 (see www.rancherssstewardshipalliance.org).

8) Measurements of a Grassbank's Success Must Be Clearly Articulated.

Although ecological measurements of success (or failure) are fairly straightforward, the social indicators are more important. For example: did the Grassbank bring people to the table? Did it inform or educate people about ecological and/or economic issues?

9) Mistakes Will Be Made—Deal With Them.

Making mistakes is the essence of adaptive management. The key is to act as quickly as possible in order to minimize their effects. Don't dwell on the first mistake; be able to regroup and learn from the experience. All 3 Grassbanks have made mistakes, but we have learned much, adapted in different ways to meet the objectives and needs of all parties involved, and are ready to start the next round.

An open, fire resistant forest of ponderosa pine after restoration through fire and grazing management.

When we took over the Valle Grande project from Bill deBuys and the Conservation Fund, we touted Grassbanks as "an idea whose time has come." Three years later, we've adjusted that to "an idea whose time is still coming." Like any good idea, follow-up versions improve on the basic model. Hopefully, by the time Grassbank 3.0 rolls out, many of the challenges will have been ironed out and the "marketplace" will be ready to employ what we believe is an important innovation.

For more information on The Quivira Coalition, visit www.quiviracoalition.org.

Acknowledgments

The authors wish to thank Linda Poole, Maria Sonett, Michael Moon, and Sheldon Atwood for their contributions to this article.

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References

1. Gripne, S. L. 2005. Grassbanks: bartering for conservation. *Rangelands* 27:24–28.
2. deBuys, W. 1999. Valle Grande Grass Bank. Newsletter; Santa Fe, NM: The Conservation Fund.
3. Nieto, A. J. 2004. Stakeholder Opinions of a Collaborative Forest Restoration Project on the Valle Grande Grass Bank. Santa Fe, NM: The Quivira Coalition.

The California Rangeland Conservation Coalition

Grazing research supports an alliance for working landscapes.

By Sheila Barry, Tracy K. Schohr, and Karen Sweet

One thing this issue of *Rangelands* has made clear is that conserving working landscapes often means working across property lines and in collaboration with planners, agencies, conservation groups, landowners, and the ranching industry. A ranch in the San Francisco Bay Area was the backdrop for a meeting between environmentalists, ranchers, and resource professionals from federal and state agencies. From this meeting of former foes in the Summer of 2005, participants drafted a resolution documenting common ground for the conservation of the rangeland encircling the central valley, including the Sierra foothills and interior coast ranges. The resolution recognized that these wildlife-rich rangelands have been shaped by grazing and the other land stewardship practices of the ranchers who own and manage them. Recent research contributed to this alliance, by showing how well-managed grazing can provide improved habitat values.

Table 1. California native plants and animals which benefit from managed grazing

Common	Scientific
Bay checkerspot butterfly	*Euphydryas editha bayensis*
California tiger salamander	*Ambystoma californiense*
California red-legged frog	*Rana aurora draytonii*
Blunt-nosed leopard lizard	*Gambelia sila*
Giant kangaroo rat	*Dipodomys ingens*
San Joaquin kangaroo rat	*Dipodomys nitratoides*
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*
Santa Cruz tarplant	*Holocarpha macradenia*

The resolution is currently signed by 64 agricultural organizations, environmental interest groups, as well as state and federal agencies (see The California Rangeland Resolution). Together these signatories form the California Rangeland Conservation Coalition. The signatories have pledged to work together to preserve and enhance California's rangeland for species of special concern, while supporting the long-term viability of the ranching industry. An important part of the group's effort will focus on educating the public about the benefits of grazing and ranching on these rangelands.

The value of grazing and other land stewardship practices of California's ranchers is being increasingly acknowledged not only as a preferred land use but also as an *essential* resource management tool. Reduction of fire hazard is widely considered a reason to graze by private and public landowners, because grazing reduces fine fuels and suppresses shrub invasion on many fire-prone California rangelands. However, published rangeland research has now also documented the other positive benefits of grazing on the habitat of several special status species.

This article has been peer reviewed.

The California Rangeland Resolution

The undersigned recognize the critical importance of California's privately owned rangelands, particularly that significant portion that encircles the Central Valley and includes the adjacent grasslands and oak woodlands, including the Sierra foothills and the interior coast ranges. These lands support important ecosystems and are the foundation for the ranching industry that owns them.

WHEREAS, these rangelands include a rich and varied landscape of grasslands, oak woodlands, vernal pools, riparian areas and wetlands, which support numerous imperiled species, many native plants once common in the Central Valley, and are home to the highest diversity and density of wintering raptors anywhere in North America;

WHEREAS, these rangelands are often located in California's fastest-growing counties and are at significant risk of conversion to development and other uses;

WHEREAS, these 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;

WHEREAS, these rangelands are a critical foundation of the economic and social fabric of California's ranching industry and rural communities, and will only continue to provide this important working landscape for California's plants, fish and wildlife if private rangelands remain in ranching;

THEREFORE, we declare that it is our goal to collaboratively work together to protect and enhance the rangeland landscape that encircles California's Central Valley and includes adjacent grasslands and oak woodlands by:

- Keeping common species common on private working landscapes;
- Working to recover imperiled species and enhancing habitat on rangelands while seeking to minimize regulations on private lands and streamline processes;
- Supporting the long-term viability of the ranching industry and its culture by providing economic, social and other incentives and by reducing burdens to proactive stewardship on private ranchlands;
- Increasing private, state and federal funding, technical expertise and other assistance to continue and expand the ranching community's beneficial land stewardship practices that benefit sensitive species and are fully compatible with normal ranching practices;
- Encouraging voluntary, collaborative and locally-led conservation that has proven to be very effective in maintaining and enhancing working landscapes;
- Educating the public about the benefits of grazing and ranching in these rangelands.

SIGNED BY:

Alameda County Board of Supervisors
Alameda Co. Resource Conservation District
Amador Resource Conservation District
American Farmland Trust
American Land Conservancy
Audubon California
Bureau of Land Management
Butte Environmental Council
Butte County Resource Conservation District
Calaveras Co. Resource Conservation District
California Association of Resource Conservation Districts
California Cattlemen's Association
California CattleWomen's Association
California Chapter of the International Soil and Water Conservation Society
California Department of Conservation
California Dept of Fish and Game
California Dept of Food and Agriculture
California Dept of Forestry and Fire Protection
California Farm Bureau Federation
California Grazing Lands Coalition
California Invasive Plant Council
California Native Grasslands Association
California Native Plant Society
California Oak Foundation
California Rangeland Trust
California Resources Agency
California Wildlife Foundation
California Wool Growers Association
Cal-Pac Section Society of Range Management
Central Sierra Region of Resource Conservation Districts
Central Valley Land Trust Council
City of Livermore
Defenders of Wildlife
Ducks Unlimited
El Dorado Resource Conservation District
Environmental Defense
Glenn County Resource Conservation District
Institute for Ecological Health
Jumping Frog Research Institute
Mariposa Co. Resource Conservation District
National Wild Turkey Federation
National Cattlemen's Beef Association
Natural Resources Conservation Service
Nevada Co. Resource Conservation District
Nevada County Land Trust
Northern California Regional Land Trust
Placer Co. Resource Conservation District
Sacramento River Watershed Program
San Joaquin Raptor/Wildlife Rescue Center
San Joaquin Valley Conservancy
Sierra Foothills Audubon Society
State Water Resources Control Board
Sustainable Conservation
Tehama Country Resource Conservation District
The Nature Conservancy
Trust for Public Land
Tuolumne Co. Resource Conservation District
University of California
US Fish and Wildlife Service
US Forest Service
VernalPools.org
Western Shasta Resource Conservation District
Wildlife Conservation Board
WildPlaces

March 6, 2007

In California's southern San Joaquin Valley, wildlife biologist Dr David Germano and team found that cover of nonnative grasses and forbs often creates an impenetrable thicket for small, ground-dwelling vertebrates. Many of the small vertebrates that evolved in this habitat of saltbrush scrub rely on open ground to forage and avoid predation. Preliminary research indicates that populations of giant kangaroo rats, San Joaquin kangaroo rats, San Joaquin antelope squirrels, and blunt-nosed leopard lizards, all listed as threatened or endangered, are affected negatively by thick ground cover. The researchers acknowledge that although grazing might originally have contributed to the introduction of nonnative plants, moderate to heavy grazing by livestock at the present time might be the best way to ameliorate the habitat for these small vertebrates.[1]

Grazed vernal pool habitat on the Hearst Ranch. Photo by Sheila Barry.

In the California's Central Valley, Dr Jaymee Marty, an ecologist with The Nature Conservancy, found that grazing maintained native plant and invertebrate diversity in ephemeral wetlands or vernal pools. She found that invasion by nonnative annual species reduced native plant cover and wetland inundation periods. Her study across 72 vernal pools examined the effect of different grazing treatments (ungrazed, continuously grazed, wet-season grazed, and dry-season grazed) on vernal-pool plant and aquatic faunal diversity. After 3 years of treatment, she found that ungrazed pools had 47% lower relative cover of native species and 88% higher cover of nonnative annual grasses than pools grazed at historical levels (continuously grazed). Species richness of native plants also declined

Bay checkerspot butterfly. Photo by Stuart Weiss.

Butterfly fenceline: the land on the side of the fence covered with goldfields is grazed by cattle. The land on the other side of the fence has been rested for a number of years and no longer supports the Bay checkerspot butterflies. Photo by Sheila Barry.

by 25% and aquatic invertebrate diversity was 28% lower in the ungrazed compared with the continuously grazed treatments. The inundation period of the pools was reduced by 50% to 80% in ungrazed pools, making it difficult for some vernal-pool endemic species to complete their life cycle.[2]

Similar impacts from nonnative annual species have been found on serpentine sites south of San Francisco Bay. These serpentine sites support many rare species, including the endangered Bay checkerspot butterfly. Conservation biologist Dr Stuart Weiss surveyed butterfly and plant populations across different grazing regimes. He observed that several populations of the butterfly in south San Jose were extirpated following the exclusion of cattle grazing, whereas nearby populations under continued grazing did not decline. His research determined that Nitrogen (N) deposition from automobile emissions is threatening biodiversity in these grasslands because N is the primary limiting nutrient for plant growth on serpentine soils. Fertilization experiments have shown that soil N limits grass invasion in serpentine soils. Estimated N deposition rates in south San Jose grasslands are 10–15 kg N · ha · year. Dr Weiss noted that grazing cattle select grasses over forbs and grazing leads to a net export of N.[3]

Benefits of grazing have also been documented on California's coastal grasslands. Plant ecologist Dr Grey Hayes examined the declining trends in annual wildflowers such as the endangered Santa Cruz tarplant. He noted that the 2 primary threats to California's coastal prairies are human development and invasion by exotic weeds, but a third major threat is the cessation of grazing. He carefully documented the changes in one population of tarplant that flourished in harmony with cattle grazing, disappeared after grazing was removed, and reappeared years later after extreme human intervention.[4]

In another study, Hayes et al[5] investigated the impact of cattle grazing on the California coastal prairie plant community. He surveyed 25 paired grazed and ungrazed sites for vegetation community composition, vegetation structure, and soil chemical parameters. The surveys were conducted for 2 years during the spring on sites across a 425-mile range of the ecosystem. Native annual forb species richness and cover were higher in grazed sites, and this effect coincided with decreased vegetation height and litter depth. Soil properties explained less of the variation. Exotic annual grass and forb cover were also higher in grazed sites. Native grass cover and species richness did not differ in grazed and ungrazed sites, but cover and species richness of native perennial forbs was higher on ungrazed sites. Based on these results, Hayes et al recognized that cattle grazing might be a valuable management tool to conserve native annual forbs, many of which are species of concern.

Because it is supported by scientific research, the message that grazing can benefit habitat on California's rangelands has been heard beyond the conservation research community and is impacting conservation regulations. The federal listing of 2 species within California contain the 4d rule.[6,7] The rule exempts routine ranching practices from the prohibitions of the Endangered Species Act (ESA), including taking, harming and harassing listed species. The US Fish and Wildlife Service has recognized that ranching activities, including grazing and maintenance of stockponds, benefit the California red-legged frog and the California tiger salamander. The US Fish and Wildlife Service took the lead in bringing together ranchers, environmentalists, and regulators to draft the California Rangeland Resolution and establish the California Rangeland Conservation Coalition.

Coalition members first gathered on January 11, 2006. The day-long summit drew over 80 members. A list of the coalition's goals was defined and prioritized throughout the day and became an action plan. The plan, the CA Rangeland Conservation Resolution, laid the foundation for coalition members to work together to acquire additional federal funding for conservation programs, coordinate permitting processes, garner support for cooperative conservation projects, and provide landowner assurances and incentives for

proactive voluntary conservation. As a coalition member, the California-Pacific Section of the Society for Range Management will be working with other coalition members to identify and close gaps in our knowledge of grassland and oak woodland management and its benefit to wildlife habitat. Coalition members have joined forces twice in Washington, D.C., March 2006 and March 2007, to present the coalition and advocate its priorities on Capitol Hill.

Scientific research has demonstrated what many have long believed: grazing can be an important component of ecosystem management. It can also help managers evaluate options and improve stewardship. Together with collaborative efforts that cross boundaries and create partnerships with private landowners, rangeland research can help to create the working landscapes of tomorrow.

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References

1. Germano, D. J., G. B. Rathbun, and L. R. Saslaw. 2001. Managing exotic grasses and conserving declining species. *Wildlife Society Bulletin* 29(2):551–559.
2. Marty, J. T. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. *Conservation Biology* 19:1626–1632.
3. Weiss, S. 1999. Cars, cows, and checkerspot butterflies: nitrogen deposition and management of nutrient-poor grasslands for a threatened species. *Conservation Biology* 13:(6)1476–1486.
4. Hayes, G. 1998. The saga of the Santa Cruz tarplant. *Four Seasons* 10(4):18–21.
5. Hayes, G. F., and K.D. Holl. 2003. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California. *Conservation Biology* 17(6):1694–1702.
6. United States Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants: Determination of threatened status for the California tiger salamander, and Special rule exemption for existing routine ranching activities. Federal Register 69(149):47212–47248.
7. United States Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants: Revised proposed designation of critical habitat for the California red-Legged frog (*Rana aurora draytonii*). Federal Register 70(212):66906–67064.

Creating a Culture of Innovation in Ranching

A study of outreach and cooperation in west-central Colorado.

By C. A. Kennedy and Mark W. Brunson

Conserving working landscapes means creating a community of landowners and managers engaged in a sustainable, productive relationship with the land despite social, economic, and environmental change. Ranchers across the West are reviewing their management options in the face of daunting forces such as drought, rising land prices, and encroaching development. While ranchers and other rangeland managers seek answers, research and Extension personnel look for the best ways to get those answers to the people who need them.

Ranchers in west-central Colorado seek out new ideas for managing rangelands, and many make changes based on these ideas. Since 1996, 3 ranches in the communities of Paonia and Montrose have received the Excellence in Range Management Award from the Colorado Section of the Society for Range Management. Their willingness to innovate could be partially due to exposure to numerous range management ideas through other ranchers and Holistic Management programs, as well as a unique support system of extension and agency personnel who have introduced nontraditional outreach approaches such as the Range Management School for Ranchers.

Area ranchers, Colorado State University (CSU) Extension personnel, and representatives of the Natural Resources Conservation Service, USDA Forest Service, and Bureau of Land Management collaborated to create the Range Management School for Ranchers.[1] Two courses were developed. The introductory course, Range 101, covers plant identification, grass phenology, plant response to grazing, animal nutrition, monitoring, animal behavior, range economics, range improvements, and poisonous plants. The more advanced class, Range 501, goes into more depth, including designing a grazing management plan. This course helps ranchers develop parts of a plan that federal agencies require, such as carrying capacity and monitoring. Each participant receives a notebook that includes material from CSU range faculty, pertinent articles from journals and magazines, NRCS publications, and speakers' handouts. The cost is $15. The first class in December of 1995 had 62 ranchers, federal land managers, private rangeland owners, and environmentalists. The School now has several well-attended classes every year and is a model for similar efforts in other areas.[1,2]

As researchers seeking ways to improve adoption rates for new range management practices, we wanted to know how these apparently successful efforts in Colorado, including the school, influence technology transfer. We explored how ranchers put new information about range management into practice—in other words, how information on range management evolves from an Extension fact sheet or workshop into application and integration into rancher operations. Previous studies have examined range management adoption, rancher characteristics associated with adoption, and barriers and facilitators of the adoption process; however, we know of no studies that specifically address the effects of a ranchers' school on technology transfer.

Ranchers operating in west-central Colorado, including school attendees, were surveyed and interviewed on their adoption of range management practices and their use/non-

This article has been peer reviewed.

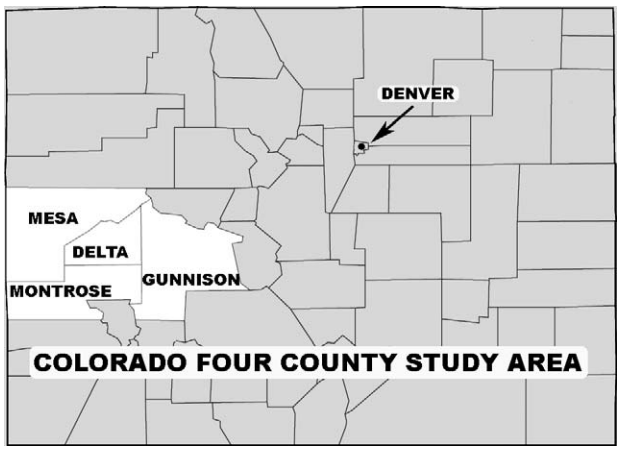

Figure 1. Two-thirds of survey responses came from a four-county region in west-central Colorado.

use of the Range Management School for Ranchers. We mailed a four-page survey to all 647 persons on the mailing list for the CSU Tri-River Extension Office. This list included Forest Service and BLM permittees in Mesa, Delta, Montrose, San Miguel, Ouray, Hinsdale, Saguache, and Gunnison counties, as well as other individuals in the area who were on the mailing list because of past participation in range and livestock Extension programs (Fig. 1). The survey included inquiries into ranchers' range management, their use or nonuse of range management innovations, and sources of information for range management ideas.

In all, 247 filled-out surveys were mailed back for a return rate of 38%. Sixty-one of the respondents did not raise livestock in 2002 or 2003, producing a final sample size of 186 respondents. We summarized data from the surveys and developed themes for exploration in qualitative interviews.

The interview sample included a subset of respondents. The survey asked respondents if they would be willing to be contacted by a graduate student "who would ask more about your experiences as a livestock producer." Eighty-eight respondents indicated yes, and provided their names and contact information. Eighteen respondents were selected from the 88 who agreed to be interviewed, using a stratified sampling strategy based on decisions to attend/not attend the Range Management School for Ranchers and to implement/not implement range management changes in their operations since 1995, and on the types of range management change implemented. This approach allowed us to interview respondents who tried both common practices (eg, adding a water source or relocating fence lines) and less common ones such as range monitoring and alternative animal handling. We were able to contact and interview 16 of the 18 respondents selected.

Each of these 16 ranchers was also asked to identify other ranchers they knew who made changes to their operations. This "snowball sampling" method[3] provided opportunities to interview ranchers who did not respond to the survey or were not on the Extension mailing list, and who had been difficult to access otherwise. Seven ranchers were identified using this method and interviewed, creating a total interview sample of 23 ranchers.

Qualitative interviews specifically aimed to gather information on the process of adapting and implementing range management innovations into individual operations. Qualitative research is increasingly acknowledged as a valuable tool in understanding range management decision making because of its flexibility and attention to context, and its ability to reveal social, historical, political, and economic factors that affect ranch management but that have eluded quantitative studies.[4] Sayre explains that quantitative research requires standardized answers, but qualitative research can be flexible and open-ended, allowing unanticipated factors to emerge. Qualitative methods also allow the researcher to evaluate decision making and decision-making environments on a case-by-case basis. The researcher spends time with individual ranchers and their ranches, gaining knowledge on rancher behavior and their management that cannot be captured using aggregate, quantitative methods.

For this study, interviews were open-ended and conversational, but semistructured using an interview guide. Questions focused on topics exploring how ranchers made changes to their operations, what forces drove them to make changes, and how they learned from their peers and other information sources.

From these surveys and interviews, common themes about range management innovations, and the role of the Range Management School and agency support in these innovations, emerged. These themes are presented and discussed here.

Who Adopts New Practices?

We found that although all ranchers experience conditions such as drought and rural development, some perceive those conditions as incentives to change, whereas others perceive them as obstacles.

A key influence on these perceptions is a rancher's personal and management goals. Different goals result in different perceptions of consequences. If a practice is seen as being likely to detract from a lifestyle goal such as "time with family," then the practice loses its appeal. One interviewee switched to management-intensive grazing on his allotment and saw benefits of better herd health and increased forage, but also found he enjoyed time spent riding the allotment with fellow permittees; for this rancher, management intensive grazing met not only ranch goals but also a lifestyle goal. Another permittee saw the same benefits, but said it took valuable time away from other important parts of his life, such as family. He had recently sold his permit.

Interviewees often held full-time outside jobs, as did their spouses and other family members. This meant their available time and labor were restricted by off-ranch commitments. This fits with previous research suggesting off-ranch commitments inhibit innovation. For example, Texas

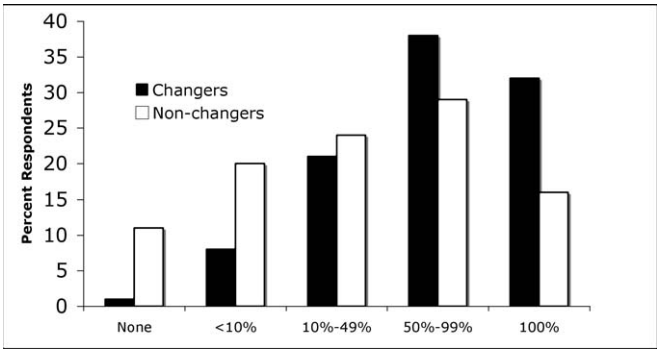

Figure 2. Proportion of income earned from agriculture among respondents who changed and did not change management practices.

