Rangelands

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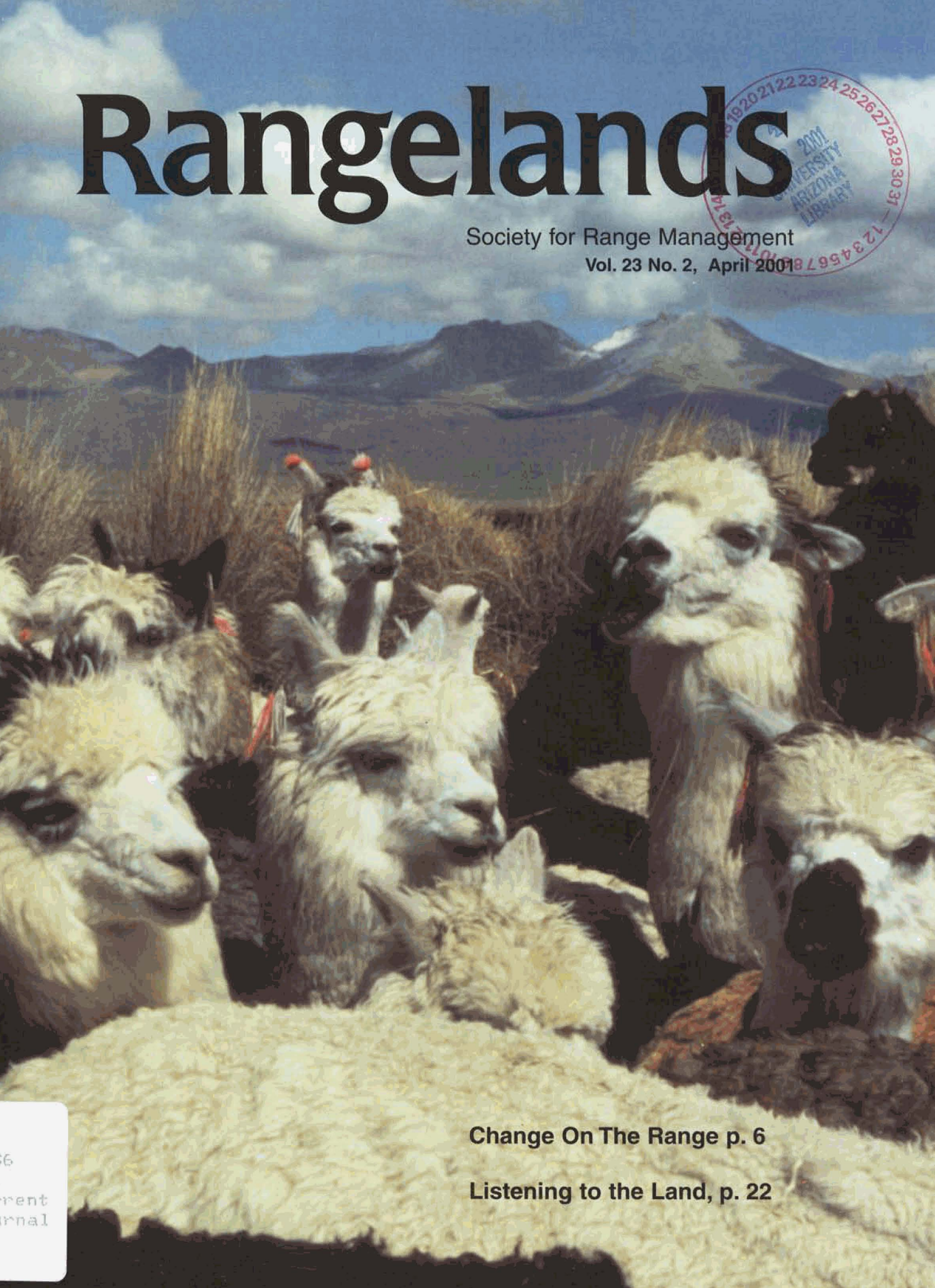

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Rangelands

FEATURE ARTICLES

DEPARTMENTS

COVER

COVER PHOTO: Alpaca adults and crias (young) in a corral at Cosapa on the Bolivian altiplano. Photo by Lita Buttolph. (See story page 10).

SRM
Society for Range Management

The Society for Range Management

The Society for Range Management founded in 1948 as the *American Society of Range Management*, is a nonprofit association incorporated under the laws of the State of Wyoming. It is recognized exempt from Federal income tax, as a scientific and educational organization, under the provisions of Section 501(c) (3) of the Internal Revenue Code, and also is classed as a public foundation as described in Section 509 (a) (2) of the Code. The name of the Society was changed in 1971 by amendment of the Articles of Incorporation.

The objectives for which the corporation is established are:

—to properly take care of the basic rangeland resources of soil, plants and water;

—to develop an understanding of range ecosystems and of the principles applicable to the management of range resources;

—to assist all who work with range resources to keep abreast of new findings and techniques in the science and art of range management;

—to improve the effectiveness of range management or obtain from range resources the products and values necessary for man's welfare;

—to create a public appreciation of the economic and social benefits to be obtained from the range environment;

—to promote professional development of its members.

Membership in the Society for Range Management is open to anyone engaged in or interested in any aspect of the study, management, or use of rangelands. Please contact the Executive Vice-President for details.

Rangelands

Rangelands serves as a forum for the presentation and discussion of facts, ideas, and philosophies pertaining to the study, management, and use of rangelands and their several resources. Accordingly, all material published herein is signed and reflects the individual views of the authors and is not necessarily an official position of the Society. Manuscripts from any source—nonmembers as well as members—are welcome and will be given every consideration by the editors. ***Rangelands*** is the nontechnical counterpart of the ***Journal of Range Management;*** therefore, manuscripts and news items submitted for publication in ***Rangelands*** should be in nontechnical nature and germane to the broad field of range management. Editorial comment by an individual is also welcome and, subject to acceptance by the editor, will be published as a "Viewpoint."

Contribution Policy:

The Society for Range Management may accept donations of real and/or personal property subject to limitations set forth by State and Federal law. All donations shall be subject to management by the Executive Vice President as directed by the Board of Directors and their discretion in establishing and maintaining trust, memorials, scholarships or other types of funds. Individual endowments for designated purposes can be established according to Society policies. Gifts, bequests, legacies, devises, or donations not intended for establishing designated endowments will be deposited into the SRM Endowment Fund. Donations or request for information on Society policies can be directed to the Society for Range Management, Executive Vice President, 445 Union Blvd., Suite 230, Lakewood, Colorado 80228. We recommend that donors consult Tax Advisors in regard to any tax consideration that may result from any donation.

Informing And Educating Is Our Task

"What's Your Pleasure?" This is the heading of the article on the inside of the *Rangeman's Journal* Volume 1, No. 1, October 1974. "Oldtimers" in the Society for Range Management will recognize that *Rangeman's Journal* was the forerunner of the current SRM publication *Rangelands*. The *Rangeman's Journal* (*Rangelands*) publication was conceived as a means of providing the SRM membership non-technical information pertaining to the use and management of the rangeland resources. In this first issue of the *Rangeman's Journal*, the editors solicited input as to what the SRM membership wanted the journal to be. They asked:

> "...Tell us specifically what you want or think you need to know. The *Rangeman's Journal* is going to be a wide-ranging journal. We plan to publish any article or news item that will benefit rangemen, rangelands, and range management. This includes information related not only to biology (soils, plants, animals) but also economics, sociology, law, history, philosophy and anything else that helps you achieve your management objectives. If we cannot find the information you want, at least we can act as a loudspeaker and publish your inquiry or description of your problem...." The Range Rider.

The editors of *Rangelands* believe that we are meeting many of these objectives with respect to the content of the articles. Our next hurdle is to present the information in a manner that makes you want to read it.

We have been making small changes over the past few years in the appearance of *Rangelands* and how the information is presented. One of the most obvious changes to how articles are presented has been the addition of color when feasible. There is a limitation to how far we can go with color alone.

Starting in this issue of *Rangelands* (April 2001) you will see some changes in the format in which the articles are presented. Some titles have been changed to be more informative and attention getting. Articles will now include a deck, a brief statement of the potential importance or impact of the information in the article. Some formal headings such as Introduction, Methods, and Conclusions will be replaced with subheads that also attract the busy reader's attention.

The purpose of these changes is to help make range-related information and research readable and available to all SRM members, livestock producers and the general public. Keep in mind that just because an article is written in a less scientific style doesn't mean the science behind it has less value. *Rangelands* is a valuable tool to inform and educate all people about range resources. Our aim is to structure the publication to do that.

This is just the beginning of our efforts to make *Rangelands* more appealing. We know your time is valuable and your mailbox is piled high with things to read. We also realize we aren't the only publication you receive; we simply hope to become your favorite. Let us know either positive or negative impacts.

Kindra Gordon
Managing Editor

Gary Frasier
Technical Editor

Patty Rich
Production Editor

Water Tanks Protect Streambanks

By David J. Chamberlain and Mark S. Doverspike

Solar powered off-site watering systems offer an economical option for diverting livestock away from riparian areas.

Riparian zones account for only about two percent of the land in Eastern Oregon but they tend to receive a disproportionate use by grazing livestock and wildlife. Readily available water, highly palatable forage, shade and relatively level ground make these areas especially attractive.

Livestock grazing in these riparian zones is a highly controversial issue of both real and perceived conflicts. Current emphasis on riparian management and rehabilitation is focused on controlling cattle use in these highly visible areas. Currently, construction of riparian corridor fencing and/or significant reductions of allowed livestock numbers are most often suggested solutions.

Reductions of livestock numbers have a large negative effect on the profitability of ranching operations. Corridor fences can provide the livestock control and management flexibility to achieve many riparian zone improvement goals. However, fences are expensive to build and maintain and can impede wildlife and recreational use of these areas. Fences may be inconsistent with the natural visual appeal of riparian zones.

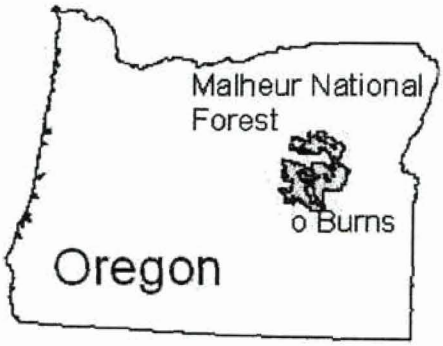
It has been our experience that livestock use tends to be focused on a relatively small portion of the total riparian area. This is especially true in pastures that are well managed and otherwise in good condition. These "hot spots" may be in fence corners or out in the middle of a pasture. Regardless of where they are located, cattle tend to "camp" in an area, regrazing the most palatable forage plants and often grazing even the most unpalatable plants beyond their capacity to recover. How can we prevent overuse of a very small portion of a grazing unit while making responsible use of the entire unit?

Historic research and experience has shown that stock water developments do divert livestock use, improving grazing distribution and forage management flexibility. Clawson (1993) found that cattle watered at a trough over 73 percent of the time even though they had unlimited access to both a live stream and a spring pond nearby. Miner, et.al. (1992) showed that stock water tanks placed near streams will divert up to 90 percent of the cow use of the stream during the winter feeding period.

University of Nevada, Reno researchers and the Utah Energy Office have reported the potential of solar powered livestock watering systems in terms of costs competitiveness, technical feasibility, and field practicality. Solar powered water pumping equipment is readily available from a wide variety of commercial sources.

Oregon Case Study

Sawtooth Creek is located about thirty miles north of Burns, Oregon, on the Malheur National Forest. The area is characterized as a dry open Ponderosa pine site with elevations from just over 5000 feet to about 4400 feet where it joins Emigrant Creek. The Sawtooth Creek allotment consists of over 17,000 acres, which includes Forest Service,



Bureau of Land Management and private lands. The current AMP permits 218 cow-calf pairs from June to October.

To improve grazing management, several relatively small areas were identified as problems. Appropriate changes had been made to the grazing system and upland water developments had been installed to improve livestock distribution. Yet, the cows still tended to congregate on at least one site in each pasture unit. For several years, the cooperator had resorted to riding and herding in an effort to move cattle off sensitive riparian sites. This effort resulted in the expenditure of significant time and money and was only partially successful, resulting in strained relations with agency range management personnel. Reduction in cow numbers and corridor fencing of the problem areas were suggested but were unacceptable alternatives.

We undertook to show that a mobile solar powered livestock water system and temporary electric fence could achieve the necessary protection to the riparian zone. We wanted to evaluate the practicality and effectiveness of an off stream water source in diverting livestock use from the riparian zone. It also offered the advantage of the educational opportunities generated by the demonstration to deliver programs on riparian habitat and watershed improvement implementation.

A solar powered livestock water-pumping system was constructed on a small trailer. The system consists of a solar array of six 33-watt panels wired in parallel and a 12-Volt submersible pump. Two 8 foot-round cattle troughs and 1,500 feet of high-pressure hose allow siting stockwater away from the riparian zone. As assembled, the entire system cost approximately $3,000.

The electric fence consisted of a solar-powered energizer, a mix of steel and plastic posts and half-inch "poly-tape" wire. The system was installed at strategic locations on the creek in each of the pastures, with or without temporary electric fence. The water system and the electric fence were moved along with the cooperator's cattle through each successive pasture during June to October of 1994 through 2000.

The water system is placed at those sites where the cattle traditionally congregate. The temporary electric fence is used to protect small areas of the riparian area but is also designed to direct cattle movement away from problem areas.

Sawtooth Creek October 1976.

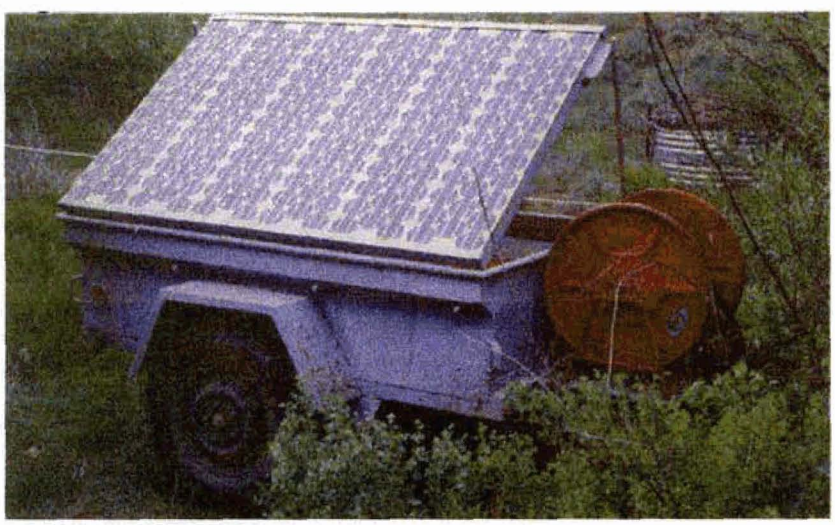
Sawtooth Creek September 1997.

Forage production, utilization and trends were documented along with an extensive photographic record at all watering sites and at permanent points on the riparian areas. Less than a half-mile of temporary electric fence was used at any site.

Off-Stream Sites Work

The system does work and does actually divert cattle use in the riparian zones. In conjunction with strategically located temporary electric fence, the off stream water has proven very effective in protecting riparian areas that have historically been heavily used by cattle. At several sites, the water system and electric fence reduced the cooperator's labor costs significantly. Cost savings from reduced riding and other livestock management tasks were estimated by the cooperating rancher to exceed $2000 per season. The system will pay for itself halfway through the second year.

In 1992, several reaches of Sawtooth Creek were rated in unsatisfactory/fair condition with a static to downward trend. Re-evaluation in 1996 found Sawtooth



Trailer set up near Sawtooth Creek. Six 33-watt panels provided 198 watts of 12 volt power.

Creek to be in satisfactory/good condition with a definite upward trend.

Even at those sites where a temporary electric fence was not used to protect the riparian area, having clean water available at 50 to 100 yards from the stream diverted a lot of the cow use. As long as the grass was green on the uplands, the majority of the cows stayed on the hillsides and came down only to water and loaf. After the upland grass dried, use of the riparian areas increased, as expected, but the cows still used the water tanks and loafed near the tanks, away from the riparian area. Any use of off site water is use that does not occur in the riparian area.

Additionally, because these pastures are on public land, BLM and Forest Service and on a major recreational visual corridor, the overall effort and visual improvements have significantly reduced conflicts. Public and agency interest has been very positive. The riparian area improved, the cost to the producer has been reduced and the reduction of "hassle" has been a large but unmeasurable benefit to everyone.

