By Gary Frasier

Frasier's Philosophy

How quickly time passes. With this issue we have completed 1 year of the new format for *Rangelands*. In this issue, you will find articles concerning "Small Acreage Management and Marketing Rangeland Products."

It has been a good year for the publication. We have had some excellent articles and great columns. I want to thank everyone who has contributed. It is only with good material that we can have a great publication.

I would encourage all of our readers to go back over the last 6 issues and (re)look at some of the stories. We have had stories of range management from around the world. Look at what some of the SRM Charter Members thought when they were starting the organization. See what some of the new youth members think (High School Youth Forum papers [August issue]). Look at the accomplishments of some of our members in the SRM Honor Awards (June issue). I can only say, "Thanks to all!"

What is in store for the future—2006? In the February issue, we will have articles related to "Managed Livestock Grazing." April topics will include "Fire and Wildlife." The June topics will have articles on "Wildlife." In August, we will again have an issue on "Youth." The October issue will have the theme of "Recreation." As always, throughout the year, we will have papers on other topics in each issue. We will have columns of interest such as "Listening to the Land" and "Browsing the Literature." If you have a paper topic or other item that may be of interest to the readers, pass the information on to the ***Rangelands*** **Editorial Board** or **Editor-in-Chief**.

Do you want to become more involved in the publication? It is easy. Come to the Editorial Board meeting in Vancouver on Sunday, February 12, 2006. Or if you are unable to attend the SRM Annual Meeting, send a note to the Chair of the ***Rangelands*** **Editorial Board** or **Editor-in-Chief**. Take this as an invitation to join.

Finally, let us take time to reflect on where we stand. We have a great organization. We are making progress on understanding and implementing the proper management of our natural resources. As I write this, the news of the problems in the South from Hurricane Katrina is all encompassing. This is just after the world has started to recover from the tsunami in the Indian Ocean. I reflect that we as a Nation have been relatively lucky in not having major large-scale disasters. When you look at the past, we have been lucky. More disasters will occur. Will the San Andreas Fault make a major earthquake? History tells us, "Yes." Will there be a major volcanic eruption? History tells us, "Yes." These items may not occur in our lifetime but may at some time in the future.

Will the "Global Warming" continue to increase? Geological records tell us that there have been dramatic changes in climate in the past. This is one item that rangeland management may be able to alleviate the impact to some extent. With proper management of our soil and water resources, we may be able to reduce the impact of a changing climate. The Society for Range Management is in the position to best recommend how to cope with a changing climate.

I hope everyone has a Happy Holiday Season. See you next year. ◆

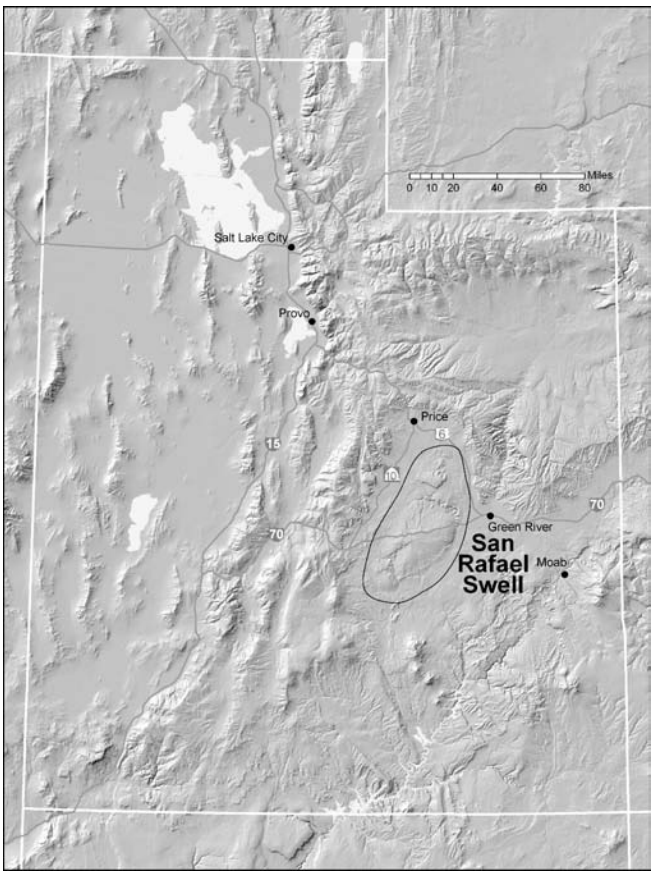
In Public Land Ranching Is the Preservation of Western Landscapes

By Jeffrey O. Durrant

In wildness is the preservation of the world.
—Henry David Thoreau

In an essay titled "Thinking Like a Mountain," former US Forest Service employee and conservation icon Aldo Leopold expresses regret for standing on a rimrock in New Mexico years earlier and gunning down a mother wolf and her cubs. He laments that he didn't know then what he believes the mountain always understood—that the mountain needed the wolf as much as the wolf needed the mountain. Without the wolf, mountain slopes became crisscrossed with deer trails and vegetation-denuded. Or as Leopold put it, "I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer."[1] Although wolves soon disappeared from the West, the notion of "thinking like a mountain" took root. Today "ecosystem" science is the rage; we talk of species and habitat interconnectedness and the need to take a holistic approach that includes the entire ecosystem—a mind-set that, among other things, led to wolf reintroduction in Yellowstone.

Current US Forest Service Chief Dale Bosworth has stated, "perhaps the most important thing we've learned is just how complex and interdependent ecosystems are."[2] The ecosystem approach has brought with it a new set of terms, among them the concept of "indicator species." As much as scientists interested in ecosystems would like to gather detailed data on numerous species, it isn't practical over large areas such as the West's vast public lands. So certain species are looked at as "indicators" of the health or proper function of an ecosystem. A central premise of indicator species is that their decline may indicate a disturbance that alters the ecosystem.



Public land ranchers are not candidates for endangered species listing and are not considered a critical ecological indicator. But they are under stress and, in some areas, fad-

ing away. Some may view this trend as a tragedy, others as a good thing. But for me, the real calamity would be in wiping out public land ranching without deep consideration of what that would mean for Western landscapes, and so, perhaps, some contemplation of them as an indicator of the trend of Western landscapes would be useful. Analogies are easily stretched thin, but they can help us carefully consider our course of action and, hopefully, provoke deeper responses and thoughtfulness. I believe we should consider carefully the future of public land ranching. Would it matter if we got rid of public land ranchers, whether by outright decree or making operations progressively more difficult until they give up? What would their demise signify about the future of Western landscapes?

A Ranching Landscape

Utah's San Rafael Swell is a million-acre upthrust of federal public land that, like much of southeastern Utah, has been carved and shaped by harsh biophysical processes into sandstone pinnacles, buttes, cliffs, washes, slot canyons, and slickrock domes. Intermixed with the spectacular, red rock formations that draw increasing numbers of climbers, hikers, campers, sightseers, and other recreationalists are rangelands where livestock have grazed since the late 1800s. Today's ranchers live in the small communities of Castle Valley to the west of the "Swell," although several ancestors' efforts to homestead the Swell are still evident in remote rustic cabins and the numerous place names that memorialize the more colorful early cowboys.

Today's San Rafael ranchers drive motorized vehicles on bumpy dirt roads that, more often than not, are a partial legacy of the uranium frenzies of the 20th century. Mixed in with the abandoned mines and decaying heavy equipment are world-class technical rock climbing areas, stock ponds, rock art sites, grazing allotment fences, and sagging gates. In recent years, Wilderness Study Area (WSA)[i] signs have blossomed, and most San Rafael grazing allotments intersect with this relatively new management designation. Multiple interviews with ranchers operating in the San Rafael Swell clearly show a plethora of views and operational adjustments resulting from interaction with WSA management policy.[ii]

The San Rafael Swell has plenty of wilderness—as one San Rafael rancher insisted, "This has been wilderness out here forever." The large "W" Wilderness, or a formal congressional designation, is another matter. On BLM land, Utah has very little, and the San Rafael Swell has none; yet, the ongoing struggle over potential BLM Wilderness designation in Utah is arguably one of the West's most contentious public land struggles.

The BLM has historically been caricatured as the "forgotten" agency or the managers of "leftover" lands nobody wanted. This characterization, although increasingly inaccurate, is readily apparent in early Wilderness advocacy efforts. The Wilderness Act of 1964 does not even mention the BLM[iii] but instead directs the other federal land management agencies to inventory their lands for possible Wilderness designation. Initial Wilderness designations, including the 9 million acres designated with the passage of the Wilderness Act, were primarily focused on relatively high-altitude rock and ice—far not only from BLM lands but also from the commodity-producing areas of other federal lands. With the passage of the Federal Lands Policy and Management Act (FLPMA) in 1976, Congress not only solidified the policy that BLM lands would be kept under federal control but determined that these lands should also be inventoried for possible Wilderness designation. In short, the forgotten lands had been found by the Wilderness movement.

In the early 1980s, the BLM conducted their first statewide review in Utah of lands possessing "Wilderness characteristics." The review process resulted in the designation of 3.2 million acres of WSAs, including 6 WSAs totaling over 260,000 acres in the San Rafael Swell. As with many federal land management agency actions, not very many people were satisfied with the outcome of the BLM process. Many individuals, often led by vocal rural political leaders, were unhappy that so much land had been "locked up." On the other side, the emerging Utah Wilderness Coalition (UWC) and like-minded supporters believed

[i] WSAs are designated by the BLM and managed to preserve the area "wilderness characteristics" until Congress (who has sole authority for Wilderness designation) acts to formally designate an area as Wilderness or release the area for other uses.

[ii] Quotes from San Rafael ranchers used in this essay are from a multiyear research project on ranching in the San Rafael Swell. For methodological detail, see Dods, N. 2003. The impact of wilderness study areas on the livelihood and way-of-life of ranchers in the San Rafael Swell [MS thesis]. Provo, UT: Department of Geography, Brigham Young University.

[iii] In large part, since in 1964, national policy was uncertain whether these lands should even remain in the public domain.

strongly that far more land should have received special designation. The UWC, led by the Southern Utah Wilderness Alliance (SUWA), conducted their own inventory and soon began aggressively promoting a proposal for 5.7 million acres of BLM Wilderness in Utah—including a substantial increase in the San Rafael Swell region. During the 1990s, both the BLM and the UWC conducted new Wilderness reviews in Utah. The BLM re-review found many additional areas outside of existing WSAs that possessed "Wilderness character," and the UWC enlarged their proposal (which over the years had been accumulating cosponsors in Congress) to more than 9 million acres. The latest UWC proposal would designate approximately 1 million acres of Wilderness in and adjacent to the San Rafael.

The Rancher's View?

Overall, attitudes toward WSA designation and management among San Rafael ranchers are very similar to the general public in southeastern Utah—some like it, some have mixed views, and many don't like it at all.[3] Many ranchers express opinions in general terms such as, "Wilderness designation would change the land use of the San Rafael Swell. I would hate to see any country go to Wilderness." However, most negative feelings toward Wilderness designation by San Rafael ranchers do not emanate from a blustery and broad philosophy but rather from specific experiences with WSA management and their belief that WSA status makes difficult ranching operations even more so—to the point of making public land ranching plainly "impractical." Top among the gripes of ranchers whose allotments in the San Rafael Swell overlap, to some extent, existing WSAs are restricted motorized access, closer scrutiny, increasing bureaucracy, and a decreasing voice in policy decision and implementation.

> *I can ride on my 4-wheeler and ride with common sense and see my cows in a matter of hours. It would take me 2 days on a horse…Let's wake up and join the twentieth century!* —Jessie May Winder, San Rafael rancher

Most rangeland is in the center of the San Rafael Swell, ringed by a remarkable jumble of red rock formations, and cattle have a bad habit of not sticking to the main roads—understandably, ranchers prefer the motorized option in tracking them down. Their ancestors may have relied on horses and wagons, but they would prefer not to do the same. They must also maintain fences and gates, and despite the arid nature of the Swell, an occasional storm through the area is likely to wash out stock ponds. Here again, ranchers prefer bringing in a backhoe rather than walking in with a few shovel-wielding friends.

> *What I'm worried about with Wilderness designation is too much red tape involved in grazing, too many forms to fill out. It's just a bunch of bureaucracy. There's plenty of that now—a lot of paper work.* —Kash Winn, San Rafael rancher

Increasing oversight and heavier management of grazing operations has been an ongoing legacy for ranchers for most of a century. In addition to enhanced expectations by the public, WSA status has added another set of guidelines to the area's management. San Rafael ranchers are apt to see the BLM as much more demanding and the general public as increasingly intolerant with their livelihoods.