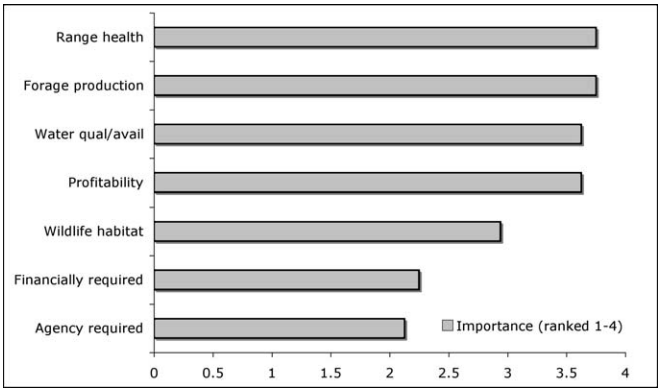

Figure 3. Mean importance of motivations for making management changes (scored 1–4 where 1 = not at all important, 4 = very important).

ranchers who invested in weed and brush control had higher proportions of family income from livestock production and less off-ranch income,[5] and innovative ranchers interviewed in Utah noted they were able to spend more time on innovations because they were full-time ranchers who didn't have to work off the ranch.[6]

Among ranchers surveyed in our study, 70% of those who had made changes in their range management earned more than half of their income from agriculture, whereas only 44% of nonchangers made more than half of their income from agriculture (Fig. 2).

Ranch Motivations and Goals

Survey respondents making range management changes ranked rangeland health, forage production, profitability, and water quality and availability as top motivations behind their decisions; financial reasons or BLM or Forest Service requirements were least important (Fig. 3). Among ranchers interviewed, ranch goals centered on increasing efficiency, increasing profits, and maintaining a ranching lifestyle, and indicators such as improved animal performance or better forage utilization were important factors in decision making.

Having clearly defined goals encouraged change. Many interviewees participated in the Holistic Management program, which emphasizes the importance of making decisions around a holistic goal, and monitoring and testing decisions toward that holistic goal. In practicing Holistic Management, ranchers work to recognize the consequences of a practice and how those consequences relate back to ranch goals.[7]

One rancher explained how after attending Holistic Management classes and learning Holistic Management principles, he worked to build goals for his ranch.

The real important part was going back to the family and getting the basic goal. Where I thought I was going to come home and build fences, I came home and got my son and daughter and wife to talk about what was important in their life. I mean that seems like a long way from building fences and growing grass, but that's really the important part, because you can make all of those mechanical adjustments, but if you don't get the deep down stuff of where you're headed in life with the rest of your family, it isn't so great. And I have seen that split families up, where when they get down to that deep what's important to them they realize they're both going different directions. It's not always good. But in our case it was good.

Seeing is Believing

It was important for ranchers to be able to see that a change was meeting or not meeting ranch goals. Without that feedback, ranchers were unsure of the benefits and drawbacks of newly implemented practices, other than their initial cost in time, labor, and money.

One rancher explained a newly implemented rotation on his allotment using electric fence. He could see it was making some difference because a lot of cattle trails were gone, but when asked if he thought it had made a difference in recent tougher years, he replied, "It's hard to say but, I can't really see that it's a night and day difference. I may not be giving it enough credit I don't know."

One important source of feedback comes from frequent interactions with other ranchers using the same practice, allowing ranchers to gain from multiple sets of "trial and error" and see various indicators of success or failure to compare to their own situation. One rancher described how he learned to use electrical fencing through his own and other ranchers' trial and error.

That was probably the thing that helped us the most, was that three of us were trying to use it at home and talking back and forth about it. Plenty of failures. I don't have any of the first electric fence posts that I bought. None of them were right. Some of the chargers, the tape, the wire, all that stuff changed how we did it, what we expected out of it. So trial and error and also neighbors' trial and error.

Other opportunities for feedback came from Holistic Management programs and the Range Management School for Ranchers. These programs provided a foundation in range management that ranchers could use to evaluate the quality of their range, and allowed them to see trends of improvement or degradation. One rancher explained, "Those schools made it a lot easier to see both why you were doing it and what results you might see and things not to do…"

The Range Management School for Ranchers incorporates frequent evidence of positive outcomes of range man-

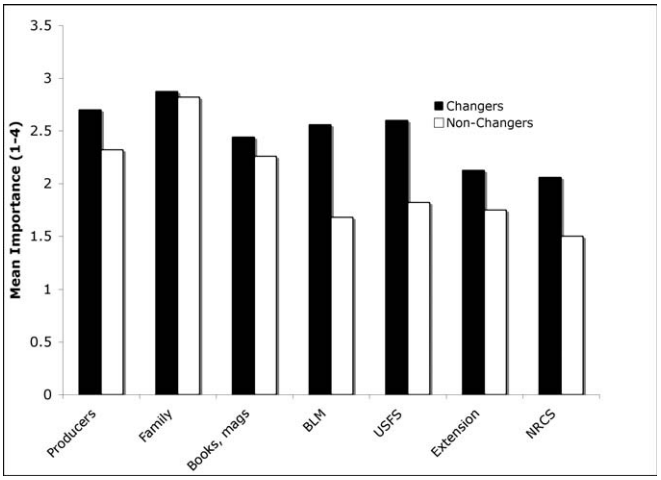

Figure 4. Mean importance of information sources used when making range management decisions, comparing those who did and did not make changes in management.

agement into the curriculum, thus enticing ranchers to try an idea or to reinforce an idea that they are already trying by illustrating the benefits they can realize.

Change and Outreach

Fellow ranchers and family members are not only important sources of feedback *after* a change is made, but also important sources of information *leading to* a change. Our survey found that family members were the most-used information source for all ranchers; however, one thing that distinguished changers from non-changers was the number of sources of information used. Ranchers making management changes were more likely to consult other ranchers, as well as experts from the NRCS, Extension, and land management agencies (Fig. 4).

So what role does the Range Management School for Ranchers play? Among survey respondents, 92% of people who had attended the school had made changes in their range management practices since 1995, whereas 62% of nonattendees had changed practices since 1995. Thus school attendance seems to positively influence ranchers' potential for change, but is not a prerequisite for change.

Among the people who attended the school, almost all made some kind of change since 1995, but nearly half (46%) of survey respondents reported that they did not change their range management practices *as a result of* attending the school. Even so, some made comments such as, "But I understand why we needed to do what we were doing," or "We were doing most of what they talked about," indicating that for these ranchers the school provided reinforcement of ideas that they were already trying.

Among the 54% of school attendees whose practices did change as a result of attending the school, several commented that after attending the school, they had the information they needed to make decisions on range management changes they were already considering. One rancher commented, "The class helped us decide." Another rancher said that changes made were "not necessarily because of the school, but the information given was a good source to help us with decisions."

Thus the school is both facilitator and reinforcer of range management change, but is less important as an instigator of change among ranchers who otherwise would be unlikely to make changes on their own. Results suggest that, for many ranchers, the initiation of an idea for change comes from information sources important to them, such as other ranchers, family members, or the BLM or Forest Service. The school then acts as a road map showing how to get there, allowing ranchers to learn how to fit the practice into their own lives. The school seems to shift an idea from an abstract suggestion by a range conservationist to a "practical and personal" piece of advice. As best-selling author Malcolm Gladwell in his book, *The Tipping Point,* pointed out, once an idea becomes "practical and personal" it becomes "memorable."

The school provides a venue to learn the specific characteristics of the innovation, giving ranchers necessary information to decide whether it will or will not work in their situation. Suggested improvements to the school, such as more practical instruction from other ranchers and practice with on-the-ground application, indicate a desire for increased opportunities to answer the question, "What will its advantages and disadvantages be in my own situation?"

According to Everett Rogers,[8] one of the world's foremost experts on innovation in multiple fields, this is a common question when forming an attitude about an innovation, because individuals are looking to decide whether to implement changes themselves. More opportunities for informed decisions can mean more implementation, as the comparison of attendee versus nonattendee rate of adoption suggests.

Interviews showed that the Range Management School also created a common knowledge base among permittees and BLM and Forest Service personnel. The school is attended and/or taught by agency personnel and permittees alike. Both permittees and agency range personnel can leave the school with the same primary range management concepts in mind.

A common knowledge base seemed to help permittees understand the reasoning behind suggestions or requirements made by the Forest Service or BLM. Also, range management knowledge lets permittees incorporate their own ideas into allotment plans and make suggestions in the language that agency personnel understand. Dave Bradford, range conservationist with the US Forest Service in Paonia, explained that he will accept permittees' changes to grazing plans, but permittees must justify these changes with range science. As one rancher put it,

(Range conservationists) have given us a lot of latitude in how we do things…I think it makes an awful lot of difference, because you feel like they're actively involved in the cooperation of it rather than setting mandates…and when you're managing livestock you know, everything is subject to different scenarios all the time and a lot of people don't really understand that… The reward's been

there for being proactive. They've given us a lot of leeway and yet still, they watch us closely, but it's been worth them watching us.

How Public Land Managers Help

Relationships with public land agencies play a large role in west central Colorado ranchers' aptitude for change. Flexible and cooperative relationships encouraged substantive, sustaining change. Conversely, those with doubts about the benefits of substantive change tended to feel constrained in their relationships with public lands agencies.

I think sometimes they don't want to listen to um, to experience. They have all these ideas they've learned out of a textbook somewhere and they feel like they have the answer, and they don't—It's like they have set answers for every place, and every place is different and every allotment's different, and sometimes it's pretty tough, because you know you have people that have run cattle for 50 years on an allotment and they've seen it all and they've done it you know, but it's kind of a continual fight…

Although Forest Service/ BLM requirements were not seen as important reasons to change among survey respondents (Fig. 3), agency suggestions or requirements did play a role in most interviewees' range management. Agency suggestions or requirements often lead to initial corrective changes. When coupled with recognizable, positive feedback these corrective changes lead to more substantive and larger-scale changes for several interviewees.

Toward a Culture of Innovation

We originally suspected that the Range Management School for Ranchers was an important reason why west-central Colorado ranchers adopt range management innovations. Our results suggest that the school plays a key role, but not quite in the way we thought. The school makes change more feasible, but it is just one part of a "culture of innovation" that exists in the area. The supportive atmosphere was also cultivated by Holistic Management training and cooperative relationships among permittees and public land managers. These cooperative relationships might be due in part to permittees and agency personnel sharing a common knowledge base via the school and/or Holistic Management training. With a common knowledge base comes a common language that helps build strong working relationships among permittees and public land managers. Thanks to these multiple facilitators of change, area ranchers who are interested in innovation have a solid network of neighbors, whose own change experiences provide valuable feedback for improved success.

The important question therefore becomes: How can range managers and education providers nurture a culture of innovation in their own areas? First off, it's important to understand the reasons why changes get made. We found that ranchers' primary motivations for change are values tied to the land base, such as forage production, range health, and water quality, as well as a desire to improve profitability. This suggests that when designing range management outreach, it's important to provide frequent evidence of positive outcomes related to land health and profitability—especially because frequent feedback is needed if ranchers are to stick with changes that have short-term costs but promise long-term benefits.

When designing outreach efforts, framing messages so that they align with common ranch goals could encourage ranchers to initiate change in their range management. Emphasizing links between range management alternatives and common goals such as increased time efficiency, profit, and maintaining a ranching lifestyle provides ranchers the necessary information for decisions to incorporate those alternatives into their own operations.

Many outreach tools, such as Extension bulletins, emphasize range conservation as the primary goal and publish specific information geared to achieve that goal. Among ranchers interviewed, conservation is a chief concern, but its feedback (negative or positive) is often years in the making. Consequences to profit, time efficiency, and lifestyle are readily felt. Outreach materials that incorporate these common ranch goals and link them to conservation are more practical and personal to many ranchers, and therefore might be more readily applied.

It's also significant that we found Forest Service and BLM personnel to be powerful proponents of range management change on both public and private lands. Working relationships between permittees and personnel encouraged change, whereas adversarial relationships seemed to discourage substantive change on rangelands. In an era when political dialogue focuses on the negative aspects of rancher/agency relationships, it's important to be able to see examples of how things can work in a nonadversarial atmosphere. The agency/ Extension/rancher partnership that led to the Range Management School for Ranchers might be unique among western working landscapes, but we strongly urge investigations of how "technology transfer" can be enhanced by nurturing such relationships among agency personnel and ranchers in other regions.

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References

1. LeValley, R. B., J. Murray, F. Reed, J. Hawks, and D. Bradford. 2000. Range management school for ranchers: or how to teach plant phenology, forage utilization, plant physiol-

ogy and other esoteric range management concepts to a bunch of cowboys. *Rangelands* 22(4):10–13.
2. Bradford, David. 2003. Personal communication.
3. Hendricks, V. M., and P. Blanken. 1992. Snowball sampling: theoretical and practical considerations. *In:* V. M. Hendricks, P. Blanken, and N. Adriaans [eds.]. Snowball sampling: A pilot study on cocaine use. Rotterdam, The Netherlands: IVO. p 17–35.
4. Sayre, N. 2004. Viewpoint: the need for qualitative research to understand ranch management. *Journal of Range Management* 57(6):668–674.
5. Rowan, R. C., and L. D. White. 1994. Regional differences among Texas rangeland operators. *Journal of Range Management* 47(5):338–343.
6. Didier, E. A., and M. W. Brunson. 2004. Adoption of range management innovations by Utah ranchers. *Journal of Range Management* 57(4):330–336.
7. Savory Center. 2005. About Holistic Management. Available at: http://www.holisticmanagement.org. Accessed 15 May 2005.
8. Rogers, E. M. 1995. Diffusion of innovations. 4th ed. New York, New York: Free Press. 518 p.

A History of Working Landscapes: The Altar Valley, Arizona, USA

How ranchers have shaped the West–and continue to do so.

By Nathan F. Sayre

Approaching rangelands as working landscapes begins from the premise that people and the environment shape each other over time. Sustainable management is therefore not only an ecological but also a social process, strongly influenced by local histories of resource use, management, change, and learning. The case of the Altar Valley, Arizona, offers insights into how economics, range science, mental models, and the scale of decision making have shaped ranchers and the landscape over time. In particular, it provides empirical answers to important questions facing range science today: How do scientific knowledge and recommendations affect on-the-ground management? How do ranchers weigh economic, ecological, and cultural goals against one another? What kinds of information do ranchers and other parties need to solve problems and improve stewardship in a rapidly changing West?

The Altar Valley is an approximately 618,000 acre (250,000 hectare) watershed located just north of the United States–Mexico boundary and east of the Tohono O'odham (formerly Papago) Indian Reservation. Elevations range from around 2,460 to 7,710 ft (750 to 2,350 m), and average annual precipitation grades from 8 to 24 inches (200 to 600 mm) with elevation (Fig. 1). Landownership is a mosaic of state trust (47.5%) and private lands (11.3%) in most of the center of the valley, with areas of US Forest Service (11.9%) and Bureau of Land Management lands (2.3%) concentrated in the surrounding mountains. The Buenos Aires National Wildlife Refuge (NWR) comprises a large block of land (18.8%) in the southern end of the watershed; portions of the Indian Reservation comprise the rest (8.3%). Thirteen large properties (12 ranches and the Buenos Aires National Wildlife Refuge—which was formed from a ranch in 1985) control 80 percent of the land base in the watershed. The refuge is not grazed by livestock; one ranch is a dude ranch, grazed by horses; the remaining ranches all run cattle. The ranches contain approximately 66% of the valley's private land.

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Although relatively overlooked by scientists, agencies, and environmentalists during the 20th century, the Altar Valley has recently emerged as a focal point in the politics of conservation in Pima County, Arizona. Despite dramatic changes in the structure and composition of vegetation and in watershed function (see below), the area provides habitat to numerous listed threatened or endangered species. Compared to the rest of eastern Pima County, the Altar Valley is also remarkably unfragmented by residential development, although the fringes of metropolitan Tucson (population approximately 1 million) reach right up to its northeastern edge. In consequence, advocates of wildlife and open space conservation are increasingly interested in the activities of the families who own the valley's major ranches. With market prices for private land in the valley ranging upward from $3,000/acre ($7,410/ha), the incentive to subdivide and the equity values of these ranches are both very high. Recently, Pima County purchased one of the ranches for open space protection and leased it back to the previous owners to manage.

Management History

The history of management in the Altar Valley is one of reciprocal influence and change in the land and in ranchers' "mental model" of how the land works.[1] The case study presented here rests on 7 years of participatory research in the area, including extensive interviews, archival research, participant observation, and collaboration with local ranchers on resource conservation projects.[2,3]

Water Development

Surface water sources were so limited prior to 1885 that the valley saw little human occupation. Ground water supplies are large but very deep. Once well drilling and pumping technologies became available in the late 19th century, water development was rapid. Similarly, the advent of gasoline-powered equipment prompted widespread earthen dam construction after about 1920. The Pima County Agricultural Extension agent promoted water development in the 1920s, and Soil

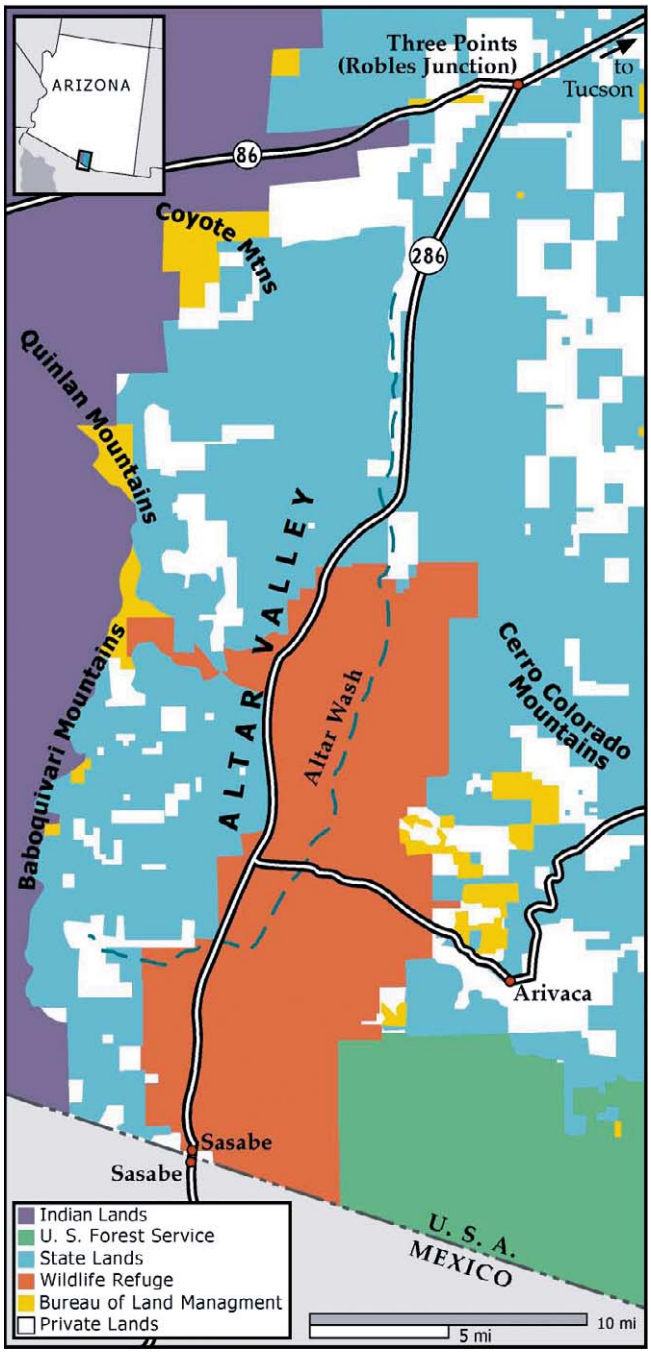

Figure 1. The Altar Valley, Arizona. Despite the mosaic of landownership types, the valley remains almost wholly unfragmented by development. (Map by Darin Jensen.)

Conservation Service programs shared costs for dams, wells, and earthen tanks beginning in the 1930s. One watering point per 4 square miles of land (1,024 ha) is a common ratio on ranches today; the Buenos Aires Ranch (today's refuge), which was large and well-capitalized, achieved 1 reliable watering point per 1,550 acres (625 ha) by 1959, and nearly twice that ratio by 1983. Throughout the valley, many watering points are earthen dams, which can be unreliable during droughts. The principal motivation for water developments appears to have been economic: they were a necessary investment required to use naturally occurring forage. Research and extension helped ensure better engineering and design, and cost-sharing programs lessened the private cost of making the improvements.

Fencing and Stocking Rates

Perimeter fencing of ranches occurred rapidly following the transfer of public domain to state trust land status after 1912, when Arizona attained statehood. Fencing was universally advocated by early range scientists, but like water development, it was probably motivated by economic necessity rather than scientific counsel. The Soil Conservation Service subsidized fence construction beginning in the 1930s. Interior fencing began on some ranches as early as the 1940s, but in most cases it occurred later, in the 1970s and 1980s, when rotational grazing became common. Two large ranches remained without interior fencing (other than along public highways) until the late 1990s.