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Authors are Associate Professor, Department of Rangeland Resources, Oregon State University and owner-operator, Hotchkiss Ranch Inc. Burns, Ore.

Change On The Range

By Helen Ivy Rowe, Matt Shinderman, and E.T. Bartlett

A Colorado survey looks at what choices public land ranchers would make if faced with potential reductions in available federal forage.

As more and more ranchland is converted to non-agricultural uses every year, ranchers and land managers are increasingly concerned about loss of open space and impacts on ranching communities. Between 1990 and 1999, Colorado farmland declined by 1.3 million acres; 400,000 acres were lost in 1999 alone. In this same decade, the average size of a Colorado farm shrunk by 152 acres (Colo. Dept. of Agr. 2000). In face of such problems we need to look closely at rancher decisions behind these sales. What strategies will ranchers use if faced with federal grazing reductions? How likely is it that public land ranchers will resort to selling their ranches if faced with public policy changes? What alternatives to selling the ranch do ranchers have? Knowledge of rancher alternatives and preferences can aid in developing strategies that will help ranchers adapt to changing economies and policies.

Western Landscape Is Changing

Western landscapes are currently undergoing some of the most dramatic changes since the settlement of agricultural communities during the opening of the West. The wide-open spaces characterizing the region have drawn millions of visitors and new residents alike. They are now threatened by their own popularity. Mountain gateway community development over the last several decades has increased dramatically to the point where the Intermountain West region is one of the fastest growing regions in the country. With growth has come rapid and irreversible loss of open space and new challenges for traditional rural communities. Since ranchland is often the primary target for subdivision, ranchers play an important role in this pattern of land use change.

Several external factors influence whether ranchers sell their land or continue ranching, including federal policy measures, local land-use planning efforts, and development of surrounding lands. Many ranchers rely on public land allotments on either BLM or USFS land for part of their ranch operations. Ranchers with a substantial amount of leased public land have the potential to be heavily impacted by changes in federal grazing policy. In a related study (Rowe et al. 2001), personal interviews with ranchers indicated that changes in

public policies would be an important factor in the decision to sell a ranch.

Ranchers retain ownership because they love the land, the lifestyle, and the opportunity to raise a family in a safe environment where they can instill positive values. Though these motivations are relatively well understood, there is no clear picture that explains how ranchers will react to multiple pressures including growth and federal land policy.

There were two overall objectives for this study. First, we looked at how ranchers would change or diversify their operations if faced with reductions in allowable federal forage. Second, we explored whether ranchers more dependent on ranching for income or ranchers with greater reliance on public grazing would be more vulnerable to policy changes.

Colorado Ranchers Give Input

The study was conducted in Routt and Moffat Counties in northwestern Colorado. These counties were selected based upon their proximity to each other and similar cultural history. Both counties maintain active ranching communities, although pressure for agricultural land conversion has been greater in Routt County.

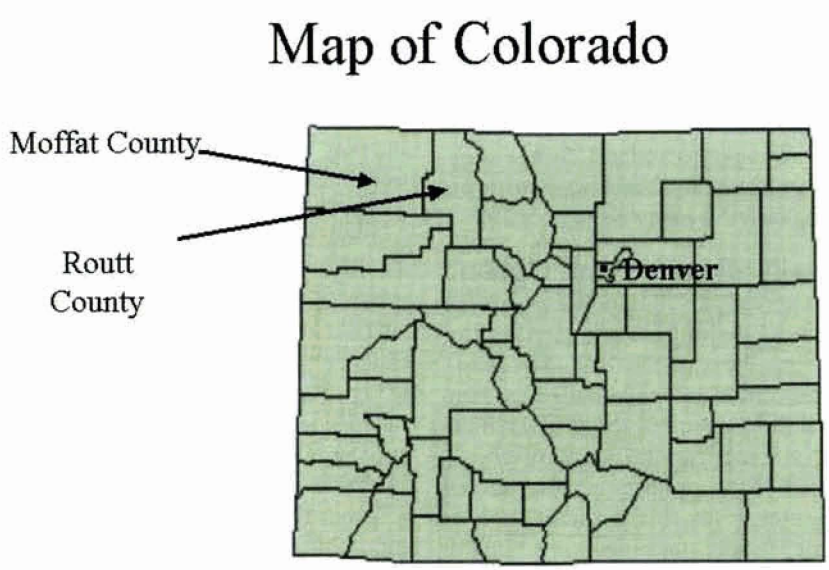
Public land ranchers were selected from a list of public land grazing permit holders obtained from the USFS and BLM offices in both Routt and Moffat Counties. Thirty-seven ranchers were interviewed at each rancher's residence. Interviews were based on a three-part survey. Ranchers were asked to describe their responses to reductions in allowable federal forage use in increments of 25, 50, and 100 percent. The survey was based on a previous survey conducted on 1,052 public land permittees across 11 western states (Gentner 1999).

To evaluate the first objective, respondents were asked to select their most likely responses to each level of reduction in federal forage from a list of seven potential responses. Response categories included: 1) continue ranching with no change, 2) sell the ranch, 3) reduce herd size, 4) replace federal forage with other forage, 5) diversify the ranch operations, 6) seek off-ranch employment, and 7) other. Multiple responses could be selected for each reduction level.

Dependence on ranching for income was established by asking the rancher if they were dependent on ranching for income. Level of dependence on public lands was derived by dividing public AUMs by total AUMs (public, leased, and private AUMs). Responses were divided into three levels of dependence: low (0–33%); moderate (34–66%); and high (67–100%).

Ranchers Don't Want To Sell

In general, ranchers favor finding alternatives to federal forage rather than selling their ranch if faced with reductions in federal forage. Frequently selected alternatives include: reduce herd size, purchase or lease forage from private sources, diversify ranch operations, or seek off-ranch employment to supplement income. Ranchers seem to sell only as a last resort; our data shows a relationship between reduction levels and selected alternatives. Responses to 100% reductions help illustrate this point. If federal forage were eliminated, on one end of the spectrum 26% of the ranchers stated they would have to sell, and at the opposite end 12% would not need to change current operations at all. In between these extremes lie the majority of ranchers. They must make some type of change, but they chose to find an alternative rather than sell their ranch. At 25% and 50% reduction levels this



middle ground is even larger.

Ranchers who were reluctant to sell but were forced to compensate for lost public forage chose reducing their herd as the most common response. Ranchers less commonly indicated they would replace federal forage with new forage, although most ranchers doubt that this option is available. Fourteen ranchers (38%) chose finding new forage as an alternative to federal grazing cuts (Figure 1). Specifically, twelve of these ranchers said they would seek more private land to lease. Unfortunately, eleven

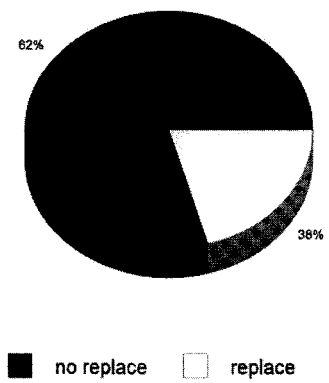
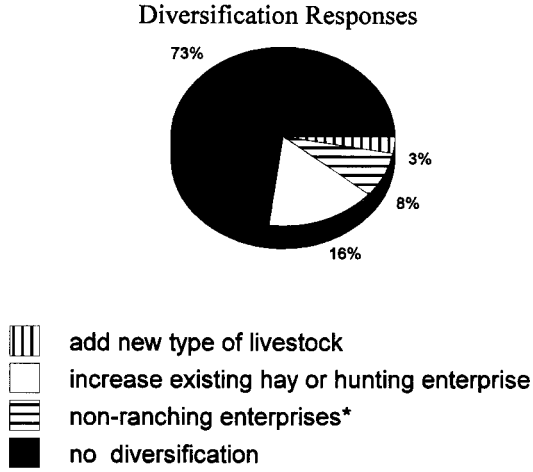


Fig. 1. ***Percentage of population that chose "Replace federal forage with other forages".***

of these twelve indicated that they would be unlikely to find private land to lease. Five of the ranchers indicated that they would like to buy more private land, but again four added that this would be very unlikely. Four of the five ranchers thought they would move more livestock onto private land; two thought this would be a likely scenario. Overall, it seems that although ranchers frequently chose finding alternative forage as their response to federal forage cuts, they realize that obtaining additional grazing resources may not be possible.

Diversification: A Viable Option?

At a recent ranching conference (The Culture, Economics, and Ecology of Ranching West of the 100th Meridian), speakers enthusiastically hailed the benefits and successes of using diversification to keep ranchers in business. Diversification projects involve adding new enterprises to the ranch such as hunting, fishing, farming, and adding or



*Non-ranching enterprises include opening a Bed and Breakfast or retreat center, offering "ranch hand" vacations, selling meat through a local coop, raising fish, establishing a vineyard and creating a hunting or fishing business.

Fig. 2. ***Comparison of 37 Colorado ranchers' selection of diversification alternatives if federal allowable forage were reduced at all levels.***

changing to a new type of livestock. Diversification could also involve starting businesses that offer on-ranch vacations or sell honey, fruit, or other products. Ranchers can add value to their existing livestock trade through processing and selling the meat more directly or switching to organic meat production. While these ideas have merit and some proven success, it appears that the concepts addressed are not widely accepted within the ranching community. From ten ranchers that would diversify ranch operations, six ranchers chose to increase their existing hay or hunting enterprises (Figure 2). Only three responses indicated interest in activities outside of ranching related enterprises.

Rowe et al. (2001) found that these same ranchers are motivated to continue ranching primarily because they enjoy raising livestock. Most ranchers agreed that enjoying animal husbandry, ranching way of life and ranch work were important reasons to continue ranching. These findings might explain rancher reluctance to choose diversification among their alternatives. Activities other than ranching may not provide sufficient satisfaction to motivate the rancher to continue. Additionally, the study found that 32 of 37 ranchers rated independence as an important factor for staying in ranching. Allowing more people onto the ranch for diversification schemes runs against the grain of ranching culture. Some ranchers complained during the interviews that bringing people onto their ranch, even to put them to work, interfered with ranch operations. Putting inexperienced people to work can require more effort than doing these tasks themselves.

It is also possible that few ranchers have been exposed to the ideas of diversification. The interviewer perceived that few ranchers had given diversifying ranch enterprises much thought. In order for ranching support organizations to successfully engage the ranching community in diversification enterprises, ranchers must be informed of the possibilities and shown successful examples. Perhaps education schemes directed at ranchers facing economic stress may convince ranchers to undertake a new enterprise. For some ranchers, diversification projects may need to stay within the bounds of ranching by switching to production, establishing a cooperative local meat packing plant or adding other agriculturally based products such as chickens, bees or fruit orchards.

Pressure To Sell The Ranch: Dependence On Ranching

The study hypothesized that ranchers more dependent on ranching for income would be more heavily impacted by reductions in federal forage than those with little income dependence. However, this study revealed no difference in willingness to sell among groups even at the 100% reduction level. The majority of

respondents in both cases indicated that they would remain on their property.

These results are somewhat surprising. Ranchers continue to ranch despite financial difficulties. They stay because of non-economic factors such as sense of place, attractiveness of lifestyle, family values, and tradition.

Dependence On Public Lands

We would expect ranchers with a high dependence (67–100%) on public lands for their ranch operations to be more heavily impacted by reductions in federal forage than ranchers with low dependence (1–33%) on public forage. Again no difference was found. In reality, this trend may be affected by other factors. In a related study using the same interviews, public dependency was found to be correlated with the length of time a ranch had been within the same family (Rowe et al. 2001). Thus, ranchers who stand the most to lose from federal grazing cuts have more history with the ranch and may be more resistant to selling. Here again, motivations such as attachment to the ranch and the lifestyle it provides may be more important than economic considerations such as loss of forage. Changes in federal grazing policy in this case did not appear to direct a rancher's decision to sell.

Ranchers would prefer to sell the ranch rather than find an off-ranch job. This may be due to the fact that ranchers who consider this option already have such employment. On the other hand, it could reveal the strength of attachment ranchers have to the actual ranch work. They might prefer to sell this ranch and buy another ranch elsewhere rather than leave ranching altogether.

Actual Reductions May Cause Ranchers To Sell

Ranchers in Routt and Moffat Counties are generally reluctant to sell their properties when faced with reductions in allowable forage on public lands. Ranchers expressed a preference to experiment with a wide variety of options in order to avoid selling their land. Dependence on ranching for income and dependency on public land did not affect rancher's decisions to sell.

Given growing numbers of ranch sales, it is surprising that so few respondents indicated that they would sell their ranch in response to federal grazing cuts. The authors offer two theories that may help explain these responses. First, the questions are based on hypothetical reductions in allowable forage. In these interviews, ranchers could perhaps answer more optimistically how they think they would deal with reductions. Some may find the prospect of selling their ranch so appalling that they do not wish to acknowledge this possibility. If confronted with actual cuts, responses may change.

Another possible explanation is the mistrust many ranchers feel for the federal government and its policies. There is a longstanding tension between ranchers and federal agencies, particularly in the West. Ranchers often view federal policy changes as an attempt to deprive them of land and livelihood and react with anxiety and skepticism towards federal involvement in their land use decisions. It is possible that reactions to reductions in allowable forage may be influenced by these emotions whereby a reluctance to sell may indicate a refusal to allow the federal government to impact their lives and denial that federal policy changes can alter a rancher's lifestyle.

For policy makers and citizens concerned about the rate of land use conversion, understanding the basis for rancher decisions in face of hardship such as federal forage reductions is critical. Cuts in livestock numbers and leasing more private land have been chosen as alternatives, but these are more costly and will decrease ranch profit. Many suggest that ranchers should diversify ranch enterprises to augment profits, but the ranchers interviewed indicate low acceptance of these ideas.

American Farmland Trust (2000) recommends that the public should be educated about the importance of public lands to maintain traditional ranching in Colorado and advocates state policies that avoid unnecessary subdivision of ranchland and decreasing competitiveness of livestock production. Additionally, the American Farmland Trust (2000) suggests increasing public land grazing, funneling more GOCO (The Great Outdoors Colorado Trust Fund) funds for acquiring ranchland conservation easements, ending federal mortgage interest deductions for recreational homes (to slow development of new homes), and allowing local jurisdictions to increase plot sizes (to slow subdivision of lands). If grazing on public lands is reduced, this data suggests that the majority of ranchers will make some adjustments. Alternatives now available to ranchers seem inadequate to cope with the problem; thus, additional policies may be necessary for ranchers to stay in business.

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Project Alpaca

By Lita P. Buttolph and D. Layne Coppock

Intensified alpaca production leads to privatization of key grazing resources in Bolivia.

Summary

Traditional alpaca production in the High Andes has depended on access to irrigated patches of rangeland called bofedales that offer green forage during dry periods. In 1993, Project Alpaca began a participatory program to improve the production and processing of alpaca wool, introducing a technical package that included fencing materials to help indigenous herders better conserve bofedal forage and improve alpaca nutrition. Our evaluation of the impacts of fencing revealed several consequences. Although households with access to fenced bofedales showed reduced rates of mortality for young alpaca, a proliferation of fencing quickly began to privatize what had been a common property resource. This led to conflict and concern that some households could be pushed out of the system. Efforts to intensify livestock production in such environments must consider the social dimensions of resource use to avoid unintended consequences of interventions.

Resumen

La producción tradicional de alpacas en los Andes Altos depende del acceso a áreas pequeñas de praderas irrigadas, llamadas bofedales, las que ofrecen forraje verde durante los periodos secos. En 1993, El Proyecto Alpaca inició un programa participativo para mejorar la producción y procesamiento de la fibra de alpaca, introduciendo un paquete tecnológico que incluye materiales para la construcción de cercos para ayudar a los productores indígenas en la conservación del forraje de los bofedales y de esta manera mejorar la nutrición de las alpacas. Nuestra evaluación de los efectos de la construcción de cercos revela varias consecuencias. A pesar de que los productores que tienen acceso a bofedales cercados mostraron tazas reducidas de mortalidad para alpacas jóvenes, muy pronto, la proliferación de los cercos inició un proceso de privatización de lo que antes fue un recurso de propiedad común. Esta situación resulta en conflictos y preocupaciones de que algunos productores podrían salir fuera del sistema. Los esfuerzos que se hacen para intensificar la producción de ganado en estos medioambientes debe considerar las dimensiones sociales del uso de recursos para evitar consecuencias no previstas de estas intervenciones.