> *Here a few years ago out on the Wedge, I had to haul some cows out of that canyon. We go down there the 1st of May. Anyway, we were gathering some cows down there in Red Canyon, and this guy and gal come up on their bikes—their mountain bikes. This little gal got onto me about how them cows were down there in that nice pristine country, you know, and all these cow pies all over. And I went on explaining to her that we went down there the 1st of November; we've got to have them out the 15th of April, which normally there ain't nobody in that country, and if you've been down there it's an ungodly place. She went on and on how disgusting it was and everything to have these cows out there. And I was getting a little bit upset with her. And I asked her, I says, "Ma'am, was that your van I seen parked up there by the trail by the bulge?"*
>
> *She says "Yeah."*
>
> *"Hell, I seen a barbecue out by there."*
>
> *She says "Yeah."*
>
> *"Well, what are you going to put on that barbecue tonight?" I says, "You're going to put a hamburger on there, or a steak, or what are you gonna put on there?"*

"Yeah, we're going to cook up some hamburgers when we're done riding."

And I said, "Where in the hell do you think that beef comes from? If it ain't for people like us running cows down here in this country, in the wintertime, when 5 years ago you people didn't even know it existed." I says, "You think that just comes out of the store?"

Then her husband grabs her by the arm and says, "Honey let's go." And they left.

Well, where does it come from? People don't have no comprehension. —Jessie May Winder, San Rafael rancher

Irate mountain bikers are not the only new players that public land ranchers must deal with—they see a number of new players who are demanding a say in public land management. Consequently, ranchers see their own voice diminishing. Many of the new voices are particularly concerned about Wilderness and WSAs. They want these areas managed in a way that they see as appropriate. They want sunsets and red rock, not filthy cattle. Organized environmental groups are seen by the ranchers as the biggest threat to their influence of local BLM managers.

You got a handful of people that calls themselves environmentalists that I'm sure a fair share of them got a rich daddy that gives them money to keep them out of their hair, and they got nothing else to do but cause trouble. They think they're saving the world. —Ross Hinkins, San Rafael rancher

San Rafael ranchers are not just upset about a new player in town with a different agenda, but also how these groups portray public land ranching. They fear that they can't compete for public good will when environmental groups are aggressively portraying them as "dirty cattlemen" who are destroying vast swaths of country.

San Rafael ranchers certainly see an impact, generally negative, of WSA designation and management on their grazing operations—but this is not all they see. It is a sobering reality for many ranchers that the impacts of WSAs are in many ways amplifications of broader trends in public land management and the livestock industry. For decades, ranchers held the upper hand in public land grazing policy—indeed some have argued that they held too much sway. But the pendulum has begun slowly shifting during the past 2 decades.[4] They are often quite aware and even outspoken about the broader cultural, economic, and political changes occurring around them and how these changes are affecting rural communities. For instance, the "New West" is characterized by booming industries in recreation and tourism whereas mining, grazing, and logging sag into decline.[5]

There has been a continuous cycle of up and down as far as cattle and livestock prices. Right now, they're high. I can remember a few years back they were way low. That cycle has repeated itself probably 6 or 7 times that I can remember. And to be honest with you I think it's awfully hard to make a living in the livestock business unless you're a corporate giant—some major corporation, something big. —Kash Winn, San Rafael rancher

There's still probably quite a few hobby ranchers, but probably not near as many as there used to be. Back when I was younger, there were only 3 things you could do in this county—that was coal mine or teach school or be a rancher. Since then, it has sort of diversified. We've got the power plants now. We've been hearing more and more about more power plants coming in, and the railroad coming in, and that will definitely impact the lifestyle. I've got mixed emotions about that. I don't know if that needs to be … —Archie Lee Jeffs, San Rafael rancher.

The result of these changes and uncertainties is that ranching, a difficult enterprise in the best of circumstances, is less profitable financially, and there is more anxiety about the future in ranching households. Wilderness designations, San Rafael ranchers appear to realize, only accelerate these changes—or make a possible outcome increasingly probable.

Conserving Western Landscapes

If we want to understand ourselves, We would do well to take a searching look at our landscapes—D. W. Meinig[6]

"Landscape" is an elusive term. Even the renowned geographer J. B. Jackson, who spent the better part of his career pursuing the idea, admitted "that the concept continues to elude me."[7] In June 2000, Secretary of the Interior Bruce Babbitt used the term when he created a National Landscape

Conservation System (NLCS), consisting of BLM National Monuments, National Conservation Areas, Wilderness Areas, and other protective area designations. Only 4 years earlier, Secretary Babbitt was instrumental in advising President Bill Clinton to designate the Grand Staircase–Escalante National Monument in southern Utah as the first BLM-administered National Monument. In creating the NLCS, Babbitt was hoping "that, by endowing the BLM with a high-profile conservation mission, the old bureaucratic mule will awaken to a new future as environmental steward right up there with National Park Service." Babbitt's motivation stemmed from his belief that "the characteristic BLM lands are the essential, defining landscapes of the American West."[8] It is easy to agree with his sentiments, but his conception of a landscape is less inviting. Babbitt's notion of landscape at times appears to magnify "nature" and ignore or minimize what a landscape, even in its broad and ambiguous use, most often represents—the interaction of humans and their environment. BLM landscapes are certainly cultural landscapes—they may not have many houses, office buildings, plowed fields, supermarkets, and schools, but they are chock-full of stock ponds, fences, climbing anchors, old cabins, mine shafts, hiking trails, scenic pullouts, and other evidence of a dynamic landscape shaped by past and ongoing human interaction. BLM landscapes are magnificent landscapes, and if we radically alter them, will we also lose a sense of the American West? And do the cow and rancher play an integral part?

Conserving dynamic landscapes is a tricky business, especially if we want to conserve what we see but not what created it. If BLM landscapes are the quintessential Western landscape, then public land ranching would be a primary architect. For better or worse, ranching has been around on these lands for over a century. Many areas with and without Wilderness characteristics are, in part, a product of ranching.

When a biological species is wiped out, or like the California Condor brought near extinction, I believe it is important. But what may be even more critical is how and why we wiped out or nearly wiped them out. And what that portends for the future of the ecosystem. What does it indicate about the past, present, and future condition?

I personally do not believe it is critical or even desirable to maintain public land ranching at the levels we have in the past, but I believe we should be concerned about how and why we would get rid of it. Does the BLM have a different conservation model as Secretary Babbitt hoped? Or is it just a lower-budget application of the National Park Service? If stock ponds, miles of barbed wire fencing, old gates for passengers to open, water tanks, and livestock themselves disappear from the landscape, what will replace them? Nothing? A return to native vegetation cover? Or will it be more information kiosks, curbed and guttered scenic pullouts, visitor centers and well-coifed federal employees, regulated hiking trails, expert-led interpretive field trips, and a forest of restrictive signs?

Do these landscapes know something that we have yet to realize? Will the absence of traditional public land uses, such as ranching, create mountains and rangelands different from that which we are trying to conserve? If the mountain didn't fear the howl of a wolf, should we feel we're in mortal danger from the bawl of a calf?

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Games People Play

Human Behavior and Invasive Weed Management

By Nicole Haynes McCoy and Pradyumna Amatya

Introduction

Human behavior has implications for the success of invasive weed management strategies. Invasive weeds are mobile; vegetative spread or seed dispersal ensures that infestations cross multiple property boundaries.

Public education serves an important role in combating infestations. However, education does not necessarily result in weed control efforts; education is only one component of the decisions that people make to support or engage in weed control efforts. A landowner may understand that invasive weeds are undesirable, but such understanding may not translate into active control of an infestation. The control of invasive species is a "weakest link" public good—the benefits to everyone are determined by the efforts of the weakest.[1]

Students of invasive plant management learn the biology of weeds, their impacts on ecological and economic systems, to map and monitor noxious weeds, to develop and employ integrated strategies, and the efficacy of alternative technologies. Yet, education of weed professionals is often missing a critical factor: the effect of human behavior. If this behavior—its rationale and implications—are not well understood, the success of long-term, landscape-level weed management is reduced.

This article uses principles of economic game theory to illustrate a strategic weed control game, Weakest Link Weed Management (WLWM), intended for use in the classroom. Game theory is the science of rational behavior in interactive situations; use of this construct allows students to explore how their preferences and limitations affect their actions.

This game is a tool that teaches weed scientists and managers the decision situations that individuals, land managers, and social planners confront in developing and implementing invasive weed management strategies. By using a simple game of 2 players, we present an example of how perceptions of value influence weed control decision-making. The game is appropriate for adults, regardless of their knowledge of weed management and can be played by 2 or more players.

The game addresses the following implications of human behavior in weed management:

1. The impact of information asymmetry in weed control decisions.
2. The effect of external costs on potential payoffs.
3. The effectiveness of regulation.
4. The potential of negotiation.

Game Framework

When a landscape is threatened by an invasive plant infestation, each landowner on that landscape decides whether to pursue a weed management strategy on his or her property. The decision any landowner makes regarding whether or not to control an infestation depends on how that individual values the outcome of weed management when compared with the value generated by other activities. In any landowner's mind, the net value of the results of weed treatment efforts must be positive for a landowner even to consider treatment. Although this is a necessary condition, it is not sufficient to

Table 1. Player handout containing neighborhood description, role descriptions, and scorecard

Neighborhood Description

A neighborhood consisting of 7,000 acres owned by 2 separate landowners is facing an infestation of an invasive exotic weed. Each landowner must determine how he or she will react to this infestation given his or her own interests and the behavior of the neighbor. Each landowner's well-being depends on the benefit he or she receives from treating the infestation as well as the benefit he or she receives from engaging in unrelated activities. This well-being is quantified in each landowner's payoff. Keep in mind that each landowner faces a budget constraint: dollars that are used for treating weeds cannot be used on other activities and vice versa.

Landowner 1 Role Description

You are a third generation rancher with a 5,000 acre cow–calf operation. Your livestock graze the ranch for several months of the year and you recognize that healthy, weed-free rangelands result in greater weight gain and healthier livestock. Lately, though, an invasive exotic weed has been encroaching onto your lands. This weed has low palatability and nutritional benefits, and you are concerned about the implications of this weed on the financial and biological health of your operation.

Landowner 2 Role Description

You are a real estate developer who has recently purchased 2,000 acres of rangeland as an investment property. The area that you have purchased is in close proximity to growing suburbs of a major metropolitan area, and you expect to start building subdivisions in this area in the next couple of years. You have some awareness that an invasive exotic weed is encroaching on the area, but this is of little concern to you as your land value is based upon developmental potential and not on ecological health; this exotic weed has no negative effect on the value of your property. You have an obligation to your investors to maximize the revenues you gain from your real estate transactions.

Payoff Scorecard Name: Role:			**Comments**
	Treatment? Yes/No	Payoff	
Round 1			
Round 2			
Round 3			
Round 4			
Total payoff			

guarantee that treatment will occur. If a landowner perceives his or her utility (well-being) to be greater by not controlling weeds, weed control will not occur.

As weed infestations are mobile, weed treatment decisions made on one property can affect the well-being of a neighboring property owner. If one landowner does not control his or her weeds, that can impose an additional cost on a neighboring property owner, whose lands are being reinfested from the nearby seed source. As a result, to maintain the same weed control benefits, more of the neighbor's budget must be allocated to weed control and less can go to other uses.

A person's wealth can be used to combat invasive weeds to generate or protect a value, or it can be allocated to purchase a breadth of other goods and services such as recreation, education, or groceries. If the price of weed control increases without a commensurate increase in value, less may be purchased.

In the WLWM game, 2 landowners occupy a landscape with an invasive weed problem. One landowner's utility is not affected by his or her neighbor. However, the other landowner's well-being is subject to the actions of the first property owner. The unaffected landowner has a dominant strategy not to treat the weeds; that strategy is costly to the neighbor.

The game was tested in 4 different courses (80 participants total) at Utah State University in the spring of 2005. Participants included undergraduates (freshmen through seniors), graduate students, and faculty. In general, under-

graduate participants had a limited knowledge of invasive plants; graduate students and faculty possessed more comprehensive knowledge of invasive weed problems. Our in-class trials provide insight for what other educators may experience when conducting the game. This article presents an abbreviated version of the game instructions with classroom discussion. Complete instructions are available at http://www.cnr.usu.edu/faculty/nmccoy.

WLWM Game Instructions

There are 2 roles in this game: 1) Rancher and 2) Developer. The instructor pairs participants and assigns each the role of Rancher or Developer; some pairs should be made up of 2 ranchers or 2 developers, and some pairs should have one of each.

The instructor gives each participant the neighborhood description, both role descriptions, and a scorecard, as shown in Table 1. Each participant should be told that their partner *may* be either a rancher or a developer, but for the time being, each person should keep his or her identity and payoff confidential. Each participant is provided the payoff scenario associated with their assigned role (Table 2). The payoff amounts selected are designed to provide incentives for participation while remaining affordable for the instructor.

Game Play

Round 1: Information Asymmetry and Dominant Strategy

As the round begins, participants are reminded that, in this game, their dollar payoff amount represents their overall well-being and that their objective is to maximize individual earnings. In this round, each partner's decision whether or not to treat their own infestation must be made simultaneously.