Stocking rates for the pre-1920 period are difficult to estimate because fences were so rare, but they appear to have been as high as 1 to 2 cows per 10 acres (0.3 to 0.5 AU · ha^{-1}), 10 times greater than typical stocking rates today. Severe droughts in 1891–1893 and 1898–1904 resulted in widespread livestock die-offs, but by the 1910s stocking rates had rebounded to as high as 75 cows per square mile (0.29 AU · ha^{-1}) in the upper end of the valley. This was nearly 4 times the rate recommended by range scientists at the time.[4] The lower, drier end of the valley did not recover as well from the droughts and carried only 5 to 10 cows per section (0.02–0.04 AU · ha^{-1}) in the 1930s—similar to rates there today. Stocking rates declined for most of the rest of the century in the higher end of the valley, due more to vegetation change and declining capacity than to enforcement. Today, ranches stock at or below official capacities, which range from 6 to 14 cows per square mile (0.02–0.06 AU · ha^{-1}) depending on elevation and rainfall.

Brush Control

Encroachment of mesquite (*Prosopis velutina*) into the valley's grasslands appears to have begun in the late 1920s and was recognized as a problem around World War II. Mechanical control techniques began on one valley ranch in the 1950s and were subsequently employed by several neighbors. Overall, some 84,000 acres (34,000 ha) of mesquite were mechanically removed on 5 ranches between 1950 and 1980, with about 60,000 acres (24,291 ha) of this on the Buenos Aires Ranch alone. Chemical controls were also attempted but without success. A nonnative perennial, Lehmann lovegrass (*Eragrostis lehmanniana*), was seeded on much of this area and has become dominant there. Both clearing and seeding were developed by range scientists and actively promoted by extension services at the time. The treatments were economical prior to the oil crisis of the early 1970s; the Buenos Aires treatments were only economical because the owner, a large venture capital firm, could write the costs off against income from other sources. Today, large-scale brush control no longer

occurs due to high costs and recognition that mesquite will re-establish without follow-up treatments. Lehmann lovegrass is now classified as an invasive species and cannot be used if federal lands or funds are involved.

Fire

Evidence of various kinds suggests that fires occurred, on average, at least once every 10 years in the grassland portions of the valley, and one rancher reports that his grandfather set fires on purpose up until the advent of fences (which were initially built with wooden posts). Heavy grazing and increasingly effective fire suppression policies virtually eliminated fire after that point, facilitating subsequent mesquite encroachment, which in turn limited fire spread. Range scientists have long recognized the role of fire in desert grasslands, but extension services discouraged burning until the 1980s. In an era of metal fence posts, valley ranchers now see fire as an important tool for controlling brush, and prescribed fires are fairly common on the Buenos Aires NWR.

Grazing Management

Before fencing, herds from different ranches intermingled and moved on their own throughout the valley; mature animals were the primary product. There is evidence that ranchers practiced dormant-season grazing in the 1920s, buying stockers in the fall and selling them in the spring. By 1950, virtually all ranches in the valley had shifted to cow–calf operations using continuous year-around grazing and relatively static stocking rates. This conformed both to range scientists' recommendations and to market demand. Rotational systems began to gain favor in the 1970s and are utilized today on 8 ranches in the valley. The ranchers attribute this shift to the advice of agency conservationists, one in particular who worked with them for nearly 30 years and whose opinions are highly regarded.

Monitoring and Assessment

Very little quantitative data on vegetation or range conditions are available from before 1970. Transects for monitoring vegetation composition, cover, and production have been installed on all but one ranch since that time, in cooperation with the Soil Conservation Service (now the Natural Resources Conservation Service). Transects are read every 1–3 years, and the data generally indicate improved perennial grass cover and production under the new rotational management systems. A recent watershed assessment, based on the rangeland health protocol,[5] found "at risk" areas concentrated along incised drainages and in areas characterized by high levels of bare ground, Lehmann lovegrass, or mesquite. Patterns of rangeland health appeared to correlate more with elevation (virtually all the land above 4,500 ft [1,370 m] was deemed healthy) than with ranch boundaries.

Motivations for Management

In the Altar Valley, economic factors have played a large role in determining adoption of recommended management practices, but this role is far from simple. Most management practices conformed to contemporary recommendations from range science: water development, fencing, improved breeding, cow–calf production, continuous grazing (in the middle 20th century), brush control/seeding, rotational grazing (in the late 20th century), and monitoring. Only the last 3, however, appear to have been prompted by range science itself rather than economic pressure or necessity. And in two cases—continuous grazing and brush control—the recommended practices are now most often viewed as having been faulty. Continuous grazing might have contributed to brush encroachment, and for late adopters, large-scale brush control was uneconomical (and is viewed now as having helped to drive some ranchers out of business altogether). Economic conditions appear to have undermined sustainable management at times when ranchers overstocked the range. Available evidence suggests excessive stocking was due to a combination of habit (ie, stocking based on past practice rather than current conditions) and economic pressure (principally the need to service debt). Finally, fire suppression was initially motivated (among ranchers) by the need to protect expensive fences.

Clearly, economic self-interest does determine management decisions, but it does not do so alone, and it does not necessarily lead to better management decisions. Whether economic incentives align with improved management depends on the time horizon of the rancher: debt, in particular, can force a short-term orientation even if long-term range degradation is a predictable result. The benefits of conservative stocking can take many years to develop in a semiarid setting such as the Altar Valley, whereas something much more expensive can be embraced if it promises rapid results (eg, mechanical brush control and seeding). A practice that is economical at one time, moreover, can become uneconomical later, yet continue to be implemented, whether because of a lag in reacting to changed circumstances or, as in the Buenos Aires case, because of larger economic and political circumstances that invert the calculus of costs and returns. It is also apparent that management decisions are taken in a larger context than that of the individual rancher's economic benefits and costs. Many practices in the Altar Valley—mesquite clearing, interior fencing, and rotational grazing, in particular—appear to have spread gradually, as ranchers waited to observe outcomes on neighboring ranches before deciding to adopt them on their own places. The long engagement and personal reputation of a single range conservationist appear to have been the key factors in more recent management decisions (rotational grazing and monitoring).

The views of Altar Valley ranchers of their present management practices and challenges are strongly informed by the history summarized above. They are acutely aware, for example, of the role of fire suppression in encouraging mesquite encroachment; they also understand that perennial grass dominance, if restored, will likely render their surface water tanks obsolete because run-off will not be sufficient to

fill them. They recognize Lehmann lovegrass as less desirable forage than native grasses, but they also prefer it to what immediately preceded its introduction: mesquite, half-shrubs, and annual forbs. That overgrazing occurred during droughts and had lasting negative impacts on the range informs their greater willingness (relative to their predecessors) to stock conservatively and to reduce their herds when the rains fail.

The collective goals of today's Altar Valley ranchers are to conserve grasslands by restoring fire and to restore the valley's floodplains, which have been incised by a network of large arroyos that began after the drought of 1898–1904. The economic benefits of both goals are extremely long-term and uncertain: fire can inhibit further mesquite encroachment but will not likely reduce the present cover for decades, and the costs of floodplain restoration far exceed what livestock production can pay. Yet the ranchers are willing to rest areas from livestock for 2–4 years in order to build up fuel, burn, and allow recovery, and they have worked for more than a decade to persuade government agencies to restore the floodplains. Increasing forage production remains a goal, but faith in rapid or high-input means of accomplishing this has waned. Most valley ranchers have been ranching (there or elsewhere in southern Arizona) for decades, and they have learned not to expect rapid results from management interventions. Their goals suggest that the ranchers' mental model now involves a longer time horizon and a larger spatial scale than that of their predecessors. Further evidence of this is the emergence of the Altar Valley Conservation Alliance, a nonprofit organization of valley ranchers who came together in the early 1990s to try to gain input into fire management in the watershed. In recent years, however, a great deal of the Alliance's time and attention has been focused on other issues.

Unplanned residential development has boomed between the valley and Tucson in the past decade, and tract housing developments have been built no more than 15 minutes' drive from the valley's north end. The specter of subdivision undercuts the ranchers' resource goals in both practical and perceptual ways. Even a small number of houses would greatly complicate efforts to restore fire in the watershed, and housing built in the erstwhile floodplain (which no longer floods due to the arroyos, and where a great deal of private land is located) would preclude restoration of pre-entrenchment hydrological conditions. For these and other reasons, the ranchers feel collectively at risk: if any one major ranch were to convert to residential subdivision, all the others would be compromised in their ability to realize their resource goals. Perceptually, subdivision of any significance would also undermine the ranchers' collective sense of the valley as a working, rural landscape. Both their goals and their management practices indicate that they do still see the area in this way.

Yet the ranchers are equally determined to protect their property values, which they view as threatened by regulations that might limit or preclude the option of development. Federal measures to protect species listed under the Endangered Species Act (which have hindered fire planning) represent one such scenario; changes in county planning and zoning codes represent another. The ranchers' dependence on grazing leases makes them all the more determined to retain the option of realizing the equity contained in their private acres. Even if funds were available to pay for conservation easements, the ranchers would be unlikely to sell without greater assurance of continued access to the leased lands for grazing. From the ranchers' perspective, all three scenarios share a common source: the political power of environmental groups who oppose all ranching in the West. Regardless of the merits of this perception—the reality is too complex to review here—it makes collaborating with environmentalists, which Huntsinger and Hopkinson[6] identify as essential to sustaining Western range landscapes, extremely difficult.

The contradiction between a commitment to ranching in the Altar Valley and a determination to protect property values inflated by the potential for development makes any simple elaboration of the ranchers' motivations impossible. Both values are upheld as paramount, in one case by the same individual in different contexts. The two are not really comparable: one is about use-value (ranching as life-way, culture, history, identity, family tradition) and the other is about exchange-value (what the ranch is worth in money at sale). They are mutually exclusive in practice—one must be given up to have the other—but they coexist in the minds and experiences of the ranchers themselves, who are trying to defend both.

Conclusions

Coppock and Birkenfeld[7] and Peterson and Coppock[8] suggest that changing socioeconomic and political conditions "may make isolated technical issues seem increasingly trivial" for ranchers. They further recommend greater "2-way communication" and "mutual learning" between rangeland users and researchers; that economic and political factors, rather than a lack of technology or information, might be the major constraints on management innovations; and that management investments might be episodic or ephemeral in response to socioeconomic circumstances.

The Altar Valley case supports these contentions. It is one particular landscape, and its relevance to other landscapes cannot be assumed. But its importance stands on its own: more than half a million acres, next door to a large and rapidly growing urban area, and endowed with a wealth of biological and other values. Moreover, many of the social, economic, and political processes driving the Altar Valley case are regional or national in scale, meaning that some commonalities with other areas can be expected.

It is clear that economic processes have been, and continue to be, strong drivers of management and land use decisions. But the character of these processes has changed with the rise of residential land use as a major competing land use. Previously, when livestock grazing was the only economical land use, ranchers' decisions focused on ranch management, and profitability was a major (albeit not the sole) criterion

of evaluation. A relatively short time horizon appears to have accompanied this focus, however, leading to some decisions (eg, about stocking) that had negative long-term impacts. With the benefit of experience, most Altar Valley ranchers have adopted a longer-term perspective on ranch management and a landscape-scale vision of range resources, embedded within their understanding of the valley's nearly 125-year history in ranching.

These shifts have serious implications for range science. The scientific questions to which ranchers seek answers are less about livestock grazing and productivity than about other range resources and land uses. Much of the existing knowledge, moreover, is not sufficiently specific to satisfy the needs of ranchers or regulators. There are many studies of fire effects in desert grasslands, for example, and most everyone agrees that fires are a necessary ecological process there. But in the presence of a non-native, fire-adapted grass such as Lehmann lovegrass, and an endangered cactus that can be killed by fires, such a general conclusion cannot resolve regulatory and management disputes. Moreover, the audience for range science and range management information is larger than it once was. Ranchers and agency range conservationists are now joined by wildlife and other government officials, urban planners and environmentalists, recreationalists, and scientists of various kinds. Communication among these groups is uneven at best, and many seem dismissive of range science because they associate it with a narrow focus on livestock production. Research into these groups' interactions is needed both to help identify problems and to improve communication across social and scientific fields. All of these conclusions point to the need for greater understanding of working landscapes, and for methods that match the scale of research to the scale of the mental models and human-landscape interactions under study.

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References

1. Lynam, T., and M. S. Smith. 2003. Monitoring in a complex world: seeking slow variables, a scaled focus and speedier learning. *In:* N. Allsopp, A. R. Palmer, S. J. Milton, K. P. Kirkman, G. I. H. Kerley, C. R. Hurt, and C. J. Brown [eds.]. The VIIth International Rangeland Congress. Document Transformation Technologies, 26 July–1 August 2003, Durban, South Africa. p 617–629.
2. Sayre, N. F. 2000. Altar Valley watershed resource assessment, task three: investigate and document historic conditions. Arizona Water Protection Fund project no. 97-041. Tucson, AZ: Altar Valley Conservation Alliance. 53 p.
3. Sayre, N. F. 2002. Ranching, endangered species, and urbanization in the Southwest: Species of capital. Tucson, AZ: University of Arizona Press. 278 p.
4. Wooton, E. O. 1916. Carrying capacity of grazing ranges in southern Arizona. USDA Bulletin No. 367. 40 p.
5. Pellant, M., P. Shaver, D. A. Pyke, and J. E. Herrick. 2000. Interpreting indicators of rangeland health. Version 3. USDI-BLM Technical reference 1734-6. 118 p.
6. Huntsinger, L., and P. Hopkinson. 1996. Sustaining rangeland landscapes: a social and ecological process. *Journal of Range Management* 49:167–173.
7. Coppock, D. L., and A. H. Birkenfeld. 1999. Use of livestock and range management practices in Utah. *Journal of Range Management* 52:7–18.
8. Peterson, R., and D. L. Coppock. 2001. Economics and demographics constrain investment in Utah private grazing lands. *Journal of Range Management* 54:106–114.

Native American Management and the Legacy of Working Landscapes in California

Western landscapes were working long before Europeans arrived.

By Lucy Diekmann, Lee Panich, and Chuck Striplen

When the Spanish first settled in California in 1769, they entered the homeland of more than 300,000 California Indians whose ancestors had inhabited the region for at least 12,500 years.[1,2] These Native Californians were some of the millions of native people living in every part of the continent at the time of contact with Europeans. Yet the idea that the original American landscape was unworked land is persistent and widespread. It colors our relationship to the historical landscapes of North America, particularly those protected in our state and national parks. Because these parks were envisioned as places where people do not live and work, the Indians who lived there had to be removed in order to create these "pristine" landscapes.[3,4] The resulting park landscapes do not represent islands of pristine nature, but a historically unprecedented creation—a radical departure from the past.[5] Over the past century and a half, national parks have helped to define American ideals about the human relationship to nature. In this model, people are removed from nature, becoming spectators rather than active participants.

This idea also affects how resource managers and the public-at-large view other public and private lands. The belief that American Indians did not have a significant effect on the natural world they inhabited thus has important implications for native people and non-Indians alike. Ignorance of the influences and needs of American Indians was once an excuse for ignoring territorial claims and curtailing traditional management practices. In addition, this attitude reinforces the idea that humanity's original relationship to nature does not involve work. This notion is integral to the belief that Euro-Americans arrived in a wild Eden and experienced a "fall from grace" once they began to work the land.[6] Euro-Americans' work in the environment is seen as the beginning of environmental degradation in North America, and the amount of work is believed to be directly proportional to the amount of degradation. Although both Natives and modern agriculturists certainly have the potential to negatively affect the environment, the pervasive and incorrect notions about how Natives lived is the opening act in a story that continues to impact ranchers and others today.

The "working landscape" idea is an important counterpoint to this narrative of inevitable environmental decline. The standard story that links work to environmental degradation does not leave room for people working responsibly with nature, nor does it allow for the possibility that productive work might enhance ecosystem health. Working landscapes represent an alternative model of people's relationship to nature. Between the extremes of nonuse and abuse there exists a middle ground where productive uses and environmental benefits can coexist.

Understanding Native management practices and their effects is an important starting point for the working landscape model. American Indians used a wide array of natural

This article has been peer reviewed.

resources for food, medicines, raw materials, and ceremonial regalia. Although acorns, salmon, and large game are often highlighted as staples of the California Indian diet, ethnographic research, archaeological research, and tribal oral histories have shown that Natives in the Golden State actively used over 500 different plant and animal species.[7,8] In order to increase the quality, availability, and predictability of these materials they manipulated ecosystems through burning, pruning, weeding, and other means.[9,10] Management required knowledge of ecosystems and species and their responses to a variety of factors, such as season and rainfall, as well as their responses to various human disturbances.

California Indian couple (Yankee Jim and an unidentified woman) shucking acorns in Placer County, California, taken 8 September 1902. Note the large gathering baskets in the foreground, which were still being made into the mid-20th century. Photograph courtesy of the Bancroft Library, University of California, Berkeley.

Burning was the Native Californians' most important and effective land management tool. Like pruning and weeding, it could be used to improve the quality and vigor of individual plants or of particular stands. On a broader scale, it could also be applied to manage plant communities and landscapes. California Indians used fire to increase the abundance of particular plant species, to shift the balance between different plant communities, and to maintain a landscape of diverse resource patches. Other uses of fire included facilitating travel, reducing the risk of large fires by reducing fuel loads, increasing animal forage, and even distributing animal forage across the landscape to control populations. Fire served many purposes, but the overall result was increased landscape diversity, heterogeneity, and productivity.[11]

As an example of the ecological knowledge and active management used to manage ecosystems, consider basketry. Basketweavers need roots, branches, and shoots that are long, straight, and supple; but left to grow "wild," many important plant species can grow to be brittle or crooked. To obtain the characteristics they desired, Native Californians used coppicing, pruning, digging, transplanting, weeding, removing debris, and burning. For example, to encourage the growth of long, straight twigs that could be used for basket material, willows (*Salix* sp.) might be coppiced—an intense form of pruning—during the dormant season. To ensure new growth of tule (*Schoenoplectus* sp.), another important and versatile plant, burning was used after summer harvest to remove old growth and allow space for new growth. This action also maintained edge complexity around ponds, lakes, and sloughs that served other taxa as well. Without burning, a thick mat of dead tules, which decompose slowly, quickly accumulates and blocks out the sunlight needed by new shoots. Imagine the steady supply of plant materials needed to meet the demand for basketry materials, when a single cooking basket, for instance, uses approximately 3,750 stems, or the output of more than 37 bunchgrass plants. Similarly, a single deer net required as many as 35,000 stalks from milkweed or dogbane.[8,9,12]

California Indian woman with baskets taken at Hank's Exchange in El Dorado County, California (date unknown). This image nicely illustrates the diversity in size, style, and materials used in basket construction by a single Native weaver in early 20th-century California. Photograph courtesy of the Bancroft Library, University of California, Berkeley.

At a larger scale, Native Californians also managed the composition of landscape patches. They managed the "proportionality" of resource patches to enhance the abundance of desired plants and to reduce the numbers of less desirable spe-

cies. In coastal areas, for instance, California Indians burned, and possibly removed by hand, salt marsh coyote brush (*Baccharis* spp.), which was not needed in large quantities, in order to prevent it from crowding out other valuable species such as willow and sedge. Further from the coast, managing proportionality could entail burning to impede the encroachment of trees and woody shrubs into grasslands.[9] Also, in the shrublands of the coast ranges, Indian burning altered vegetation patterns, converting predominantly evergreen chaparral and coast sage scrub shrublands into a mosaic of open shrublands and grasslands.[13]

Over a period of many thousands of years, California Indians developed management practices that were well-suited to the natural diversity of the environment. It is important to remember, however, that these management systems were not static. Many people who recognize California Indians' profound role in shaping the state's ecosystems often assume that before the disruption of the colonial period and its aftermath, the state's original inhabitants lived in a stable, harmonious balance with nature.[14] There are several reasons why this characterization is inaccurate. First, Native Californian management was well suited to the Californian environment precisely because it could accommodate variability in productivity from place to place, season to season, and year to year.[8,11] Second, climate change altered the distribution of vegetation communities, on shorter (eg, El Niño) and longer time scales. In addition, ecosystems in California are occasionally subject to larger, less predictable events; earthquakes and flooding have the power to cause dramatic changes within habitats, and dendrochronological evidence shows that large, catastrophic fires occasionally swept through precolonial ecosystems.[15] In addition to responding to these ecological changes, California Indians continued to innovate, developing new practices and techniques that shifted their relationship to and effect on the local landscape.

In sum, California Indians developed a system of management that was designed to influence the productivity and abundance of particular plants and animals. Unlike farmers who often focus their efforts on the scale of plot or field, California Indians used fire to affect productivity and diversity across the broader landscape. By burning certain ecosystems at different intervals they created a patchwork of diverse habitats. The resulting mosaic of habitats maintained at different stages of succession provided a wide range of resources for Indians' use and consumption. Not only did a diverse resource base provide a nutritious diet, it also gave California Indians greater flexibility and choice, buffering them against periods when certain resources were unavailable. Managing at the landscape scale was a strategy particularly well-suited to California's environment where productivity varies greatly over space and time.[8,11] Consequently, the landscapes that European colonists encountered and that Californians prize today are not solely the product of ecological and geological processes. Instead their form and function were the result of a mix of human intervention and natural processes. Rather than think of precolonial landscapes as wilderness, it is more accurate and more useful to think of them as cultural landscapes, and perhaps working landscapes, in which human use also has the potential to enhance ecosystem productivity and diversity.

Case Study: Año Nuevo State Park

Although it is generally agreed that the precolonial landscapes of California were both natural and cultural creations, less is known about the exact nature and extent of Native influence. Contemporary land managers and restoration ecologists could benefit from knowledge of the methods and the botanical communities modified through cultural activities over long time periods, but this requires research that specifically addresses landscape history and Native management practices. Currently one such project is under way in Año Nuevo State Park in southwestern San Mateo County, California, approximately 55 miles south of San Francisco. Like other undeveloped places, the park no longer resembles what it was when the Quiroste Band of Ohlone Indians occupied this stretch of California's coastline. To understand the nature of the changes that have taken place since the functional removal of the Quiroste from the California Central Coast, and to reconstruct a model of Quiroste resource management, requires a multidisciplinary approach at various temporal and spatial scales.