Livestock production on rangelands is often critically dependent on relatively small patches of highly productive bottomlands such as wetlands, riparian zones, and oases that offer green forage during dry periods. Scoones (1991) referred to such sites as "key resources." Changes in access to key resources, whether due to biophysical events or alterations in resource use, can severely compromise the viability of pastoral systems.

An example of such key resources can be found in the arid and semi-arid Bolivian highlands (or altiplano), where llamas and alpacas have been raised by pastoralists as a source of meat and wool for over 7,000 years (Browman 1984). In this environment, characterized by chronic frost and drought, highly specialized management practices have been developed. One ancient practice has been the creation of extensive "cushion peat bogs" (called bofedales) by diverting water from rivers and springs using complex networks of hand-dug canals. Dominated by low-growing mixes of perennial grasses, sedges, and forbs that are adapted to chronic frost, bofedales can be created after only a few years of irrigating dry bunchgrass and shrubland sites. Alpaca, in particular, require the green forage in bofedales to provide them with a high level of nutrition essential for production. Bofedales thus serve as key resources for alpacas, especially during dry seasons and drought.

Recently, development agencies in Bolivia have attempted to widen economic opportunities for Andean pastoralists by focusing on indigenous livestock species such as alpaca. One effort, called Project Alpaca, was initiated in 1993 by the Asociación Integral de Ganaderos en Camélidos de los Andes Altos (AIGACAA), an association of indigenous *Aymara* camelid herders. Its goal was to develop a value-added system of production, processing, and marketing for alpaca wool. Funding was used to construct a modern fiber-processing plant in La Paz, and deliver financial and technical assistance to producers in several locations. A participatory approach was used whereby the producers themselves owned the processing plant and directed project operations. Local interventions included efforts to improve water resources and enhance alpaca health, nutrition, and breeding.

Bofedales were recognized by AIGACAA as a central element in improving alpaca productivity. Alpaca, sheep, and to a lesser extent llama exerted heavy grazing pressure on bofedales, especially in dry periods. Two different strategies were used by AIGACAA to enhance the role of bofedales in alpaca production. Expensive irrigation projects were implemented in a few locations to expand the size of bofedales. Elsewhere, fencing materials were made available to herders to improve forage in bofedales. It was assumed that fencing would allow the vegetation more rest from grazing, and this deferred use would improve forage quantity in the later stages of the dry season. This, in turn, would benefit the diets of pregnant and lactating alpacas as well as those of young animals (called crias). All could have positive consequences for recruitment.

The objectives of our work included the determination of how bofedales

Alpaca mothers and young (called crias) on a bofedal dominated by low-growing vegetation. Forage from bofedales is essential for alpaca to maintain a high plane of nutrition.

were used for livestock production and the impacts of deferred grazing on bofedal vegetation, resource use, and alpaca productivity. We made our observations at the community of Cosapa, one of several locations where Project Alpaca operated. Our focus was on how the provision of fencing fundamentally altered access to key grazing resources in this community.

The Bolivian Landscape

Situated on the western edge of the south-central altiplano, Cosapa is approximately 260 km southwest of the city of La Paz, in one of the most isolated regions of Bolivia. The elevation of Cosapa is 3,900 m (approximately 13,000 feet). The climate is semi-arid with an average annual precipitation of 332 mm. Precipitation occurs primarily as rain in the summer between December and February. Diurnal temperature fluctuations can be very high, ranging from –10 to 20°C. Frost occurs 260 days per year. The people of Cosapa are of the indigenous *Aymara* group and their livelihoods are primarily based on the production of llama, alpaca, and sheep. Llamas and sheep are raised primarily for their meat (both for home consumption and commercial production), while alpacas are raised more for their high value wool. In Cosapa during 1994–6 the average number of alpacas, llamas, and sheep per household was 34, 64, and 43, respectively. Some households with access to hilly terrain produce crops such as potatoes, barley, and *quinoa* (a local cereal crop), but high risks of frost and drought generally preclude cultivation.

The landscape of Cosapa consists of a wide valley surrounded to the East and West by rugged mountains. Settlements are concentrated on or near the valley floor. Bofedales are a common site type of the valley floor, while bunchgrass and shrubland site types more typically dominate well-drained uplands. Bofedales are also associated with water-collecting locations in the mountains. Overall, we estimated that bofedales occupy about 10% of the landscape at Cosapa.

Effects of fencing on the mortality of alpaca crias were determined through a social survey that compared neighboring households with and without access to fenced bofedales. Households were asked to enumerate total cria born and those that died during the research period. General patterns of resource use and aspects of project intervention were determined using a combination of household interviews, personal observations, review of project documents, and attendance at local and regional meetings. Details are available in Buttolph (1998).

Land Tenure And Grazing Systems

Grazing lands at Cosapa were under ownership by groups of households that shared a common hamlet (or estancia). Each household held title to land, but often shared that title with other households. Within this system of communal ownership, however, each household had a designated area where their animals were allowed to graze. Because human out-migration has been relatively low in recent times, local population

Freshly dug irrigation canal in bofedal. A web-like system of canals is used to create and maintain this wetland vegetation type.

growth has increased pressure on grazing lands. Trespassing by livestock was becoming a chronic problem.

Rotation of livestock among different grazing sites throughout the year has been a traditional management strategy. During the wet season, alpaca and sheep, in particular, alternated grazing between upland and bofedal sites on a daily basis to reduce pressure on bofedales. In the dry season, however, alpaca and sheep spent most of their time grazing bofedales. In contrast, because they tolerated drier conditions, llamas were often taken to the mountains to graze. Llamas made more use of bofedales during dry periods.

Effects Of Fencing

Provision of credit and materials led to rapid proliferation of barbed-wire fencing after 1993. Our work indicated, however, that protection from continuous grazing had varied ecological effects. In terms of forage production and standing crop, protection conferred surprisingly few benefits, and plant species diversity even declined inside fenced areas compared to the heavily grazed situations. In cases where herders were able to provide more regular irrigation, some increases in standing crop were observed in protected sites. Overall, bofedal vegetation appeared to be very stable and slow to respond to this intervention despite high levels of soil moisture. We attribute these observations to a plant community that is highly adapted to intensive herbivory and frost, which limit plant growth. Paradoxically, however, provision of fencing was positively associated with a reduction in cria mortality rates of 26%. Survey respondents said that cria could forage in protected sites and achieve a better diet compared to that of continuously grazed sites. If this is correct, it suggests that sufficient forage improvements occurred from protection that were undetected by our field measurements. We concluded that fencing did provide some of the benefits intended by AIGACAA, although more time may be required to observe larger effects of fencing on vegetation.

The appeal of fencing to households, however, came not only from improvements to alpaca recruitment, but also because it provided a new way to establish exclusive rights over productive land otherwise under common access. Population increases led to increased pressure on grazing lands and higher tensions over land use and access. Fencing could thus limit problems of animal trespass and mitigate labor constraints for herding. Reductions in labor availability were becoming more common due to universal schooling (removing children from the labor pool) and greater opportunities for wage labor off-farm.

When Project Alpaca was initiated, only households with relatively small herds of alpaca were given credit to purchase fencing materials. The argument was that the larger herd owners were accruing greater benefits from communally owned land, and fencing would allow smaller operators to build-up their herds. The initial fenced areas were relatively small in size (ranging from 1 to 3 hectares), and were situated on relatively non-controversial sites where grazing rights were uncontested. As time went on, however, others began constructing larger fenced sites, ranging up to 8 hectares in size. Many of the newer fenced sites were annexed by larger operators, and they were placed in the center of the bofedales, thus increasing conflicts. In one estancia about 50% of the formerly communal bofedales were annexed for private use within 2 years.

Annual marking and blessing of yearling and adult alpacas and llamas. This ancient ceremony, called the **K'illpa**, *is practiced by Aymara pastoralists for practical and religious purposes. Colorful ribbons and tassles are used to identify ownership and sex of animal from a distance, while permanent slits cut in the ears identify ownership.*

Thus, rather than reducing pre-existing tensions over land use and access, fencing often exacerbated the problem.

The fencing of bofedales in Cosapa was thus contributing to a breakdown of the traditional norms and social institutions that regulated rights to grazing lands and linked the well-being and decision-making power of individual households. Caro (1992) describes the benefits of communal land tenure on the altiplano, stating that it allows households to redistribute pasture resources according to relative changes in herd sizes and labor pools. Fencing resulted in privatization, and, consequentially, differential access to key resources. Households without exclusive access to bofedales may now face greater risks of livestock mortality, particularly during periods of prolonged drought. A drought in the early 1980s decimated local livestock herds, even when bofedal access was unregulated. The implications of privatization thus include increased risk and vulnerability for those without fencing, greater economic polarization within the community, and a greater likelihood that poorer households will be expelled from the system. The routine ability for producers to react in a flexible and opportunistic manner becomes more limited with privatization of key resources (Scoones 1991).

Fencing Isn't A Long-Term Solution

Fencing serves as one example of the many technical innovations that attempt to release pastoralists from the constraints of low productivity. One problem with the "tech-fix" approach, however, is that changes are imposed on the system without sufficient consideration of the social relations and institutions that may be disrupted as an unintended consequence. Many of these institutions are informal and thus overlooked when implementing development programs, even when using participatory approaches that seem relatively unbiased and transparent. Benefits may accrue to a certain portion of the population, but increase vulnerability for others. Despite some of the short-term benefits of fencing on this production system, the longer-term consequences may be more detrimental as a whole.

The extensive nature of pastoral systems and vital role of key resources requires more careful development approaches. For example, rather than emphasizing increased animal production, development efforts could focus more on increasing farm-gate prices and profits for producers by widening market channels for wool as well as value-added artisan goods such as rugs, knits, and textiles. Full participation of the entire community in any development strategy is critical, along with their definitions of what constitutes "improved welfare." A development assessment, for example, might find that higher incomes through alpaca production may not be the critical variable to improved welfare, or at least not worth the social costs incurred through the process of intensification. Attempts to better manage household risk, diversify the economy, and promote community cohesiveness to deal with ecological or economic shocks may be more appropriate for pastoral peoples than merely undertaking efforts to increase productivity.

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Conditioned Food Aversion: From Theory to Practice

By Michael H. Ralphs, Frederick D. Provenza, James A. Pfister, David Graham, Glenn C. Duff and Gary Greathouse

Can livestock be trained to avoid eating certain poisonous plants?

In most plant communities there are plants that can poison animals. A few plants contain high levels of toxins, or contain highly toxic compounds, and pose a real threat to grazing livestock. Some of these plants may be readily grazed by livestock, which makes it difficult to manage around them. Conditioned food aversion offers a way to train livestock to avoid eating specific poisonous plants.

Provenza (1995) developed a diet selection theory for rangeland herbivores that indicates animals learn which plants or foods to eat and which to avoid, based on the food's effect on the digestive system. Foods that provide adequate nutrients are preferred, while plants that cause nausea or illness are avoided. Associations are formed between the taste of the plant and its effect on the body. If an animal gets sick from eating a particular plant, the hedonic value or palatability of the plant declines, and the animal subsequently avoids eating that plant. This mechanism can be used to train animals to avoid eating specific plants or foods.

Conditioned (learned) taste aversion is a prominent tool in the behavioral sciences (Braveman and Bronstein 1985). Aversions have been used to prevent coyote and wolf predation on livestock and rodent depredation on crops (Gustavson and Gustavson 1985), and in treatment of alcoholism in humans (Logue 1985, Nathan 1985). Zahorik and Houpt (1981) first demonstrated that cattle, sheep and horses could be averted to specific foods.

Laycock (1978) was first to suggest that aversions may be able to prevent livestock from grazing poisonous plants. We have taken food aversions from a theory, and developed the procedures to create aversions as a management tool to prevent livestock from grazing important poisonous plants on western U.S. rangelands, such as larkspur (Ralphs 1997), locoweed (Ralphs et al. 1997) and Ponderosa pine (Pfister 2000).

How To Create Aversions

To induce an aversion to a particular plant, animals are fed the target plant in a pen or controlled setting. Once animals have eaten enough to taste the flavor, they are restrained and dosed with an emetic to induce stomach sickness. The animal associates the taste of the plant with the illness and refrains from eating the plant in the field.

Lithium chloride (LiCl) is the most effective emetic to induce aversions in cattle, sheep and horses. It causes nausea without dangerous side effects. Apomorphine is another common emetic used in large animals and has been used to induce aversions in livestock (Zahorik et al. 1990). However, apomorphine did not create total aversions to a novel food in cattle, and the aversions did not last (Ralphs and Stegelmeier 1998). Apomorphine was also used to create aversions in horses, but it caused unacceptable behavioral side effects, such as wild, uncontrolled behavior (Pfister, unpublished data).

The strength of the aversion and its duration varies with the intensity of the induced illness. Total aversion was obtained from LiCl doses of 130 mg/kg body weight in rats (Nachman and Ashe 1973), 150 mg/kg in sheep (du Toit et al. 1991), 190 mg/kg in horses (Pfister, unpublished data), and 200 mg/kg BW in cattle (Ralphs and Cheney 1993). The lethal dose of LiCl to cattle lies between 250 and 500 mg/ kg body weight (Johnson et al. 1980), however, horses have shown few adverse effects from LiCl up to 400 mg/kg (Stegelmeier, unpublished data). Because of its caustic nature and the relatively large quantities required to create aversions in livestock, lithium must be administered into the rumen or stomach, either in solution (mixed with water) by stomach tube, or in gelatin capsules or boluses, allowing dilution in digestive fluid.

Novelty and intensity of the taste of the plant are important for livestock to create and retain an aversion. Aversions are best created to new tastes that are strong or distinctive. On the other hand, it is difficult to create aversions to familiar foods (Burritt and Provenza 1996), because they fall into a "learned safety" status (Kalat and Rozin 1973), which must first be overcome. Several pairings of the taste with illness are required (Ralphs et al. 1997), and if the animal reverts and samples the plant without negative consequences, the aversion will disappear.

Hunger has little direct influence on forming aversions. In fact, hungry animals may eat more during conditioning

and learn the flavor better. When training, we typically fast animals for 1 or 2 days to force them to consume the target plant. After training, we test the strength of the aversion by repeatedly offering the plant to the animals. Hunger during the testing phase can reduce the strength of the aversion because hungry animals may eat the plant even though it "tastes" bad.

Age of the animal or stage of maturity may affect retention of aversions. Mature animals are set in their diet preferences and are less likely to sample new foods (Squibb et al. 1990). The inquisitive character of young animals in sampling foods, and being influenced by others, may make it harder for them to retain an aversion. Younger animals did not retain aversions as well as mature animals in several species: rats (Guanowsky et al. 1983, Steinert et al. 1980), sheep (Thorhallsdottir et al. 1990), and cattle (Ralphs and Cheney 1993). However, if aversions can be reinforced in young animals, the aversions may last a lifetime.

Social facilitation or "peer pressure" is an extremely strong force influencing what animals eat. They tend to sample plants or foods they see others eating. If averted animals see non-averted animals eating the target plant, they will sample it. If illness is not forthcoming, the aversion will eventually disappear (Ralphs and Olsen 1990, Burritt and Provenza 1989, Lane et al. 1990). Therefore, averted animals must be grazed separately from non-averted animals to maintain the aversion.

Case Studies In Producing Aversions To Three Poisonous Plants

Tall larkspur is an important poisonous plant on mountain rangelands. It is palatable to all livestock, especially in its latter stages of growth, but is acutely toxic to cattle. Larkspur alkaloids block the nerve-muscle junction, resulting in muscular paralysis and rapid death from respiratory failure. Since the toxin affects the nervous system, not the gut or emetic system, cattle do not form natural aversions to larkspur (Pfister et al. 1997).

Tall Larkspur. Photo by Mike Ralphs.

In a small pasture field trial, 6 cows were trained to avoid tall larkspur by dosing them with lithium chloride (200 mg/kg BW) via stomach tube in 1993. The aversion lasted 3 years while cows grazed separately on larkspur-infested pastures (Ralphs 1997). The non-averted control cows grazed larkspur for up to 30% of their diets, and 3 died from larkspur poisoning. In 1996, 16 cows were averted to larkspur and allowed to graze freely on the larkspur-infested allotment. They did not consume any larkspur during the summer.

Finally, we implemented a ranch-scale demonstration project to determine if aversion training can be practical on a large scale. The ranch was a 300 cow enterprise in Yampa, Colorado. The associated 5,000 acre Forest Service grazing allotment had a history of serious losses to larkspur. Death losses from larkspur exceeded 10% of the herd in 1987 and in 1991. The stocking rate on the allotment was reduced to 150 cows (from 300) to help alleviate the poisoning problem.