Participants record their first-round play (treatment or no treatment), and all players reveal their roles to their partners. Possible payoffs for all 3 pair-types are shown in the matrices of Table 3A–C (the developer's payoff is listed first, the rancher's is second); players can be shown these matrices after the first round. Participants should record their individual

Table 2. Player handout containing payoff scenarios; each player receives only the scenario that corresponds to his or her assigned role

Landowner 1 (Rancher) Payoff Scenarios

There are 4 possible scenarios that you may encounter:

1. Both you and your neighbor treat the infestation on your respective lands. For you, this is an ideal situation. You can get a handle on your own weed problem, and you won't be facing a reinfestation from your neighbor's lands. You can devote your budget to eradicating this infestation and then use the money you save from not having to treat the infestation over the ensuing years on other activities (eg, invest it in the stock market). As this is an ideal situation for you, you will enjoy the maximum payoff of $0.40 under this scenario.
2. You treat your weeds, but your neighbor does not treat his or her weeds. This is a highly undesirable outcome for you. Because your neighbor fails to treat his or her weeds, no matter what you do, you face reinfestation from your neighbor's lands over the long term. As a result, the long-term costs of treatment exceed the long-term benefits. You will have spent money that could have been used in an alternative, and more productive, fashion (eg, invested in the stock market). Your payoff under this scenario will be -$0.10.
3. You do not treat your weeds, but your neighbor does treat his or her weeds. Even if you do nothing, you will receive some benefit from your neighbor's actions because the infestation of the weed onto your property will slow as a result. You can use the money you don't spend on weed treatment to invest in the stock market or take the family to Disney World, even though your livestock productivity starts to fall because the weed infestation worsens. Your payoff under this scenario is $0.20.
4. You do not treat your weeds, and your neighbor also does not treat his or her weeds. If you do not treat your weeds, you can still devote your entire budget to other activities. However, while your family is at Disney World or watching its stock portfolio grow, your rangeland is rapidly becoming infested, and your livestock productivity decreases quicker than in scenario #3. As a result, your payoff will be $0.10.

Landowner 2 (Developer) Payoff Scenarios

There are only 2 scenarios that you face:

1. You do not treat your weeds. Your payoff is not dependent on the actions of your neighbor; treating weeds involves a cost that would not be recouped when the land is developed. As a result you are indifferent to what your neighbor does with his or her own weeds. You plan on using your full budget to create realizable value for your investors: utility infrastructure, access, and marketing. If you do not treat your weeds, your payoff will be $0.40.
2. You treat your weeds. If you treat your weeds, the outcome, according to the scenario defined above, will be undesirable. Your payoff can only be negatively affected by treating your weeds; for you, there is no benefit of weed treatment, and if you use your budget to combat the infestation, that is money that could have been otherwise used to add real value to your property (eg, utility infrastructure). If you treat your weeds, your payoff is -$0.10.

Table 3. Payoff matrix for rounds 1 and 2; the payoff for the row is listed first; the instructor pays each participant the amount he or she earns; negative payoffs mean a participant must pay the instructor

A.

		Rancher	
		Treat	**No Treat**
Developer	**Treat**	-$0.10, $0.40	-$0.10, $0.20
	No Treat	$0.40, -$0.10	$0.40, $0.10

B.

		Rancher	
		Treat	**No Treat**
Rancher	**Treat**	$0.40, $0.40	-$0.10, $0.20
	No Treat	$0.20, -$0.10	$0.10, $0.10

C.

		Developer	
		Treat	**No Treat**
Developer	**Treat**	-$0.10, -$0.10	-$0.10, $0.40
	No Treat	$0.40, -$0.10	$0.40, $0.40

payoffs on their scorecards. There is no discussion between rounds 1 and 2.

There are 2 sources of uncertainty present in round 1: first, the role of the "neighbor," and second, the payoff a neighbor (and hence the player themselves) receives from alternative actions. This uncertainty leads to information asymmetry; one party knows more than the other. In this case, developers know that their payoffs are unaffected by the actions of their neighbors, and ranchers know that their payoffs are affected by their partners.

Developers have a distinct advantage in this round because they know how they will fare regardless of their partners' play. This illustrates the presence of a dominant strategy—a rational developer will always choose not to treat the weeds. Therefore, the outcome of the developer–developer pairs should result in both parties maximizing their payoffs.

In the rancher–developer pairing, the outcome should be in the bottom row of Table 3A, reflecting the no treatment option employed by the developer. The payoff for the rancher depends on whether or not he or she decided to treat. This illustrates a further information asymmetry: simultaneous decision-making ensures that the rancher does not possess all of the information that he or she needs to make a decision that will result in a positive payoff.

The rancher–rancher pairing illustrates what is known as a prisoner's dilemma problem. Both ranchers maximize their payoffs if they both treat their weeds. However, there is an element of uncertainty present in this problem because neither rancher knows whether his or her partner is a rancher. If ranchers suspect that their neighbors are developers, they may decide not to treat for fear of losing money.

Round 2: Complete Information and External Costs

Using the information learned from round 1, players again decide whether or not to treat; simultaneous decision-making is not necessary, but discussion between partners is not allowed.

The expected outcome of this round should be identical for the developer–developer pairing (each partner earns $0.40). In the absence of uncertainty, the rancher–rancher pairing should yield a result in which both players maximized their payoffs by treating their weeds. The rancher–developer pairing should have resulted in both parties deciding not to treat their weeds, with an outcome for the developer ($0.40) being greater than that for the rancher ($0.10).

Discussion of Rounds 1 and 2

This discussion period is used to explore the behaviors that were observed during the first 2 rounds. The instructor may raise the following questions:

- Is this game fair?
- What was the impact of information asymmetry on ranchers?
- Did player behaviors change from the first to the second round and why?
- Did any developers decide to treat their weeds in either round 1 or 2? What makes these developers "different"

Table 4. Potential payoffs under regulation scenario; the new payoff amounts provide a strong incentive for both participants to treat their weeds

A.

		Rancher	
		Treat	**No Treat**
Developer	**Treat**	-$0.10, $0.40	-$0.10, -$0.20
	No Treat	-$0.20, -$0.10	-$0.20, -$0.20

B.

		Rancher	
		Treat	**No Treat**
Rancher	**Treat**	$0.40, $0.40	-$0.10, -$0.20
	No Treat	-$0.20, -$0.10	-$0.20, -$0.20

C.

		Developer	
		Treat	**No Treat**
Developer	**Treat**	-$0.10, -$0.10	-$0.10, -$0.20
	No Treat	-$0.20, -$0.10	-$0.20, -$0.20

from the developer described in the role description?

- If the entire class represents the landscape vs just 2 landowners, what is the status of invasive weed management?

Participants may grumble that the game is not fair. Information asymmetry dictates that one participant knows more than the other and, therefore, has a better likelihood of achieving an optimal outcome. The instructor may remind the students that the game is intended to simulate real-world situations, which are often "unfair."

Many ranchers will lose money in the first round. In our experiments, results from the first round showed that 85% of all ranchers treated their weeds. Asked why they risked a negative payoff that could result from their partner being a developer, many ranchers responded that they trusted that their neighbors would treat their weeds, regardless of their partners' role. Although both partners possessed both role descriptions, their ignorance of their partners' role and payoff matrix and the relatively small loss resulting from a suboptimal decision led an overwhelming majority to treat their weeds.

Once the pairs learned who their neighbors were, their behavior adjusted accordingly. In the second round, only 8.7% of ranchers in rancher–developer pairs elected to treat their weeds, whereas 100% of rancher–rancher pairs treated their weeds. Ranchers who treated their weeds and lost money stated that they believed that weeds were undesirable and were, therefore, treating weeds "on principle."

Nine percent of developers treated their weeds, earning a negative payoff. These developers maintained that they knew weeds were bad and that they believed their "true" payoff would be greater than what was specified by the game. In all cases, the rancher saw the developer's choice and responded accordingly, resulting in a (-$0.10 and $0.40) payoff for the developer and rancher, respectively.

Participants may raise the issue that, in the real world, invasive weed infestations would not stop at the boundaries of a 7,000-acre landscape. The instructor should ask the students what would happen if their entire class represented the landscape at risk of invasion. If the game was changed so that any landowner's payoff would be negative if just one other landowner failed to treat his or her invasive plants, it would provide a strong disincentive for anyone to manage his or her weeds.

Successful landscape-level weed treatment programs must acknowledge that payoffs are critical in decision-making. The payoff from not treating weeds must be less than the payoff earned from weed management. One way this can be achieved is to enact a penalty for not treating weeds, thereby reducing the no-treatment payoff.

Before the next round, the students and instructor should create a new matrix that reflects the lowered payoffs resulting from noncompliance and in which the equilibrium outcome has both parties treating their weeds. The amount of the penalty doesn't matter, as long as the dominant strategy for both parties is to treat their weeds. Table 4 shows an option in which a penalty for not treating weeds reduces both payoffs to -$0.20.

Table 5. Potential outcomes from negotiation: (A) shows an outcome where the rancher treats the developer's weeds at no cost to the developer but some cost to the rancher (row 1, column 1), and (B) shows an outcome where the developer compensates the rancher because he or she does not treat the weeds (row 1, column 1)

A.

		Rancher	
		Treat	**No Treat**
Developer	**Treat**	**$0.40, $0.30**	$0.10, $0.20
	No Treat	$0.40, -$0.10	$0.40, $0.10

B.

		Rancher	
		Treat	**No Treat**
Developer	**Treat**	$0.00, $0.40	$0.00, $0.20
	No Treat	**$0.30, $0.30**	$0.30, $0.20

Round 3: Regulation

Using the new payoff matrix, the pairs should play a third round. The expected result is that all treat their weeds. The ranchers earn $0.40 and the developers lose $0.10, which is less than what they would have to pay if they did not treat their weeds.

Classroom Discussion of Round 3

Although regulation has achieved a desirable outcome in which invasive weeds are now treated, the instructor will likely hear grumbling from half of the class. Whereas ranchers continue to earn money, the developers lose money.

Developers may be frustrated with an outcome that costs them. This is an ideal place for the instructor to introduce the effectiveness of regulation. A significant problem on many rangelands is that their size and scope prevents regulatory authorities from effective enforcement. If individuals don't believe enforcement will be carried out, they are unlikely to continue with an activity that is perceived as resulting in a negative payoff.

Round 4: Negotiation

For the last round of the game, all participants should be organized into developer–rancher pairs. They are told that there is no regulatory authority available to enforce weed treatment efforts. However, the pairs are free to discuss their respective situations and negotiate an outcome. Two possible outcomes include: 1) ranchers agree to treat developers' lands in addition to their own, and 2) developers don't treat their lands but compensate ranchers for losses or increased treatment costs.

Although it is not cost-effective for ranchers to treat their lands if developers do nothing and allow their weeds to spread, it may be cost-effective for ranchers to offer to treat the developers' lands. The payoff for the ranchers under this scenario is somewhat less than if the developers treat their own lands, but it is more than if the ranchers treat their lands but the developers do not. As long as a rancher's payoff is greater than or equal to $0.20, the new solution will be optimal for both players. Developers maintain their payoffs ($0.40) because they are indifferent to whether or not their weeds are treated. One suggested payoff matrix is shown in Table 5A.

In the second scenario, the developer recognizes that by allowing weeds to spread onto his or her neighbor's property, an external cost is being created. Although the developer does not suffer the financial implications of this cost, he or she may be concerned about the social cost of his or her behavior. The rancher and the developer are able to agree that the developer will pay the rancher a sum that compensates the rancher for the external cost (Table 5B). The rancher is free to use that sum to combat the ongoing weed problem, or he or she may decide to invest the sum in another endeavor.

Discussion of Round 4

In all of our classroom trials, students were able to negotiate an outcome that was desirable for both neighbors. Although most of the outcomes from our trials followed the model of those presented above, a couple of interesting variations arose in one of the graduate classes. In one pair, the rancher agreed to treat the developer's weeds if the developer gave the rancher access to his forage while the land remained undeveloped. This allowed the rancher to recoup the costs of treating the developer's land. In another pair, the rancher threatened the developer into treating his own weeds. The rancher, knowing that the developer wished to create a subdivision in the area, stated that she would start a pig farm on her ranchland if the developer did not comply. The developer realized that his payoff from not treating his weeds would be reduced significantly in the presence of a pig farm and, therefore, agreed to treat his weeds.

It is useful to ask the participants how they were able to negotiate a desirable outcome. Many cite the fact that "they know each other." People who play this game have often spent

days or even weeks getting to know each other inside a classroom. This may create an implied social contract. Students who are in close proximity, in either space or time, may suffer social ramifications of not "getting along" with each other.

In classes where this game is conducted, participants may be aware of, and concerned with, invasive exotic plants. As a result, any student whose role is a developer will have a greater understanding of, and education about, the invasive weed problem than the "developer" character they were assigned. The combination of education and a social contract can change a developer's internal payoff structure, even when he or she is ostensibly losing money.