Beginning in summer 2007, this interdisciplinary research project will test the hypothesis that precolonial peoples served as "ecosystem engineers," a concept that incorporates people as participants in natural communities. It is expected that the removal of these ecosystem engineers had significant and measurable effects on landscape form and function.[16] The particular foci of this research are determining the role of fire in maintaining specific habitats and the consequences of removing Indian burning.

Although it is relatively easy for people studying California Indians to uncover evidence of pre-colonial occupation, it is much more difficult to discover how past landscapes appeared and were used. Tribes in California had no written language, nor did they produce pottery or (at least in this region) large dwellings that could be examined. Because much of California Indian material culture was constructed primarily of plant material, researchers need to expand the breadth of their analyses to include microbotanical and even isotopic tools. Methods drawn from archaeology, landscape ecology and history, and paleoethnobotany will be used to ascertain how the Quiroste maintained and modified coastal grassland and oak woodland habitats. Historical ecology methods that draw on early maps, documents, and photographs will be used to characterize the landscape changes that have taken place since colonization, which took place around 1770 in this locale. Archaeological and paleoethnobotanical sources will provide information about diet and subsistence. Information about the resources that were being used can then be combined with fire scar date, climate reconstructions, and the natural history attributes of key, culturally-managed spe-

cies to generate a localized, seasonally-focused management regime for this area.

Historically Managed Landscapes Today: Lessons for Contemporary Ecosystem Managers

California's iconic oak woodlands, coastal prairies, and montane meadows were regularly used and frequently burned by Natives as recently as the 1850s.[12,17-19] Many western ecosystems, including California rangelands, were shaped by the work American Indians did to make their local environments produce needed food and raw materials. These practices created, maintained, and enhanced distinctive habitats. Removing Natives from their role as ecosystem managers, and failing to recognize the role of "work" in shaping those ecosystems, has had far-reaching ecological consequences, as the project at Año Nuevo State Park seeks to demonstrate.

Recognizing that many of the ecosystems that so impressed early explorers and settlers were actually anthropogenic landscapes can help contemporary land managers and conservationists see that excluding human activity might not have the desired consequences. The realization that people played an important part in shaping certain distinctive ecosystems—and that their work in nature oftentimes maintained and enhanced natural diversity—can suggest alternate ways of protecting landscapes and resources. Rather than achieving protection by removing productive human activities—activities which are not recreational or leisure-based—managers might consider protecting valued landscapes and habitat characteristics through use and work. The hunting, gathering, and burning practices of Native people can expand the types of productive uses that might benefit both people and landscapes. Although acknowledging that active human use and management has the potential to have positive environmental outcomes makes environmental decision-making more complicated, it also offers more options.

It is equally important to remember that American Indian managers and management are not a thing of the past. Today there are roughly 150,000 Native Californians living in self-governing Indian communities, cities, farms, and ranches. For these people, the plant and animal resources that were used historically for food, raw materials, medicines, and ceremonial purposes remain important. Modern tribes are involved in resource management both on and off reservations, at the local, regional, and national levels. Groups such as the California Indian Basketweavers Association, the Native American Traditional Plant Coalition, the Native American Fish and Wildlife Society, and the National Tribal Environmental Council, are actively involved in protecting and maintaining culturally important natural resources. Drawing on traditional ecological knowledge and restoring traditional management is not just an opportunity to rehabilitate ecosystems, but also a chance to strengthen cultural practices and to build political relationships with contemporary Tribes.

In 1894, when John Muir coined the term "range of light," he was referring to the open, fire-resistant woodlands of Yosemite and the forests of the Sierra Nevada. From the late 19th century into the mid-20th century, western ranchers frequently burned brushlands to open them up for grazing and to reduce fire hazard. In the intervening decades, however, resource managers instituted fire suppression policies and simultaneously suppressed native and agriculturalist burning. Over the same period, a host of other indigenous management practices became impossible as Native populations lost land and declined in population. As a result, shrubs and trees have encroached on open meadows and tremendous fuel loads have accumulated in the forests and rangelands of the West, often with disastrous effects. This current situation is due in part to our standard model of environmental degradation, which is premised on the American landscape being unmodified wilderness at the time of European contact. By better understanding the original working landscapes of the West's original inhabitants, we can start to see the historically and culturally dynamic nature of ecosystems. A more inclusive and comprehensive story of how landscapes have been managed offers a range of new management alternatives and practices as well as the opportunity to establish mutually beneficial relationships with American Indian tribes.

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References:

1. Moratto, M. J. [ed.].1984. California archaeology. Orlando FL: Academic Press. 757 p.
2. Arnold, J. E., M. R. Walsh, and S. E. Hollimon. 2004. The archaeology of California. *Journal of Archaeological Research* 12(1):1–73.
3. Spence, M. D. 1999. Dispossessing the wilderness: Indian removal and the making of the national parks. New York, NY: Oxford University Press. 190 p.
4. Jacoby, K. 2001. Crimes against nature: Squatters, poachers, thieves, and the hidden history of American conservation. Berkeley, CA: University of California Press. 305 p.
5. Cronon, W. 1995. The trouble with wilderness, or, getting back to the wrong nature. *In:* W. Cronon [ed.]. Uncommon ground: Toward reinventing nature. New York, NY: W.W. Norton. p 69–90.
6. White, R. 1995. Are you an environmentalist or do you work for a living? *In:* W. Cronon [ed]. Uncommon ground: Toward reinventing nature. New York, NY: W.W. Norton. p 171–185.
7. Heizer, R. F., and A. B. Elsasser. 1980. The natural world of the California Indians. Berkeley, CA: University of California Press. 271 p.

8. Lightfoot, K. G., and O. Parrish [eds.]. in prep. The diverse worlds of the California Indians. Berkeley, CA: University of California Press.
9. Striplen, C. J. 2006. Life and times at the edge of the bay. *News from Native California* 20(1):24–25.
10. Shipek, F. C. 1989. An example of intensive plant husbandry: the Kumeyaay of Southern California. *In:* D. R. Harris and G. C. Hillman [eds.]. Foraging and farming: The evolution of plant exploitation. London, UK: Unwin Hyman. p 159–180.
11. Huntsinger, L., and S. McCaffrey. 1995. A forest for the trees: Euro-American forest management and the Yurok environment, 1850 to 1994. *American Indian Culture and Research Journal* 19(4):155–192.
12. Anderson, M. K. 2005. Tending the wild: Native American knowledge and the management of California's natural resources. Berkeley, CA: University of California Press. 526 p.
13. Keeley J. E. 2002. Fire management of California shrubland landscapes. *Environmental Management* 29:395–408.
14. Preston, W. 1998. Serpent in the garden: environmental change in colonial California *In:* R. A. Guiterrez and R. J. Orsi. [eds.]. Contested Eden: California before the gold rush. Published in association with the California Historical Society, Berkeley, CA: University of California Press. p 260–298.
15. Stephens, S. L., and D. L. Fry. 2005. Fire history in coast redwood stands in the northeastern Santa Cruz Mountains, California. *Fire Ecology* 1(1):2–19.
16. Striplen, C. J. 2005. A proposal to the Ford Foundation—the ecological role of pre-colonial peoples in central coastal California: Observations on ecosystem management. Berkeley, CA: University of California. 8 p.
17. Bean, L. J., and H. W. Lawton. 1973. Some explanations for the rise of cultural complexity in Native California with comments on proto-agriculture and agriculture. *In:* T. Blackburn and M. K. Anderson [eds.]. Before the wilderness: Environmental management by Native Californians. Menlo Park, CA: Ballena Press. p 27–54.
18. Blackburn, T., and M. K. Anderson [eds.] 1993. Before the wilderness: Environmental management by Native Californians. Menlo Park, CA: Ballena Press. 476 p.
19. Lewis, H. T. 1973. Patterns of Indian burning in California: ecology and ethnohistory *In:* T. Blackburn and M. K. Anderson [eds.]. Before the wilderness: Environmental management by Native Californians. Menlo Park, CA: Ballena Press. p 55–116.

Speaking With People in Our Profession

An interview with Dr Kirk McDaniel

Kirk McDaniel is a Rangeland Science Professor in the Department of Animal and Range Sciences at New Mexico State University (NMSU) in Las Cruces, New Mexico. Kirk is a respected scientist who has spent 27+ years working at field sites across New Mexico. His publications on taxonomy, ecology, and control of major shrub and weed species in the region are highly regarded. At the Society for Range Management's 2007 annual meeting this past winter in Sparks, Nevada, Kirk received the W. R. Chapline Research Award, the Society's highest award for sustained accomplishments in rangeland science and related disciplines.

Shattering Myths

Question: What activities are piquing your interests these days?

Answer: I'm summarizing results from some long-term field studies started early in my career, nearly 27 years ago. Wow! I can hardly believe life at NMSU kicked off for me that long ago. Anyhow, I find these studies have become increasingly interesting through time. In some ways, they've shattered a few of my early misconceptions or myths about rangeland dynamics.

What are some of the myths that have been shattered?

One study that I've particularly enjoyed following is my first research project at NMSU, which examined snakeweed control and population change. I've visited 9 study sites scattered across the state annually since 1979, and I've been quite surprised by how infrequently snakeweed germinates and survives. At all sites, I've only recorded 2 or 3 instances where snakeweed successfully propagated over the history of these studies. The only year where there was a widespread germination event was in 1981, and these plants generally died out by the late 1980s. For the past 15+ years, I've been waiting for snakeweed to return, but in general, it hasn't. One explanation may be that the seed bank is depleted. However, I've been particularly surprised at how rarely the needed environmental conditions converge to allow a plant like snakeweed to thrive.

These are very valuable perspectives that have to be built up over time. Are there any other myth busters of note that you've observed in your work that you want to mention?

I am not sure whether these are myth busters or not, but there are many other weed species that behave similarly to

snakeweed, in particular, locoweed. Under New Mexico's climate, it is rare that conditions are just right to create the ideal setting for plant germination and establishment. This suggests to me that an emphasis should be placed on weed control early in the species' life history rather than later. On a different note, I've found the long-term Bureau of Land Management (BLM) brush-control work on big sagebrush, mesquite, and creosote bush in New Mexico to be very fascinating and informative. The BLM has methodically treated brush on acreages each year since the early 1980s. Now, after 20+ years, plant communities are in various stages of renewal and development, and the broader landscape has become more dynamic and diverse. We need these kinds of long-term perspectives to evaluate the effectiveness and consequences of those changes.

Speaking of change, what's the current situation regarding the state of knowledge on salt cedar?

Salt cedar control has been studied to the extent that many of the principles needed for managing the plant have been identified. We probably do not need to keep focusing on those issues. What we need to decide is what we want after the salt cedar has been removed. That decision will then determine or at least influence how we should go about controlling the plant. Again, a long-term perspective is important in developing postcontrol goals. River basins and their riparian communities have always been in various stages of building and destruction. We need to recognize the inherent dynamics that river systems exhibit and appreciate that restoration following salt cedar control is not a discreet target but rather a never-ending process.

Are there other invasive species on the horizon that we should be paying closer attention to now?

New ones seem to always be surfacing. Actually, I think the resource management and science communities have done a very good job in recent years in raising the red flag about invasive species. People are generally quite alert about recognizing species invasions. There are a number of emerging invasive species around our state that have the potential to be a local problem; it just depends upon where you are. We have a good idea about this array of invasive species, from yellow star thistle to leafy spurge to the knapweeds to pepper weed, just to name a few of the more obvious ones.

Given this focus on long-term dynamics and change, how do you see range management in the future?

One of our primary assets as rangeland managers is helping and providing answers to questions coming from people living on the land. Current and future generations may want information in a different form than previous generations, but many of their questions will be the same. We just might have to frame our answers in ways that better address a new generation of rangeland users.

With all of these interests and activities, how has your golf game fared of late?

My golf game is a lot like our rangelands—very dynamic, strongly influenced by the weather, and often outside of my control. However, it has made life more interesting in the past 15 years since I first learned to swing a golf club.

Interview was by Susan R. McGuire, a pen name used by the author of this article. Her interviews with members of our profession will be a regular contribution to Rangelands. All costs of publishing these interviews are sponsored by a research unit of the Agricultural Research Service, the in-house research agency of the US Department of Agriculture, whose rangeland scientists are a segment of our Society. Upcoming interviews by Ms McGuire in 2007 will include candidates for Society office in 2008.

New Roles for Rangelands and Grasslands

The Cooperative State Research, Education and Extension Service (CSREES) is retooling its efforts to build awareness for rangeland and grassland attributes.

By Kindra Gordon

As concerns about urbanization, rural economies, and clean air and water continue to challenge society in the future, rangelands and grasslands could play an important role in addressing those issues.

That's the thinking behind renewed efforts by the USDA Cooperative State Research, Education and Extension Service (CSREES) to develop a national program in rangelands and grasslands.

"America's increasing population requires land managers to view rangeland as a source of many benefits," says Jim Dobrowolski, who was named the National Program Leader for the CSREES effort last September. He points out that whereas rangelands and grasslands are important for production-based outputs, such as energy, grazing, and minerals, they also need to be considered for offering aesthetics, wildlife habitat, and recreation.

He believes building awareness for rangelands and grasslands will help people recognize the ecosystem services these lands provide—such as helping maintain air and water quality, open space, and providing open lands around urbanization.

Jim Dobrowolski

"Our goal is to design a program that meets the needs of society by integrating research, outreach and education programs, and enabling land managers to make appropriate decisions about the most effective uses of the land," says Dobrowolski.

Based in Washington, DC, Dobrowolski is helping coordinate the Rangelands and Grasslands program by developing partnerships with university, USDA, and other federal, state, and private entities to deliver research, education, and outreach efforts. He anticipates that the new program will help to promote a broader education of land managers and the public about the positive benefits of properly managed grazing lands as well as provide insight into rangeland watershed management and restoration efforts (see "Program under construction").

Why Now?

Dobrowolski reports that few new initiatives in rangeland and grassland research, education, and outreach were introduced over the past 15 years. "The timing was right, and the need was there to combine rangeland and grassland ecosystems into a single national program." With 22 years of experience in both the extension service and as a teaching/researching university professor, Dobrowolski was recruited from Washington State University to lead the new program.

This article has been peer reviewed.

Program under construction

In developing CSREES's National Rangelands and Grasslands program, Jim Dobrowolski is holding listening sessions with researchers, educators, and stakeholder groups to gather input on the needs they've identified in the areas of rangelands and grasslands research, education, and outreach.

He cites some of the goals for the program as

- continuing to improve assessment procedures for rangeland and grassland health and status in ways that are faster, better, cheaper;
- continuing research efforts in ecology, physiology, and biotechnology of both plants and animals to aid in fire restoration and invasive weed control efforts, to help preserve biodiversity, to assist with sustainability, and to provide ecosystem services, such as water, habitat, and aesthetics;
- improving key sustainability factors that will ensure flexibility in addressing future demands for products and services;
- identifying employment potential in rangeland and grassland careers and relaying that information to universities and students.

If you'd like to visit with Dobrowolski about the CSREES Rangelands and Grassland Ecosystems program, contact him at (202) 401-5016 or jdobrowolski@csrees.usda.gov.

With the growing concern about weeds, fire, fragmentation, drought, watershed management, and sustainability, among the many issues challenging today's land managers, Dobrowolski believes the renewed interest in developing the program could have much to offer.

Through a 3-pronged approach focusing on rangeland and grassland research, education, and outreach, Dobrowolski believes possible outcomes may include

- improved public perceptions about the value of rangeland and grassland ecosystems and the people who manage them;
- slowed weedy invasions and improved production and biodiversity;
- sustainable rangelands and grasslands both kept as large unbroken landscapes and smaller sustainable parcels linked by riparian and other corridors;
- maintaining appropriate fire cycles and ecological status;
- and thriving human communities.

As an example of such outcomes, Dobrowolski shares that 2 national Conservation Effects Assessment Project watersheds, including 1 related to the drinking water supply for Wichita, Kansas, cite proper management-intensive grazing practices that help enhance watershed quality. Through the national Rangelands and Grasslands program, more strides could be made in research for similar projects as well as providing technical assistance to landowners to implement new science-based technologies.

Dobrowolski is hopeful the program will also help identify the critical issues that rangeland managers and scientists need to be trained in for the future, so university curricula can be adapted to meet those needs. For instance, the increasing trend for people to own small acreages or ranchettes presents unique land issues that future land managers need to be able to address.

Additionally, Dobrowolski believes that the program may be beneficial in identifying strategies to landowners that can boost rural economies. For example, value-added income streams may include water leasing, grass banks, supplying native seed, fee hunting, and/or paid nature and agritourism experiences.

Linking Land and People

Dobrowolski says another important area in which the CSREES Rangelands and Grasslands program can have an important impact is in connecting people—especially youth—to the land.

He points out that fewer young people have the opportunity to grow up with exposure to agriculture and nature—which is leading to a new challenge in today's society referred to as "Nature Deficit Disorder" (NDD). That term was coined by author Richard Louv in his book *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder,* in which he argues that kids are so plugged into television and video games that they've lost their connection to the natural world.

Dobrowolski points out that this disconnect could create a risk to agricultural and rural economies in the future. He says, "When youth don't have a grasp of the importance of agriculture and natural resources and what rangeland and grassland ecosystems can provide, the result is that as adults they aren't concerned with issues like maintaining land from being fragmented by urbanization."

He adds that NDD could produce a future generation that does not have the knowledge or understanding of dynamic environmental processes or that humans are an integral part of ecosystems. He is concerned that this growing disconnect with nature has serious implications for the future stewardship of our public lands and waters, which could endanger our country's conservation legacy.

Dobrowolski believes rangeland programs could help bridge the gap caused by that disconnect. He says, "We have kids in society who will never have the opportunity to be on a farm or ranch—unless they [farmers and ranchers] provide that to them. If they have experiences with nature, they have a better chance of understanding the societal value that rangelands and grasslands provide."

Educational tools available

The new CSREES Rangelands and Grasslands program leader is liaison to the Renewable Resources Extension Act (RREA)–funded web-based learning center at www.forestandrange.org. Coordinated by the University of Tennessee, with input from several other land-grant universities, the center offers educational opportunities for private forest and range landowners. It includes interactive learning modules that allow participants to improve their knowledge of natural resources.

Teachers interested in including rangeland and grassland principles in the classroom also have a new curriculum available that they can tap. The publication is called "At Home on the Range," and it is targeted toward 4-H and K–12 youth. Initiated in 2005 by a group of individuals who convened at Montana State University representing Cooperative Extension, the Nature Conservancy, 4-H, primary schools, universities, and others, "At Home on the Range" is the first national curriculum for rangeland that meets the National Science Education standards. To obtain information about this curriculum contact Kirk Astroth, Director, Montana 4-H Center for Youth Development, Montana State University, 210 Taylor Hall, Bozeman, MT 59717-3580.

As an added benefit, exposing youth to rangelands and grasslands may stimulate career choices in natural resource fields as well, says Dobrowolski (see "Educational tools available").

Building Relationships

As the CSREES Rangelands and Grasslands program is developed, Dobrowolski anticipates that new methods of providing research and management knowledge to land managers and the public must also be developed.

"We need to be able to provide knowledge that people can use today to help their bottom line or their management planning without a tremendous amount of interpretation," he says.

He believes that means developing relationships with land managers that foster behavioral change. He says, "Often Extension folks get tapped to provide larger and larger workshops, reducing their ability to build trusting relationships that might eventually lead to adoption of new practices and behavior changes that make a real impact."

He points out that, in today's Web-based world, people can easily go to the Internet to find information. "We must develop new tools that combine current and future education technologies with a relationship of trust to help landowners sort through the information and make decisions for their operation."

To that end, Dobrowolski suggests educational materials of the future must be developed and delivered so they are user-friendly and available to youth—downloadable as podcasts, for example. He cites what he calls the four Rs for successful extension—Reliability, Relevancy, Response-time, and Research-based.

He adds that educators and rangeland managers also need training in social issues and working with people so they can facilitate relationship building and foster technology adoption and change.

Of the CSREES Rangelands and Grasslands program, he concludes by saying, "It's time for us to retool and see how we can be more effective."

Author is a freelance writer based near Sturgis, SD, and has been a member of the Society for Range Management since 1992, office@gordonresources.com.

Water Harvesting From Ranch Roads

By Jim Thorpe

"A good road lies easy on the land, *if* it is located on a landform where it can be readily and effectively drained (neither too steep nor too flat); is functional when used as intended (class of vehicle, season and suitable weather conditions); has appropriate drainage features (closely spaced, properly situated and adequately maintained); preserves the natural drainage pattern of the landform; conserves water; does not cause or contribute to accelerated soil loss, lost productivity or water pollution; does not encroach on wetland or riparian areas; and is scenically pleasing."

So writes Bill Zeedyk, building upon the experimental and practical work of a 35-year USFS career, now a full-time consultant[i] living near Albuquerque, New Mexico. Perhaps best known for his pioneering work in low-tech and low-cost riparian restoration (see book reviews in the April issue), Bill has also applied his past US Forest Service (USFS) experimental forest experience and innovative tinkering to the design, construction, and maintenance of low-standard rural roads. *Low standard?* These are not your go-like-hell, see-the-dust-for-miles, John Denver sing-along, country roads, but roads that are "roads" in perhaps name only—not always the best ones for your town visitors to attempt in their low-riding rigs; roads of occasional or infrequent use, low speeds, and generally light loads; roads that all too often are rutted, gutted, and gullied so that not only do they ride rough, but they inevitably become conduits of erosion, bleeding needed "irrigation" away from thirsty vegetation. In western arid regions, like New Mexico, where every drop of precipitation needs to be "harvested" for a contribution toward production, any water running down the road to the neighbors is a wasted opportunity!