Part of the herd was averted each year. In 1997, 45 cows were averted to larkspur; 59 additional cows were averted in 1998; and another 45 cows were averted in 1999, for a total of 149 head.

The aversion procedure consisted of sorting the cows into small groups (less than 20) and fasting them for 24 hours. They were then offered fresh-picked larkspur. Those that ate larkspur were sorted out, restrained in a squeeze chute and dosed with LiCl at 200 mg/kg BW using a stomach tube. Those cows that did not eat were held and offered larkspur later when they were hungrier. The cows were allowed to recover for 3 days then were offered larkspur again to test the aversion. Only 1 cow consumed larkspur after being averted and she was dosed a second time at 100 mg/kg.

Following the aversion treatment each successive year, the newly averted cows were trailed to the mountain grazing allotment and placed with the cattle that had been averted in previous years. A rider located the cows each day and observed them to see if they consumed any larkspur. In 1997, 16 cows were observed to sample larkspur, but only 2 ate it consistently, and one cow was poisoned and died. In 1998, 8 cows started eating substantial amounts of larkspur,

Plant Names

Tall larkspur—*Delphinium barbeyi* Huth High mountain rangelands

White locoweed or silky crazyweed—*Oxytropis sericea* Nutt. in T.&G. Foothills of Rocky Mountains, plains and high mountain grasslands

Lambert locoweed or crazyweed—*Oxytropis lambertii* Pursh Plains and mountains

Woolly locoweed—*Astragalus mollissumus* Torr. Shortgrass prairies

Ponderosa pine—*Pinus ponderosa* Lawson Foothills and intermediate elevations in mountains

but were removed from the allotment to prevent poisoning and stop them from influencing others to start eating larkspur. No cows were observed eating larkspur in 1999. Although some cows ate larkspur during 1997 and 1998, the aversion procedure was successful considering the past high death loss.

In summary, the rancher felt it was feasible to have a rider watch the cattle and remove those that started eating larkspur. The aversion treatment, combined with the reduction in stocking rate and a rotation scheme to ensure the cattle were always moving to fresh feed, essentially eliminated the larkspur poisoning problem on this allotment.

Locoweed is the most wide spread poisonous plant on western U.S. rangelands. It is relatively palatable to all classes of livestock and causes chronic poisoning resulting in weight loss, reduced fertility and abortion. The toxin's gradual or chronic effects do not create a distinct stomach sickness that could be associated with the taste of locoweed.

A Colfax County New Mexico rancher adopted the strategy of averting his yearling replacement heifers to white locoweed each year. Thus over a period of years, he will replace his entire herd with averted cows. In the spring of 1998, 43 replacement heifers were averted to white locoweed. The aversion protocol consisted of corralling the heifers and fasting them for 24 hours. Five heifers at a time were run into an alley and offered fresh picked locoweed in rubber feed troughs. They were closely observed and those that didn't eat were separated into another pen and offered locoweed later when they were hungrier. Those that ate substantial amounts of locoweed were restrained in a squeeze chute and dosed with LiCl at 200 mg/kg BW by bolus. The heifers were transported to a locoweed-infested pasture in mid May. Before being released, they were again offered locoweed to test the aversion, but all refused. The heifers were watched closely to see if they would graze locoweed in the pasture. Eleven heifers were observed eating locoweed and were returned to the corral and dosed a second time. All the heifers abstained from eating locoweed for the remainder of the grazing season. In the fall of 1998, we attempted to avert another 44 heifers immediately after weaning. However, only 24 would eat locoweed and were dosed with LiCl. The next spring, the remaining 20 heifers were again offered locoweed, but they refused to eat it. Apparently, they developed natural aversions to locoweed. They were grazed with the averted heifers on locoweed-infested rangeland for the spring and summer, but none consumed locoweed. The averted animals were grazed separately from the regular herd to maintain a "clean" herd and to prevent them from being influenced to sample locoweed by other cows that may be eating it.

Two other New Mexico ranchers used aversions to solve locoweed problems. A Union County New Mexico rancher had 32, two-year-old heifers that were eating white locoweed and had started to abort in November 1998. The cows were corralled, fed locoweed, and were dosed with LiCl using a stomach tube. There was no further locoweed consumption and the abortions stopped. A rancher in western New Mexico had 22 mature cows that were eating old, dried woolly locoweed. The rancher picked the dried locoweed and offered it to the cows in a pen on 15 Dec 1998. All the cows ate it, were dosed with LiCl, and subsequently refused to eat any more locoweed.

Aversive conditioning was next tested on the Colorado State University Research Foundation Maxwell Ranch. Cows that had consumed locoweed during the fall and winter and had aborted were retained to determine if they could be conditioned to avoid eating locoweed in the future. Conditioning occurred in the spring when white locoweed was in full flower. The cows (37) were fasted overnight and offered locoweed the next morning. Four to 6 cows at a time were placed in a smaller corral and offered locoweed in a feed bunk. Those that ate substantial amounts of locoweed were restrained in a chute and dosed with LiCl by bolus.

We had some difficulty using these gelatin boluses. The cows averaged 1,000–1,100 lbs and each received 4 boluses (25 g LiCl each bolus). The boluses were dipped in mineral oil to facilitate sliding through the speculum and down the esophagus. Even with the oil, the boluses required gentle force from a soft rubber tube to insert them far enough down the esophagus so the cow would swallow them. Some of the boluses broke and were coughed up. The caustic nature of LiCl caused acute trachitis in 4 cows. We learned from this experience that it is safer to put LiCl in a 25% w/v solution in water and pump it directly into the rumen by stomach tube. Mixing LiCl in solution is also less labor intensive than packing it in boluses.

The averted cows were turned out on pastures infested with both white and Lambert locoweed. The cows were observed from horseback each day during the late afternoon and evening grazing period. Four cows grazed locoweed. They preferred the Lambert locoweed

White and Lambert locoweed. Photo by Mike Ralphs.

Ponderosa Pine. Photo by Jim Pfister.

which was in full flower (they were averted to white locoweed), and selected only a few pods of white locoweed later in the season. These 4 cows consumed locoweed for about 20% of their diets during late June, declining to 1–2% by the end of July. The 4 cows that did eat locoweed apparently did not influence the others to start eating it.

We are developing procedures for dosing horses with LiCl using a tube introduced through the nose into the stomach (Pfister, unpublished data). This is a more difficult procedure than using a stomach tube in cattle, and may require a skilled technician or veterinarian. However, the extra effort may be worthwhile in preventing valuable horses from being poisoned on locoweed.

Ponderosa pine needles cause abortion in cattle if consumed in the last trimester of gestation. Abortions are common in regions where the ranch headquarters are on the edge of pine forests and the ecotone is used for protection and shelter during calving. Pine needles are ideally suited for aversions because of their strong taste due to high levels of terpenes.

Cattle were averted to green Ponderosa pine needles and they retained the aversion in numerous pen trials. However averted cattle, grazing in a pine pasture in Oregon, began eating pine litter on the ground, and then eventually switched from dry needles to eating green needles off the trees (Pfister et al. 2000). It is probably important to avert animals to all forms of the plant they will encounter when grazing.

Lessons Learned

Conditioned food aversion is a powerful tool for modifying animal diets. We have shown that it is a potential management tool to prevent livestock from grazing poisonous plants. The following principles will increase the strength and longevity of aversions:

- mature animals retain aversions better than young animals;
- novelty of the plant is important, although aversions can be created to familiar plants;
- lithium chloride is the most effective emetic for large animals;
  the optimum dose for cattle is 200 mg/kg BW, horses 190 mg/kg, and sheep 150 mg/kg;
- averted animals should be grazed separately to avoid the influence of social facilitation which may cause the aversion to disappear.

The cost of lithium is about $6 for a mature cow, or $2.80 for a 600 lb replacement heifer. Our process required 3 people for 2–3 hours, for 2–3 days to handle the cattle and avert 40 to 70 cows on each ranch. If livestock losses to poisonous plants are small or occasional, aversion conditioning would not be practical. However, if losses are high and occur each year, and other management alternatives are limited, aversions may be practical, especially for valuable animals such as horses, purebred cattle, or foundation cows or sheep.

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Shinnery Oak Poisoning Of Rangeland Cattle: Causes, Effects & Solutions

By Lance T. Vermeire and David B. Wester

Shinnery oak in the Southwest can reduce livestock performance and even lead to death. Here are strategies to recognize shinnery oak poisoning and treat or prevent it.

Oak poisoning has been reported for many species of animals around the world, but the majority of cases involve cattle in the American Southwest. Results of poisoning range from reduced livestock performance to wide-spread mortality. Oak poisoning caused an estimated annual loss of $10 million to the Texas cattle industry alone during the early 1960s.

Sand shinnery oak is a low-growing shrub that can dominate sandy soils in the southern Great Plains. It is very accessible to cattle and one of three oak species most commonly involved in livestock poisoning.

Distribution, Phenology And Associated Vegetation

Shinnery oak is a native shrub of sandy sites in western Oklahoma, the southern High Plains of Texas, and eastern New Mexico (Fig. 1). Shin oak occurs within the same region and appears similar to shinnery oak, but is restricted to limestone soils. Sites dominated by shinnery oak typically have highly permeable soils of low fertility, and are subject to wind erosion. Shinnery oak density, height, and cover are inversely related to surface soil clay content and positively related with depth to a clayey horizon.

Shinnery communities are dominated by shinnery oak and tallgrasses. Dominant grass species include big bluestem, little bluestem, switchgrass, giant dropseed, and sand dropseed. Sand sagebrush, sand plum, and skunkbush sumac are co-dominant shrubs and prominent forbs include annual buckwheat and western ragweed. Shinnery communities are relatively productive because the sandy soils provide better soil moisture than heavier-textured soils in the same precipitation zone. The dominant grasses are generally desirable cattle forages and the diversity of forbs

and shrub cover in these sandy communities provides good habitat for numerous species of wildlife.

Shinnery bud burst occurs in mid-March, with full leaf development and flowering during April and May. Acorns are up to 1 inch long and mature in a single season, providing a valuable food source for many species of wildlife. Plants remain physiologically active until October or late November.

Effects Of Oak Poisoning

Shinnery-dominated rangeland is commonly grazed by livestock (primarily cattle) because of its wide distribution and associated vegetation. Consumption of oak leaves, buds, catkins (flowers), twigs, or acorns usually reduces animal performance and may lead to death. Negative effects of oak browsing are caused by various chemicals in the plants called tannins. Tannins are classified as either condensed or hydrolyzable. Condensed tannins can be broken down only in strong acids, whereas hydrolyzed tannins are easily degraded and can be absorbed into the blood stream.

Interpretations of tannin studies are confounded by many factors. Plants containing tannins may contain other toxins, and tannins added to diets may differ from those found in plants. Tannins can also interfere with fiber analysis. Despite these interpretational problems, tannins clearly reduce digestibility and affect animals with specialized or variable diets. Specific effects on animals are dose-dependent.

Condensed tannins bind with proteins, carbohydrates, starch grains, and intestinal bacteria, all of which are important for normal digestion, growth, and maintenance of ruminant animals. When these food components become attached to tannins, they are unavailable for digestion and animal performance is reduced. Dry matter and fiber digestion can be reduced by tannins, but reduced nitrogen (protein) digestion is more common. Tannins bind with numerous forms of proteins. These include dietary protein, microbial protein, tannin-binding salivary proteins (TBSP), and proteins recycled from the lining of the digestive tract. Reduced nitrogen digestion has been observed when tannic acid exceeded 6% of the diet.

Tannin effects on animals vary with

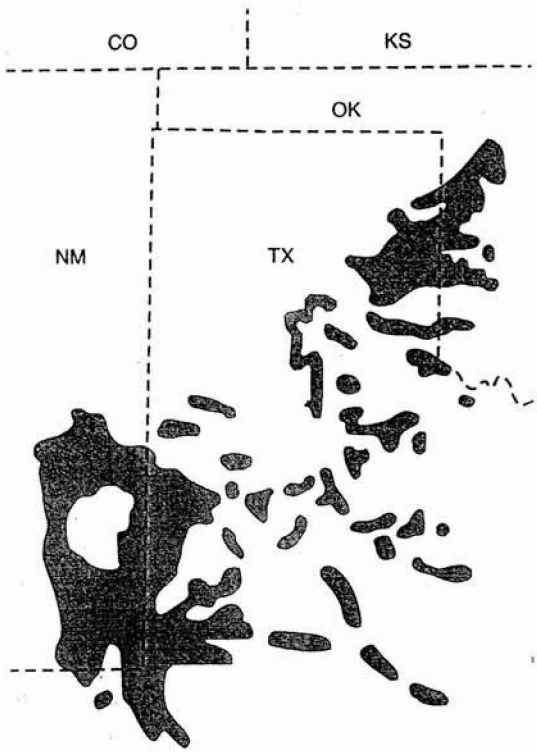


Fig. 1. ***Distribution of shinnery oak occurrence in Oklahoma, Texas, and New Mexico. (Borrowed from Peterson and Boyd 1998).***

species and digestive system. Animals with a greater presence of TBSP, such as deer, are generally better adapted to tannin-rich diets. Tannins preferentially bind with TBSP, leaving other protein sources available for digestion. Cattle lack functional TBSP, so tannins are available to bind other forms of protein. Although the loss of protein is not as great for animals producing TBSP, protein digestion is still reduced by tannins.

Hydrolyzable tannins appear to have little or no effect on digestibility because they do not bind strongly with proteins. Hydrolyzable tannins can be degraded and absorbed, reducing digestion-inhibiting effects, but toxicity is increased. These tannins are broken down into gallic acid and pyrogallol, which directly attack the gut lining and cause hemorrahaging in the stomach and kidneys.

Animal performance is reduced when tannins exceed 5% of forage weight. Cattle have been reported to become ill when oak comprised more than 50% of the diet by weight and mortality was likely when oak exceeded 75% of total intake. However, these figures were based on tannin concentrations of 2 to 6% in mature leaves. Tannins comprised 18 and 20% of shinnery catkins and buds collected in early April, when most poisoning occurs. So, illness and death may occur with one tenth to one third as much shinnery oak.

Shinnery can comprise significant amounts of cattle diets, depending on the growth stage and availability of associated species. Plumb and Pettit (1982) showed that oak consumption by cattle increased throughout the summer. Shinnery comprised 6% of the diet in June and 24% of the diet in August. Oak consumption by Angora and Spanish goats also increased from 31% to 51% as preferred forages were reduced between June and August (Villena et al. 1987). Shinnery oak consumption is often greatest in March and early April, when oak buds provided most of the green forage.

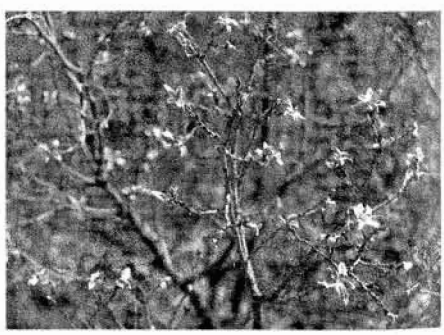
Symptoms

Tannins affect animal performance long before symptoms of toxicity become evident. Visible symptoms of oak poisoning occur in three stages, the first of which appears only after several days of oak consumption. The first stage is marked by dark, dry feces with mucus and blood, reduced appetite, and constipation. These symptoms are followed by bloody diarrhea, frequent urination, and animals remaining near water. In the final stages, cattle will have a rough coat, dry muzzle, reddish urine, and possibly watery swellings on their underside. Symptoms last 3 to 10 days before the animal either recovers or dies. Internally, the primary lesions are inflammation of the kidneys and stomach. The abomasum and small intestines are often inflamed and ruptured as well.

Prevention and Treatment

Oak poisoning occurs when oak is the main source of forage. Herbaceous forage is often limited before spring greenup, in early fall, or during drought. Most oak poisoning occurs during the first 30 days after oak leaves emerge. Green herbaceous forage is limited during this period and tannin concentration is greatest in young oak leaves and twigs. Pigeon et al. (1962) found young and mature shinnery oak leaves were 15.1 and 4.2% tannin, respectively. Physical alterations of oaks may also increase the risk of poisoning. Tannin concentration is greater in oaks that have been cut and in young leaves that have been killed by frost. Poisoning during fall is typically limited to years of abundant acorn production. Calves are more likely to be poisoned by oak than mature animals, although it is not clear whether they are less capable of coping with tannins, or if they are simply more likely to consume oak. Nursing calves may receive elevated doses because tannins concentrate in milk.