Some participants may be more likely to negotiate because the payoff losses from negotiation are relatively small. A developer or rancher who gives up one dime loses very little compared with the loss of thousands of dollars or a livelihood. As the stakes of the game increase, negotiations become more complex. Nevertheless, as people have more to lose, they may be more willing to seek mutually beneficial ways to address the problem.

Cases may arise in which a negotiated outcome does not occur. In fact, this result happens quite often in the "real world." This is the heart of the social problem in weed management. In a patchwork landscape comprised of landowners who don't all know one another, who may or may not be present in the landscape, who face different incentives in a climate of ineffective regulation, it is almost inevitable that weed infestations will be undertreated.

Discussion

Ultimately, the invasive weed problem is a human predicament. For some landowners, invasive weeds may not be undesirable. This attitude may arise from a lack of education (if it is green it must be good), but, just as important, the belief may be real. In the WLWM game, the value of the developer's investment was unaffected by the presence of an invasive plant. This raises the question of why invasive weeds are considered "bad." Invasive weed infestations result in many negative ecological consequences. Yet, these consequences are only undesirable if our well-being is reduced by these implications. For the developer, that was not the case.

Regulation is one means of internalizing the external cost of invasive weed spread. Most states have regulations requiring landowners to treat noxious weeds, and if weeds are not treated, landowners can be either fined or billed for weed control conducted on their behalf. The United States has over 1.8 billion acres of rangeland in both public and private tenure; enforcement of regulations on that large of an acreage is next to impossible.

The value of weed treatment efforts is not limited to how the land is being used (eg, ranching vs development). The value a landowner places on weed treatment efforts may be impacted by how he or she is perceived by neighbors. Landowners who have close community ties may be more inclined to engage in weed treatment efforts, even when they perceive the direct value to be low because the social value of engaging in activities that benefit (or, at least, do not harm) the neighbors may be significant.

Negotiation can be an effective means of internalizing externalities if landowners are willing to come to the table. As the number of landowners in a landscape increases, negotiated outcomes become more and more difficult. Nevertheless, they are possible. In a recent study, we found that voluntary coalitions comprised of public and private landowners and private citizens were effective in managing invasive plant infestations in the southwest United States.

The WLWM allows weed managers to experience and discuss the complexity of human behavior and its implications for invasive plant management. After all, ultimately, the efforts of these landowners collectively influence the severity and outcome of invasive plant infestations.

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Community-Based Rangeland Planning on the Tohono O'odham Nation

By John U. Hays, Jr, Maria E. Fernandez-Gimenez, and the Sif Oidak Livestock Committee

Cattle have been part of Tohono O'odham culture for over 300 years, but efforts to promote rangeland management on the Tohono O'odham Nation had little success until a community-based rangeland planning project in the Sif Oidak District helped increase understanding of this unique socioecological system and empowered villages to restore and manage their rangelands.

Living with Livestock in the Sonoran Desert

The Tohono O'odham Nation is an American Indian reservation that covers 2.8 million acres of Sonoran Desert grasslands and shrublands in south central Arizona and is divided into 11 political districts, originally designated as grazing districts in 1934. The Sif Oidak District spans more than 420,000 acres of Sonoran desertscrub and is located at the northern end of the reservation. This vast area of open range (Photo 1), unfenced except for its boundaries, receives an average of 8.3 inches of precipitation annually. The Tohono O'odham people have lived with cattle since the late 1600s, beginning with the arrival of Spanish missionaries. Since that time, cattle and horses have played a major role in O'odham society. When livestock were abandoned by the missions in the 1700s, O'odham people hunted them as wild game. Later, in the 1860s, the Tohono O'odham began to domesticate these feral herds of cattle, employing skills learned while working on neighboring ranches in Mexico and the United States.[1] Mixing these new skills with their own social values, which emphasize community and extended family over individual advancement, and generosity rather than accumulation, a unique system of communal livestock management emerged.[2]

Photo 1. The Sif Oidak landscape.

Sif Oidak's rangelands are divided by "invisible boundaries" that separate the customary grazing areas of the district's 9 villages. These boundaries are flexible and change depending on the particular year's forage production, availability of water, and arrangements made between villages.[3] Village livestock representatives (or "reps" as they are called in Sif Oidak) are elected by each of the villages to oversee the livestock that carry brands registered in their village. They are also responsible for organizing multivillage roundups and representing their village's interests in neighboring village roundups. The livestock representatives also meet monthly as members of the Sif Oidak Livestock Committee (SOLC) to plan for roundups, approve new brands, and address issues related to livestock management in their district.

In the beginning of the 20th century, the Tohono O'odham Nation's rangelands suffered heavy degradation from a combi-

nation of overstocking and extreme droughts.[4] In response to the degradation and decline in productivity of rangelands on the reservation, federal agents attempted to implement various range improvements and grazing plans. These well-intentioned efforts frequently neglected to include the direct participation of livestock owners and other community members during the planning phase, and, as a result, most range management programs met with strong resistance.[5,6]

Origins of the Sif Oidak Community-Based Planning Project

In January 2001, the SOLC volunteered to participate in a pilot rangeland management planning project proposed by the Tohono O'odham Coordinated Resource Management Planning group. The SOLC joined this project for 3 major reasons. First, it wanted to increase its members' understanding of the district's rangelands and of rangeland planning and management. Second, SOLC members were interested in continuing to be the principal managers of their own rangelands. Federal legislation in the mid-1990s mandated that tribes develop and implement grazing regulations. By developing a district rangeland management plan through a community-based planning process, SOLC members hoped to demonstrate their ability to manage grazing in their district and influence forthcoming tribal grazing regulations, preempting outside interference in local affairs. Third, the SOLC wanted to access technical assistance and cost-share programs from the tribe's newly formed Rangeland Conservation and Management Program (RCMP) and the Natural Resources Conservation Service's (NRCS) Environmental Quality Incentive Program (EQIP). Both programs required a management plan as a condition of assistance. The project was facilitated by the University of Arizona Cooperative Extension, with support from the RCMP, the Sells, Arizona, NRCS Field Office, and the Tohono O'odham Soil and Water Conservation District. The most important participants, and those who made and continue to make the decisions, were the SOLC members and their respective communities.

Two facets of the project distinguish it from past rangeland planning attempts on the Tohono O'odham Nation. First, the project was directed by the village livestock representatives. Changes to current management are decided on by the livestock committee only after consensus has been reached within each representative's village and among the committee's members. Second, the community-based planning process was grounded on building a knowledge base that community members can draw on when making management decisions. This knowledge base was developed through educational workshops, field trips, invited speakers, and participatory mapping and inventory of the district's rangelands.

The Community-Based Planning Process

The SOLC and facilitators (the lead authors of this article) met monthly for 2.5 years. The planning meetings were open to any interested community members, and, occasionally, guests from other districts attended and observed. The first several months were dedicated to identifying and discussing key rangeland and livestock management issues in the district. Through this process, the group identified both long-term goals and short-term objectives that could be addressed through management actions. Because the group had limited financial resources, it gave priority to objectives that would have the greatest positive impact on other management issues in the district.

Once key management objectives and concerns were identified, the SOLC representatives and facilitators worked together to produce a geographic information system (GIS) map of the district identifying conservation action sites—sites where the identified threats and opportunities were greatest. The map also documented existing infrastructure and livestock movement patterns. To develop the map, the facilitators and NRCS staff met with community members and livestock representatives from each village individually to visit their village rangelands and record their livestock management practices, resource concerns, and management opportunities.

SOLC members also identified gaps in their knowledge and sought specific information they needed to make management decisions. A knowledge base was built through the monthly meetings, guest speakers, field trips, and hands-on workshops on topics such as rangeland ecology and health, revegetation and reseeding, and grazing and drought management. Through this self-education process, the facilitators discovered that very little rangeland science literature addressed rangeland management for 8-inch precipitation zones in the Sonoran Desert. Even less information was available (at least from the United States) about managing livestock under a multivillage, communal land tenure system in which livestock are primarily used for subsistence (rather than produced commercially). Because of the unique ecological and cultural context of livestock management in Sif Oidak, the group critically evaluated the relevance and applicability of all information and recommendations it received. The need for site-specific information to guide management eventually led to an MS thesis research project by one of the facilitators (John U. Hays, Jr), which assessed the relationship between grazing intensity

Community-Based Natural Resource Management

Community-based natural resource management (CBNRM) promotes the direct involvement of local resource users in natural resource planning and management. Advocates of CBNRM believe that local people are more likely to implement beneficial management practices and policies if they participate directly in designing them and that management decisions are based on better and more complete information when local people's knowledge and needs are considered.

Photo 2. Educational workshops like this one on ecological sites and rangeland health were a key part of the community-based planning process. Workshops involved local community members as presenters and brought in outside experts in rangeland science and management.

and the density of perennial forage grasses on upland sites in the district and documented historic and current uses and management of livestock in Sif Oidak.[3] The demand for more workshops and educational materials about local rangeland ecology and management led to a successful spin-off project, funded by the US Department of Agriculture (USDA), Western Sustainable Agriculture Research and Education program (WSARE), to develop and implement a rangeland curriculum for the Tohono O'odham Nation.

Gaining Broad Community Support

Throughout the planning process, the village livestock representatives kept other district residents informed about the project. They took information and ideas back to their villages, and the SOLC made quarterly presentations to the Sif Oidak District Council, the local elected government. To participate in the NRCS EQIP program, cooperators are required to show that they have "control" of the management area. This requirement presents special challenges on Indian reservations because individuals cannot own Indian Trust Land, and, in the Tohono O'odham Nation, land is held and used in common by all district residents. To meet EQIP requirements, control was defined as written approval by the community to participate in the cost-share agreement in a given area. Encouraging participation and maintaining open communication with all district members from the start helped the project gain support both at the village level and from the district council (Photo 2). The district council even created a rotating loan fund, making a temporary loan to a village to initiate the cost-share work. This seed money was then returned to the district and used in another village. Without early and consistent communication and broad participation, village and council support for the planning project might not have been as strong. In this consensus-based society, where local decisions still hold the greatest sway, the project could not have progressed and succeeded without village and district council backing.

Tangible Outcomes

One tangible outcome of this project is a formal, written rangeland management plan. The written plan provides a synthesis and analysis of the major rangeland and livestock management issues in Sif Oidak and presents management alternatives and recommendations developed and discussed throughout the planning meetings. It incorporates maps that portray specific resource concerns, such as areas of accelerated erosion and regions that lack reliable water developments, and includes ecological inventory information and baseline data. Because of the challenges of communal tenure, the sometimes disputed "invisible boundaries" between village ranges, and unresolved issues over how to allocate unbranded stock during roundups, the plan is not prescriptive. Instead, it presents a detailed description and analysis of the current situation and proposes and evaluates several different strategies that individual villages might take to improve livestock and rangeland management. The plan thus respects the decision-making autonomy of each village and provides options for village-level management while stressing the need for continued dialogue to resolve district-wide tensions over key issues.

Although the plan does not lay out detailed management actions for the entire district, it defines the issues and presents viable solutions that individual villages may choose to follow. The planning process served as a catalyst, inspiring several villages to develop their own, more specific management plans and to participate in the EQIP program (Photo 3). One village identified a large, low-lying area of clay soils prone to periodic flooding as a key resource area and fenced the area with the help of the NRCS. The area currently is resting, and the bottom will be used in a rotational grazing system. Another village targeted a large saltbush (*Atriplex canescens*) community as an emergency drought reserve, rehabilitated an adjacent water source, and is now in the process of fencing the area so that it can rest during the

Photo 3. Field trips to livestock associations on other parts of the reservation, such as this one to the Tres Equis Livestock Association, and to ranches off the reservation exposed participants to a variety of rangeland and livestock management strategies.

Photo 4. One of the cofacilitators of the community-based planning process assisted in a number of roundups in Sif Oidak, giving him an inside view of livestock management in the district and helping build trust between the facilitators and local livestock owners.

spring growing season. A third village is concentrating on halting erosion and increasing infiltration in the rangelands around their community by constructing dikes and improving existing structures.

Increased Knowledge, Understanding, and Cooperation

The collaboration among the NRCS, RCMP, University of Arizona Cooperative Extension, and the SOLC in this project helped to strengthen working relationships between natural resource professionals and livestock owners on the Tohono O'odham Nation and in Sif Oidak. Top-down imposition of a tribal grazing ordinance on the district would likely have encountered strong opposition from local livestock owners and led to continued distrust of tribal and federal agency involvement in resource management at the village level. Although a tribal grazing ordinance is still on the horizon, the planning project familiarized district members with the terms and concepts employed by rangeland managers, and tribal and NRCS range professionals are now more aware of the needs in the district.

Increased cooperation between livestock owners and the district council was another positive outcome from this project. Both groups worked together to overcome the challenges of navigating federal programs that assume all cooperators are private property owners. These skills will help livestock owners leverage support from their district and others to meet future objectives.

Key Learnings

- **Begin with a small, feasible project.** At the beginning of an extended project that focuses on goals that may take a long time to realize, a small, achievable task allows people to interact in a less formal environment and helps establish trust among participants and confidence in the group process.