"A road is not easy on the land if it collects, concentrates, or accelerates surface or subsurface runoff; causes or contributes to soil erosion; impairs or reduces the productivity of adjacent lands or waters; wastes water; unnecessarily intrudes upon key habitats, stream channels, floodplains, wetlands, wet meadows or other sensitive soils; and is aesthetically offensive."

Ranchers Hosting Workshops

With these 2 paragraphs of succinctly elegant prose as preface, Bill Zeedyk's new road handbook (published in April 2006) encapsulates the basic message of his Ranch Road Workshops held over the past half-decade in conjunction with various sponsoring partners, spearheaded by the Quivira Coalition[ii] and including the New Mexico Environment Department, the Bureau of Land Management (BLM), and the US Environmental Protection Agency (EPA). These workshops have been held at a number of ranch locations in New Mexico, including an August 2003 workshop at our ranch near Newkirk, New Mexico (midway in the middle of

[i] Zeedyk Ecological Consulting, LLC; Restoring Wetland, Riparian, and Upland Habitats; bzcreekz@att.net. Bill first worked with these low standard road approaches in the 1960s in Kentucky's Daniel Boone National Forest and has seen them implemented and adapted to local needs and conditions on more than 300,000 miles of the USFS road web. Bill wishes to recognize the work of Keith Guenther, who concurrently contributed to the development of these approaches.

[ii] A rangeland conservation-oriented nongovernmental organization (NGO) based in Santa Fe, New Mexico. (http://quiviracoalition.org).

nowhere between Albuquerque, New Mexico, and Amarillo, Texas).

Holding a 2-day workshop at a location 150 miles from primary cities and 35 miles from the nearest interstate motels certainly has its logistical challenges, but the Quivira Coalition is a seasoned producer of such contemporary rangeland events. Close to 50 people turned out, with cowboy hats, ball caps, and pony tails (on both genders) in abundance. Quivira workshops generally offer an optimum combination of outdoor classroom and practical field work and demonstrations, with plenty of time for networking and idea-swapping in-between. Holding a "working" workshop on your ranch can be a good way to get a few things accomplished—the only drawback is that quite a bit of time is spent in exposition and rumination and not quite as much in using the time and equipment that has been made available!

After a few rounds of coffee and how-do-you-dos, Bill sits everyone down for a bit, to shift some paradigms. As important as low-standard ranch roads may be for transportation, getting from here to there, hauling feed and salt, checking livestock, and all the other indispensable chores of windshield ranching, their most important function is to, hopefully in a positive but too often negative way, aid in water management. Rangeland roads are often designed, built, and maintained with speed and least-costs in mind (think of those hurry-up oil and gas outfits!) with too little attention being given to their potential impact on surface runoff patterns and consequent influence on vegetative growth.

Water control structures are often placed (if at all) as haphazard after-thoughts roads with little consideration of where the water goes—and what it does—when it finally leaves the roadbed. The conventional wisdom mind set is that storm water is a nuisance that needs to be shunted aside; the Zeedykian paradigm, in marked contrast, is one of water harvesting. We often notice how vegetation thrives along highway right-of-ways (and may sometimes daydream about using them as paddocks); with a little bit of thoughtful adjustment of management, and a few of Bill's tricks and tips, we can capture much of that same effect for the ranch.

Matching road design to intended purposes (are 20-ft-wide roads always necessary for infrequent travel?), understanding characteristics of soils and available road construction materials, and learning to read the landscape to our advantage (it's not that hard: water tends to run downhill!) are all part of the approach, as well as common sense (if you don't really have to drive on it when it's saturated and muddy—don't!). Keeping storm flows as much as possible within their originating microwatersheds and providing for frequent road drainage ("First chance, best chance, last chance, every chance") will discourage the exponential increase in erosive force often acquired by the accumulation of flowing waters.

After this re-education session, it's time to go out in the field to look at some situations. Sometimes a road may not be necessary or may not necessarily need to be where it is. Near our ranch headquarters are several small trap pastures handy for holding cattle before shipping or other workday events, as well as one we use for the first-calving heifers after calving; we drive in that one most every day to check the pairs and feed them "cake" (supplemental protein cubes). This

Quivira Road Workshop, August 2003, viewing runaway ruts.

Same view, October 2006.

100-acre pasture is a long, narrow valley shaped like a giant zucchini, running uphill through a galleta-dominated swale before reaching blue-black gramma, sandy-loam uplands that abruptly end at sandstone rimrock. Not surprisingly, the main 2-track "road," with all our driving back and forth and the coming and going of cattle to water (at the lower end), gets beat down and torn up considerably. We explained to the workshop our concern that, between our feed truck and the trailing cattle, our run-away ruts were soon going to become incised arroyos.

The workshop group ruminated on various suggestions, such as whether management could be flexible enough to change the location of the feed and access road away from the potentially productive swale (and somehow snake it through the mesquite thorn–infested, tire-eating side slopes), whether the grazing management could be altered to provide adequate rest and recovery time, whether cattle traffic patterns could be (inexpensively) altered, whether reseeding was necessary, and whether we shouldn't just regard the feed zone as a no-big-deal sacrifice area.

The treatment decided upon was to route a new feed trail that stayed out of the bottom (and, after trimming, hacking, and spot-applications of herbicide on opposing mesquites, serpentine along the side slopes), use the idling nearby dozer to rip a herringbone pattern of draw-away ditchlets across the old route, lay cut juniper boughs across the bare areas to create protected microsites, and install temporary 1-wire drift fences to encourage cattle trailing at angles appropriate for dispersing and spreading runoff. Not much to it, really. Three years later (without any further treatments), we now often feed cattle in this area to encourage a bit of animal impact on the thick stands of self-reclaimed galleta and alkali sacaton.

Variations on an Old Theme

Of course, we just can't undo and unroad our whole transportation network (despite the pleadings of all the roadless visionaries). For the roads we do need (and use!), the workshop addressed the design of that most common of ranch-road drainage structures, the *water bar*, or as it is often known in the southwest, the "Thank You, Mam!" (I suspect that the near whiplash, tipping effect on the hat and head and neck, sometimes unexpectedly compelled by abrupt contact with these devilish rangeland speed bumps, may be the slightly satirical derivation of the moniker "Thank You, Mam").

As we were now in the 21st century, we needed an updated name as well as design. Water bars may now be going the way of the 19th century buggy whip; their replacement is the *rolling dip*. What's in a name? Well there are some subtle differences of angle and approach, which would require a couple more pages (much more than Frasier has allotted me here, and I'm not even discussing the challenges of culverts!). Suffice it to say that a rolling dip is a vast evolutionary improvement over the traditional water bar, requires less frequent maintenance (actually, they are often self-maintaining), and provides a much smoother ride (especially when they are properly scaled, lengthwise, for the longest vehicles expected, such as cattle-trucks or crewcabs bumper-pulling featherlites).

Installing and maintaining these rolling dips and other contemporary designs does require some retraining of road equipment operators, especially those employed by local government road departments. Indeed, it is essential because a "helpful" operator can often undo, in a few minutes, hours of careful design and installation. Bill has begun working with watershed groups and county road departments in New Mexico (Colfax) and Arizona (Pima). The county road departments are attracted by the prospect of potentially lower maintenance costs (they are a bit spooked, however, that these unconventional approaches might have unforeseen liability repercussions). By getting these techniques validated and incorporated into conventional practice, the multiplier effect, in terms of the ecological and social benefits of increased forage production and watershed integrity, could be substantial. Overcoming tradition and past practice continues to be a great challenge in this as in other rangeland innovations—this author believes that all of us, as individuals and as a professional society, have an important role in developing support and validation for such rangeland innovations of merit.

All of these, the basic principles, the new paradigms, the rolling-dip details, and more (including a new, somewhat oxymoronic invention, *the flat-land drain,* first conceived and constructed during this ranch workshop) are in the ranch roads workbook—and it's *free* (plus shipping) for the asking via quiviracoalition.org! (It's amazing what a retired federal employee, teamed up with a rangeland-oriented NGO and numerous willing landowners, can accomplish outside of the boxes of protocol, tradition, and turf.)

A final tip from Bill: The best time to read the roadscape is in the rain. Get out there, and see how the water flows, where it's going, and where it might be better directed. Take that decorative item (otherwise known as a shovel) out from its prominent place on the pick-up headache rack, and, like any good irrigator, turn that water where it needs to go to grow a little more grass. Just be careful it doesn't become a lightning rod!

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Essays of a Peripheral Mind

By K. M. Havstad

Faith

My oldest son, when he was about 12, asked his mother a question that prompted her, despite being an accomplished professional, to respond "Why don't you ask your father?" He quickly replied "I don't want to hear that much."

OK, I admit it. On occasion, when asked a question in my fields of interest, I might respond at length. Primary examples of personal questions that could trigger too many words from me would include "Were the 1962 New York Yankees really better than the 1962 San Francisco Giants?" "What are the best features of the 2007 Ducati S2R 1000 motorcycle (Fig. 1)?" and "Should you add a bit of water to a single malt scotch or drink it neat?" Really, though, like most of us, this behavior of expression bordering on wordiness, or even ranting, is an act of faith. By definition, faith is the cherished values, beliefs, or ideals of an individual (or of a group). The key word in this is *cherish*, meaning to care for, tend, cultivate, or nurture. When we cherish something, and it is questioned, queried, or challenged, we rise to the occasion. It is our nature and at least enough of my nature for my son to have been wary even at an early age.

Given the world strife and suffering in the name of faith, cherishing the baseball of my youth, Italian motorcycles, and a good drink seems to be a harmless expression of my personal values. Yet, it is faith that also permeates and clouds my professional beliefs, and I often forget this. This problem deserves more words.

My professional beliefs and values and their resulting faith are built on rhetoric, which is basically our discussions about experiences, our literature, and the teachings that have been generated from that literature. It might be a bit naïve to defend this professional faith and its fundamental rhetoric as supported by the best science. It is doubtful that our science, in a field so subjected to the vagaries and whims of nature, is truly inductive, that is, informed from logical inference or reasoned conclusions. Years ago, Sir Peter Medawar, the biologist and winner of 2 Nobel Prizes, wrote that scientific papers, the foundation of our professional rhetoric, are misrepresentations because the observer is always biased. Everyone interprets observations based on faiths, whether or not those faiths are admitted. In a sense, our rhetoric, our literature, the scientific basis of our faith and the underpinnings of our profession, are really based on "methods of making plausible

Figure 1. An illustration of an article of the author's personal faith that may require further testing and evaluation—the 2007 Ducati S2R 1000 motorcycle.

guesses" (see P. Medawar, 12 September 1963, "Is the scientific paper a fraud," *The Listener*, p. 377–378). Granted, the ramblings within this essay are often confined to graduate courses in philosophy taught within ivory towers. Yet, the biases of our faith are often evident within our profession, and these biases deserve discussion in more open forums. When I pick up any issue of our journal from the first issue in 1948 to the most recent, I find repeated expressions of faith. By this, I mean ideas that may have been first proposed decades ago and are held tightly today in spite of conflicting evidence or little initial supporting evidence, but which, over time, have become ingrained into the rhetoric.

Recent discussions within our Society and profession concerning the advantages and disadvantages of rotational livestock grazing have demonstrated this point to me. These discussions have become arguments of faith, of beliefs that have been built up from selected plausible guesses. And, as with any arguments about faith among the faithful, the discussion becomes one of challenges from those with newly surfaced beliefs or defenses, and skepticisms from those with long-held beliefs. To illustrate, in 1961, Harold Heady reviewed some of his data and the state of the literature on the advantages and disadvantages of rotational grazing systems (see Heady, 1961, *Journal of Range Management* 14:182–193) and stated that advantages lay with the continuous systems. He concluded that there was little chance that specialized systems would be either feasible or lead to overall improvements. But, in that article, Heady observed that most studies did not contain adequate measures nor had there been sufficient numbers of studies conducted. More than 40 years later, I think we have reached similar conclusions that stocking rates and weather, and not stock rotations, are the primary effects on grazed rangelands (I can draw from many examples in support of this statement, but for one illustration, see Gillen et al., 1998, *Journal of Range Management* 51:139–146). Yet, I know that faith in a myriad of specialized systems persists within the profession despite this long history of conflicting evidence, and the resulting arguments are passionate. And, I also know that the above interpretations are the guesses originating from my beliefs.

What I really need to remember is to maintain a willingness to let my beliefs stand up to review. Not that I have ever added a bit of water to a well-aged single malt scotch, but I do need to try it once, some day. My professional beliefs certainly do need a routinely applied dash of water and subsequent scrutiny and review. In 1979, Medawar (in his book *Advice to a Young Scientist,* Harper and Row Publishers, 109 p.) wrote: "I can not give any scientist of any age better advice then this: The intensity of the conviction that a hypothesis is true has no bearing on whether it is true or not. The importance of the strength of our conviction is only to provide a proportionately strong incentive to find out if the hypothesis will stand up to critical evaluation."

I consistently fail to heed this advice. Yet, a value of this Society to this profession and its science is to provide the means to critically evaluate. I often overlook this value and think that practicing my profession is about convictions in my hypotheses, or my faith. It isn't faith in my beliefs that I should hold so tightly, but the faith that those beliefs should constantly be evaluated and challenged. That scrutiny is hard to accept and tolerate. Fortunately, I have faith and many data points that suggest my friends and colleagues will readily share their criticisms of my rhetoric. I also have faith, though, that, on many subjects, my son would still think I may have said too much. However, now that he is older, he may be willing to sit through a faithful discourse on Italian motorcycles. Better yet, maybe I should buy one and subject it to more critical evaluation. I'll see.

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SRM Honor Awards

Presented at the Society's 60th Annual Meeting in Reno, Nevada, on February 14, 2007.

John Tanaka, Linda and Tom Bartlett, and Ginger Renner.

Fredric G. Renner Award

The Fredric G. Renner Award is the highest bestowed by the Society for Range Management. The award is named for one of the SRM's founding fathers, who served as its second president.

The Society for Range Management's most prestigious award, the Fredric G. Renner Award, is presented this year to **Tom Bartlett**.

Tom Bartlett joined the American Society of Range Management in 1963. He is only 10 years away from being a Founding Member.

When one thinks of the Finance Committee of the Society for Range Management, one immediately thinks of Tom Bartlett. For 11 years, Tom served on the Finance Committee of the SRM, also serving as Chair. Many of those years were a time of considerable change in the Society. Whereas the Board of Directors was selling one property, housing the staff in rented facilities, and considering whether to purchase a new facility, the Finance Committee had to constantly try to keep the Society afloat financially. At the same time, new thought was going into how the Executive Vice President (EVP) position should be handled and by what sort of person. For that, the Finance Committee had to act as advisors for the financial interests of the Society. Through this, Tom stayed the course as a solid advisor and, as people who know Tom will tell you, he did not mince words about what he would suggest. The Society now finds itself with a new office facility; a full time EVP, who shares his time between Washington, DC, and Denver, Colorado; and with a sound Financial Plan in place. We would not be there without a sound Finance Committee, one that had Tom Bartlett at its core.

Tom also served 3 years on the Society Board of Directors.

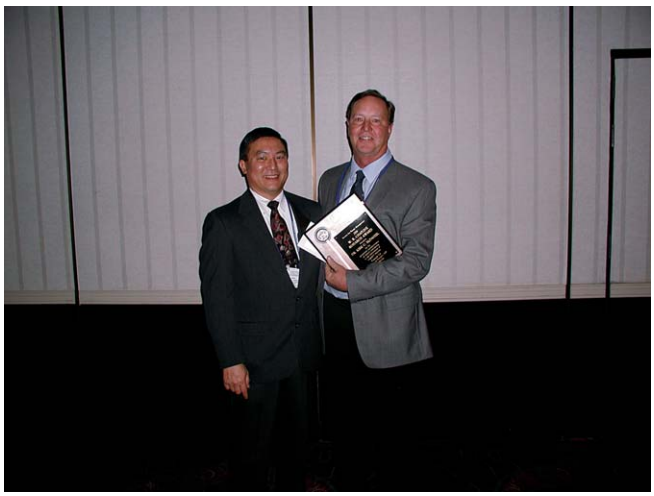
We all think of Tom as the leader in the Range Economics world and rightfully so. He has been the mentor to most of the present-day range economists on University faculty and in land management organizations. No one can speak about federal land grazing fees without thinking of Tom Bartlett. He has been at the heart, or in the leadership, of the many studies that have been done over the years on this topic.

Although many regard Tom as an academic from the research side, we forget that he was the Advisor for the Colorado State University Range Club for 27 years. He served on the Student Affairs Committee for 6 years, leading the Student Display Contest.

When most folks would be entering their retirement years and finishing tasks left undone, Tom took on the leadership of the Sustainable Rangelands Roundtable. An effort initiated by the US Forest Service, the Roundtable quickly took on a national level of involvement, thanks to Tom's dogged determination to see the effort through. With monitoring and assessment "standardization," a high priority within

the profession, new thinking in ecological classification of rangeland conditions, and the need for data on the status of rangelands nationally, this effort caught the attention of all in the range science field. The effort required committed people for a long period and involved an enormous amount of coordination between topic groups. Tom skillfully coordinated these subgroups through countless meetings held around the country.

Tom Bartlett, through SRM membership, sustained accomplishments, eminence, and contributions to the Society, is truly deserving of the Frederic G. Renner Award.



John Tanaka and Kirk McDaniel.

W. R. Chapline Research Award

The W. R. Chapline Award was established in 1986 to provide recognition to members of SRM for exceptional research accomplishments in range science and related disciplines.

Dr Kirk McDaniel joined the New Mexico State University (NMSU) faculty in 1978 and is a Professor in the Department of Animal and Range Sciences with a joint appointment in research and extension as the Range Brush and Weed Control Specialist. He is recognized nationally and internationally as a leader in the development of vegetation management strategies in natural ecosystems.

Dr McDaniel has pioneered innovative approaches for managing shrub and weed species on New Mexico's rangelands. We now have a better understanding of the ecology and preferred control strategies for invasive species, including broom snakeweed, locoweed, sagebrush, creosote, salt cedar, mesquite, and other problem species, thanks to Dr McDaniel's research and extension programs. His brush-control research is unique in that it documents the long-term ecological consequences of managing plants for land restoration purposes.

Millions of dollars have been spent to control salt cedar along the rivers of the West, and more will be spent. These control programs are based on years of research (both successes and failures) conducted cooperatively between Dr McDaniel and John Taylor and others at the Bosque del Apache near Socorro, New Mexico. The Bosque is now held up as "the example and proof" that salt cedar can be managed and controlled.

Kirk's work has always emphasized collaboration with others, including ranchers, land agency personnel, private industry, students, and other university scientists. Dr McDaniel's research provides one of the few long-term databases documenting benefits from managing plants for land restoration. Kirk is also widely recognized for his expertise in rangeland ecology, rangeland monitoring, and public land policy. Over his career, Kirk has assisted in resolving public land management conflicts and encouraged sound management practices on both public and private lands.

Dr McDaniel has written over 200 peer-reviewed articles and given many invited presentations that recognize his expertise in the management of numerous brush species that are problematic on southwestern rangelands. He has served for 15 years as research leader for US Department of Agriculture (USDA) research grants to NMSU on rangeland ecosystems and locoweed research. Combined funding for research directed by Dr McDaniel has been more than half a million dollars per year in the past 10 years. He has been active in SRM, serving on various national committees and as Section President, and serving on the New Mexico Section Board of Directors.

Kirk is a careful, thorough, and exacting researcher. His numerous former students acknowledge the hard work and attention to detail expected of them. The Society for Range Management and the Weed Science Society have benefited from his leadership, research contributions, and professional activities. It is a pleasure for me to participate in awarding to Dr McDaniel the W. R. Chapline Research Award.

It is with great honor that we hereby present Dr Kirk C. McDaniel with the 2007 W. R. Chapline Research Award.

W. R. Chapline Stewardship Award

The W. R. Chapline Stewardship Award was created in 1986 to provide recognition to members of SRM for exceptional accomplishments and contributions to the art and science of range management through specific rangeland entities.

F. Stephen Hartmann of Midland, Texas, is the 2007 recipient of the Society for Range Management's W. R. Chapline Land Stewardship Award. As the Executive Director of University Lands–West Texas Operations, Steve is recognized for his distinguished service and exemplary success in managing the 2.1 million acres of Permanent University Fund lands of the State of Texas. Most of these lands are semiarid or arid rangelands in western Texas. Revenue from this land is deposited into the Permanent University Fund, which has a current value of more than $9 billion. Investment income from this Fund and income generated from the surface estate are used to finance construction, facility renovations, major library acquisitions, significant educational and research equipment, and academic excellence programs in The University of Texas System and the Texas A&M University System.

Hartmann's mission is "to maximize the revenue from University Lands by applying intensive management, ac-

F. Stephen Hartmann and John Tanaka.

counting, conservation, and environmental programs which will improve and sustain productivity of the lands in a manner which will protect both the interest of The University of Texas System and promote awareness and sensitivity to the environment." In addition to oil and gas revenues, the surface estate generates income ($9.1 million in 2005) from grazing, hunting, recreation, business site, and farming leases; pipeline, power line, and utility line easements; and permits for oil field-related operations. Steve's flexible lease policy yields maximum income from 116 grazing leases while ensuring sustainable production from rangeland resources and stability for grazing lessees. Under his policies, a leaseholder pays rent on the hunting value, recreational value, and the actual number and types of livestock grazed. The fees vary yearly based on actual steer–calf prices at a major regional market. Stocking rates are based on Natural Resources Conservation Service (NRCS) recommendations. Aerial surveys are used to verify the livestock numbers present are appropriate. Grazing lessees are required to develop and implement sound conservation and range and wildlife improvement plans with the NRCS. Revenue from surface damages for oil and gas development is used to improve grazing management and wildlife habitat on University lands. Steve values sound research for improving rangeland health and sustaining its productivity. His agency funds about $300,000 annually for range research. Over 1 billion gallons of water are sold annually to several Texas cities from wells on University lands. About 100 wind turbines, with a total generating capacity of 65 megawatts, have been erected on University land and are currently producing electricity for Texans. Steve's proactive management ensures that significant archaeological sites or rare and endangered plants or animals are not disturbed by any type of development activities.