Poisoning can best be prevented by using moderate stocking rates and main-



taining a diverse forage base. Dollahite et al. (1966) suggested supplementing calcium hydroxide at 10% of total intake as a preventative measure. Calcium hydroxide seems to prohibit tannin absorption by forming insoluble complexes. Other alternatives include denying cattle access to shinnery-dominated range for the first 30 days of oak foliation, removing cattle if frost blackens oak leaves, or supplementing high-energy and high-protein feeds. Poisoned animals should be given a mild laxative and adequate access to food and water until recovery is complete.

Cattle will not consume toxic levels of oak if desirable forage is in ample supply. However, during drought conditions, careful herd monitoring and preventative management are recommended. Animal performance is affected long before visible symptoms become apparent. Oak poisoning is largely a symptom of overstocking and poor range condition. Additional preventative measures include deferment of spring grazing and supplementation with calcium hydroxide.

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Listening To The Land Where The Buffalo Roamed

By Thad Box

America's rangelands were always grazed. Although our virgin rangelands did not have cattle on them, they had plant-eating animals for as long as we have evidence. Rangelands evolved with grazing.

Pre-history teases us with tidbits. We know there were plant-eating dinosaurs. Pollen tells us kinds of plants. The fossil record gets better after the last ice age. We know there were little horses and giant bisons in abundance. And that many grasses and shrubs were similar to the ones we have today.

Still, we have little record of grazing effect. We know not if overgrazing existed or how it changed evolving rangelands. Paleo-biologists argue over the different kinds of animals that used the Great Plains and the Great Basin. But we know grazing was natural on all virgin rangelands.

Our first recorded history of American rangelands is in journals of early explorers, usually adventurers and soldiers with little scientific training. The medical officer often became the interpreter of natural history. There is nothing written by ecologists or range managers; such people did not exist. The main items recorded were the land's ability to provide forage for expedition horses and wild animals for human survival.

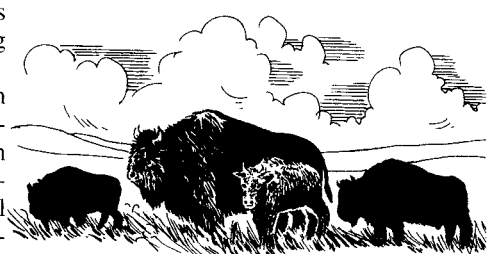
Spanish explorers gave us the first descriptions of virgin rangelands. And arguably the only description. They brought with them a new kind of grazer, domestic livestock, destined to change the landscape. Descriptions vary from ranges with grass touching saddle stirrups to vast lands so closely grazed there was no feed for horses. In some areas availability of wildlife was plentiful; in others, explorers went days without sighting anything for food.

At best, the early journals are snapshots in time and space. But they are consistent in a few areas: Pristine rangelands were highly variable. All were grazed or browsed by some kind of animals. Density of animals varied, both spatially and seasonally. Native people and wild animals were concentrated around water sources. With the exception of turkeys, few animals were "domesticated."

Spanish records, including five-hundred-year histories of settlement in New Mexico and California give the earliest insight into American rangelands. Largely, they remain an untapped treasure buried in archives of Mexican churches. Many scientists lack language and archival skills to access them.

English records of pristine rangelands are recent, mostly less than 150 years old. The first, like the Spanish records, are those of explorers and military expeditions. They, too, show virgin rangelands as highly varied and universally grazed.

Those in the "great American prairie," had dense sod of tall grasses. Beautiful flowers raised colorful heads seasonally. Specimens of tall grasses were collected and sent to botanists for classification. Big



bluestem, little bluestem, Indiangrass, and switchgrass received Latin names and were recognized as the "big four" of a province that covered much of America's mid-west. The sod was often too dense to cut with a plow. That "province" is now grainfields of America's breadbasket. Rangelands exist only as protected remnants.

As explorers went west, they found decreasing rainfall, shorter grasses and dry shrublands. New areas were described as short-grass plains, buffalo grass deserts, and America's great "Zahara." Capt. Marcy, trying to find a route from Ft. Smith, Arkansas to Santa Fe wrote: "When we were upon the high table land, a view presented itself as boundless as the ocean. Not a tree, shrub, or any other object, animate or inanimate, relieved the dreary monotony of the prospect; it was a vast illimitable expense of desert prairie—the dreaded "Llano Estacado" of New Mexico. He went on to say that the only herbage was a "short buffalo grass" and that "all animals appear to shun it."

Yet records from other explorers, hide tanners, and military expeditions sent to pacify Indians show pristine ranges grazed by huge herds of animals. Exact numbers are disputed, but there may have been as many as 50 million bison and another 100 million deer, pronghorn, elk, bighorn sheep, and mountain goats grazing virgin American ranges. Elk, now largely a mountain animal, ranged widely. Bison and deer were everywhere.

The coming of the camera in the late 19th century left a visual record of some pristine ranges. Many "virgin" lands were heavily used when the first military missions arrived. Photos at Miles City, Montana show heavily grazed grasslands, extensive buffalo wallows, and bison-trampled stream banks. Photographs from the Black Hills of Dakota show open savannahs instead of dense pines. Pictures along the U. S.-Mexican border show desert grasslands where creosote bush now grows. Like the written records, they show America's pristine rangelands as highly variable and all grazed. In addition, virgin ranges appear much more open than they are today.

Then bison were killed. Most were shot by contract hunters funded by the military as the most effective way to control Indians. Settlers moved into the prairie and found ways to turn its sod. Railroads poked their way through virgin grasslands and deserts. With killing of the buffalo, most rangelands were without a major grazer. Their evolution was interrupted. But not for long. The Mooar brothers, contract buffalo killers hired by the army, arrived on the southern Great Plains in 1873. By 1894, domestic cattle were dying by thousands on overgrazed ranges where rifles removed the buffalo.

One scene in Andy Adam's "Log of a Cowboy" has a grizzly bear, somewhere in the northern Great Plains, stand and sniff the air. She smells an approaching trail herd from Texas. America's rangelands had not been "virgin" since the Spanish brought horses, sheep and cattle five hundred years ago. The air the grizzly smelled carried the aroma of change; it also announced the need for the profession of range management.

SRM Awards

Presented at the Society's 54th Annual Meeting in Kona, Hawaii on February 21, 2001.

Frederic G. Renner Award

The Frederic G. Renner Award is the highest award bestowed by the Society for Range Management. The award is named for one of SRM's founding fathers and second president.

Dr. James A. Young

Dr. James A. Young is recognized by the Society for Range Management because of his collective accomplishments as a research scientist, educator, writer and historian. Dr. Young's extensive research on the restoration of sagebrush, bitterbrush and salt desert shrub rangelands has added tremendously to the scientific knowledge based used by natural resource managers and ecologists in the Great Basin and Intermountain West. This contribution has resulted, in large part, from a problem solving approach that melds current scientific knowledge with social, cultural and political history. Dr. Young's positive influence on the art and science of range management arises from his recognition that current ecological concepts are best understood and applied when research results are integrated with the cultural and social history of the landscape. The accolades for his book *Cattle in the Cold Desert* by both ecologists and historians is ample demonstration of his ability to communicate the complexity of rangeland ecosystems to a diverse audience.

Born and raised on a northern California ranch and educated at Cal State-Chico, North Dakota State University and Oregon State University Dr. Young has authored or coauthored over 700 scientific publications. The caliber of his research effort is reflected in the application of his findings to the disciplines of wildlife management, livestock production, plant ecology, plant physiology, restoration ecology, conservation biology and the settlement history of the western states. His influence on Range Management has also been felt through his continuous service in both the Nevada Section and the parent Society for the past 36 years.

W.R. ChaplineResearch Award

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

Gary W. Frasier

During his research career, **Gary Frasier** has earned regional, national and worldwide recognition for his work on the conservation and efficient use of rangeland water supplies and, specifically, in the design and installation of water-harvesting systems for livestock, wildlife and human consumption. Furthermore, Gary has built on his knowledge of water harvesting techniques to perform much needed research on the water-soil-plant linkages within the shortgrass ecosystem. From experience gained in this arena he has moved on to studying the dynamics of the soil-water continuum in montane riparian zones. Gary's 100+ technical publication record is remarkable in the face of his responsibilities as the lead scientist on the 15,000-acre USDA-ARS Central Plains Experiment Station. Even though Gary Frasier's research contribution to the field of Range Science warrants recognition, it is his overall contribution to the range management profession that brings him here today.

Gary Frasier may be best known by the Society's membership as the Editor and Champion of *Rangelands*. He has also contributed 1,000s of hours to development and implementation of the editorial policy for the *Journal of Range Management.* To occupy the rest of his spare time Gary was awarded Affiliate Faculty status in the Rangeland Ecosystem Sciences Department at Colorado State University. In this capacity he has co-advised 8 Masters level and 5 PhD students since 1994. Through his service with the Agricultural Research Service, the Society for Range Management and the Soil and Water Conservation Society Gary has been recognized as a Fellow of the Society for Range Management (1988) and the Soil and Water Conservation Society (1989), given the Outstanding Service Award by the Arizona Section of the Society for Range Management and granted the Society of Range Management's Outstanding Achievement Award in 1996.

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.

Jack Maddux

Through his efforts to make his livestock operation part of the Nebraska rangeland ecosystem **Jack Maddux** has become a knowledgeable spokesman for proper range management. Jack utilizes interseeding, high intensity-low frequency grazing and annual range monitoring to improve and maintain the overall condition of his rangeland. He has also installed many miles of water pipeline and cross-fencing to facilitate his grazing system and breeding program. Because of the increasing productivity of his rangeland he has begun the development of a composite cattle breed that will perform well on grass without requiring extensive supplementation. While these accomplishments speak highly of Jack's stewardship, his most notable achievement is his effort to teach young people how to manage our natural resources.

Each year Mr. Maddux hires several high school students to help him in his monitoring effort. These students have the opportunity to work side-by-side with Jack and his employees to learn all aspects of a working ranch, including planning and monitoring the outcome of range and livestock management efforts. Many times Jack has helped finance the advanced education of one of his student "helpers".

Jack Maddux has served agriculture and conservation interests through contributions of his time, knowledge and resources. He served as a 4-H and Boy Scout Leader, as President of the Nebraska Stockgrowers, a Board Member of the University of Nebraska Foundation, as a member of the Platte River Whooping Crane Trust and as mayor of Wauneta, Nebraska. In each of these capacities Jack has been a promoter of sound management and continuing education.

Outstanding Achievement Award

The Outstanding Achievement Award is presented to individuals or groups for eminently noteworthy contributions in advancing the science and art of range management.

Dr. Barbara Allen-Diaz

Dr. Allen-Diaz exemplifies the qualities of a faculty member in a land grant institution. She is committed to developing and conducting a research program that addresses the problems and concerns of the people of California. Not content with simply solving problems she has also been active in sharing her research results with ranchers, land managers, wildlife enthusiasts, conservationists and her fellow scientists. Building upon her experience in oak woodland and montane meadow ecology she has made significant contributions to the management of California's annual grasslands. Her expertise and reputation for objectivity has led her to be named team leader for the Sierra Ecosystem Assessment project and as a member of the National Research Council's review committee on large ungulate grazing in Yellowstone National Park.

Dr. Allen-Diaz's ability to synthesize and analyze information from a variety of sources has made her an effective teacher in whether in the classroom or as a specialist in outreach and continuing education efforts. She has published articles in the *Journal of Range Management, Ecological Applications, the Journal of Soil and Water Conservation* and contributed to numerous Cooperative Extension publications.

Dr. Terry Bidwell

During his tenure as Oklahoma Range Management Specialist **Dr. Terry Bidwell** has developed a reputation for outstanding leadership in the promotion of rangeland principles and the application of a conservation ethic to management issues. Unique among a variety of talents is his ability to address nontraditional audiences interested in nontraditional uses of rangelands. A brief sampling of his instructional efforts over the last 10 years indicates 400 presentations to over 25,000 people, 8 journal articles, 7 proceedings and one book chapter. In addition to his publication effort he has established contacts with a broad spectrum of agencies and organizations. Through these contacts he has developed working relationships outside the sphere of most range managers. For example, he has been an invited instructor at the National Advanced Resource Technology Center and routinely works with personnel from the US Fish and Wildlife Service. Regardless of the venue Dr. Bidwell continues to communicate rangeland management principles to students and agency personnel alike.

Even though Dr. Bidwell has a 100% Cooperative Extension appointment, he contributes to Oklahoma State University's range science teaching mission. Terry routinely teaches undergraduate and graduate courses on rangeland ecology and management and is the instructor/course coordinator in three national-level programs on prescribed burning. He has also successfully completed a full revision of the National Range Judging Contest. His success as an instructor comes, in large part, from the knowledge gained through his applied research on the effects of fire on wildlife and livestock.

Dr. Wayne C. Leininger

Wayne Leininger is a strong supporter of the interactive role between research and education in the land grant university system. He has developed and maintained a series of undergraduate and graduate courses in range and natural resource management that are highly regarded by students and their employers alike. His efforts are all the more remarkable because he has advised over 30 graduate students and 100 undergraduates while delivering a high quality instruction program. Wayne's knowledge of rangeland principles and dedication to the professional development of his students is reflected in his success as the coach of the Undergraduate Range Management Exam Team since 1984. Wayne is an effective instructor because of his talents as a teacher and because of the information he shares from his own research.

Significant improvements in the understanding and management of western riparian ecosystems have resulted from Dr. Leininger's research effort. He and associates like Dr. Joseph Trlica and Gary Frazier have elucidated the avenues through which livestock grazing alters riparian vegetation, soils and hydrologic properties. This information has then been crafted into a series of management strategies that can be used to maintain riparian function under economic grazing levels. He has also provided some of the fundamental information on the linkage between grazed stubble height and sediment filtration from stream flow. All of this information has been shared with fellow researchers and land managers through the *Journal of Range Management, Rangelands*, 17 popular press articles and 7 extension publications.

Dr. Charles A. (Butch) Taylor

For over a quarter of a century **Dr. Taylor** has conducted research on a broad span of range related topics at the Sonora Research Station. Because of his recognition for the need for diverse kinds of information his research efforts have addressed topics like grazing management, range animal nutrition, wildlife management, prescribed burning and watershed management. The quality of this work has been of the highest order because of his abilities and his capacity to seek out and then foster cooperative research projects with other institutions. While Dr. Taylor's research results have been highly regarded by fellow researchers, it has been the numerous station reports and tours of the Sonora Station that have brought him the respect of Central Texas ranchers and land managers. He has extended the productivity of the Sonora Station even further during his tenure as Station Director.

During a period of declining state support Dr. Taylor was able to expand the capacity of the Sonora Station for conducting range, watershed and wildlife research by creating collaborative research opportunities and with innovative revenue generating programs, like fee hunting. The outcome of leadership and research endeavor has been the enhancement of Texas rangelands through enlightened land stewardship.

Dwight A. Tober

Dwight Tober has played a significant role in the advancement of range and pasture management programs in the Northern Great Plains. Through scientific inquiry, commensurate skills and hard work Dwight has contributed to the evaluation of 2,000 accessions of grasses, forbs, shrubs and trees for use in the Northern Great Plains. The identification of superior strains has enhanced the productivity and nutritional quality of rangeland, pastures and hayland. In addition to these benefits many of the cultivars have also proved valuable for restoration of wildlife habitat, erosion control and the protection of water quality. Recently Dwight has turned his considerable skills to the development of technologies for prairie restoration and the use of native plants for low-care landscaping. Much of Dwight's productivity has arisen from his talent for working with other scientists and land managers in cooperative research projects.

Dwight has worked with US Fish and Wildlife Service, National Park Service, North Dakota Game and Fish Department, Soil Conservation Districts, US Bureau of Reclamation, US Office of Surface Mining, US Army Corps of Engineers and Ducks Unlimited to enhance wildlife habitat, forage production, erosion control, watershed protection, wetland values and landscape aesthetics. He is widely recognized for his editorial skills and has been especially helpful in the review of agency documents, Extension Service publications, state agricultural experiment station reports and USDA-ARS publications.

Dr. Darrell Ueckert

Beginning in 1995 **Drs. Ueckert** and **McGinty** set out to develop a program that would help Texas landowners deal with brush encroachment problems in a cost-effective and environmentally safe manner. While brush control technologies had been available for a long time the majority of methods had become unacceptable because of escalating costs, urban development, reduction in land parcel size and lack of species selectivity. Limited application of brush control had increasingly negative effects on rangelands, wildlife habitat and recreational opportunities. This challenge led McGinty and Ueckert to develop a program that emphasized the use of commonly available spray application equipment that maximized worker efficiency and fostered minimal herbicide use.