- **Participatory mapping helped outsiders understand local realities while helping villagers learn about their resources and options.** The community mapping process empowered livestock owners to share their knowledge with agency and Cooperative Extension personnel. The village livestock representatives explained in detail the seasonal migratory habits of their cattle, locations of different plant communities, variations in forage production, and duration of water sources. They also discussed boundary issues among villages and pointed out other significant aspects of the landscape. Through the use of GIS, this information was presented back to the SOLC in the form of several different thematic maps. The maps were an excellent tool to increase the group's awareness of the landscape, facilitate decision-making, and assist the village livestock representatives in communicating and explaining their ideas to other villagers.

- **Flexibility, adaptability, trust, and understanding are more important than rigid objectives or rules.** Because of the high climatic variability of the Sif Oidak area, policies or plans that assume predictable weather patterns are ill-advised. The availability of forage and water is in continual flux, and being able to adapt to these changes as they arise is key. Developing ways to solve problems together and creating an environment where participants feel comfortable enough to freely voice their opinions is more beneficial than passing bylaws that address today's issues but are potentially irrelevant to future conditions. Creating a safe environment for participation is not easy, especially when distrust is long-standing and rooted in historic power differences within communities or between local people and outsiders, but without it, and without the dialogue it allows, community-based planning will not work.

- **Informal interactions are as important as formal planning meetings.** Initially the facilitators assumed that formal planning meetings would be an effective way for participants to share ideas and values. In reality, they learned much more about Sif Oidak livestock management and feasible management options in other settings. For example, one facilitator helped gather cattle during a number of roundups in Sif Oidak (Photo 4). Later, Sif Oidak community members helped him collect ecological data on their rangelands for his thesis research. These opportunities helped the facilitators gain a much better understanding of what the local cattle are like and how Sif Oidak livestock producers work together to gather cattle. Attending roundups gave the facilitators a chance to observe how people react in real situations, which is not always the same as the descriptions provided in meetings. Additionally, people are more willing to discuss their

viewpoints openly in smaller groups. Most of the real conversations between the facilitators and SOLC members happened in pickup trucks bouncing along dirt roads leading to remote stock tanks. These conversations helped the outsiders learn about local conditions and built trust among all participants.

- **Continued, long-term commitments are crucial for this type of project to work.** The planning process is a slow one. The key to success for this work was the sincere commitment in time and interest by all the participants. The SOLC, University of Arizona Cooperative Extension, NRCS, and RCMP all devoted long hours to the process. They also were quick to realize that many of the desired outcomes would not happen overnight and to put to rest concerns about things moving too slowly.

Conclusions

The community-based rangeland planning project in the Sif Oidak District was a success on several levels. The project forged a positive working relationship among district livestock owners, the NRCS, and the Tohono O'odham Range Conservation and Management Program—relationships that continue today. The project helped bring villages together to collectively address ecological and livestock management challenges that affect all district members. The project also strengthened the partnership between the SOLC and the Sif Oidak District Council and enhanced their problem-solving skills.

On a larger scale, the initiative shown by the Sif Oidak District through its participation in this pilot project helped contribute to a more optimistic outlook towards rangeland management on the Tohono O'odham Nation. The project was observed by other districts on the reservation, and several have requested that the process be replicated in other locations. We hope that other districts will follow Sif Oidak's lead, and that the key learnings distilled in this article will be helpful to them in embarking on their own community-based rangeland planning efforts. Although they are specific to a particular place and culture, these lessons may also provide useful insights to rangeland professionals and community members working with other Native American nations to improve the stewardship of their rangelands for future generations.

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Rangeland/Pasture Restoration

By Matt Mattox

The past several growing seasons have been tough on many ranchers. Drought has caused many of the "good" native grasses in rangeland plant communities to decline or die out. Some producers who have bermudagrass, in addition to native grass, were able to have cattle overgraze the bermudagrass while resting the native grass, keeping it from declining severely. However, many ranchers didn't have this option and now have poor native grass. Where little bluestem and indian grass once were, threeawn, tumblegrass, and silver bluestem have established, not to mention high populations of ragweed, broomweed, bitterweed, and the like.

Now the question becomes, "What do you do to turn this situation around?" The answer that immediately pops into some folks' heads is to thicken the stand or completely replant. In some cases, this may be the answer. If you asked an economist, the answer would probably be "it depends"—which always results in a few heads shaking and maybe a little dust being kicked, but I promise you they don't say it to elicit that response. As anybody in agriculture knows, this business depends on many variables such as weather, markets, cash flow, genetics, and soils. The answer to the question depends on your circumstances. It depends on how many years you can wait for your native grass to improve. It depends on how much risk you can bear in replanting a native grass stand. It depends on how many cattle you have to run to make a living. And most importantly, it depends on your management capabilities. So, before you come up with your own answer, thoroughly examine your situation. The first thing you need to know is how to identify native grasses. Qualified personnel from the Natural Resources Conservation Service (NRCS), Bureau of Land Management (BLM), County Extension service, and other agencies should be able to help you. There are some good illustrated books on the market, and for those of you with computers, the Noble Foundation's Web site has a very good native plant photographic gallery at http://www.noble.org/imagegallery/index.html.

Knowing the condition of your native grass relative to the natural potential for that particular site on your ranch is necessary. Check the grass' condition. Again, consultants can help you, or you can use the range section of your county soil survey, a book funded by your tax dollars and obtainable through your county NRCS office. If good plants represent more than 15%–20% of the area in question and are fairly well distributed, grazing management, with the proper stocking rate, can normally improve the condition of native grass. This method is often the most economical, depending on the production potential of the site and the potential for effective rainfall during the growing season.

Grazing management alone can sometimes take longer than a person is willing to wait. If good plants are scarce, consider replanting, which can be expensive whether you are planting native grass or introduced grasses such as bermudagrass. If the native grass is in poor condition, you don't want to wait several years to improve it, and wildlife use of the area is not important to you, consider planting something like bermudagrass or an Old World bluestem variety. However, many soils will not support sufficient stands of introduced grasses. So, check your county soil survey before planting introduced grasses on rangeland. If you are having trouble making a decision on replanting an area, resting it for 1 growing season, if practical, can often help you decide. Normally, seeds from good native grasses

are within a 5-yard perimeter of the parent plant. You can usually get a decent idea of the status of your seed bank within 1 year because good native grasses and seedlings will be taller and easier to see. If you do decide to replant native grass and want a successful seeding, you will need to

- Make sure the site is suitable for seeding (not too rocky, droughty, etc)
- Choose plants that are adapted to the site
- Kill weeds, and prepare as adequate a seedbed as possible (normally, this means very light tillage, if at all, in higher rainfall areas to reduce weed competition)
- Plant during theoretically optimal growing conditions
- Consider planting mixtures of species to reduce risk of planting failure
- Follow seeding rate guidelines
- Plant at proper seeding depth

Weather can make or break you, but completing these tasks as well as possible will greatly improve your chances of obtaining a good stand of native grass.

If you think your home on the range needs a little housecleaning, contact a forage or rangeland professional to discuss your situation. Better yet, the coming years may provide us with better growing conditions, and we can take "it depends" out of our vocabulary for a few years.

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Small Tract Rangelands Task Force: An Effort Begun a Decade and a Half Ago

By John Buckhouse and Angela Williams

In 1990, the SRM, under the direction of President Rex Cleary, created a Task Force to investigate and educate members and the public about small acreage, rangeland homesteads and the potentials germane thereto.

A number of individuals were involved in this project, including John Buckhouse at Oregon State University (OSU) as Chair, and current SRM President Angela Williams as a Task Force member.

The Task Force ultimately prepared 3 brochures: The first dealt with horses on small acreages and was entitled, "Why Horse Around?" It spoke to land resource and pasture values as they apply to proper horse husbandry and to land ethics. The second dealt with other livestock on small tracts of rangeland. Like the "horse" brochure, it spoke to animal husbandry and land ethics. The third was called "Other Attributes of Small Tract Rangelands." The concept here was to recognize wildlife, habitat, water, soil conservation, and esthetic considerations on one's small acreage or homestead.

It is unlikely that any of these brochures are still in circulation or are available now that 15 years have passed since the initiation and, ultimately, the sunset of this Task Force.

There were several lessons to be learned, however, and perhaps a call toward future action:

Lesson Learned:

First, it became abundantly clear as we dealt with horse owners on small acreages that most were in it for the horses and were naive or unconcerned about land issues. Most felt, apparently, that their acreage was too small to matter environmentally and were unable to see how multiple small acreages might be added together to create significant land abuse.

Second, these owners were very passionate about their animals. We got their attention when it was mentioned that an abused pasture was susceptible to poisonous and noxious weed invasion, mud problems—and, therefore, disease and hoof rot issues, and dust and irritant problems. If one could manage differently to solve these horse health issues (and incidentally prevent or resolve land stewardship issues), they were willing to listen to techniques for manure management, land drainage, irrigation, water development, pasture rotation, dust abatement, and pasture renovation.

Third, other livestock owners tended to have sheep, cattle, llamas, etc for their children's 4-H or other projects, to keep "weeds and grass down," for farmland use taxation purposes, or because they had an interest in some particular, usually exotic, species. These people, like horse owners, were hard to reach from a land ethic point of view, although there is some promise of success if one were to couple a 4-H land stewardship program with the husbandry of other animals.

Fourth, the brochure concerning other attributes, while appealing in concept, never really went anywhere—perhaps, because SRM was unsure exactly how to market it.

Call to Action:

The potential call for action is that this issue of small acreage management has not gone away. In fact, most governmental agencies now have "fragmentation," bureaucratese for urban sprawl and small acreage homesteads, as one of their top 5 challenges for the future. Perhaps, it is opportune for SRM to establish a new Small Tract Rangelands Task Force and attempt to move this important issue forward.

Coupled With This Call Is a Recurring Challenge:

We, as a professional society, need to focus on how to market our message. We have a wonderful product and concept. Yet, we frequently seem to stutter and fall when it comes to expressing this to others in a logical and compelling way. Perhaps that "way" is to commit to always "thinking within as well as outside of the box" and to recognize that we need to be responsive to both our "traditional" as well as "nontraditional" users.

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Selected Essays on Science, Rangelands, and Roles of the Society for Range Management

By Kris Havstad

We are members of a field profession. As a scientist, I am also a member of a profession based on the written word. Often, unfortunately, in writing about this field, our chosen words often reflect the perpetual nature of the environment: dry, dusty, and typically sparse. Maybe it is part of the nature of objective scientific writing. The following collection contains 4 short essays that have been written over recent years as an alternative to this more xeric verbiage. Mostly, these have been written to be buried on the 3rd page of an obscure SRM section newsletter. A few have appeared in the SRM Member Resource News. It is my impression that these essays have been read by 2 people—me, and another person who thinks I am of questionable intellect and who can't wait to read my latest rambling as further proof of his conviction, and who then shares his reasoning with me.

I have assembled these essays into a single collection here to offer an array of viewpoints for readers of *Rangelands*. These viewpoints range from perspectives on the sufficiency of our science to cultural statements expressed within a dairy parlor in China. The central thread is probably best summed as a passion for the profession occasionally tempered by a sense of humor for my minor role in that profession.