Steve Hartmann has been an active member of the Society for Range Management for 40 years. He has served as a Director, second and first Vice President, President of the Texas Section–SRM, and was named a Fellow of the Texas Section in 1999. He also participates with his clientele in 9 other societies and associations. He is held in the highest esteem among all rangeland resource managers, educators, scientists, ranchers, and agency personnel who know him. His stewardship of the 2.1 million acres of Permanent University Fund lands has been diligent and exemplary. Steve Hartmann is most highly deserving of the honor bestowed by the W. R. Chapline Land Stewardship Award.

Fellow Award

The title of Fellow is conferred upon members of the Society for Range Management in recognition of exceptional service to the Society and its programs in advancing the science and art of range-related resource management. This high honor is granted in the belief that special recognition should be given for exceptional and dedicated service to the Society.

Dr Walter H. Schacht has been actively involved in range management during his entire professional career and has been a member of SRM since 1979. His current posi-

John Tanaka and Walter Schacht.

tion at the University of Nebraska–Lincoln (UNL) includes both teaching and research responsibilities. Dr Schacht ranks among the top educators in the nation in the discipline of Range and Forage Sciences. He has received several teaching awards, successfully competed for education grants, and is active in teaching, advising, scholarly activities, and curriculum development. He has been responsible for extensive revision of the Range Ecology and Management major at UNL and a key leader in the development and administration of the Grazing Livestock Systems and the Plant Biology majors. At the regional and national level, his leadership in range management education is made evident by his coordination of the development of a regional distance-education program in grassland management in the central Great Plains, active roles in the Range Science Education Council, organization of educational symposia, membership of the SRM accreditation committee, and long-term commitment to student activities associated with SRM. Dr Schacht's research concentrates on

the study of interactions between grazing animals and the biotic and abiotic components of grassland ecosystems. His long-term research projects have focused on developing ecologically and economically sustainable, year-round grazing and foraging programs. His productive research program has focused on graduate student education and multidisciplinary and multistate projects. He has mentored numerous graduate students that have gone on to become successful professionals. His research has been supported by a diversity of grant sources and led to the publication of 50 articles in refereed journals or symposium proceedings. He also is an associate editor of *Rangeland Ecology & Management*. His skills and expertise in many aspects of range management have gained respect from students, ranchers, and peers. Dr Schacht also has an active leadership role in the Society for Range Management as Chair and Committee Member at both the International and Section levels.

John Tanaka and Carolyn Hull Sieg.

Dr Carolyn Hull Sieg has served the Society for Range Management in elected, volunteer, and assigned positions over the past 20 years. She has been elected as Director on the International and State levels as well as Section President of the South Dakota Section. She has taken major responsibility in 2 of our annual, international meetings, with primary program responsibility in 1997. She has volunteered for the Public Affairs Committee and the Information and Education (I&E) Committee at both the Section and National level and has served as Chair of the Advisory Board. All of these positions are positions of responsibility that require active management and participation in SRM functioning. All of these positions can make a lasting impact on our professional Society.

Probably the most time-consuming volunteer position Dr Sieg has performed is that of Associate Editor for our professional journal. After serving a 4-year term as an Associate Editor, Carolyn volunteered to remain with the journal for an additional year through the transformation from the *Journal of Range Management* to *Rangeland Ecology & Management*. Her insight and dedication helped provide the continuity to make the journal change.

In summary, Carolyn has served the Society in every conceivable office and committee. She has improved how the SRM functions by serving on numerous committees that address not only the business of the Society but also how the Society does business. She consistently provides a professional and caring attitude that enhances the SRM both internally and to other professionals and organizations—and she has done this for more than 20 years. Naming Carolyn Hull Sieg as Fellow of the Society for Range Management is clearly deserved and long overdue.

Sustained Lifetime Achievement Award

The Sustained Lifetime Achievement Award is presented by the Society for Range Management to members for long-term contributions to the art and science of range management and to the Society for Range Management.

Dr Charles A. (Butch) Taylor's work at the Texas A&M Sonora Research Station since 1983 has established him as a leading authority in Texas and the Southwest on rangeland resource management, especially in the areas of livestock grazing management and the use of prescribed fire and goats for managing juniper and prickly pear cactus. Through his leadership, the Sonora Research Station has become a premier location to see and learn about the latest rangeland management techniques.

John Tanaka and Charles A. (Butch) Taylor.

Dr Taylor discovered that terpenoids limit juniper consumption by goats. He found that there is genetic variation within goats and the use of a selective-breeding program can create a goat herd with greater genetic ability to tolerate terpenoids. This, along with top-killing large junipers, has allowed ranchers to seriously address the juniper invasion threatening ranchers and rural communities of the Edwards Plateau.

Butch's innovative research on prescribed fire has shown that fires conducted under hot, dry conditions can effectively control

juniper and prickly pear cactus without permanently damaging the desirable grasses. His low-cost summer burning program is rapidly being adopted by ranchers. He also recognized that prescribed burning required more skill, labor, and equipment than individual ranchers possess. Thus, he has "neighbors helping neighbors" carry out prescribed burns on 40,000+ acres of the over 1 million acres represented by the Edwards Plateau Prescribed Burning Association 200 members.

His research on rangeland water budgets was completed long before the importance of rangelands as watersheds for expanding urban populations was recognized. Thus, he is partially responsible for the Texas Brush Control Program—targeting more than 1 million acres of Texas rangelands for brush control to increase water yield.

Recognizing the changing landscape of land ownership, with the "new" owners knowing little to nothing about ranching and rangeland management, Dr Taylor and 2 colleagues created the Academy for Ranch Management to teach these new landowners how to be good stewards of their range resource. Currently they have taught more than 70 students with land holdings in excess of 500,000 acres.

For his continuing dedication to rangelands, it is an honor to present Dr Charles A. Taylor with the Sustained Lifetime Achievement Award.

Outstanding Achievement Awards

The Outstanding Achievement Awards are presented by the Society for Range Management to members and other qualified individuals and groups working in rangelands. The Outstanding Achievement Awards have been subdivided into 2 groups: Research/Academia and Stewardship (ranchers, agency professional, and consultants).

Research/Academia

Dr Terrance Booth is one of those rare scientists who have taken their knowledge of rangeland science and applied it to the development of new knowledge and theory that has greatly benefited many whose careers involve the management of western rangelands. Starting out in seedbed ecology and reclamation research, Terry made several substantive advances that have affected or changed industry standards in the processing of seeds, in the reclamation of disturbed lands, and in the development of a new cultivar. He advanced the science of seedbed ecology by elucidating the physical, physiological, and morphological reactions of seeds in processing and priming and the consequences for seedling vigor and plant establishment. His research pointed out the need to fully understand, for all relevant species, their seedbed ecology, including all diaspore functions that contribute to seedling establishment. He also pointed out the need to understand seed processing to develop the most economical and effective seed-handling protocols.

John Tanaka and Terrance Booth.

More recently, but building on work begun as a graduate student under Dr Paul Tueller, Dr Booth created an aerial survey system that fully addresses the rangeland monitoring problem defined by Brady et al., who in 1995, commented in a *Journal of Range Management* (48:187–190) article, "The monitoring problem in natural resource management is one of how to design … *economical* inventory methods that will detect ecologically important vegetation changes with acceptable error rates." The technical problems and obstacles in this accomplishment were multiple, substantive, and, to many, would be defeating. But Terry persevered, and today has developed an aerial monitoring system that numerous groups, including organizations like the Bureau of Land Management (BLM), US Department of Agriculture–Agricultural Research Service (USDA–ARS), the Northern Nevada Stewardship Group, Nevada Bighorn's Unlimited, and Bitterroot Restoration Inc., see as a solution to the problem in monitoring vast acreages of rangelands.

In summary, Dr Terry Booth has been a dedicated and accomplished rangeland scientist who has used his scientific skills and knowledge to develop critical tools that rangeland managers desperately need. His curriculum today is a leading range science program, and his contributions will be a standard upon which future advances in aerial monitoring will be based.

Mr Duane McCartney's contributions to range management have been substantial with most of his contributions being in the planted pasture arena rather than the more traditional rangeland management arena. This is largely because planted pastures are key components of rangeland grazing systems in the Aspen Parkland region of Alberta and Saskatchewan, Canada. Moreover, where operations include significant amounts of native rangeland, his work has allowed operators to delay and shorten their native rangeland grazing period, which is of direct benefit to the rangeland resource.

Mr McCartney is held in high esteem by both his colleagues and customers. This is because, in the past 5 years alone, he has 1) research accomplishments including 24 refereed journal articles, 27 conference proceedings, and 8 other publications; 2) 50 written and 34 oral technical and

John Tanaka and Duane McCartney.

John Tanaka and Kevin Sedivec.

semitechnical presentations; 3) received many distinguished professional awards; and 4) enjoyed many significant leadership roles on both a national and international level, such as organizing numerous conferences including the International Grasslands Congress in Winnipeg and Saskatoon, Canada, which hosted 1,100 people from 90 countries for 2 weeks, and presenting the opening address at the same Congress; forming a Canadian Chapter of the Society for Range Management for Saskatchewan and Manitoba, Canada; serving as President of the Northern Great Plains Section of SRM (North Dakota, eastern Montana, and Saskatchewan and Manitoba, Canada); serving on the nomination and awards committee of SRM; representing the grazing and range industry on the Expert Committee on Forage Crops; forming the Western Forage Beef Network that brought together all forage and beef researchers at Ag Canada and Universities plus all the forage and beef extension personal from British Columbia, Alberta, Saskatchewan, and Manitoba, Canada, on an annual basis for the further development of the forage beef industry; serving on an array of Saskatchewan Department of Agriculture Food and Rural Revitalization forage and beef committees and Prairie Farm Rehabilitation Administration (PFRA) Green Plan committees; and serving as a Canadian ambassador and instructor on an educational trade mission to Ukraine and Cuba. In addition to these many accomplishments, a capstone achievement of Mr McCartney's is that he initiated and led a team of 55 people from across Canada in the development of a forage and beef cattle informational Web site http://www.foragebeef.ca.

Because of the above accomplishments, it is truly a privilege for the Society for Range Management to honor Mr McCartney with a 2007 Outstanding Achievement Award.

Dr Kevin Sedivec has distinguished himself as an outstanding rangeland extension specialist, educator, and research scientist. His success as an extension specialist is reflected by the sheer number of extension workshops, meetings, etc that he has organized or participated in over the past 15 years. For example, he has organized or chaired 70 customer workshops and 35 in-service training courses. He has made more than 350 educational presentations, authored or coauthored 20 peer-reviewed extension publications, 38 other extension publications, and 75 field day reports or fact sheets. He and his work have been featured in more than 225 popular articles, videos, and other avenues of outreach. Dr Sedivec has taught several rangeland science courses at North Dakota State University, and he has served as either major or co-major advisor to 22 graduate students. In addition, he has served as a member of 19 additional Graduate Student Committees. His independent and graduate students' research has resulted in 1 senior- and 9 junior-authored, refereed journal articles and 46 abstracts. Also, he has been the principle or coprinciple investigator on 76 research grants funded to the amount of $2.9 million. Dr Sedivec has received numerous awards for his dedicated service to his profession, including the 1998 SRM Outstanding Young Professional Award. He has also served in numerous SRM leadership positions in the North Dakota Chapter, the Northern Great Plains Section, and the Parent Society.

Because of these accomplishments, it is truly a privilege for the Society for Range Management to honor Dr Sedivec with a 2007 Outstanding Achievement Award.

Dr Roger Sheley has developed an international reputation as a weed ecologist. He is currently a lead scientist for the Agricultural Research Service program in Burns, Oregon, and previously was on the faculty at Montana State University. Roger has developed research programs that span the spectrum from very applied to very theoretical. He is a prolific speaker and writer, often giving 20–30 presentations per year, and he recently was senior or coauthor on 10 scientific journal publications in a single year.

During the past 10–12 years, Dr Sheley has worked to provide a conceptual framework that would help integrate research, teaching, and management associated with rangeland weed management. A strength of this approach is that research and management can be evaluated on a unified basis. The second real advantage to the system (which Roger

John Tanaka and Roger Sheley.

has termed *Ecologically Based Invasive Plant Management*) is that it forces both managers and researchers to consider the primary mechanisms of succession when evaluating success and failures. Roger's goal is to develop principles for weed management that are based on the best existing ecological knowledge.

Much of his drive to improve rangeland weed management comes from a sincere desire to improve the land for our children. Along with his extensive research effort, Roger has also mentored a host of graduate students and other professionals, been active in technology transfer and outreach activities, and generally contributed to the success of those with whom he has worked.

Dr Allen Torell joined the New Mexico State University faculty in 1984 and is a Professor in the Department of Agricultural Economics and Business. Dr Torell is recognized as one of the top range economists in the western United States. His research and teaching emphasis has contributed extensively to the areas of production economics, resource economics, public land policy, and ranch and range economics. He is widely sought for his knowledge and expertise in econometrics, computer applications, and farm and ranch management.

John Tanaka and Allen Torell.

Dr Torell has contributed to rangeland science for many years, conducting critical economic evaluations that are particularly valued by land management agencies. His cost-and-return data for ranches of various sizes has been invaluable to landowners, academia, bankers, and real estate personnel. He has been the driving force and major investigator in the "What is a Ranch Worth" idea, showing that rangelands have values far beyond just livestock grazing. He is, however, passionate that we continue to recognize that livestock grazing is a major factor in managing rangelands. His "Ran-val" work is used across the western United States and is a valuable tool for determining true ranch value when all aspects of ownership are taken into consideration.

Dr Torell not only conducts economic research, he has been instrumental in collaborating with rangeland scientists in New Mexico and nationally. He has worked and published on the economic impact and benefits from managing various brush and weed species, including mesquite, sagebrush, snakeweed, locoweed, and others. He is widely sought to determine economic values, impacts, and effects on local economies of various rangeland and ranching practices. Nearly all his publications are multiauthored, indicating the degree of collaboration.

Dr Allen Torell was bestowed with the New Mexico Section SRM Rangeland Manager of the Year Award in 2005. In part, he was recognized as the *one* agricultural economist available to New Mexico residents that is well versed on, and knowledgeable in, rangeland economics.

He was further recognized as always willing to spend time and energy to disseminate this information in a usable, timely, and understandable fashion.

Dr John Walker has distinguished himself as an outstanding rangeland scientist and agriculture administrator. The primary focus of Dr Walker's research has been in developing new understandings of grazing livestock diet selection processes and incorporating findings into the development of

John Tanaka and John Walker.

effective grazing management strategies that can affect the consequences of domestic herbivory on rangeland ecosystems. In this interest, he has investigated the effects of grazing systems on many aspects of range livestock production systems, the use of livestock to manage noxious weeds, and the use of selective breeding to modify diet preference. He has also investigated a variety of other topics including rangeland monitoring, many aspects of range livestock production systems, brush removal to increase rangeland water yield, and fecal near-infrared reflectance spectrometry (NIRS) to predict diet composition. These research endeavors have resulted in numerous scientific publications including 16 senior- and 25 junior-authored, refereed journal articles, 70 other publications, 33 abstracts, and 29 invited presentations or papers.

Dr Walker has also distinguished himself as an outstanding rangeland agriculture administrator having served as a Postdoctoral Rangeland Scientist, a Category 1 (CAT 1) Rangeland Scientist, and as acting Research Leader at the USDA–ARS Sheep Experiment Station, Dubois, Idaho (1988–1997), and as Resident Director of Research at the Texas A&M University Agricultural Research and Extension Center in San Angelo, Texas (1997–present). At both locations, Dr Walker's role was to provide leadership to a multidisciplinary team of scientists developing new technologies for increasing the efficiency and sustainability of range livestock production.

Because of these accomplishments, it is truly a privilege for the Society for Range Management to honor Dr Walker with a 2007 Outstanding Achievement Award.

Stewardship

Christopher Dale Allison's major career emphases have been in grazing management, poisonous plants, public land management, and youth development. Chris has developed range-monitoring techniques that have been applied by ranchers and federal land management agencies. He also developed a program to certify resource consultants for the New Mexico State Land Office. He has been extensively involved with public land agency–producer–environmentalist conflict resolution throughout his career. He recently developed a rangeland evaluation protocol (*Rapid Assessment Methodology*), which is being used in Arizona and New Mexico to determine range suitability for livestock grazing.

Recent emphasis on elk–livestock interaction and competition has led to involvement with the federal and state agencies and producer groups in trying to resolve this growing conflict on rangelands. A study initiated by Chris in 1995 attempted to partition forage consumption into elk and livestock components.

Chris' involvement with toxic plant management is focused on developing management strategies and guidelines for grazing locoweed-infested pastures. He has developed, with the local extension agents, criteria for supplementation and proper turn-in time for cattle that minimize incidence of locoism as well as conducting field trials on locoweed aversion.

Chris works extensively in the 4-H and Future Farmers of America (FFA) youth education areas also. He developed a judging contest for evaluating rangelands in New Mexico as well as assisted in development of the national rangeland-judging contest held annually in Oklahoma City, Oklahoma. He instructs at the state 4-H horse school and the state 4-H livestock schools and started the first 4-H pig school. He conducts the state and national 4-H shotgun contest in the 4-H Shooting Sports Contest and serves as the state and national Chair of the shotgun event at the Youth Hunter Education Challenge (YHEC).

Chris has served as the Interim Coordinator for the Range Improvement Task Force, he serves as the Department Head for the Extension Service's Animal Resources Department, and he has served as the Administrator of the Clayton Livestock Research Center.

Chris has more than 65 refereed journal articles and other professional publications. He has given over 75 public presentations.

Dr Charles R. Hart is deserving of the SRM Outstanding Achievement Award for his comprehensive and integrat-

John Tanaka and Christopher Dale Allison.

John Tanaka and Charles R. Hart.

ed programs to improve rangeland health and stewardship. These projects include the Pecos River Ecosystem Project, the first in Texas to attempt to reclaim and restore an entire river ecosystem damaged by salt cedar invasion. Through his leadership, the project has, as of this date, reclaimed over 289 river miles (13,497 acres), with an estimated 10,000–15,000 acre-feet of water salvaged annually along the Pecos River in Texas.

Dr Hart's achievements are not limited to rangeland watershed issues. He also developed the Integrated Toxic Plant Management Program in 1996. More than 700 landowners have been trained in workshops conducted by this program. One outstanding achievement of the program was the book *Toxic Plants of Texas* (College Station, TX: Texas Cooperative Extension Service B1605, 2003), which includes color pictures of over 100 toxic plants in the state as well as descriptions of symptoms, toxic agents involved, distribution, habitat, and suggested integrated management strategies to reduce livestock losses. This has been one of the most popular rangeland publications produced by Texas A&M University.

Dr Hart's achievements are many, including his work to develop the Texas Digital Diagnostics System, his 200 or more applied research and demonstration projects in the area of rangeland weed and brush control, and his authorship of 24 Extension Service publications.

There can be no better measure of achievement than "making a difference." Dr Charles Hart and his work as an Extension Service Range Specialist in West Texas have made a difference for rangeland owners and, most important, for the ecological health and productivity of rangelands.

John Tanaka and Mark Moseley.

For more than 30 years, **Mark Moseley** has been a practitioner and promoter of rangeland management and sustainability. Beginning on the family ranch in McCulloch County, Texas, through the pursuit of a bachelor's degree in Range and Wildlife Management at Texas Tech University, work at several NRCS field offices in Texas, the NRCS State Rangeland Management Specialist position in Oklahoma, and finally, the state Grazing Lands Conservation Initiative (GLCI) Coordinator for Texas, Mark has exhibited a contagious passion for rangelands.

Mark is very well respected among partners as a leading authority on rangeland issues in Oklahoma and Texas. He was instrumental in the formation of the original GLCI coalition in Oklahoma. Mark has served as a mentor to many young conservationists. He enjoys training and helping others to learn, as is evident in his efforts with the National Range Judging Contest, range camps, High School Youth Forum, and many NRCS training sessions. He is always available to answer questions and provide guidance when needed. His positive effect on these individuals is evident in the fact that most of them remain in contact with Mark many years later, despite career changes and relocation.

To Mark, it does not matter what time it is, it does not matter whether he is on the clock or off the clock, it does not matter whether he is participating in a major conference, out on the ground visiting with a rancher, or talking to a grade-school class, Mark is *always* promoting rangelands and rangeland management. He has the ability to talk at whatever level is necessary—carving out policy, regulations, etc; spilling his knowledge to help ranchers with their management skills; or telling the story of rangelands to fourth graders who may become the next generation of policy-makers, ranchers, or agency employees. Mark never stops promoting rangelands and range management.

His long-term service and passion for rangelands make Mark Moseley a most worthy recipient of the SRM Outstanding Achievement Award.

John Tanaka and John Williams.

John Williams, long-time SRM member and County Chair for the Oregon State University Cooperative Extension Service, Wallowa County, Oregon, has many, far-reaching accomplishments. He is known regionally in northeastern Oregon as the "go-to guy" for rangeland management, water quality, land management, weed control, and team build-

ing. He is the motivation behind the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan, which is touted in Oregon, Washington, and British Columbia, Canada, as the model to follow in dealing with the "sticky wickets" germane to creating an acceptable rare and endangered species recovery plan across 3 states and an international boundary! Mr Williams would modestly suggest that the plan itself is not exportable, but that the process is … meaning that the format, protocol, and social and biophysical processes that he fostered to resolve conflict and actively engage in positive pathways are the critical features of any successful plan.