Dr. Allan McGinty

Their initial efforts focused on the establishment of a series of large-scale test plots in west central Texas. Over 100 workshops/seminars were held to showcase the outcome from the demonstrations. Titled Brush Busters the program's impact was broaden through dissemination of leaflets, videos, CD-ROM and the web. Through Ueckert and McGinty's efforts over 1.5 million acres of Texas rangeland has been treated for mesquite since 1997. Mesquite reduction has saved Texas ranchers about $18 million, reduced the threat to non-target species through a 19% reduction in herbicide use and conserved between 300 and 600 billion gallons of water. The broad appeal of the Brush Brush Busters training program and the significant improvements gained through its application has led the Natural Resources Conservation Service and several major agriproducts companies to adopted the Brush Busters approach for controlling unwanted plants.

Jack and Merry Vandervalk

Jack and Merry Vandervalk share a common view of rangeland stewardship, "leave the land in a more productive state than we found it." Because of this attitude they fenced their riparian areas and established specific grazing criteria for these fragile areas 30 years before riparian grazing was an issue. While visionary in their management of riparian areas, they have not neglected the rest of their ranch. Using a combination of native range, tame pastures and flood irrigation they have made significant strides in "drought-proofing" their ranch. Their determination to operate their ranch in an environmentally friendly manner has led to recent efforts to minimize fossil fuel use and preserve trees and shrubs throughout their ranch.

The Vandervalks have shared their philosophy and experience with hundreds of ranchers, land managers and students from Alberta and Montana through their service on International Mountain Section Boards and Committees, the Foothills Forage Association and the establishment of the Stockman's Range Management Course. As a member of the 54,000-acre Waldron Ranching Co-op Jack has been instrumental in assuring that the 20,000 aums harvested from the ranch each year do not impair the sustainability of the rangeland ecosystem. While many profess a love of wild places and the people who make their living from the land, few have put their belief into action as successfully as have Jack and Merry Vandervalk. Because of their land ethic the International Section of the Society for Range Management recognized the Vandervalks in 1990 (Outstanding Rangeman) and again in 1997 (Excellence in Grazing).

Fellow

The Fellow Award is bestowed upon members of the SRM in recognition of exceptional service to the Society and its programs.

Dr. Val Jo Anderson

Dr. Val Jo Anderson is an outstanding example of why the Society of Range Management was created. As an undergraduate Dr. Anderson was encouraged to continue his professional training through involvement in the Student Conclave, the Utah State University Plant Judging Team and in the Graduate Student Presentation Competition. His dedication to his education and involvement in Utah Section affairs earned him the L.A. Stoddart Scholarship. Following completion of his PhD Dr. Anderson began to give back to the Society through service on the Student Affairs Committee, Chair of the Undergraduate Student Paper Session, President of the Utah Section and General Chairman for the Annual SRM Meeting in Salt Lake City. He has been the coach of both the Plant and URME teams at BYU since 1990. During this time his students have consistently placed as high individual competitors or been members of the top finishing teams.

Val Jo has also demonstrated how Sections and the parent SRM Society can be used to foster better understanding and management of rangelands. By working with SRM members who were employed by the US Forest Service and the Utah Division of Wildlife Resources Dr. Anderson was able to develop a cooperative investigation of cattle and elk interaction in Utah's high elevation parklands. Val Jo's professional contribution to this project earned him the Centennial Partnership Award from the Uinta National Forest.

Dr. Merwyn "Mort" Kothmann

Dr. Mort Kothmann has been active in and has provided exemplary service to the Society for Range Management since 1959. He has supported the growth of the Society through leadership roles, committee service, annual meeting organization and student recruitment for 40+ years. During the same period he has made significant contributions to the "art and science" of Range Management through quality research and the transfer of new technologies through computer software packages. While his service and research activity has been noteworthy, Dr. Kothmann's most enduring contribution to the range profession has been his long and distinguished career as a professor of range management at Texas A&M University. Ever since 1971 Dr. Kothmann has taught 1 to 2 courses each semester on topics as diverse as introductory range principles and range research methods. Most of all, his strength of character, professionalism and personal ethics have had a lasting influence on the professional careers of his undergraduate and graduate students.

Dr. Kothmann's productivity as a researcher and college professor were recognized by the Society for Range Management with an Outstanding Achievement Award in 1995.

Paul Nyren

Dr. Phil R. Ogden

Dr. E. Lamar Smith

Paul Nyren has distinguished himself as an outstanding range professional in a number of ways. As a researcher and later director at North Dakota State University's Central Grasslands Research Extension Center he has established a record of quality research and outreach education. Paul has conducted research on complementary grazing systems for the Northern Great Plains, range fertilization, interseeding, wildlife management and the use of remote sensing for determining range condition. Results from are shared annually through station field tours and the distribution of nearly 40,000 copies of *Central Grasslands Annual Review* to other land grant colleges and to researchers in Canada, Mexico, Africa, Russia and Australia. His efforts have not been confined to research and extension. He developed a grant in cooperation with the Chase Lake Foundation, the North Dakota Parks and Recreation, North Dakota Department of Transportation and the North Dakota Game and Fish Department to create a Prairie Interpretive Center. The consortium ultimately received $65,000 from the South Central Regional Council to begin the project. Paul has also served on the Board of Directors of Prairie Public Broadcasting and was instrumental in bringing cohesiveness and fiscal stability to the network.

Through his work within the Northern Great Plains Section of the SRM and hundreds of North Dakota ranchers, land managers and wildlife biologists Paul was able to develop a successful legislative initiative that infused an additional $500,000 into North Dakota rangeland research.

Through nearly fifty years of continuous professional activity **Dr. Phil Ogden** has maintained an unswerving commitment to the improvement of the range resource. Whether serving as a Range Science instructor at the University of Arizona, working with Federal land managers and permittees as a Range Extension Specialist, serving on Society of Range Management committees or providing advice and assistance on range improvement projects in Brazil, Niger, Ethiopia, Kenya, Chad and Iran, Dr. Ogden's energy and dedication to sound range management never lagged. His knowledge, skill and ethical behavior have won the respect of even his strongest critics. There has never been the slightest doubt in anyone's mind that Dr. Ogden's primary concern was the betterment of the range resource rather than the advancement of an agenda.

The elevated level of management on Arizona rangelands over the past 20 years can be attributed, in large part, to Phil's efforts as a Range Extension Specialist and his leadership roles in the Arizona Section. Dr. Ogden's productivity as a teacher and student advisor were recognized through the University of Arizona, College of Agriculture, Professor of the Year Awards in 1970 and 1993 and the Range Science Education Council's Outstanding Undergraduate Teaching Award in 1991.

Dr. Smith personifies the growth of the Society of Range Management from an under recognized, regional association of Federal land managers and ranchers to a dynamic leader in national and international natural resource issues. Enrolling as an undergraduate in Forestry and Range Management at Colorado State University in 1954 he became involved in Society affairs as Student Chapter President and as a member of the Plant Judging Team. After completion of his PhD, Lamar became the Forage and Crop Advisor for the University of Arizona's Brazilian program and eventually joined the faculty at the University of Arizona. His international experience continued with a second round of service in the Brazilian Forage and Range Project and as Visiting Scientist with CSIRO's Division of Wildlife and Rangeland Research in Australia. As Dr. Smith's professional experience grew so did his opportunities to serve the Society for Range Management.

Lamar has served the Arizona Section as President-elect, President and Past President, committee chairman, Board of Director member (3 times) and Newsletter Editor. He served on the National Range Science Education Council as Arizona's representative from 1980 to 1989 and as Chairman of the Task Group on Unity in Concepts and Terminology from 1988 to 1992. The highlight of his service to the Society came when he was elected as Second Vice-President and successfully fulfilled those responsibilities before moving on to First Vice-President and finally President in 1998. Following his tenure as President he has either chaired or co-chaired the SRM Certification Committee and Range Assessment and Monitoring Committee.

Sustained Lifetime Achievement Award

This award is presented to SRM members for long-time contributions to the art and science of range management and to the Society for Range Management.

James J. Butler

During a career that spanned seven National Forests, four regional office positions and private consulting **James Butler** has designed and directed the restoration of thousands of acres of overgrazed and degraded rangeland. Long before the concept of integrated natural resource management was promoted Jim was using a combination of prescribed burning, range renovation, reseeding, contour furrowing and intensive grazing management to slow erosion and "jump-start" ecological succession. Through open communication, empathy and sound judgment Jim successfully negotiated stocking rate reductions as high as 40% to enhance the various range renovation practices he and his teams had implemented. In today's environmentally sensitive society it is important to note that wildlife and recreationists benefited as much from his range and watershed improvement projects, as did livestock producers. In the mid 1960's Jim's range improvement experience was applied to the development and implementation of mined land reclamation standards for public lands in the West. Capitalizing on his knowledge of seedbed preparation, seeding rates and cultivar performance Jim began a successful consulting business after retirement from the Forest Service. As a consultant he developed reclamation plans for mine sites and powerline transmission corridors in Arizona, Colorado, New Mexico and Utah. Even though many of Jim's recommendations met stiff opposition, the consistent improvements in disturbed land rehabilitation and watershed condition that occurred under his stewardship won many of his opponents over to his side. His record of accomplishments prompted Forest Service leaders to bring Jim out of retirement at 73 to plan and implement a sheep grazing program to control leafy spurge in a watershed that had been badly overgrazed by cattle.

Jim Butler's long list of accomplishments is not lacking in service to the Society for Range Management. He has served as Utah Section President, on the Utah Section Board, on the organization committee for the 1984 Annual Meeting in Salt Lake City and was Chairman of the 1972 SRM Summer Tour of the Great Basin. Jim also worked closely with Joe Pechanec to erect a monument recognizing the efforts of Range Science Pioneer Arthur Sampson. Many of the professional hydrologists and range conservationists that worked for and with Jim Butler share a common belief, "He [is] a great mentor and communicator. Jim got the most out of everyone who worked him. He [is] truly a great manager."

Outstanding Young Range Professional Award

The Outstanding Young Range Professional Award was inaugurated by SRM in 1988 to recognize the promise and potential of our younger members. One of the major criteria for this important award is the age of the nominees, who must have been less than 35 years old on January 1, 2001.

Dr. William E. Fox

During the 10 years since graduation **Dr. William E. Fox** has demonstrated tremendous potential and promise as a range management professional. In this relatively short period Bill has published 7 articles, coached New Mexico State University's plant judging and URME teams, taught a college level course and worked as a practicing range management consultant. As a result of his training and graduate research experience Dr. Fox has developed and published plant identification manuals for New Mexico and the south-central US. The south-central plant ID manual is currently being used to train technicians for wetland delineation throughout the South. Coupled with his work has been broad service within the Society for Range Management. Dr. Fox has served on the Texas Section membership and county awards committees, is currently chair-elect of the Youth Activities committee and serves on the Student and Youth and Accreditation Committees for the Society for Range Management. His recent appointment as an Extension Associate with the Texas Agricultural Extension Service will give him many more opportunities to sharpen the talents and skills his has developed to date.

RSEC Undergraduate Teacher Award

Dr. Edward F. Redente

Dr. Edward F. Redente is awarded the RSEC-Teaching Award. Dr. Redente has an extraordinary record of teaching and advising undergraduate students throughout his career. His teaching and advising on a one-on-one basis has changed the lives of many students. When it comes to working with undergraduate students, Ed has "made a difference." In visits with the graduating seniors, Ed is singled out as a competent and caring teacher that has made a difference in their education and selection of a career path.

Dr. Redente's innovation in the classroom has encouraged students to get involved in the learning process motivating them to dig deeper into the subject matter. He uses unique ways to involve students in the learning process. Experimental learning is part of the tool bag he uses to reach out to students. Students recognize that he is on the cutting edge of his discipline and they want to learn with him. In addition to working with undergraduates, Ed advises many graduate students, currently 13, and makes the time to inspire each one of them as well.

Ed is a superb "team" player. He actively participates in teaching sections of other classes. When teaching a section of Principles of Rangeland Management class, Ed weaves together a variety of topics in a clear and practical way that brings reality and principles into focus. Student reactions to his participation in my class indicate that they finally see how things fit together. The lights begin to turn on.

Dr Edward Redente is a man with the highest integrity. He has always dealt with people in an open and honest way. He is a gentleman.

2001 Annual Meeting Winners

High School Youth Forum Winners

1st Place: *Joye Kreycik (Nebraska Section), and President John McLain.*

4th Place: *Abby Kirkbride (Wyoming Section), and President John McLain.*

2nd Place: *Dawn Rahn, (Nebraska Section) and President John McLain.*

5th Place: *Darcee Moldenhauer (Texas Section) and President John McLain.*

3rd Place: *Katie Johnson (Nevada Section) and President John McLain.*

4th Place Individual URME
Sandy Jimenez, photo unavailable

Undergraduate Range Management Exam Winners

Team

1st Place: *(University of Alberta) (Alphabetically) Alusia Book, Christine Boulton, Matthew Calfat, Chris Dallyn,* ***Mae Elsinger (3rd Place Individual),*** *Brent Finnestad, Linda Hunt, Jennifer Joy, Amanda Joynt, Jason Machroy, Jody Metcalfe, Billie-Sue Schattle, Chris Stefner, and President John McLain.*

2nd Place: *(University of Arizona) (Alphabetically) Rachel Meade,* ***Sandy Jimenez (4th individual, not pictured),*** *Valerie Oriol, and President John McLain.*

3rd Place: *(Brigham Young University) (Alphabetically) Brady Allred, Rick Bank, Neal Bryan, Jeff Barnham, Danae Cann, Jennifer Coleman, Megan Ferguson,* ***Libbie Noall (5th Place Individual)****, Josh Rasmussen, Tim Royer, Amber Swanson, Danny Summers, Jeff Taylor, Kevin Wright, President John McLain.*

Individual

1st Place USFS Award: *President John McLain, Kurtiss Schmidt (Texas A&M), and Ann Bartuska.*

2nd Place: *President John McLain, and Kate Hoffman (University of Idaho).*

3rd Place: *President John McLain, and Mae Elsinger (University of Alberta)..*

Team

4th Place: *(Texas A&M) (Alphabetically) Brad Britton, Stephanie Doell, Michael Margo, Kurtiss Schmidt, Theresa Swihart, and President John McLain.*

Individual

5th Place Tie Award: *President John McLain and Libbie Noall (Brigham Young University).*

5th Place: *(University of Idaho) (Alphabetically) Leslie Furgeson, Amanda Helmer,* ***Kate Hoffman (2nd Place Indiviudal)****, Carl Ruddeen and President John McLain.*

5th Place Tie Award: *President John McLain, Valerie Oriol (University of Arizona).*

Undergraduate Public Speaking Contest

1st Place Award: *President John McLain and Jenny Fleer (University of Nebraska).*

2nd Place Award: *President John McLain and Tarah Sullivan (Colorado State).*

3rd Place Award: *President John McLain and Samantha Bartling (Colorado State University).*

Range Plant Identification Winners

Team

1st Place: *(University of Alberta) (Alphabetically) Christine Boulton, Alysia Book, Matthew Calfat, Chris Dallyn,* ***Mae Elsinger (1st Place Individual),*** *Brent Finnestad, Linda Hunt, Jennifer Joy, Amanda Joynt, Jason Machroy, Jody Metcalfe,* ***Billie-Sue Schattle (5th Place Individual)****, Chris Stefner, and President John McLain.*

2ndPlace: *(University Autonoma Agraria Antonio Narro) (Alphabetically)* ***Abid Francisco Moo Cruz (Individual 2nd Place), Catauna Cerecedo Cruz (3rd Place Individual)****, Luis Villegas Ortiz, Julian Cerano Paredes, Juan M. Martinez Reyna,* ***Edgar De Anda Villarreal (Individual 4th Place),*** *and President John McLain.*

3rd Place: *(Brigham Young University) (Alphabetically) Brady Allred, Rick Baxter, Neal Bryan, Jeff Burnham, Danae Cann, Jennifer Coleman, Megan Ferguson, Libbie Noall, Josh Rasmusson, Tim Royer, Amber C. Swanson, Danny Summers, Jeff Taylor, Kevin Wright, and President John McLain.*

Individual

1st Place BLM Award: *President John McLain, Mae Elsinger (University of Alberta), and John Fend.*

2nd PlaceAward: *President John McLain, and Abid Francisco Moo Cruz (Universidad Autonoma Agraria Antonio Narro).*