Cannibalism, Transmissible Spongiform Encephalopathy, and Rangeland Management

In the 1950s, as thoroughly described in the book "Deadly Feasts" by Richard Rhodes, Dr Carleton Gajdusek (pronounced GUY-du-shek) traveled to New Guinea and began investigating the origins of a degenerative human brain disease called kuru. Gajdusek had graduated from Harvard Medical School, studied under Linus Pauling at Cal Tech, and had worked on hepatitis, the plague, hemorrhagic fever, encephalitis, and rabies in various locations around the world. Described by Rhodes as an extremely intelligent, manically energetic, fearless, and self-centered scientist, Gajdusek began a very systematic study of this disease common to women and young children within tribal groups of reported cannibals called the Fore in remote parts of New Guinea. The symptoms of this disease mirrored those of other degenerative brain diseases and included tremors, hysteria, dementia, and eventual death. At its peak occurrence kuru was reported to have killed 1% of the population annually, mostly women and young children in kinship groups, who would have prepared deceased relatives for consumption in mortuary feasts. The agent or agents of kuru were unknown. Gajdusek began a series of studies and systematic autopsies of the Fore killed by kuru. In the late 1950s, a neuropathologist with the National Institutes of Health (NIH), Igor Klatzo, began studies of tissues collected by Gajdusek, which had been sent to labs in Maryland. Very quickly Klatzo associated kuru with brain disease cases reported in Germany by Drs Creutzfeldt and Jacobs (Creutzfeldt-Jacobs Disease, CJD) in the 1910s and 1920s. CJD was known to occur globally and was broadly diagnosed as a spongiform encephalopathy, or a disease in which the brain is characterized by a sponge-like appearance of holes. At a similar time, William (Bill) Hadlow, a veterinary pathologist based in Hamilton, Montana, and working for the NIH on Rocky Mountain spotted fever, was sent to England to study a disease of sheep called scrapie that had begun to occur in US flocks. First reported in the British Isles in 1730, scrapie-infected sheep staggered, developed tremors, and eventually died. In 1930, the disease was shown to be

infectious, but the specific agent or agents were unknown. In 1959, Hadlow became aware of Gajdusek's work on the Fore tribe and the strikingly similar brain tissue effects of kuru and the effects he had observed in scrapie-infected sheep. Hadlow and Gajdusek met late in 1959 and began a lengthy period of collaborations on these similar diseases that shared unique characteristics, including lengthy incubation periods and dementia, yet that lacked normal signs of infection such as tissue inflammation and fever. Hadlow, after returning to Montana, learned that mink also contracted a scrapie-like disease, and infected tissues transmitted that disease when fed to other mink. By the early 1960s, their activities, the seriousness of these diseases, and their merging similarities attracted other scientists including Mike Alpers, a government physician; Elizabeth Beck, a neuropathologist based in London; and Patricia Merz, a PhD student, self-taught in the skills of electron microscopy (EM). Alpers was involved in experiments that showed that tissue from kuru victims would transmit the disease to primates, Beck confirmed that the disease transmitted to primates was kuru, and Merz's high-quality EM pictures of infected brain tissues showed for the first time a possible actual agent of these transmissible spongiform encephalopathies (TSE)—twisted fibers of what was later identified as proteinaceous infected particles or prions. Though the actual agent is still not known, and may yet turn out to be a virus, tremendous progress involving this problem was made by a highly diverse group working towards a common goal. In 1976, Carleton Gajdusek was awarded the Nobel Prize in medicine for his work on kuru and TSE.

In the mid-1980s, the subject of TSEs took on a more human side. Beef cattle in Great Britain were sickened by a new degenerative brain disease that caused aggressive and nervous behavior that led to death. The media quickly labeled this "mad cow disease" but it was obviously a bovine form of spongiform encephalopathy (BSE). Subsequent research identified that infected cattle had been fed scrapie-contaminated meat and bone meal from infected and rendered sheep (or infected cattle). In the early 1990s, human deaths in Britain were reportedly caused by a variant of CJD (vCJD) at incidences above the normal and rare natural occurrence, including several young people in which, it was suspected, that the disease was caused by consumption of BSE-infected beef. The variant form of CJD was characterized more by anxiety and depression than the dementia of classic CJD, and symptoms that lingered for years rather than weeks or months. The resulting arguments among societies, cultures, governments, countries, producers, consumers, scientists, and the media primarily in Europe led to various bans, boycotts, media-promulgated scares, animal slaughter, and public confusion that still linger today.

Nearly 50 years after Gajdusek began his investigations in New Guinea, we know considerably more about the prevalence of TSEs; we understand some of the commonalities of the occurrences of similar diseases such as kuru, BSE, chronic wasting disease, and CJD; and we understand some elements of disease transmission and some characteristics of the possible agent. For example, Dr S. B. Prusiner (Nobel Prize in physiology in 1997) of the University of California at San Francisco has focused on the class of pathogens called prions, which cause neurodegenerative diseases. His lab has shown that prions can be created either spontaneously by mutation of a host protein or by exposure of the latter to prions from an exogenous source. (How exactly a protein would be infectious is still being investigated and explained.) Prions are primarily or entirely composed of a modified form of the prion protein and can multiply without a nucleic acid genome. Spongiform encephalopathies can be infectious or genetic, and in humans, sporadic CJD may occur in one in one million people. Interestingly, a recent article in *Science* (2003, 300:640–643) reported evidence that, worldwide, there has been genetic selection for a prion protein gene that has conferred relative resistance to these prion diseases during the evolution of modern humans.

We also understand that what we have learned has been the result of unlikely collaborations among scientists from highly diverse fields, that what is needed to understand this disease requires both extensive field work and highly controlled experiments, and that there is still much to be learned. But we have made progress. Earlier, in May 2003, the North American press reported a confirmed case of BSE in Canada. The overall rational response and effective containment of this outbreak illustrates the advances that have been made in the nearly 20 years since the BSE epidemic in Britain. In particular, the quality and depth of the information reported by the press has been encouraging. Although the headlines still employ the ludicrous label "mad cow disease," the content of the stories has been quite well based in current science. Two prominent examples have been columns in *USA Today* (May 21, 2003) and in *The New York Times* (May 25, 2003) that effectively reported not only on the Canadian BSE case but what has been learned from science about spongiform encephalopathies over the past 3 decades.

What a story about cannibalism and its ties to TSE, which are seemingly unrelated to range science, illustrates are a set of principles that can have direct application to today's issues engulfing rangeland management. These principles include 1) with difficult problems, we need people from many different disciplines involved (their backgrounds may be quite unrelated to each other or to specific problems); 2) solving difficult problems takes time, and solutions occur a bit at a time (we understand how TSEs are transmitted but are still not sure of the specifics of the transmitting agent); 3) relevant policies can be developed even from imperfect knowledge (such as don't feed infected meat to other animals or humans even if we don't yet know the specifics on infectious agents); 4) objectivity in the face of public perceptions and misperceptions is a formidable task (see the furor in Europe around "mad cow disease"); 5) complex topics can be effectively explained by an educated media; 6) honesty about both what we know and what we don't know is crucial (the

proactive response to the Canadian infection was partly attributable to the credibility of the science); and 7) the best way to serve industry and producers is to provide both industry and the public with objective information and not to pander to or protect perceived interests as advocates.

As has been done in response to the threat of TSE, our rangeland resource problems of today will be best addressed by continued science, objective policies, diverse collaborations, energized education programs, well-articulated syntheses of our ecologically based principles, and continued development of credible management practices. This is the role of SRM.

Complex Ecological Systems

There has been considerable interest of late in rangeland monitoring and considerable debate about what needs to be done, who needs to do it, what needs to be measured, what it means, how quality of information can be ensured, who will have access to any data, and many other issues. Irrespective of how this debate may eventually play out, there will be an increased (renewed?) awareness that we are trying to capture a working understanding of complex ecological systems. Relevant to this discussion are the publications by James Brown (Professor in the Department of Biology at the University of New Mexico) and his colleagues on their long-term studies on the dynamics of rangeland environments in the Southwest. Several of these articles have been published in *Science* including Brown and Heske (1990, 250:1705) and Ernest and Brown (2001, 292:101). Recently, Dr Brown and 3 colleagues synthesized aspects of their work in *Science* (2001, 293:643–650). That article deserves further comment.

Since 1977, Brown and coworkers have studied sets of ~ 0.5-acre plots near Portal, Arizona. They have selectively removed species of seed-eating rodents and ants from these plots and monitored various environmental responses over the past 25 years. They had hypothesized that some simple relations among precipitation, plant production, and rodent populations would be apparent. What they actually observed were some complex dynamics. Sometimes rodent populations increased during droughts and decreased during wet periods. When they removed rodents, such as kangaroo rats, from plots, they observed substantial increases in other seed-eating rodents. However, increases were seen in both resident rodent species and species that migrated to the study site from surrounding areas.

There were also effects observed in response to the increased winter precipitation that this area has recorded during the last 2 decades of the 20th century. Some previously dominant species went extinct from these sites whereas other species increased. In addition, they observed spatial variation in these responses. In other words, different responses were seen in study areas just a few miles from their research site in Portal.

Removing a species, such as banner tail kangaroo rats, from these plots was a disturbance that cascaded through this system. For example, plant species changed on the abandoned rat mounds, certain fungi increased with increased seed availability, rattlesnakes and burrowing owls declined, harvester ants declined, and horned lizard declines followed. Yet, these systems didn't collapse as much as they restructured and compensated in response to these manipulated perturbations. In fact, with all of these changes, the total number of species remained relatively constant.

These studies illustrate that we live in a constantly changing environment, that small changes can result in significant responses, that changes are often unpredictable and complex, but that some responses can also be dampened and relatively insignificant. It is quite clear that these systems have thresholds in response to disturbances, and if a threshold is not exceeded, that effects of disturbances, such as species reductions or drought, are minimal. However, if thresholds are exceeded, the responses can be significant and long lasting.

An obvious broader implication of these studies is that it is very difficult to evaluate any system based on a one-time assessment or on a superficial monitoring of system properties such as species composition or biomass production. If we are truly going to understand these rangelands and our use of them, we need to record more seriously observations of important ecological attributes such as soil stability, hydrologic function, and biotic integrity. More importantly, we need to admit that we are often bringing simplistic, even naive, understandings to our decision-making processes concerning management of these rangelands. Our current approach, of management that is heavily influenced by court decree and public opinion, is both inadequate and inappropriate.

One appropriate and immediate action is for the scientific community to work more effectively to understand how these systems function and to identify reasonable ways to monitor their responses to changing environments and our management.

Science

Donald Kennedy is President Emeritus of Stanford University and the current Editor-in-Chief of *Science*, one of the world's most highly respected journals. He published a short article on sustainability, a topic certainly of interest to the readers of this section newsletter, in the Summer, 2005, issue of the Renewable Resources Journal (Sustainability, Can Science Get Us There? 23(2): 13–15). In his article, he wrestles with the complexity of the concept of sustainability in a dynamic world (ecologically, culturally, economically, politically, and socially). He writes that sustainability is an important concept, if we can agree on what it is. For this editorial, though, I do not want to wade into the topic of sustainability. I wish to discuss the issue of science more broadly. For this discussion, I want to focus on the last sentence of Kennedy's essay: "Science, it seems, is necessary; but it is not yet, alas, sufficient."

I agree, sort of.

You might think that it is pretty cheeky of a government scientist of very modest credentials to discuss points made by one of the world's most respected science figures. Well, maybe, but the truth is he writes for a journal read around the world by millions, and I'm writing for, well, something less. It's not like I'm taking a big risk here.

Yet, for this audience I'd like to make what I think is an important point.

Science is necessary, and the questions we ask can certainly be more relevant and better tested, but the information we have is sufficient to a point. What is important to this discussion is a balanced perspective of what science can actually accomplish.

I think that natural resource issues, such as understanding effects of livestock grazing, are going to be, not science based, but science informed. There is a difference. Science based would mean that you have tested a specific question, and its hypothesis, for a particular situation and have data that support a strong inference regarding that hypothesis and question. Given the many different experimental settings, ecological sites, variable environments, array of local conditions, etc, that confound our scientific tests of these hypotheses, it is unlikely that we can develop data for strong inferences for more than a few specific situations. For those specific situations, we may be able to have management adapt to science-based information. That will be the exception.

Yet, for decades, we have worked to develop science-based principles that have broader application where management can be science informed. Those principles have been tested, and when in the hands of a capable land manager, they can be applied sufficiently. There are many examples of well-managed rangelands around New Mexico, the Southwest, the United States, and globally to attest to this fact. Science has played a role in that management, and often, it is not because specific experiments have been applied to every piece of well-managed rangeland. Science has informed some part of the management of those places. So, this is why I "sort of" agreed with Donald Kennedy's statement. Science has played a sufficient role in the past.

Now, though, the setting is different, and the "alas" part of his remark is quite appropriate. We now see rangelands as part of a large system, as part of larger landscapes, as having characteristics and dynamics different than what we had previously thought. We are now less concerned with their condition in relation to some point in the past and more concerned with their basic functioning and health. These newer perspectives are a result of science conducted around the world, and they point to the complexities of these rangelands.

An example here may be useful. If we look at data collected over many decades from the Las Cruces grazing district of the Bureau of Land Management (BLM) and if we looked at these data from the rangeland condition and trend perspective of old, we would tend to say that these BLM lands have been in a static trend since the 1930s. In other words, we really couldn't see noticeable improvement in the climax plant communities for many of these rangelands. However, if these same data are evaluated given a more thorough understanding of where the data are collected from across a landscape, the specific soil features, and the relationship of monitoring sites to the larger landscape, we start to see more useful and enlightening results. From work done by scientists and BLM personnel, we have learned that vegetation changes are being strongly influenced by landscape position and certain soil features. Subtle differences in particular soil attributes, such as a few decimeters difference in elevation, small percentage differences in maximum clay accumulation, and deep vs disseminated calcium carbonate distinguished soil patches that were vulnerable to vegetation loss from those that were resistant to them, may explain what is actually observed—that some sites are stable over time, some become more vegetated, and some become more bare. This is a very different conclusion than previously assumed. From this work, we will have to develop principles and apply those principles in an informed way to different landscapes.

So, is our science necessary and sufficient? It certainly is necessary in that it is addressing questions relevant to tens of millions of acres of rangeland and the people that use resources from these landscapes. It has been sufficient in that it has built principles in the past based on a coarse understanding of these systems. But more work needs to be done to make principles based on stronger inference.

Science is necessary; it has been coarsely sufficient for past management demands, but it is not yet, alas, sufficient for today's demands.