Mr Williams has been instrumental in enhancing and providing education on Confined Animal Feeding Operations (CAFO) requirements and in the Local Environmental and Resource Network (LEARN) to help beleaguered landowners find ways to comply with land-use regulations that are acceptable and financially doable. He has provided leadership to the Natural Resource Advisory Committee (NRAC), which has provided more than $1 million in input toward road inventories, satellite imagery research, training in stewardship principles, removal of fish passage barriers, vegetation projects, and investment in off-site livestock watering.

John Williams is a compelling force for the better. He is believable, acceptable, and clearly in it for the long haul.

Outstanding Young Range Professional

The Outstanding Young Professional Award is presented by the Society to an individual member who has demonstrated extraordinary potential and promise as a range management professional. This award is presented as an encouragement for outstanding performance by young men and women entering the profession of range management.

Duane Coombs is an unusual and remarkable young man. As a Utah State University graduate by education and a "cowboy" by a lifetime of experience, he has brought professionalism, intelligence, and insight to the Smith Creek Ranch grazing operation in central Nevada.

One of Duane's first responsibilities when he started work at the Smith Creek Ranch was to work with BLM and the ranch's consultants to develop and implement an allotment management plan. He was instrumental in developing the grazing management system for the plan by incorporating innovative ideas on training cattle to graze uplands and use off-riparian watering areas and on implementing selective culling of the cattle herd based on trainability of the cattle to the herding system.

Duane is a strong advocate of the adage that you cannot manage what you do not measure. He participates in the ranch's third-party monitoring and in agency monitoring, and he has implemented a monitoring program of his own.

Duane is constantly striving to learn more about resource management, and he is always willing to share his ideas and experience with local land managers, interest groups, and livestock growers. Duane also has the ability to be adaptable; he learns from mistakes and devises solutions to meet resource and economic goals. Duane has been active in Nevada's sage grouse planning effort and is implementing sage grouse management practices on the ranch. He is also working on pinyon juniper control and aspen regeneration projects on the Smith Creek Ranch.

Duane has a strong land and resource management ethic and believes in sharing this with youth and is an avid supporter of Nevada Range Camp. Ask Duane about some of his accomplishments, and he will start naming the young men and women that he has worked with over the years. He will tell you that he is most proud of his cowboys. Without good, well-trained, and enthusiastic employees, much of what has been accomplished on the Smith Creek Ranch would never have occurred. Duane is proud to say that he has been an influence on at least 2 of his employees, who are now attending college in rangeland management programs.

Duane Coombs is most deserving of the Outstanding Young Range Professional Award.

John Tanaka and Duane Coombs.

John Tanaka and Paul Meiman.

In his short tenure as Extension Service Specialist for Rangeland Resources at the University of Wyoming, **Dr Paul Meiman** has quickly risen to the ranks of "superstar." He rapidly developed a trustworthy reputation for applying scientific insight to practical rangeland management challenges. He is in high demand to make presentations to a broad spectrum of groups that care about sustainable rangeland management—all while maintaining the respect and esteem of agency personnel, ranchers, and environmental interest groups. He also has the skill to make the connection between research and aiding on-the-ground application through Extension Service education.

Dr Meiman has successfully established a statewide Rangeland Management School and a Wyoming rangelands Web site, developed a series of regularly broadcasted radio and television Public Service Announcements, and helped with the Wyoming Rangeland Resources Camp each summer. He has had 12 televised informational programs aired in Wyoming since June 2004. He has *already* had 140+ formal presentations, 5 scientific journal articles, 8 popular articles, 6 Extension Fact Sheets, and several other publications since he arrived at the University of Wyoming in 2003.

In addition to his Extension Service duties, Paul teaches 2 classes, has diverse research interests (from invasion ecology to soil–plant–microbe interactions to watershed interactions to wild land ecology), and is collaborating on several interdisciplinary projects.

Paul is one of those rare individuals that we in higher education look for to carry on and expand our intellectual horizons. He has a great aptitude for developing keen insights regarding the underlying principles of his profession and has demonstrated an ability to understand the cross-disciplinary linkages.

He is a real leader—well respected and liked by those who have had the good fortune of working with him.

Dr Meiman is aware that the future of range and natural resource management depends on recruitment of quality young men and women into the field. Paul takes the time to visit with high school and college students in group settings and individually about career opportunities in range and natural resource management.

Dr Meiman is an excellent example of an "Outstanding Young Rangeland Professional" and is most deserving of this award.

Range Science Education Council Outstanding Undergraduate Teacher Award

The Outstanding Undergraduate Teaching Award is presented annually to the individual who makes the greatest contribution to undergraduate education in the broad discipline of range science. The award is presented jointly by the Range Science Education Council and the Society for Range Management.

The Range Science Education Council and the Society for Range Management proudly present **Dr Christopher Call** with the 2007 Outstanding Undergraduate Teaching Award. Since 1987, Dr Call has taught a wide range of undergraduate range management courses in the Department of Wildland Resources at Utah State University. Dr Call also serves as an advisor to the Student Chapter of the Society of Range Management at Utah State University and was the former Coach of the Range Plant Identification Team.

John Tanaka and Christopher Call.

Dr Call is well known among his colleagues as a faculty member driven to learn the process of teaching students. He immerses himself in literature which describes the many different learning techniques and continues to integrate them into his classes. He also strives to better the department by presenting these findings to other faculty, so they too can make their classes more advantageous. He describes teaching as a learning experience. All students have a story, and Dr Call learns through their questions, observations, and challenges, just as each student learns from Dr Call's presentations, exams, and assignments. He boosts interest in subject matter by letting students interact with one another in small groups as they attempt to solve real-world problems. These groups facilitate critical thinking and encourage interpersonal communication among students. At Utah State University, Dr Call has developed a study abroad program for undergraduate students in the College of Natural Resources. The program exposes students to the culture and management of natural resources in countries such as Mexico, Iceland, and Morocco. Dr Call is also known for his development of the Undergraduate Range Management Exam (URME) Contest.

Dr Call is a highly motivated teacher who strives to know his students on an individual level. He makes himself readily available to students and is well known for his friendliness and willingness to help. It is no wonder that he has been awarded Teacher of the Year at Utah State University more than once and is now being recognized as the Outstanding Undergraduate Teacher for 2007.

Annual SRM International Travel Fellowship 2007

The SRM International Travel Fellowship, presented for the first time in 2006, is awarded to a rangeland scientist or man-

ager from a developing country. The purpose of this fellowship, which includes a $1,000 travel stipend, is to foster international exchange about advances in rangeland ecology and management and to promote participation in SRM by rangeland scientists and managers from developing countries. The fellowship is competitive and is awarded on the basis of scientific merit and applied significance of research, financial need, professional development objectives, and clarity of expression in English.

The 2007 winner of the International Travel Fellowship is **Dr Batjaviin Batbuyan** for his paper titled "Herder and Livestock Practices in Mongolia."

SRM 2007 Distinguished Service Awards

Recipients: **Mr Thane Johnson** and **Mr Donald Smith**

If SRM was governed by a royal family as opposed to a board of directors, these 2 west Denver, Colorado, residents and long-time SRM members would both be granted Knighthood at this awards ceremony today.

They are both great friends of our society; they both believe deeply in what our organization stands for, and their dedication and service to SRM is exemplary.

From key business and construction connections to showing up at the office with their cars and trucks full of tools for building maintenance to finding a local youth to help with yard and landscape projects, Thane Johnson and Don Smith have been there to assist our Denver, Colorado, staff with the upkeep and maintenance of our new office building.

These 2 men have saved SRM countless dollars through their efforts to complete both small and large maintenance jobs at the new office building in Wheat Ridge, Colorado. Our organization has benefited in many different ways from their connections to local businesses, construction firms, and other maintenance companies.

Their willingness to work with our Denver-based staff on making our new building functional and operational has been a great shot in the arm to our Society.

For this reason, SRM is very pleased to announce that both Thane Johnson and Don Smith are receiving Distinguished Service Awards from our Board of Directors.

Congratulations and a great big THANK YOU to Mr Thane Johnson, and Mr Donald Smith for all that they have done for our Society.

Don and Thane are the recipients of the 2007 Distinguished Service Awards from our Board of Directors. *Editor's note: As part of the recognition, Don Smith received a Life Membership along with the award. Thane Johnson was already a Life Member.*

Special Life Membership

During the awards ceremony, Bill Hurst, on behalf of the Society for Range Management, presented **Ginger Renner** a Life Membership for her continued endorsement of the Society's highest award, the Fredric G. Renner Award, named for her late husband. ◆

Requiescat in Pace

Everett R. Doman, 1912–2007

Everett R. Doman, 94, died March 1, 2007, at home. He was born July 27, 1912, in Welling, Alberta, Canada, the second son. After living in Canada for about 1-1/2 years, the family returned to Huntsville, Utah. He was a graduate of Weber County High School, Weber Junior College, and, in 1938, of Utah Agricultural College (now Utah State University), with a degree in Wildlife Management. He married Gay Wangsgard of Huntsville, Utah, on December 2, 1938, in the Salt Lake Latter-Day Saints Temple. They were married 62 years before Gay died September 25, 2000. Early career employment with the Utah Cooperative Wildlife Research Unit and the Utah Department of Fish and Game was followed by an extensive career with the US Forest Service. With the Forest Service, Everett transferred frequently. He began his Forest Service career in 1943 as Assistant Ranger on the Navajo Lake Rural District in the Dixie National Forest. Then he served as District Ranger on the Fishlake National Forest and as the Wildlife and Range Staff Officer on the Manti National Forest. He transferred to Jackson Hole, Wyoming, as Assistant Forest Supervisor of the Teton National Forest. From 1954 to 1957, he served in Washington, DC, as Assistant Director of the Division of Wildlife Management. From there, he became Forest Supervisor of the Lincoln National Forest in Alamogordo, New Mexico. From 1960 to 1970, he was Assistant Regional Forester and Director of Range Management, Fisheries, and Wildlife in the Pacific Southwest region in San Francisco, California. In 1966, he was presented the Forest Conservation Award by the California Wildlife Federation. He finished his career as Director of the Division of Wildlife Management in the national office in Washington, DC. After a 31-year career with the Forest Service, he retired in December 1974 and moved to Ogden, Utah. During Everett's tenure with the Forest Service, he saw it change from a primarily timber and range management agency to a true multiple use agency with recognition given to the size and importance of the Forest Service's wildlife and fisheries habitat management jobs. He was proud that he had a part in bringing this about. Everett was a member of the National Wildlife Federation, American Forests, a 69-year member of the Wildlife Society, and a charter member (60 years) of the Society for Range Management. In 1999, he was awarded the Society for Range Management's Sustained Lifetime Achievement Award. Locally, he was active with the Wasatch Audubon Society, the Golden Spike Gem and Mineral Society, the Weber Historical Society, and the Forest Service Old Timers' organization. Early in his retirement, Everett's activities included traveling, rock hounding, lapidary, silversmithing, skiing, fishing, camping, backpacking, and wilderness trail riding. More recently, his interests included gardening, bird watching, reading, photography, and sports. He was an avid basketball fan. Everett was a generous man of enormous integrity, with an unfailing commitment to family. He is survived by 2 daughters, Lois and Kathy, and 2 granddaughters. He was preceded in death by his wife, his eldest daughter, Mary, and four brothers. E-mail condolences to the family at lom@lindquistmortuary.com. ◆

Thad Box

Landscapes, Connections, Sunsets, and the Idea Factory

South of Las Cruces, New Mexico, though not yet to the Texas border, I turned my pickup east toward the Organ Mountains. Jenny and I were headed to a cave where an archeologist friend found and described 5,000-year-old corn—one of the earliest records of corn in the United States. I had no global positioning system (GPS) unit or coordinates. I came only with my friend's verbal directions and a promise I would not reveal his location to anyone.

I took a seldom-used dirt road through mesquite. Each tree anchored a large sand dune, its branches reaching skyward above the sand. Among creosote bushes, the road turned to a service track for a power line. I parked when the track became a trail. I could have picked my way through the shrubs with my pickup, but the desert soils had suffered enough without my adding tire marks. We took our packs and hiked toward the hills.

We found the cave easily, but vandals had found it first. A 4-wheel-drive truck had come in from the north, uprooting shrubs and overturning boulders. In the cave, someone dug large holes and left them unfilled. Beer cans and fast food containers littered the ground. The site's historical value existed now in my friend's words in a professional journal.

Slightly higher on the hill, we found shade in a rock shelter—an unimpressive notch in the mountain where a large boulder had split from the cliff. We spread our blanket and laid out our picnic lunch on the area protected by the overhanging ledge. The underside of the ledge was black from past fires.

Ancient rock paintings were layered with soot. Names of modern people were scratched on top of them. Petroglyphs etched into the face of the cliff above where the boulder had fallen matched those on the boulder that lay below us. Mortars were worn in fallen rocks. Meal from mesquite beans or corn had been ground thousands of years ago. Pottery shards, flint chips, cartridge casings, beer caps, condoms, and facial tissues testified to use by many generations.

Jenny and I shared our lunch and wondered about those who used the shelter before us. My archeologist friend said modern sheepherders, Apaches, Mimbres people, and at least one culture of unnamed ancients had made the cave he excavated home.

We looked out over the marvelous landscape of the valley below us. Distinct desert plant communities followed geologic patterns of uplift and outflow as the land sloped toward the Rio Grande. Across the river, a plateau rose and sloped upward toward the distant Florida Mountains.

I tried to imagine what the valley was like in 1598 when Juan de Oñate forded the Rio Grande a few miles south and took the first permanent European settlers of what is now the United States to Santa Fe. Earlier explorers had livestock with them, but it was Oñate who brought sheep and cattle that have been part of the ecosystem for the past 400 years.

From Oñate's first settlement until the mid-1800s, when the Treaty of Guadalupe Hidalgo and the Gadsen Purchase transferred the land to the United States, the valley below us was the major thoroughfare for commerce between New Mexico colonies and New Spain—the

famous Chihuahua Trail. During the 18th and first half of the 19th centuries, hundreds of thousands of livestock passed through the funnel-like valley below me, grazing their way toward markets in Chihuahua and points south.

Gone are the cottonwood groves where market herds of wethers, under military escort to prevent them from being stolen by Apaches, shaded during their trek. Carefully tended pecan orchards now replace natural bosques. Grassy flood plains of the past are irrigated farms. Towns and villages have grown into one another, making a continuous human settlement from El Paso, Texas, to the metropolitan area of Las Cruces, New Mexico.

Interstate Highway 10 follows the Chihuahua Trail from El Paso, Texas, to Las Cruces, New Mexico, then turns west across the desert toward Los Angeles, California. Thousands of cars speed along the freeway. Trucks carry cheap trade goods from factories in unAmerica to big box stores throughout our country. Fertilizers mined in Morocco or manufactured elsewhere replace nutrients used by crops.

Jenny and I watched in hushed reverence as the sun set over the spectacular landscape. Dust from farming and tailpipe emissions filled the air, enhancing brilliance of reds, oranges, and yellows as the sun dropped behind the Floridas.

This issue of *Rangelands* is about landscapes—their use and management. During recent decades, landscape ecology has become an expanding subbranch of the science of ecology. As ecologists developed principles for their science, those principles were applied to ever-expanding geographical areas. New theories were proposed for the flow of energy and the transfer of matter between ecological units of large areas.

Applied ecologists and land-care professionals were long ago forced to consider large land areas. Soil scientists used geological formations, soil families, and other tools to group the land into similar units. Hydrologists and water scientists used watersheds as their collective land unit. Foresters used timber stands and habitat types. Range managers used plant communities and range sites. All searched for ways to group unique individual ecological units into manageable systems.

Economists, planners, and social scientists likewise searched for ways to group land and human populations into units—political, social, economic, religious. These units are intertwined with, and ultimately dependent upon, the land itself. But what land? How are they connected?

These questions relate more appropriately to systems science than to ecology of individual units. A new breed of system scientists develops theories and tools to answer those questions. Kevin Kelley, in his all too appropriately named book, *Out of Control*, explores the relationship between the new biology, social systems, machines, and the economic world.

He advocates system science, biology, and artificial intelligence as ways to understand complex systems. He writes the wildness of nature is the chief source for clarifying insights into our postindustrial future: "As we look at human efforts to create complex mechanical things, again and again, we return to nature for directions. Nature is more than a diverse gene bank harboring undiscovered herbal cures for future diseases—although it is certainly that. Nature is also a *meme bank*, an idea factory. Vital, postindustrial paradigms are hidden in every jungle ant hill."

Researchers working in their own, ofttimes narrow, disciplines give us understanding of individual units in a landscape. We have a great deal of knowledge about individual species and processes. But the management of landscapes requires understanding interconnectedness—the location, strength, and importance of the connections within a system and between systems.

The range management profession exists to promote sustainable rangelands—to keep options open for future generations. Based on ecology, our profession formed while working with interconnections, but in a limited time period. Range management is only a little over 100 years old. It is not enough to know the connections in the landscape below an Organ Mountain rock shelter today. Or how the Mimbres people used the landscape.

We seek to know how, and why, the Merino sheep and cattle that Oñate drove up the river in 1598 changed the system through time to what it is today; what connections were changed or broken. We want to understand what combinations of events caused the desert grassland to drop below base survival levels, why shrubs crossed a threshold to take its place. Such knowledge is more vital to sustainability of the landscape than knowing how many cows can be run safely today on a square mile below the rock shelter.

As scientists expand our knowledge of ecological units and interconnections within large areas, landscapes help provide cultural wants and needs of each generation. Past activities of each generation need to be documented, as my archeologist friend did in the 5,000-year-old cave, so connections through time can be as accurate as possible.

To keep the basic productivity of landscapes sustainable, we embrace the experience of past and present land stewards, the careful observation of naturalists, and the controlled experimentation scientists. We balance Leopold's land ethic of being one with the land against the constantly changing character of the land itself.

To develop new concepts about the future of this balancing act, we draw on nature, Kelly's meme bank, the factory of ideas. Sustainability of landscapes and the future of human kind depend on our ability to draw freely from that factory and invest those ideas in principles for managing change.

And chances for success are improved by spending time with one you love, enjoying a sunset over a desert landscape.

Thad Box, thadbox@comcast.net

Jeff Mosley

Browsing the Literature

This section reviews new publications available about the art and science of rangeland management. Personal copies of these publications can be obtained by contacting the respective publishers or senior authors (addresses shown in parentheses). Suggestions are welcomed and encouraged for items to include in future issues of *Browsing the Literature*. Contact Jeff Mosley, jmosley@montana.edu.

Animal Ecology

Do pronghorn (*Antilocapra americana*) perceive roads as a predation risk? S.D. Gavin and P.E. Komers. 2006. *Canadian Journal of Zoology* 84:1775–1780. (Dept. of Biological Science, Univ. of Calgary, Calgary, AB T2N 1N4, Canada). Pronghorns near high-traffic roads were more vigilant and spent less time foraging compared with pronghorns near roads with less traffic.

Nutrient requirements of horses, 6th ed, revised. National Research Council. 2007. ($90; National Academies Press, 500 Fifth St. NW, Washington, DC 20055 or http://books.nap.edu. 360 p.). Updated summary of energy, protein, mineral, vitamin, and water requirements for horses.

Nutrient requirements of small ruminants: sheep, goats, cervids, and New World camelids. National Research Council. 2007. ($116; National Academies Press, 500 Fifth St. NW, Washington, DC 20055 or http://books.nap.edu. 384 p.). Updated compilation of nutrient requirements for sheep, goats, white-tailed deer, red deer, elk, caribou/reindeer, llamas, and alpacas.

Swift fox use of black-tailed prairie dog towns in northwest Texas. K.L. Nicholson, W.B. Ballard, B.K. McGee, J. Surles, J.F. Kamler, and P.R. Lemons. 2006. *Journal of Wildlife Management* 70:1659–1666. (Dept. of Range, Wildlife and Fisheries Management, Texas Tech Univ., Lubbock, TX 79409). Prairie dog towns do not provide important habitat for swift foxes in northwestern Texas.

The effect of fire on spatial distributions of male mating aggregations in *Gryllotalpa* major Saussure (Orthoptera: Gryllotalpidae) at The Nature Conservancy's Tallgrass Prairie Preserve in Oklahoma: evidence of a fire-dependent species. D.R. Howard and P.S.M. Hill. 2007. *Journal of the Kansas Entomological Society* 80:51–64. (Biological Sciences, Univ. of Tulsa, Tulsa, OK 74104). Prairie mole crickets prefer recently burned sites for leks.

Grazing Management

Characteristics of ungulate behavior and mortality associated with wire fences. J.L. Harrington and M.R. Conover. 2006. *Wildlife Society Bulletin* 34:1295–1305. (Dept. of Wildland Resources, Utah State Univ., Logan, UT 84322). Pronghorn, mule deer, and elk deaths due to roadside fences were largely caused by animals getting caught between the top 2 wires. Woven-wire fences topped with a single strand of barbed wire were more lethal to wild ungulates than woven wire with 2 strands of barbed wire above it or 4-strand barbed wire fences.

Herbivore optimization by North American elk: consequences for theory and management. K.M. Stewart, R.T. Bowyer, R.W. Ruess, B.L. Dick, and J.G. Kie. 2006. *Wildlife Monographs* 167:1–24. (Dept. of Biological Science, Idaho State Univ., Pocatello, ID 83209). In wetter forest sites, but not in dry forests or grasslands, moderate elk grazing increased plant yield compared with no elk grazing. This is the first study to document this phenomena in woody plant communities.

Impact of grazing intensity during drought in an Arizona grassland. M.R.R. Loeser, T.D. Sisk, and T.E. Crews. 2007. *Conservation Biology* 21:87–97. (Center for Environmental Science and Education, Northern Arizona Univ., Flagstaff, AZ 86011). In northern Arizona grassland, over an 8-year period, rest–rotation cattle grazing at moderate intensity maintained greater native plant diversity than either no grazing or short duration grazing.