3rd PlaceAward: *President John McLain, and Catalina Cruz Cerecedo (Universidad Autonoma Agraria Antonio Narro).*

Team

4th Place: *(South Dakota State University) (Alphabetically) Chris Fischer, Chris Kopp, Lindsay Maras, Troy Oldert, Brian Pavel, Monte Steinbrecher, Levi Tibbs, Mike Wooters, and President John McLain.*

5th Place: *(Utah State University) (Alphabetically) Dominic Bachman, Brant Hallows, Cindy Lu Heaton, Jared "Red" Redingtow, Josh Rydalch, Robin Wignall, Ada Williamson, and President John McLain.*

Individual

4th Place Award: *President John McLain, and Edgar Gerardo De Anda Villayreal (Universidad Autonoma Agraria Antonio Narro).*

5th Place Award: *President John McLain, and Billie–Sue Schattle (University of Alberta).*

University Student Display Contest Winners

1st Place Award: *(Utah State University) (Alphabetically) Don Bachman, Esther Benson, Sandy Long (not shown), Robin Wignall and President John McLain.*

2nd Place Award: *(Oregon State University).(Alphabetically) Jody Martz, Kristine Miller, Amanda Wright, and President John McLain.*

3rd Place Award: *(Colorado State University) (Alphabetically) Julie Allen, Samantha Bartling, Carrie Kennedy, Tara Krebs, Lydia La Belle, Yasuko Matsuoka, Amy Randell, Tarah Sullivan, and President John McLain.*

High Combined Award Winners

1st Place NRCS High Individual Award: *President John McLain, Diane Gelburd, and Mae Elsinger (University of Alberta).*

2nd Place Award: *President John McLain and Billie-Sue Schattle (University of Alberta).*

3rd Place Award: *President John McLainl and Libbie Noall (Brigham Young Univresity).*

Masonic Scholarship Winner

4th Place Award: *President John McLain and Chris Stefner (University of Alberta).*

5th Place Award: *President John McLain and Jeff Burnham (Brigham Young University).*

Masonic Scholarship Award: *President John McLain and Katie Johnson (Nevada Section).*

Graduate Student Paper Award Winners

Ph.D. category

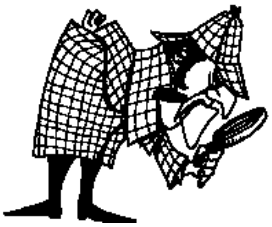
1st place: *Steven L. Petersen, Oregon State University—Classification of willow species in eastern Oregon using high-resolution aerial photography. Steven L. Petersen, Tamzen Stringham, and Andrea Laliberte.*

2nd place: *Mark S. Thorne, Colorado State University—Soil loss effects on photosynthetic rates of western wheatgrass and blue grama. Mark S. Thorne, M.J. Trlica, W.C. Lenninger, and R. Dennis Child.*

M.S. category—there is a tie for first place

1st place: *Christian J. Carleton, University of California Davis—Practical implementation of watershed calibration for the paired watershed study design.*

1st place: *Amy J. Hunt, Brigham Young University—Fecundity and genetic variability in isolated populations of Utah Juniper. Amy F. Hunt, Val J. Anderson, and Loreen Allphin-Woolstenhulme.*



Sneek A Peek at the upcoming issue of Journal of Range Management

Restoring Degraded Riparian Meadows: Biomass And Species Responses

David W. Martin And Jeanne C. Chambers

Riparian meadows in central Nevada utilized for livestock grazing, are often degraded resulting in altered species composition and decreased productivity. A 3-year study evaluated mesic meadow response to yearly nitrogen addition and clipping on grazing effects, and one-time aeration and revegetation to on restoration potential. Nitrogen addition alone and in combination with clipping increased biomass, but decreased rooting activity on these sites and may retard recovery; aeration did not affect biomass, but increased rooting activity and is a potential restoration treatment. A complexity of factors structure riparian meadows with water table significantly influencing both functional processes and recovery potential.

Comparative Rumen And Fecal Diet Microhistological Determinations Of European Mouflon

Jean-Louis Chapuis, Patrick Boussès, Benoît Pisanu And Denis Réale

Every 2–5 years there is a massive winter mortality due to shortage of European mouflon on an island of the sub-Antarctic Kerguelen archipelago. Microhistological feces and rumen analysis were compared to develop an understanding of food resource utilization in relation to the population growth dynamics. Quantitative results were similar from both methods with regard to major constituents of the diet. The microhistological analysis of feces seems thus applicable to a long-term monitoring of diet variation in the mouflon population.

Breeding Bird Responses To Juniper Woodland Expansion

Steven S. Rosenstock And Charles Van Riper III

We studied effects of juniper woodland expansion on breeding birds at 2 grassland sites in northern Arizona. Ground-nesting grassland passerines predominated in uninvaded grassland but declined dramatically with succession from grassland to juniper woodland; early successional and developing woodlands were dominated by tree-nesting and cavity-nesting species. Habitat suitability for grassland birds declined at densities of ≥10 juniper trees ha^{-1}, an approximate threshold at which restoration treatments should be considered. Restoration of juniper-invaded Southwestern grasslands will benefit grassland-obligate birds and other wildlife.

Antelope Bitterbrush Seed Production And Stand Age

Charlie D. Clements And James A. Young

Antelope bitterbrush is an important browse species to native ungulates and domestic livestock, but lack of seedling recruitment and livestock grazing on antelope bitterbrush seed production are major issues. We investigated seed production of antelope bitterbrush in grazed and ungrazed communities in California and Nevada during 1995 and 1996 using a system of seed traps to estimate seed production in relation to size, age, and grazing of various stands. Seed production was significantly greater at one ungrazed site, as this site was also significantly younger in age. Protection of older age class bitterbrush shrubs may not favor seed production.

Forage Kochia Seed Germination Response To Storage Time And Temperature

Stanley G. Kitchen And Stephen B. Monsen

Forage kochia establishment is generally poor when planted with seed stored in typical warehouse conditions. In laboratory experiments, we examined the effects of storage time and temperature on viability and cold-temperature germination rate and related results to field germination and seedling establishment. Seed germination became significantly more rapid with time in warm-temperature storage, resulting in poor seedling establishment relative to cold-stored seed. Results suggest that cold, dry storage of forage kochia seed is required to conserve viability and the delayed, asynchronous germination pattern of recently harvested seed; a pattern conducive to seedling establishment in wildland settings.

Species Composition On Reclaimed Ski Runs Compared With Unseeded Areas

Ron J. van Ommeren

Construction and reseeding of ski runs with non-native species may inhibit the re-establishment of native plants and cause the spread on non-native plants to adjacent undisturbed areas. The vegetative cover, plant species richness, and the proportion of native versus non-native species were compared between reclaimed ski runs and adjacent natural undisturbed areas. Results suggest that neither re-establishment of native species on ski runs nor invasion of non-native species on adjacent natural areas is occurring. Minimizing initial soil disturbance and preserving seed banks during ski run construction promotes the re-establishment of native plant communities.

Remote Sensing Of Redberry Juniper In The Texas Rolling Plains

J.H. Everitt, C. Yang, B.J. Racher, C.M. Britton, And M.R. Davis

Redberry juniper is a noxious shrub or small tree that is invading rangelands in northwest Texas. Techniques were developed to quantify the extent of juniper infestations using computer analysis of color-infrared aerial photographs. An accuracy assessment of the classified image had a user's accuracy of 100% and a producer's accuracy of 94%. Aerial photographs provide a record that can be stored and examined for comparative purposes at any time and provide the highest resolution and capture the spatial essence of the scene with greater fidelity than any other procedure.

Characteristics Of Nest Sites Of Northern Bobwhites In Western Oklahoma

Darrell E. Townsend II, Ronald E. Masters, Robert L. Lockmiller, David M. Leslie, Jr., Stephen J. DeMaso And Alan D. Peoples

Few scientists have analyzed cover and structural characteristics of vegetation associated with bobwhite nesting sites. In western Oklahoma nest sites were consistently associated with more structural complexity and were more concealed than random nests. However, vegetational species composition was not an important factor in determining reproductive success. Light to moderate cattle grazing usually maintains about 50% grass and 20–30% woody vegetation, which is required to sustain bobwhite populations in western Oklahoma.

Drought and Grazing III: Root Dynamics And Germinable Seed Bank

A. Hild, M. G. Karl, M. R. Haferkamp, And R. H. Heitschmidt

Few controlled field experiments have documented below-ground responses to drought and grazing. A 4-year rainout shelter experiment employed minirhizotron root counts and seedbank collections to evaluate drought and grazing influences upon plant root distribution and germinable seed bank. Roots in A horizon were impacted more by grazing and B horizon roots responded to drought while seed of cool season annual grasses accumulated following drought. Complex below-ground responses may help to explain threshold transitions following a particular sequence of climatic and management events.

Escape Protein and Weaning Effects on Calves Grazing Meadow Regrowth

Gregory P. Oardy, Don C. Adams, Terry J. Klopfenstein, Richard T. Clark And June Emerson

Protein in milk makes an important contribution to the metabolizable protein supply to the nursing calf. The effects of milk and supplemental undegraded intake protein (a source of metabolizable protein) on calf body weight gain and nutrient intake by weaned and nursing calves grazing subirrigated meadow were evaluated in the Nebraska Sandhills. For grazing calves, milk was an important source of metabolizable protein. During late lactation, milk and forage from subirrigated meadow regrowth may not provide enough metabolizable protein to support the growth potential of a young calf; therefore the calf may respond to supplemental undegraded intake protein.

Activated Charcoal And Experience Affect Intake Of Juniper By Goats

Matthew G. Bisson, Cody B. Scott And Charles A. Taylor, Jr.

Goats consume juniper, but toxic terpenoids within the plant limit intake. A series of studies were conducted to determine if dosing animals with activated charcoal would improve intake of juniper. Activated charcoal did not affect long-term juniper intake, however dosing with activated charcoal did increase redberry juniper intake during initial exposures With the goats increasing intake of juniper and apparently adapting to terpenoid levels over several days. Improving the acceptability of the plant through repeated feeding increases the likelihood of using goats as a biological control of juniper.

The Nutritive Quality Of Cholla Cactus As Affected By Burning

J.E. Sawyer, L.A. Knox, G.B. Donart, and M.K. Petersen

Alternative feeds for livestock may be required when forage availability is decreased. The quality of cholla cactus as a feed alternative was examined when spines were removed by burning or left intact. Cholla is a readily fermentable energy source with adequate crude protein to reduce or eliminate supplemental protein needs; burning slightly improved the digestibility of the cactus. Accumulation of particular minerals may require alternative management, and the high moisture content of cholla would require large amounts to be fed to achieve acceptable levels of dry matter intake.

Activity Budgets And Foraging Behavior Of Bison On Seeded Pastures

Bruce D. Rutley And Robert J. Hudsons

Wild ruminants alter their daily activity pattern in response to seasonal fluctuations in forage biomass and environmental temperature but there is little published information on annual foraging behavior and activity budgets of bison grazing seeded pasture. Forage selection and daily foraging, bedding and minor activity patterns were evaluated in northern British Columbia. Evident from changes in activity and forage selection patterns, farmed bison adjusted grazing behavior in relation to their seasonal nutritional requirements and pasture conditions. Provision of supplemental feed alters foraging behavior, therefore, managers must select a winter feeding program that is consistent with their overall management goals.

Cattle Preference for Lambert Locoweed Over White Locoweed

Michael H. Ralphs, Gary Greathouse, Anthony P. Knight, And Lynn F. James

Since Lambert locoweed matures later in the summer, cattle may continue to graze it after white locoweed matures, and thus increase the critical period of poisoning when livestock graze areas infested by both species. A season-long grazing trial was conducted in 1998, and 4 intensive grazing trials were conducted throughout the summer in 1999, to compare the relative palatability and consumption of these two species growing together. Lambert locoweed was preferred over white locoweed and grazed throughout the summer. However, the toxic locoweed alkaloid swainsonine was not detected in this population of Lambert locoweed.

Canadian Bluejoint Response to Overutilization

William B. Collins, Earl F. Becker, And Alison B. Collins

Canadian bluejoint readily monopolizes cutover or burned boreal forest and often prevents establishment of hardwood and spruce seedlings. Heavy grazing was evaluated as a means of reducing the competitive vigor of the plant to allow for enhanced germination and survival of competing hardwoods, important for browse and cover for wildlife. In wet, disclimax bluejoint stands, heavy grazing maintained the plant in an early phenologic condition with seedhead production, seed weights, and seed viability about the same as in ungrazed stands. On wet sites, heavy grazing does not adequately reduce the vigor of this grass.

Herbage Response To Precipitation In Central Alberta Boreal Grasslands

Edward W. Bork, Tamiko Thomas and Brent McDougall

Little information exists on the response of boreal grasslands to variation in inter-annual precipitation. Long-term precipitation and herbage yield data from uplands and lowland grasslands within Elk Island National Park were correlated with current and water year precipitation. Herbage yields on upland grasslands were positively and linearly related to current year precipitation while lowlands expressed a negative, curvilinear response to increasing water year precipitation. These results suggest that while uplands remain susceptible to summer drought, considerable redistribution of moisture occurs between uplands and lowlands, ultimately limiting the prediction of forage yield from precipitation data in these rangelands.

Application of Non-equilibrium Ecology To Rangeland Riparian Zones

Tamzen K. Stringham, William C. Krueger, And David R. Thomas

Recent discussions within the ecological literature support the application of the theoretical concepts of multiple steady states and alternative pathways of plant community succession within rangeland ecosystems, however, scientific data supporting the non-equilibrium model within rangeland riparian areas is lacking. We utilized the relationships between depth to water table, soil moisture content and plant communities to determine the applicability of non-equilibrium ecological theory to semi-arid riparian zones. Results indicated that a state-and-transition model based on growing season soil water attributes was appropriate for the communities contained within the study area. Empirical data are critical for the verification of proposed theory.

Browsing The Literature

Jeff Mosley

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 publisher or senior author (addresses shown in parentheses). Suggestions are welcomed and encouraged for items to include in the future issues of *Rangelands.*

Animal Ecology

Effects of predation and hunting on adult sage grouse (*Centrocercus urophasianus*) in Idaho. J.W. Connelly, A.D. Apa, R.B. Smith, and K.P. Reese. 2000. Wildlife Biology 6:227-232. (Idaho Dept. of Fish and Game, 1345 Barton Rd., Pocatello, ID 83204). Predation was the most common cause of death, accounting for 83% of deaths for adult males and 52% of deaths for adult females.

Genetic and phenotypic parameters for dietary selection of mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. *vaseyana* [Rydb] Beetle) in Rambouillet sheep. G.D. Snowder, J.W. Walker, K.L. Launchbaugh, and L.D. VanVleck. 2001. Journal of Animal Science 79:486-492. (USDA-ARS, U.S. Sheep Experiment Station, HC 62, Box 2020, Dubois, ID 83423). Sheep dietary preference for big sagebrush appears to be moderately heritable.

Geophagia in horses: A short note on 13 cases. P.D. McGreevy, L.A. Hawson, T.C. Habermann, and S.R. Cattle. 2001. Applied Animal Behaviour Science 71:119-125. (Dept. of Animal Science, Univ. of Sydney, Sydney, NSW 2006, Australia). Larger concentrations of iron and copper in the soil apparently stimulated horses to eat soil (i.e., geophagia).

Guidelines to manage sage grouse populations and their habitats. J.W. Connelly, M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Wildlife Society Bulletin 28:967-985. (Idaho Dept. of Fish and Game, 1345 Barton Rd., Pocatello, ID 83204). Presents the current sage grouse management guidelines from the Western Association of Fish and Wildlife Agencies.

Mineral content of Sonoran pronghorn forage. L.M. Fox, P.R. Krausman, M.L. Morrison, and T.H. Noon. 2000. California Fish and Game 86:159-174. (Yukon Charley Rivers Natural Preserve, P.O. Box 167, Eagle, AK 99738). Pronghorn diets appeared deficient in sodium, phosphorus, copper, zinc, and selenium in southwestern Arizona.

Mourning dove numbers on different seral communities in the Chihuahuan Desert. L. Saiwana, J.L. Holechek, R. Valdez, and M. Cardenas. 2001. Western North American Naturalist 61:50-56. (J. Holechek, Dept. of Animal and Range Sciences, New Mexico State Univ., Las Cruces, NM 88003). Grass, shrub, and shrub-grass mosaic plant communities in mid- or late-seral stages provided equally suitable habitat for mourning doves.