Pink, Plastic High Heels

The first and only time I saw her was as she came out from behind the counter to wash a petri dish. I'd guess she was in her early 20s, slender, with long black hair, and dressed in a gray pants suit of a style that would be quite characteristic of an urban office worker. It was supervisor-type attire and in stark contrast to her surroundings. She stood in the middle of this small dairy parlor, surrounded by 2 dozen dairy cows, a few farm workers, and about 6 or 7 sheep herders from Inner Mongolia relocated to this dairy cooperative on the outskirts of Xilinhot, a Chinese city of about 3 million people. She was performing a quick test on the fresh milk and using a hose in the center of the parlor periodically to clean the glassware.

Why she was there is quite a story. The term used by the Chinese central government is "ecological emigration." It refers to the movement of herders from their current and ancestral location on the steppe grasslands in Inner Mongolia to dairy cooperatives adjacent to the large cities in the region. These people are part of the 580 million of China's 1.3 billion who live on less than $2 a day and who are now part of more than 100 million who have left the rural areas for work in cities. Estimates are that eventually 300–500 million will migrate in the next 10–20 years (*The New York Times*, September 12, 2004). In part, the move-

ment is government-driven and a reaction to the overgrazed conditions of the steppe grasslands, which are a truly stunning expanse of perennial grasses such as Stipa and Agropyron. Intense dust storms originating from the region blow east each spring into Beijing and create havoc. Given that the herders each have a small allocation of land, there really is no way to provide relief to the landscapes short of complete rest for an extended period. The Chinese government has invested in the development of extensively managed irrigated farms adjacent to the cities that produce the forage and silage for these new dairy cooperatives (and potatoes under contract to the fast food industry that has expanded into Asia). Given the new growth in the Chinese economy, the urban Chinese population (hundreds of millions) is increasing its income and consumption of various products, including dairy (and french fries). Relocated herders, each with a few Holsteins, now provide a set of agricultural products in great demand. The herders don't have to move to these dairy villages, but they do have to leave their former homes, and alternatives to the dairy villages are few. So they now live in suburban conditions where the government provides the infrastructures, such as milking parlors placed within the villages, to harvest and market their products. They are paid for the milk per kg produced and pay for the forage and silage used. It is still a subsistence existence, but one viewed by the government as a solution to abject poverty and resource deterioration.

Standing in one of these milking parlors in a dairy village in central Inner Mongolia, I watched some relocated herders disdain the modern milking machinery and hand-milk their few dairy cows. I'm not sure if their disdain was for modern technology, or its links to the government, or both. As the milk from each cow was individually collected, they lugged or carted the liquid output to the classic feed barn scale at one end of the parlor and the gray-suited woman behind the counter.

Her shoes, though, made her the protagonist of this story. She was wearing pink, plastic, pointed-toed high heels. The points were at least 3 inches long. The kind of point you would expect if they had been dipped in a vat of hot pink sauce and slowly extracted leaving a cooled ribbon of perceived fashion extending beyond the toes. She had made a stark statement by her attire that she was in a position of authority and a bold statement with her heels that she was neither poor nor rural. In among this environment of people forced to move from their homes of abject poverty and of ancient agricultural traditions, clashed against modern technologies, I was just struck by these shoes and that she could make this kind of statement in a milking parlor within the rangelands of Inner Mongolia. Even in a region where livestock and livestock products are a highly important part of both the culture and the food supply, the faces of agriculture and of a society of well more than a billion people are changing. Things may be changing elsewhere in the world, but I don't see change this rapid where I live. In part, the pace of change is rapid in China because the resources are severely stressed.

There are lessons here, but I have to first get over that image of pink high heels.

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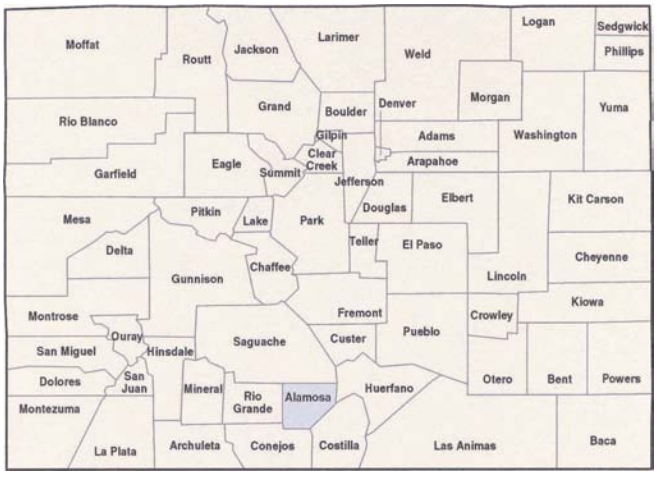
NRCS and the Acequia Community–A Lifestyle of Family Farming

By Petra Barnes

In southwestern Colorado, specifically in Costilla and Conejos counties, agriculture's past and present come together to ensure a promising future. Many landowners in the area continue to farm in the traditional fashion of their ancestors and use the acequia–vara-strip method of land and water stewardship. The customs demonstrated in this approach to farming, which has origins tracing back the 1500s, are not only proven farming techniques, but also a way of life.

Acequia literally means "an irrigation ditch." However, the word acequia also implies a vital community structure based around a ditch system. Vara strips are individually owned properties laid out within an acequia community, and the term "vara" is a unit of measurement used to define property boundaries. Unlike most land divisions, which usually consist of 640-acre-square grids, vara-strip boundaries are long and narrow, and vary in size. "The typical vara strips in Colorado range between 90 to 300 acres and are polygon-shaped," states Dr Devon Pena, Professor of Anthropology and American Ethnic Studies at the University of Washington in Seattle and a local landowner in southwestern Colorado. "Traditionally, land was divided in this fashion so that everyone within the community would have access to every life zone, ie, water, riparian areas, etc., in a particular region."



Acequias provide the water to unite the vara strips into a strong land-based community. Allocation of acequia water differs from the more common priority system of water management. Under the common system, junior water users may lose out on water in drier years; the system is "first in time, first in right." In contrast, the acequia system follows a principle of "one person, one vote," and each participant has equal access to the water.

Joe Gallegos, President of the Acequia Association; Dr Devon Pena, Professor of Anthropology and American Ethnic Studies; and Richard Aragon are local landowners within the Colorado acequia community.

Pena goes on to say that, *"within the acequia community, we honor and respect the 'Right to Thirst ideology.' No living thing has any more right to water than any other living thing within the community."*

Colorado hosts 2 of the 6 counties in North America that continue this traditional Hispanic farming method. And the Natural Resources Conservation Service (NRCS) in Colorado is the only federal agency that provides both financial and technical assistance to the acequia–vara-strip strategy.

"I think one of the main reasons I'm here is because of the acequia way of life," says Karma Anderson, NRCS District Conservationist, San Luis Valley Field Office. "I believe the acequia system is one of the few remaining models of sustainable farming in the U.S. Within the acequia community, at least here in the Conejos and Costilla counties, the people live off of what they grow and they are deeply connected to the land. This is not large production agriculture. It is a quintessential example of family farming in the U.S."

The agricultural practices within Colorado's acequia community are effective and are carried out with a holistic thought process. NRCS provides assistance to enhance efficiency of many of the practices surrounding improved irrigation methods, such as installation of gated pipe and head gates.

"I am thankful for the support that NRCS gives us and has given us over the decades," said Joe Gallegos, President of the Colorado Acequia Association and a local landowner. "The San Luis People's Ditch is priority one with regard to water rights in Colorado. We hold the very first water rights developed in the state, and NRCS has always been there to provide support and information. As a matter of fact, we developed the 'acequia madre,' or mother ditch, here in the 1960s and NRCS (well, SCS back then) helped us make the delivery of water from that ditch more efficient and that structure still exists today."

"I'm learning just as much from the acequia community about sustainable agriculture and environmental stewardship as they may be learning from me," Anderson goes on to say. "From their traditional grazing methods to the use of cooperative labor, it is clear that this culture embraces farming as a cooperative system."

Recently, NRCS implemented the Acequia/Vara-strip Environmental Quality Incentives Program. In 2004, NRCS set aside $50,000 specifically to assist traditional acequia–vara-strip farmers. Response to the program was exceptional and because of the demand, NRCS funded projects totaling nearly 3 times the monies initially allocated. The program has continued to gain momentum in 2005 and is expected to continue to do so.

"I own 250 acres in the Valley. That doesn't include the 100 acres my grandfather owned or the 68 acres my great-grandfather owned," said Richard Aragon, San Luis farmer and rancher. "In all, the family owns about 400 acres and we intend to keep it in the family even though we have gotten some really lucrative offers to buy the property. If it weren't for NRCS and the support we get, I know I would have had to sell off all of my livestock. NRCS values and supports the family farm and the family farmer."

The acequia program that NRCS started 2 years ago is not only improving the conditions of the natural resources, but it's helping improve the economy in the 2 poorest counties in Colorado while helping younger generations understand and retain traditional cultural values.

Author is Public Information Officer, USDA-Natural Resources Conservation Service, Lakewood, CO 80215.

Country Living

Code of the Urban West

By Gary Frasier

A few months ago I read in the *Denver Post* an article about the "Code of the West" developed for people that have moved from urban areas into the "country." Many of these people are looking for open spaces and quiet living. They are looking for a rustic, secluded lifestyle.

What they do not realize is that this open space and quiet living comes at a price that they are not accustomed to. Depending upon the specific area and how "far out" they have moved, they may have to haul water, the roads are graveled (at best), no garbage service, mail down at the corner of the County Road. Their friends do not just "drop in." They live out too far. There may be cattle on adjacent land that tend to go where they want, perhaps into your garden or lawn. Some people have moved next to (within a few miles of) a cattle feed yard, dairy, or other large agricultural enterprise that generates dust or odors. These neighbors are now undesirable, even though they were there first.

All of a sudden, these new rural residents want the roads improved; they are rough and dusty in dry weather and muddy in the winter and spring (maybe impassable without 4-wheel drive). They want garbage pickup and other niceties that they had in the city. They don't like the neighbor's rooster crowing or donkey braying.

What about emergencies? With cell phones, most rural places can have a phone, even if there is no land line. If there is an emergency, you can call 911, but it may take minutes for a response vehicle to arrive. Many rural areas are serviced by volunteer fire and rescue personnel. Many times these people are working or at home, and it takes time for them just to get to the emergency vehicles and then to travel to the site.

To counter these complaints, some rural areas have developed "Code of the West" guidelines that attempt to provide some information as to what to expect for living "in the country." Several rural counties in Colorado, Arizona, Idaho, Wyoming, Montana, Washington, Kansas, and places in Canada have adopted the code. Some counties in Indiana and Ohio have a similar code. This "code" basically states that if you live in a rural area, there are some things you might need to know:

- If your road is unpaved, it may stay unpaved in the foreseeable future.
- In extreme weather, county-maintained roads may be impassable for periods up to several days. You may need 4-wheel-drive vehicles with chains on all 4 wheels.
- Recycling is on your own. Be happy if there is trash pickup within a mile or so.
- Repair the washing machine or dishwasher. Many repair people will charge a mileage fee just to look at it.
- Rural areas have creatures frequently referred to as pests—rattlesnakes, mountain lions, deer, elk, skunks. The rural area is their home too.
- In some areas, there is no electricity unless you have a home generator.
- Water—if you are lucky you can drill a well. In many rural

areas there is no suitable groundwater, and you have to haul all the water. This can amount to 10 gallons per day per person for cooking, drinking, and washing. If you have flush toilets and showers, 20–40 gallons per person per day is required. Many people who go to the country want to have animals. Horses use 10–12 gallons per day, sheep 1–2.5 gallons per day, and cattle 10–15 gallons per day. If you are hauling water, this can be a frequent chore—winter and summer, weekdays and weekends, holidays.

There are some people who can fit in very well with a rural environment. For others, it can be a big disappointment. I have told several people not to make a decision to move to the country in the summertime. Everything looks good then. Go to the area in the winter. See what the roads are. If you work in town, can you take driving over bumpy roads for periods of up to an hour or so twice a day?

For the right people, country living can be great. You can see the stars (if there are no clouds). Coyotes may howl, but they are part of the area. In most country areas, there is quiet (no street noises, no neighbors fighting, no kids screaming, unless they are your own). You may not have good, free TV reception, but a satellite dish can put you in contact with the world. You do not go down to the corner store for a bottle of milk. You plan your trips to town to get supplies that will last for periods of a week or more.

To some people, as the late Eddie Albert used to say on the TV show "Green Acres," "country living is the place to be." To others, it is a place to visit.◆

Some Things I Learned on the Farm

Don't name a calf you plan to eat.

Country fences need to be horse high, pig tight, and bull strong.

Life is not about how fast you run, or how high you climb, but how well you bounce.

Keep skunks, lawyers, and bankers at a distance.

Life is simpler when you plow around the stumps.

Mortgaging a future crop is like saddling a wobbly colt.