Integration of plant species diversity on grazing behavior and performance of livestock grazing temperate region pastures. K.J. Soder, A.J. Rook, M.A. Sanderson, and S.C. Goslee. 2007. *Crop Science* 47:416–425. (USDA–ARS, Pasture System and Watershed Management Research Unit, Bldg. 3702, Curtin Rd., University Park, PA 16802). Summarizes the importance of plant species diversity on performance of livestock grazing in temperate pastures.

The value to herbivores of plant physical and chemical diversity in time and space. F.D. Provenza, J.J. Villalba, J. Haskell, J.W. MacAdam, T.C. Griggs, and R.D. Wiedmeier. 2007. *Crop Science* 47:382–398. (Dept. of Wildland Resources, Utah State Univ., Logan, UT 84322). Foraging within diverse mixtures of plants enables grazing animals to optimize intake of nutrients and secondary compounds.

Hydrology/Riparian

Butterflies (Papilionoidea and Hesperioidea) as potential ecological indicators of riparian quality in the semiarid western United States. S.M. Nelson. 2007. *Ecological Indicators* 7:469–480. (Bureau of Reclamation, PO Box 25007, Denver, CO 80225). Although butterfly abundance was related to weather, some assemblages of butterfly species were found in "high quality" riparian habitat whereas other assemblages were found in "low quality" habitat.

Development of a reference-based method for identifying and scoring indicators of condition for coastal plain riparian reaches. R. Rheinhardt, M. Brinson, R. Brooks, M. McKenney-Easterling, J.M. Rubbo, J. Hite, and B. Armstrong. 2007. *Ecological Indicators* 7:339–361. (Dept. of Biology, East Carolina Univ., Greenville, NC 27858). Describes a rapid field method for assessing condition of stream channels and riparian vegetation.

Measurements

A photo-based monitoring technique for willow communities. C.S. Boyd, K.T. Hopkins, and T.J. Svejcar. 2006. *Wildlife Society Bulletin* 34:1049–1054. (T. Svejcar, Eastern Oregon Agricultural Research Center, 67826-A Hwy 205, Burns, OR 97720). A photo-based monitoring technique using digital image-processing software produced quick and repeatable estimates of willow abundance.

Estimating shrub forage yield and utilization using a photographic technique. D. Damiran, T. DelCurto, D.E. Johnson, S.L. Findholt, and B.K. Johnson. 2006. *Northwest Science* 80:259–263. (T. DelCurto, Eastern Oregon Agricultural Research Center, 67826-A Hwy 205, Burns, OR 97720). Shrub yield and utilization were accurately assessed using a non-destructive photographic technique.

Plant Ecology

Broadleaf and grass weeds of the West identification combo CD pack, version 3.1. J.M. DiTomaso. 2007. ($60; Western Society of Weed Science at http://www.wsweedscience.org/Store/onlinestore.asp). Computer-based, interactive weed identification guide to 754 broadleaf species and 231 grasses. The 2-CD pack contains more than 4,000 color photographs and illustrations.

Ecological effects of changes in fire regimes in *Pinus ponderosa* ecosystems in the Colorado Front Range. R.L. Sherriff and T.T. Veblen. 2006. *Journal of Vegetation Science* 17:705–718. (Dept. of Geography and Environmental Studies, Univ. of Hawaii, Hilo, HI 96720). At elevations below 6,400 feet, historic fires were of low severity. However, in most of the ponderosa pine zone along the Front Range, forest structure was shaped primarily by severe fires rather than by surface fires.

Influence of mycotrophy on native and introduced grass regeneration in a semiarid grassland following burning. M.E. O'Dea. 2007. *Restoration Ecology* 15:149–155. (School of Natural Resources, Univ. of Arizona, Tucson, AZ 85721). In southern Arizona, introduced lovegrasses (*Eragrostis* spp.) reestablish after fire more quickly than native grasses because lovegrasses do not require infection by soil mycorrhizal fungi.

Rehabilitation/Restoration

Effects of frequent mowing on survival and persistence of forbs seeded into a species-poor grassland. D.W. Williams, L.L. Jackson, and D.D. Smith. 2007. *Restoration Ecology* 15:24–33. (L. Jackson, Dept. of Biology, Univ. of Northern Iowa, Cedar Falls, IA 50614). Mowing tallgrass prairie weekly during the growing season reduced competition for light from large established grasses and enabled forbs to establish and thrive. Grasses were not harmed after weekly mowing for 2 growing seasons.

Effects of prescribed fire on habitat of beaver (*Castor canadensis*) in Elk Island National Park, Canada. G.A. Hood, S.E. Bayley, and W. Olson. 2007. *Forest Ecology and Management* 239:200–209. (Elk Island National Park, 8336-76 Ave., Edmonton, AB T6C 0J1, Canada). Prescribed fire did not improve beaver habitat.

Fertilization augments Canada thistle (*Cirsium arvense* L. Scop) control in temperate pastures with herbicides. C.W. Grekul and E.W. Bork. 2007. *Crop Protection* 26:668–676. (E. Bork, Dept. of Agricultural, Food and Nutritional Science, Univ. of Alberta, Edmonton, AB T6G 2P5, Canada). Picloram + 2,4-D, or clopyralid, effectively suppressed Canada thistle in central Alberta, and control was enhanced with annual spring fertilization of N–P–K–S.

Mid-spring burning reduces spotted knapweed and increases native grasses during a Michigan experimental grassland establishment. N.W. MacDonald, B.T. Scull, and S.R. Abella. 2007. *Restoration Ecology* 15:118–128. (Dept. of Biology, Grand Valley State Univ., Allendale, MI 49401). Spring burns decreased spotted knapweed and increased seeded native warm-season grasses. Spotted knapweed density and yield also declined on unburned plots through time, suggesting that warm-season grasses may effectively compete with spotted knapweed even in the absence of fire.

Revegetation guidelines for western Montana: considering invasive weeds. K. Goodwin, G. Marks, and R. Sheley. 2006. Montana State Univ. Extension Bulletin 170. 44 p. ($3; MSU Extension Publications, PO Box 172040, Bozeman, MT 59717). A detailed, step-by-step guide to revegetating degraded sites with desirable plant species.

Using herbicides to rehabilitate native grasslands. T.G. Barnes. 2007. *Natural Areas Journal* 27:56–65. (Dept. of Forestry, Univ. of Kentucky, Lexington, KY 40546). Imazapic, clethodim, and sulfosulfuron herbicides all showed promise for removing tall fescue and increasing native warm-season grasses.

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HIGHLIGHTS

Rangeland Ecology & Management, May 2007

A Method for Landscape-Scale Vegetation Assessment: Application to Great Basin Rangeland Ecosystems

Tara A. Forbis, Louis Provencher, Lee Turner, Gary Medlyn, Julie Thompson, and Gina Jones

The growth of landscape-scale land management necessitates the development of methods for large-scale vegetation assessment. Vegetation cover data were collected in a stratified random design within 6 Great Basin vegetation types, and the probability of detecting change in native herbaceous cover was calculated using power analyses. This method provides a cost-effective procedure to assess important indicators, including native herbaceous cover, extent of woody encroachment, and ground cover. The development of a method that integrates field measurements of key indicators with remotely sensed data is the next critical need for landscape-scale assessment.

Landscape Factors Influencing the Abundance and Dominance of the Invasive Plant *Potentilla recta*

Bryan A. Endress, Bridgett J. Naylor, Catherine G. Parks, and Steven R. Radosevich

Little is known about the relative importance of environmental, biotic, historical, and spatial factors that influence invasive plant abundance, dominance, and distribution across landscapes. We estimated *Potentilla recta* stem density and dominance from field measurements across the landscape and used Classification and Regression Tree Analyses (CART) to assess the importance of various factors. A strong relationship between *P. recta* dominance and habitat type (r^2 = 67.5) was found, with dominance greatest in old fields on relatively flat slopes (mean dominance of 34.1%). Because old fields are common, are highly susceptible to *P. recta* invasion, and represent a source of seeds, containment and restoration activities should focus on these areas.

Key Attributes Influence the Performance of Local Weed Management Programs in the Southwest United States

Mary E. Hershdorfer, Maria E. Fernandez-Gimenez, and Larry D. Howery

Little is known about the effectiveness of local weed-management programs in the southwest United States. We surveyed coordinators of local weed-management programs in 4 southwestern states to determine how program attributes were related with program performance. We found that 1) programs that involved multiple organizations or citizen volunteers conducted more monitoring, but other programs treated more weeds; and 2) programs that used a light-handed enforcement approach treated more weeds than those that used more punitive enforcement or had no enforcement authority. Successful weed management in the southwest United States will require adequately funded, locally adapted approaches supported by locally enforceable weed regulations.

Cheatgrass Invasion in Salt Desert Shrublands: Benefits of Postfire Reclamation

Brad D. Jessop and Val Jo Anderson

Fire is promoting cheatgrass expansion into salt desert shrublands. In western Utah, postfire revegetation was implemented in 2 affected salt desert shrub communities to deter cheatgrass encroachment. We monitored cheatgrass densities for 3 years after the fire in burned drill-seeded, burned not-seeded, and unburned plots to determine whether drill seeding perennial species would affect cheatgrass. There was a trend of lower cheatgrass densities in drill-seeding plots vs not-seeded plots. Attempting to restore salt desert shrub sites before cheatgrass becomes fully established may help curb the magnitude of invasion.

Prickly Pear Cactus Responses to Summer and Winter Fires

R. James Ansley and Michael. J. Castellano

Prescribed fire is used to manage prickly pear cactus (*Opuntia* spp.), but little is known regarding the response to fires conducted in different seasons. We evaluated effects of fire season and fire intensity on motte mortality and structure of brownspine prickly pear (*Opuntia phaeacantha* Engelm.). Summer fires were more effective than high-intensity or low-intensity winter fires in increasing prickly pear mortality and reducing motte canopies. Results reinforce the importance of

fire application when prickly pear mottes are relatively small and herbaceous fuel remains adequate, and some mortality can be expected from winter fires, although probably not as high as from summer fires.

Is Altering Grazing Selectivity of Invasive Forage Species With Patch Burning More Effective Than Herbicide Treatments?

D. Chad Cummings, Samuel D. Fuhlendorf, and David M. Engle

Sericea lespedeza has been identified as an invasive on rangelands, and control measures are expensive and frequently ineffective. We compared sericea lespedeza invasion in patch-burned pastures and traditionally managed pastures, and we investigated sericea lespedeza response to herbicide applications. Invasion was 4 times greater in traditionally managed pastures compared with patch-burned pastures over 7 years; herbicides only resulted in increases of desirable species in 39% of the studies. Rangeland management with patch burning is a viable alternative to traditional management for the suppression of invasive forage species and may serve as a vital part of an integrated management plan.

Recovery of Big Sagebrush Following Fire in Southwest Montana

Peter Lesica, Stephen V. Cooper, and Greg Kudray

Use of fire to decrease sagebrush (*Artemisia tridentata*) cover is hotly debated among land managers, but our ability to make informed decisions is hampered by our lack of knowledge of how and how quickly vegetation changes as succession proceeds from immediate postfire to mature stands. We measured composition and canopy cover of vegetation as well as age and height of sagebrush plants in paired burned and unburned plots representing 38 wildfires and prescribed fires in southwest Montana. The 3 sagebrush subspecies had very different recovery trajectories, with mountain big sagebrush recovering to preburn conditions in an average of 33 years. Managers can use this information to help decide where and how often to burn sagebrush to achieve their goals.

Grazing-Induced Modifications to Peak Standing Crop in Northern Mixed-Grass Prairie

Justin D. Derner and Richard H. Hart

Selective grazing can modify productive capacity of rangelands by increasing the composition of grazing-resistant species. Peak standing-crop responses to grazing system (season-long and short-duration rotational grazing) and stocking rate (light, moderate, and heavy) were evaluated from 1991 to 2006 on northern mixed-grass prairie. Productivity was 19%–23% less with moderate to heavy, compared with light, stocking rates, and grazing system did not affect responses. Structural and functional changes associated with replacement of cool-season grasses by less productive, warm-season shortgrasses likely alters the vegetation state and substantial modifications in management may be needed to transition the plant community back to perennial cool-season grasses.

Habitat Effects on Condition of Doe Mule Deer in Arid Mixed Woodland-Grassland

Louis C. Bender, Laurie A. Lomas, and Tomas Kamienski

Mule deer populations are declining throughout the western United States. We studied relationships between habitat and the amount of body fat doe mule deer were able to accrue because of known strong relationships between body condition and productivity of large herbivore populations. Levels of body fat were most closely and negatively related to the amount of pinyon–juniper in a deer's annual home range, likely because pinyon–juniper communities provided little preferred food. Managing pinyon–juniper communities to increase forage quantity and quality, while maintaining cover attributes, can significantly contribute to recovery of mule deer populations in arid woodland habitats.

Runoff and Erosion After Cutting Western Juniper

Frederick B. Pierson, Jon D. Bates, Tony J. Svejcar, and Stuart P. Hardegree

Western juniper has encroached upon, and now dominates, millions of acres of sagebrush and bunchgrass rangeland in the Great Basin and interior Pacific Northwest. We used rainfall and rill simulation techniques to evaluate infiltration, runoff, and erosion on cut and uncut field treatments 10 years after juniper removal. Cutting juniper stimulated herbaceous plant recovery, improved infiltration capacity, and protected the soil surface from even large thunderstorms. Although specific inferences drawn from the current study are limited to juniper-affected sites in the Intermountain sagebrush steppe, the scope of ecosystem impacts are consistent with woody-plant invasion in other ecosystems around the world.

Cattle Grazing Effects on Macroinvertebrates in an Oregon Mountain Stream

James D. McIver and Michael L. McInnis

Cattle grazing effects on aquatic macroinvertebrates were assessed in a 4-year experiment of a mountain stream in northeastern Oregon. Stream bank and geomorphological variables were also measured to provide context for interpretation of effects on aquatic macroinvertebrates. Macroinvertebrate response to grazing was subtle, indicated by significantly lower abundance in grazed units. Although the drop was more precipitous in grazed units, declines were common to all study units, suggesting that something more widespread affected the system during this time. Logging just upstream of the study area sent sediment plumes into the study area and could

have caused the precipitous decline in aquatic macroinvertebrates.

Influence of Plant Functional Group Removal on Inorganic Soil Nitrogen Concentrations in Native Grasslands

Kirk W. Davies, Monica L. Pokorny, Roger L. Sheley, and Jeremy J. James

Plant functional groups are presumed to use resources different from one another, and therefore, high plant functional group diversity has been suggested to decrease resource availability. However, evidence of high plant functional diversity reducing resource availability is generally lacking. We investigated the effects of removing different functional groups on soil inorganic nitrogen concentrations. Removing functional groups increased soil inorganic nitrogen concentrations. The increase in inorganic nitrogen concentrations varied with functional group removal and, often, the interaction between season and functional group removal. These results demonstrated high functional group diversity was important to maintaining low soil inorganic nitrogen concentrations.

Effects of Forage Management on Pasture Productivity and Phosphorus Content

M. M. Haan, J. R. Russell, J. L. Kovar, W. J. Powers, and J. L. Benning

Phosphorus is essential for plants and animals; excess phosphorus in the environment can diminish water quality. Forage production and phosphorus uptake and concentration were monitored in cool-season grass pastures managed by spring hay harvest and fall stockpile grazing, rotational stocking, continuous stocking, or unharvested. Annual forage productivity and phosphorus uptake were greater in the harvested treatments than the unharvested treatment. Forage phosphorus concentrations were adequate to meet the nutritional requirements of spring-calving cows under all harvest practices evaluated. If soil phosphorus concentrations are at optimum levels for plant growth, supplemental phosphorus should not be required for beef cows grazing midwestern smooth bromegrass pastures.

Wildlife Responses to Vegetation Height Management in Cool-Season Grasslands

Brian E. Washburn and Thomas W. Seamans

Herbaceous vegetation comprises the main habitat type in cool-seasons grasslands and can be managed by various methods. We compared changes in plant communities and wildlife use of grasslands that were not managed, managed by mechanical methods (mowing), or managed by chemicals (plant growth regulator). We observed more birds per 5-minute survey in unmanaged than mowed or growth regulator plots, whereas more white-tailed deer (*Odocoileus virginianus*) used mowed plots than either unmanaged or growth regulator plots. Vegetation height management practices altered plant communities and animal use of grassland areas and thus might be useful for accomplishing species-specific habitat management objectives.

Standardized Ecological Classification for Mesoscale Mapping in the Southwestern United States

Patrick J. Comer and Keith A. Schulz

Consistently defined and mapped ecological classification units form the foundation for effective data collection, assessment, and reporting on ecosystems, but the lack of a robust classification has often hampered regional mapping efforts across the southwest United States and beyond. NatureServe defined over 630 "meso-scale" units that describe uplands and wetlands across the lower 48 United States. Because environmental setting, ecological processes, and vegetation are integrated into the concept of each unit, they lend themselves to mapping, biophysical modeling, and robust characterization of wildlife habitat. Regional-scale mapping of near-natural land cover was completed by the Southwest Regional Gap Analysis Project using 109 ecological system units, producing what is currently the most detailed regional land-cover map of its kind.

BOOK REVIEW

My First Summer in the Sierra. By John Muir. 1987. First published in the United States in 1911. Edition with an introduction by Gretel Ehrlich was first published by Penguin Books in 1987. This edition was published by Penguin Books in 1997. 264 p. US$12.00 softcover. ISBN 0-1402-5570-2.

John Muir was born in 1838 and at a young age emigrated from Scotland with his family to a farm in Wisconsin. He escaped the hard labor of the farm and the cruel discipline of his father to enroll in the University of Wisconsin. Except for a short stay at the university, he was self-taught in botany, geology, biology, and Latin. He did work in a machine shop for awhile and left when an industrial accident left him temporarily blind. He had a keen memory for physical detail and a longing to ramble freely in the wilds.

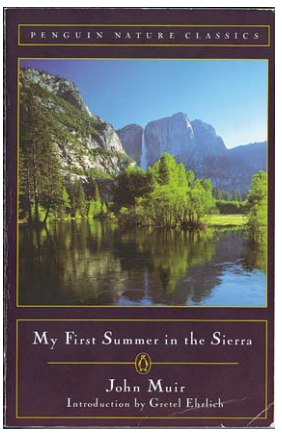
He walked from Indiana to Florida, suffered a bout of malaria, traveled to Cuba and the Panama Canal, then on to California in just 1 year. He had no particular destination. When he was 30 years old, he had already walked thousands of miles or more before he reached San Francisco, California, in 1868. While walking the width of California, he came upon the Sierra Nevada. After a brief visit, he worked as a ferry operator, sheepherder, and bronco buster. In May 1869, Muir was short of money (as usual) and hired on to help move a band of sheep to summer pasture at the headwaters of the Tuolumne and Merced Creeks near Yosemite. He hated the sheep but found his employer, an Irishman named Pat Delaney, to be a mentor and friend. Delaney urged Muir to sketch, hike, and botanize freely in the mountains.

Leaving in June 1869, Muir, Delaney, and a Saint Bernard named Carlo began moving the sheep up the mountains. As they traveled, Muir made notes about wild rose, azaleas, and cedars. He made notes about everything around him. He made acquaintance with lizards, ants, and squirrels. He mused about sheepherders and camp life. He absorbed himself in the wonders of his surroundings: magnificent landscapes, lush foliage, wildlife, and graceful rivers. The book includes more than 20 of Muir's original sketches.

My First Summer in the Sierra is an account of Muir's excursion as a sheepherder from June until September, when the sheep were brought back to the foothills. More than 40 years after that experience, Muir gathered the detailed notes and wrote this book.

In her introduction Gretel Ehrlich writes, "*My First Summer in the Sierra* is the most purely refreshing, savory, and lyrical of all John Muir's books." As a reviewer, I agree. This book was pleasing to read, and I look forward to reading other books by Muir.

Jan Wiedemann, Society for Range Management, Texas Section, College Station, TX. ◆



Provo Scientist Designated Forest Service "Super Scientist"

Research geneticist Durant McArthur, from the Rocky Mountain Research Station's Shrub Sciences Laboratory in Provo, Utah, was recently named a "super scientist" by the Forest Service.

The U.S. Department of Agriculture and the Forest Service have a ceiling on the number of scientists who can be awarded the Science Technical level classification. There are only a handful of researchers across the nation with the Science Technical grade and McArthur is the only Forest Service scientist in the entire Interior West given the honor of super scientist.

Durant McArthur

McArthur has written more than 400 scientific publications – more than any other Forest Service scientist past or present. He is the world's expert on the sagebrush that is a critical habitat component for mule deer, sage grouse, and many other wildlife species.

In 2007, McArthur was designated leader of the Station's research for grassland, shrubland, and desert ecosystems. In that capacity he oversees arid land research from Canada to Mexico and from the Sierras to the Great Plains. In recent years he has overseen research in restoring damaged ecosystems in Utah and the Great Basin, and worked to find ways to combat the invasion of cheatgrass that is degrading rangelands and critical wildlife habitat across the West.

An unidentified technician in Nevada collecting data on cheatgrass germination for sagebrush/fire/cheatgrass dynamics.

Previous awards include the Utah Society of Range Management's Manager of the Year Award in 2004, Shrub Research Consortium Distinguished Service Award 2002, Eminent Science Publication Award 2000, Forest Service Distinguished Scientist Award 1996, International Society for Range Management Outstanding Achievement Award 1992, and Forest Service Superior Scientist Award 1990.

McArthur has raised a family and been very active in church and community affairs near his home in Orem. He grew up in Utah's Washington County and attended the University of Utah. He often rides his bike to work and plays pickup basketball at BYU.