Grazing Management

Influences of livestock grazing on sage grouse habitat. J.L. Beck and D.L. Mitchell. 2000. Wildlife Society Bulletin 28:993-1002. (Dept. of Fish and Wildlife Resources, Univ. of Idaho, Moscow, ID 83844). "Residual grass cover following grazing is essential to conceal sage grouse nests from predators."

Performance of light vs. heavy steers grazing Plains Old World bluestem at three stocking rates. C.J. Ackerman, H.T. Purvis, G.W. Horn, S.I. Paisley, R.R. Reuter, and T.N. Bodine. 2001. Journal of Animal Science 79:493-499. (G. Horn, Dept. of Animal Science, Oklahoma State Univ., Stillwater, OK 74078). Steer weight gains were either depressed or unaffected by increasing stocking rate from light to moderate to heavy.

Improvements

Combining mowing and fall-applied herbicides to control Canada thistle (*Cirsium arvense*). K.G. Beck and J.R. Sebastian. 2000. Weed Technology 14:351-356. (Dept. of Bioagricultural Science and Pest Management, Colorado State Univ., Fort Collins, CO 80523). Mowing before spraying did not consistently improve Canada thistle control with picloram, picloram plus 2,4-D, chlorsulfuron, dicamba, or clopyralid plus 2,4-D.

Responses of photosynthesis and water relations to rainfall in the desert shrub creosote bush (*Larrea tridentata*) as influenced by municipal biosolids. S.G. Yan, C.G. Wan, R.E. Sosebee, D.B. Wester, E.B. Fish, and R.E. Zartman. 2000. Journal of Arid Environments 46:397-412. (C. Wan, Dept. of Range, Wildlife and Fisheries Management, Texas Tech Univ., Lubbock, TX 79409). Biosolids applied at high rates decreased the amount of soil water, which delayed and decreased photosynthesis after rainfall.

Smoke exposure among firefighters at prescribed burns in the Pacific Northwest. T.E. Reinhardt, R.D. Ottmar, and A. Hanneman. 2000. USDA Forest Service Research Paper PNW-526. (Publications Dept., Pacific Northwest Research Station, P.O. Box 3890, Portland, OR 97208). Some workers conducting prescribed burns were exposed to carbon monoxide and respiratory irritants that exceeded occupational exposure limits.

Management Planning

Making it work: Keys to successful collaboration in natural resource management. M.A. Schuett, S.W. Selin, and D.S. Carr. 2001. Environmental Management 27:587-593. (Division of Forestry, West Virginia Univ., P.O. Box 6125, Morgantown, WV 26506). Organizational support, personal communication, and team building were some of the keys to success identified from a study of 30 collaborative initiatives.

What is a good public participation process? Five perspectives from the public. T. Webler, S. Tuler, and R. Krueger. Environmental Management 27:435-450. (Social and Environmental Research Institute, Leverett, MA 01054). Processes for public input into environmental decisions require leadership and compromise, they need to be fair, and they need to facilitate discussion.

Plant/Animal Interactions

Defoliation-induced enhancement of total aboveground nitrogen yield of grasses. R.A. Green and J.K. Detling. 2000. Oikos 91:280-284. (1180 Town Center Dr., MS 423, Las Vegas, NV 89144). Regrazing at monthly intervals will optimize forage yield and forage nitrogen in northern mixed-grass prairie.

Distribution, movements and habitats of sage grouse (*Centrocercus urophasianus*) on the Upper Snake River Plain of Idaho. K.M. Leonard, K.P. Reese, and J.W. Connelly. 2000. Wildlife Biology 6:265-270. (Grand Canyon National Park, P.O. Box 129, Grand Canyon, AZ 86023). The major landscape change in sage grouse habitat of southeastern Idaho has been the loss of winter range, with about 60,000 acres of rangeland converted to cropland from 1975 to 1992.

Plant Ecology

Alien plant invasion in mixed-grass prairie: Effects of vegetation type and anthropogenic disturbance. D.L. Larson, P.J. Anderson, and W. Newton. 2001. Ecological Applications 11:128-141. (U.S. Geological Survey, 1987 Upper Buford Circle, Saint Paul, MN 55108). "…five of the six most abundant alien species at Theodore Roosevelt National Park had distributions unrelated to disturbance."

Effects of fire retardant chemical and fire suppressant foam on shrub steppe vegetation in northern Nevada. D.L. Larson, W.E. Newton, P.J. Anderson, and S.J. Stein. 2000. International Journal of Wildland Fire 9:115-127. (U.S. Geological Survey, 1987 Upper Buford Circle, Saint Paul, MN 55108). By the end of the growing season, green rabbitbrush, big sagebrush, and species richness were unaffected by fire retardant chemical (Phos-Chek) or fire suppressant foam (Silv-Ex).

Fire history and vegetation pattern in Mesa Verde National Park, Colorado, USA. M.L. Floyd, W.H. Romme, and D.D. Hanna. 2000. Ecological Applications 10:1666-1680. (Environmental Studies Program, Prescott College, Prescott, AZ 86301). Fire frequency and extent in the park during the last 50 years have been similar to the fire regime of the late 1800s.

Natural history and invasion of Russian olive along eastern Montana rivers. P. Lesica and S. Miles. 2001. Western North American Naturalist 61:1-10. (929 Locust, Missoula, MT 59802). Beavers preferred plains cottonwood trees to Russian olive trees, and Russian olive grew nearly three times faster than green ash, a native late-successional tree species.

Reclamation/Restoration

Summer establishment of Sonoran Desert species for revegetation of abandoned farmland using line source sprinkler irrigation. B.A. Roundy, H. Heydari, C. Watson, S.E. Smith, B. Munda, and M. Pater. 2001. Arid Land Research and Management 15:23-39. (Dept. of Botany and Range Science, 401 WIDB, Brigham Young Univ., Provo, UT 84602). Irrigating daily for 1-2 weeks after seeding (until seedlings emerge) should sustain survival of grass and shrub seedlings.

Soils

Nitrogen dynamics in perennial- and annual-dominated arid rangeland. T. Svejcar and R. Sheley. 2001. Journal of Arid Environments 47:33-46. (USDA-ARS, Eastern Oregon Agricultural Research Center, HC 71 4-51 Hwy 205, Burns, OR 97720). Soil nitrogen did not differ between native bunchgrass sites and adjacent stands that had been dominated by cheatgrass for at lea

Author is professor and extension range management specialist, Dept. of Animal and Range Sciences, Montana State Univ., Mont. 59717.

Resource Roundup

The majority of Americans believe ranching should be protected by allowing grazing on federal lands, according to a Roper Starch Worldwide "Green Gauge 2000" study on environmental attitudes and behaviors. The study found 62% of Americans feel ranching is an American heritage that should be protected by allowing grazing on public lands.

Public support for ranching may relate to concern about open space. The study found that seven in 10 Americans view the loss of farms and ranches to the development of subdivisions and malls as a serious personal issue. Only 25% don't feel this way.

Environmental kudos to The Triple U Ranch, Correctionville, IA, the national winner of the National Cattlemen's Beef Association's (NCBA) Environmental Stewardship Award. Craig, Elaine, Brad, Karen, Kirk and Barbara Utesch and their children own and run the operation, which demonstrates innovative and sound practices that protect and improve natural resources.

Regional winners also recognized for their stewardship practices were: Ritters' Farm, Joan and Greg Ritter, Glascow, KY; Gaddis Farms, Ted Kendall III, Ted Kendall IV, and Kendall Garraway; Morgan Cattle Co., Ralph and Evelyn Morgan, Chickasha, OK; Hanson Livestock Inc., Donna and Dan Hanson, Lusk, WY; Johnson Ranch, Darrell Johnson and family, Rush Valley, UT; and Cammack Ranch, Gary and Amy Cammack, Union Center, SD.

This was the 10th annual Environmental Stewardship Award presented by NCBA. The award is sponsored by Dow AgroSciences.

After last year's wildfires, expect more weeds on rangelands. A recent study in central Utah found the amount of squarrose knapweed on rangeland nearly doubled within one year following a wildfire.

"Noxious weeds often invade and spread rapidly in response to the natural disturbance of fire," says Utah State University Extension weed specialist Steve Dewey.

Weeds to watch for after fire include: yellow starthistle, knapweeds, medusahead, dyer's woad, toadflax, thistles, hoary cress, leafy spurge and many others.

On the bright side, fire can actually help control of some weeds, Dewey says.

His research indicates treating squarrose knapweed with herbicides soon after a wildfire resulted in excellent weed control. The combination of fire followed by a herbicide application resulted in much better squarrose knapweed control than if we sprayed and had no fire, Dewey says.

In another study, knapweed control two to three seasons after a single herbicide application (Tordon + 2,4-D) averaged only 20% on non-burned land, compared to 86% on land where the application was preceded by burning, he adds.

In that same study, forage grass yields were five times greater on plots that were both burned and sprayed (2,591 kg/ha) compared to 512 kg/ha on plots that were just sprayed.

Dewey recommends land managers inspect burned areas for weeds soon after any fire. If a weed problem is noted, map where the infestations are and start control efforts promptly.

The collar prototype acts a virtual fence. It controls movement of cattle by whispering electronic versions of the commands "gee" (go right) and "haw" (go left) into the cow's ears. It also locates cows with a global positioning system antenna that receives and uses these satellite signals to apply bilateral cues. The cues not only change an animal's location but also its direction of movement. If a cow ignores all sound cues, mild electrical shocks follow.

Ranchers can program future grazing locations based on sound ecological and economic data. The cues are then given autonomously for making the change only when the cow is on the move to minimize stress.

For more information, contact Dean M. Anderson, ARS Southern Plains Range Management Research Unit, Las Cruces, NM, at 505/646-5190 or e-mail deanders@nmsu.edu.

There's more money made or lost in forage at seeding time than any other time of the year. That's because decisions made at seeding affect crop performance in year one and for the lifetime of the crop, says Surya Acharya, forage breeding researcher at the Lethbridge Research Centre.

Acharya provides these six "golden rules of forage establishment" to ensure better forage stands and productivity.

1. Choose the right crop to get the best yield. Look for the correct forage species and variety for the purpose and local conditions. For maximum hay production, pick a species with good yield, even if it has a shorter life span. For the best economic return, choose varieties that yield well for three to four years. For a long-term stand, select for good winter hardiness and disease resistance.

Under irrigation, it's important that species have high levels of disease resistance. For pasture, look for grazing tolerance. When in doubt, get advice and variety comparisons from independent forage sources.

2. Prepare the seed. Some forage crop seed (like alfalfa and cicer milkvetch) requires preparation through scarification or inoculation before planting. Legumes fix their own nitrogen but, to be effective, legume seeds should be inoculated with nitrogen-fixing bacteria. Treated seed will establish better and produce healthier plants.

3. Seed early. "Research clearly demonstrates that the earlier you seed in spring, the better the stand," says Acharya.

4. Seed pure forage stands. Don't plant cereal or canola as a companion or "nurse" crop, says Acharya. Research shows companion crops vigorously compete with the forage crop for valuable nutrients, water and sunlight.

"Even after four or five years, the effect of the companion crop shows up in reduced yield," he says. "The increased forage brings in more income by far than that from the companion crop."

5. Seed shallow. For best results, plant forage seeds at a half inch depth. Because most forage seeds are small, there's not much energy in those seeds to poke through deep profiles of soil, Acharya says. On irrigated land, irrigate the seedbed three to four days before seeding. On dry land, direct-seed or harrow the field, then cover and pack the seed well.

6. Mow the crop for weed control. Mow the forage crop when the seedlings are about 1-ft. high. This reduces competition from annual weeds and helps the crop stool out and quickly cover the ground. If weeds are mowed, herbicides should be unnecessary.

For more information contact Surya Acharya, Lethbridge Research Centre at 403/317-2277, or visit their Web site at http://res2.agr.ca/lethbridge.

"Resource Roundup" is compiled by Kindra Gordon. Contributions welcome: 952/851-4671 or kgordon@intertec.com.

Book Review

New England Forests through Time. Insights from the Harvard Forest Dioramas. By David R. Foster and John F. O'Keefe. 2000. Harvard Forest, Harvard University, Petersham, Massachusetts. Distributed by Harvard University Press, Cambridge, Massachusetts. 67p. US$9.95 paper. ISBN 0-674-00344-6.

"I can count too Ben…"
—from John Wayne's *The Sons of Katie Elder.*

Quality often eludes efficiency; those concerned with the latter generally look to the future, while seekers of the former sometimes must look to the past. In *New England Forests through Time,* David Foster and John O'Keefe examine changes in the New England landscape over the past 300 years as represented in the Harvard Forest Dioramas—minaturized, realistic, three-dimensional scenes constructed in the 1930's with funds provided by Dr. Ernest Stillman, a conservationist-philanthropist. The book consists mostly of a series of vignettes, each designed around a single diorama, showing either one in a series of landscapes over the past three centuries, or an example of a practice or activity in forest management.

The text is organized into four main parts. In Part 1, seven dioramas represent the majors stages in the landscape history of central New England, including the pre-settlement forest, homesteading, maximum clearance for agriculture, farm abandonment, old-field white pine regeneration, succession to hardwoods, and growth of a hardwood forest. The current forest landscape is then examined (with a photograph, of course, rather than a diorama), and the future of the forest is discussed briefly. Conservation issues in the history of New England forests are examined in Part 2. Here the dioramas are used to examine such matters as old-growth forests, wildlife habitat, accelerated erosion, wildfires, and prescribed fire. Forest management practices are addressed using ten dioramas in Part 3, with coverage of practices such as thinning, pruning and harvesting. Some close-up photographs of parts of some of the dioramas are included here.

The text of Parts 1–3 of *New England Forests through Time* provides a sound description of the activities portrayed in the dioramas. Continuity is less of a problem than redundancy, as if the text were edited a piece at a time without concern for slight repetition among descriptions. The photographs showing the dioramas are clear enough, but I am sure they cannot convey all of the three-dimensional splendor of the actual minature landscapes.

To fully appreciate Parts 1–3, you will need to read Part 4, *Artistry and Construction of the Dioramas*, where the reader sees how *copper* wires are soldered, wrapped, etched, and painted in remarkable detail to produce realistic hardwood trees. Seeing the *quality* in materials and construction, and the uncompromising attention to detail reminded me that many of the older educational tools, relics and buildings of forestry and range management science, from forestry camps to old books to old tools, have been lost, dispersed or abandoned, and that so much quality in materials, construction and character has been lost in the quest for efficiency, or just modernity. Like the dioramas, all of this quality often has value far exceeding its function—value in attracting students, in interesting them in traditions, in interesting them in *quality* itself. Part 4 on the artistry and construction of the dioramas will likely have some readers reexamining the earlier photographs, and will have most wishing they could see the actual dioramas, but those immaculate minature meetings of science and art had me thinking about efficiency, quality, and money well spent. I recalled the message of Robert Pirsig's *Zen and the Art of Motorcycle Maintenance*, and considered how we seem to have more of most things in the world of today, except more intrinsic *quality*.

Two years ago, I sat in a meeting to evaluate the progress of a young scientist toward tenure, and for the entire hour, not one mention was made of the *quality* of his research. Near the end of the meeting, a dispute arose concerning the number of journal papers the man had published. I watched a group of scientists doing their best impressions of university administrators pre-occupied with efficiency, pens and pencils in hand, pointing, tapping, and *counting*. Periodically, someone would announce his count, only to have it differ from another counter's count, with the result that each would *re-count*. After a couple of minutes, I commented, into a particularly intense, counting-induced void of silence, that "counting beans can certainly be difficult." The counting ended, more or less, and when I asked if it were not important that we evaluate the *quality* of the scientist's research, someone commented that he did not see himself as capable of evaluating the quality of his research, and most of the group agreed that they were not *qualified* to evaluate *quality*. Even though the research involved basic, understandable wildlife management rather than, say, *cryogenic electromagnetic theory,* I decided that I couldn't reasonably pursue the matter of *quality* with a group of scientists who were that passionately quantitative. Actually, if they couldn't evaluate quality I didn't need their help anyway, because *I can count too*.

As an introduction to the history, succession, and management of New England landscapes, but mostly as a tribute to some inspired, likely over-budget work of *quality* that was done years ago and has aged beautifully, *New England Forests through Time* is worth reading. The Depression Era individuals, behind the diorama project did not make the best use of the material. In fact using some synthetic material to enhance the visual effect of the project could develop the overall response to the projects. Today's technology of using virtual reality would be a positive enhancement and would be more cost effective, in allowing multiple views of the projects.—*David L. Scarnecchia*, Washington State University, Pullman, Washington.