A bumble bee is faster than a John Deere tractor.

Trouble with a milk cow is she won't stay milked.

Don't skinny dip with snapping turtles.

Words that soak into your ears are whispered, not yelled.

Meanness don't happen overnight.

To know how country folks are doing, look at their barns, not their houses.

Never lay an angry hand on a kid or an animal; it just ain't helpful.

Teachers, bankers, and hoot owls sleep with one eye open.

Forgive your enemies. It messes with their heads.

Don't sell your mule, buy a plow.

Two can live as cheap as one if one don't eat.

Don't corner something meaner than you.

You can catch more flies with honey than vinegar, assuming, of course, that you want to catch flies.

Man is the only critter who feels the need to label things as flowers or weeds.

It don't take a very big person to carry a grudge.

Don't go hunting with a fellow named Chug-a-Lug.

You can't unsay a cruel thing.

Every path has some puddles.

When you wallow with pigs, expect to get dirty.

The best sermons are lived, not preached.

Anonymous

The Local Livestock Sale Barn

By Gary Frasier, Roger Herrick, and Jackie Herrick

Remembering the Past

One of the things remembered from growing up on ranches in Southwestern Nebraska was the local sale barn. Many of the towns had a sale barn where local farmers and ranchers could bring their livestock for sale or where they could buy animals they wanted. Sale day in these towns was the busiest day of the week. People would go to town to do their weekly purchasing and to see their neighbors to catch up on the gossip. If the sale day was on Saturday, the kids would frequently go to the afternoon matinee at the local movie theater.

Most sale barns consisted of a group of pens where the animals could be held prior to and after the actual sale. Frequently the animals were sorted into small groups with like features (such as weight or conformation). The actual sale was held in an enclosed ring that could hold 10 to 20 animals at a time. The sale ring was surrounded by tiered seats where the buyers and sellers could sit. The auctioneer was seated on the other side of the ring on a raised podium where he could see the group. Usually there was a scale for weighing the animals behind the auctioneer. Most animals were sold before weighing. This put a lot of pressure on the buyer to judge the weights of the animals when observing them in the ring.

As a small child (Frasier) sitting with my father and grandfather in the tiered seats around the sale ring, listening to the auctioneer do his chant was fascinating. To the uninitiated, the auctioneer's sales pitch is a bunch of disconnected repeated words. This is not true. The auctioneer uses a series of words in a "sing-song" chant to repeat the price they are looking for. They usually start at a low value and increase the asking price as the various bidders signal their acceptance. Many of the buyers would only nod their head or move a finger to note that they were accepting the price being offered. There were 2–3 "ring people" who would be moving the animals around for viewing. They also had the task of finding

the buyers and "yelling out" when a bid was accepted. Once a bid was accepted the auctioneer would increase the asking price. When the asking price reached a point that drew no more bidders, the auctioneer would announce the animals as sold. It was a real challenge to a small child to look around and try to identify who was bidding on the animals.

For a seller, sale day would start several days in advance of the actual sale. The livestock would be rounded from the pastures and sorted as to what animals would be sold. If the rancher had a large number of animals to be sold, they were frequently hauled to town in large semi trucks ("pots") which could double-deck smaller animals. Smaller groups of livestock would be hauled in the rancher's farm truck. As a youngster this was an exciting time, watching the cattle being driven up the loading chute into the waiting trucks. After the animals were loaded we would clean up and drive to town.

Most sales would start about noon. This allowed time for the farmers and ranchers to get the animals to the sale barn. As the animals were brought in they were inspected by the State Brand Inspector assigned to the area to ensure ownership. The animals would be put into a small pen until time for their turn to be sold. Frequently, prospective cattle buyers would make a round of the holding pens to see what was available and to make a judgment as to how much they thought the animals would sell for.

In some instances, if the livestock was being hauled in from some distance, the animals would be brought in a day or two in advance to allow for feeding and watering before being auctioned off. This was an added expense but the animals would look better and maybe weigh a little more by replacing the "shrink" water lost during moving. In the fall of the year when the yearling calves were brought in from the grass rangelands, the sales might last until the wee hours of the next morning.

Sale day would end by going into the sale barn business office and receiving a check for the animals sold, or paying for the animals purchased. If animals were bought, arrangements were made to have a trucker haul them home, marking the end of a long day for a small child….

Weigh-ups

Weigh-ups are cows, bulls, and other odd lot animals that are being culled out of the herd. They might be old cows that the calves have been weaned off of and aren't productive anymore. Some weigh-ups are old bulls, or sometimes a young bull that has gotten hurt or crippled and can't be used for breeding anymore. They are sold by the pound and usually are made into hamburger. Some buyers come in only for the weigh-up part of the sale and are usually buying for some packing plant.

Some sales have up to 500 weigh-ups. When prices are extremely high, the producers will dump older animals like crazy. Some old cows will "pound" out (sell by the pound) to about as much as a bred cow would bring. Some of the big bulls bring prices in the 70 to 80 cents-per-pound range as weigh-ups, which is a lot of money for a 2,000-pound bull. In some years, a lot of stock that is still capable of being in the herd may be culled just because the weigh-up market is high.

Each sale barn would have a small restaurant where you could get anything from a cup of coffee to a complete meal. Usually they had pies for sale also. The restaurant was a good place to visit with your neighbor. The sale barn in my local town had a waitress that was the most efficient and pleasant person you would ever want to meet. She knew everyone in the county and never had a bad word to say about anyone. When I saw her last, she said she was still working. She has to be pushing 50 years of working there. She has some of the best stories to tell about the people. One of the favorite stories is this:

One day a local man came in and said, "I'm ready to marry you." She replied, "I'm already happily married. My husband is out there working the ring." He said, "Well I was talking to your husband and he said that you were a good wife, but that you had had a squabble with him this morning and he wasn't sure if you would be back." She replied, "I have been married to that man for over 40 years and plan to be married for a long time to come. I am sure not going to try to break a new one in."

In many areas the local sale barn has gone the way of the buffalo. There are still sale barns around in some of the larger towns of the west. They still operate in much the same

way of selling animals. What is gone is the "event" they used to create in going to town and seeing relatives and neighbors and just having a good time.

A Sale Barn of Today

My name is Jackie Herrick. My husband, Roger, and I have owned and operated the North Platte Livestock Auction for the past 13 years. Gary Frasier has asked that we write about our experience with the sale barn life.

First I would like to say that Gary and I are cousins. Our dads were brothers and our mothers were sisters. We were both raised on cattle ranches in the Dundy County area of Nebraska. So our childhoods were similar in regard to the ranching life. Roger has been around sale barns all his life. His dad was a brand inspector and Roger helped around the barns in Benkelman, Nebraska, from his 5th grade on. He has been involved in the cattle industry all his adult life. Our purpose as owners of a livestock sale barn is to get the highest market value for the seller and the best condition and purchase price for the buyer so that both will be satisfied customers. Sometimes that can be a challenge. We have lived through blizzards before big sales, mad-cow disease scares, and the Black Monday stock market scare; even 9/11 was on a "big sale" day.

There is an excitement that is felt on a large cattle sale day. Buyers represent many states on sale days. The buyers try to get there early enough to have a good dinner at the cafe and then get settled in for the long afternoon. The first animals sold are the weigh-ups. The buyers that start coming in around noon are the ones that come for the quality cattle that are selling in the big bunches. Some are order buyers for someone else and some are the producers, who are interested in buying for themselves.

Video Auctions

Auction Markets as we know them now are in for a big change. Some of the barns have gone to the video sales in addition to regular sales. At some video sales the buyers sit at tables, have a big prime rib meal, and bid on the cattle that have been videotaped on the ranch. Buyers can also be at home and watch it either on a certain TV station or on the Internet. This is all live, so all can bid.

The auctioneer and ring men can be heard in the adjacent business sale office as each group of cattle is sold and bids are taken. A lot of "yipping" from the ring men means the sale is going well!!

Hours go into planning each sale. Advertisement goes out 6 days before the sale. Buyers have to be called each week to let them know what is coming for the sale. Many producers want the barn owner to look at the cattle before they consign them.

Most cattle have to be sorted to sex, weight, and color. In today's sale barns the ring is the scale, so the buyer knows the weight before he bids.

I can see changes coming in the future. Cattle are sold by using videos of the stock. They are shown on big screens at large gatherings and also on TV. You can bid by phone on these cattle or you can attend the sale. You can also watch an actual sale barn auction on the Internet and bid with your computer as the cattle are in the sale-barn ring.

A lot of the smaller producers won't have as many options to sell their cattle if the sale barns as we know them start disappearing. The video buyer likes load lots. Auction markets are essential for giving the smaller producer a competitive selling tool.

If the trend to video sales continues, it will be hard for the livestock auction markets that just try to sell cattle at the barn to survive. The overhead of an auction barn is extremely high and the rules and regulations that have to be followed can sometimes be overwhelming. I can't see that sale barns will survive as they are now by just selling weigh-ups and the cutoffs that can't make it on the videos.

Many livestock producers still see the sale-barn auction market as the true test for the actual market. We get many calls a week from producers wanting to know what the true market really is.

It really is up to the producers if the traditional auction market is going to survive.

Authors are Editor-in-Chief of Rangelands (Gary Frasier) and Owners of the North Platte Livestock Auction in North Platte, NE (Roger and Jackie Herrick).

A History of Range Use in British Columbia

By Alfred H. Bawtree

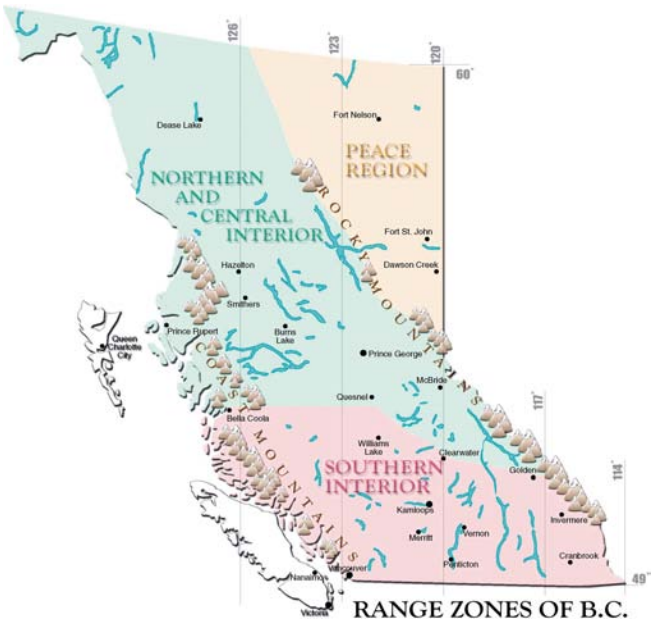
Range use in British Columbia (BC) is closely allied to the various distinctive vegetative and geographical zones of the province. BC rangelands generally lie between the Rocky Mountains to the east and the Coast or Cascade mountains to the west. An exception is the Peace River zone in northeastern BC, which is on the east side of the Rocky Mountains. Most of the land area lies in the Central and Northern zone, a vast area dominated by coniferous forest with patches of subalpine and alpine vegetation, aspen groves, wet meadows, and swamps. The Southern Interior zone is the warmest and driest zone and contains virtually all the native grassland in the province. Forests dominate all of these zones and consequently most of the rangeland has been greatly influenced by periodic fires and, in more recent times, by logging.

The Southern Interior Zone

The earliest fur traders to explore the Southern Interior reported that the native people possessed horses and made good use of them, including eating them. It is believed that horses first entered the province from the United States during the first half of the 18th century. The native grass provided sufficient forage for them in all but the most severe winters. Horse numbers were greatly reduced in severely cold winters with deep snow.

Prior to the exploration by the fur traders, there were deer, elk, and bighorn sheep, but it seems that their numbers fluctuated greatly through the years. Written records from the early 1800s report very few native ungulates. Elk disappeared from most of the range about that time, probably because of a very severe winter, although the recent acquisition of horses and guns by the natives may also have played a part.

The discovery of gold in 1858 initiated the first large influx of people and cattle into the province. Most of the cattle were herded through the Southern Interior to the gold fields by way of the Columbia, Okanagan, and Kootenay river valleys from Washington, Oregon, and Montana. The bunchgrass ranges in the hot, dry valleys attracted some people to settle on the land and commence raising horses and cattle. The rapidly growing populations in Vancouver and Victoria provided a market for beef and horses, but transport to those markets entailed difficult drives along steep and nar-



RANGE ZONES OF B.C.

row trails over the Cascade Mountains. The completion of the Cariboo wagon road in 1863 and the trans-Canada Canadian Pacific Railway in 1885 greatly facilitated the growth of the Southern Interior cattle industry. Cattle and horse numbers grew rapidly in the Southern Interior during the latter half of the 19th century but some severe winters killed many animals and indicated that supplemental feeding was required. By the turn of the century overgrazing was evident along major drive routes. Cattle and horses grazed the grasslands only, with very little grazing occurring in the forest or at upper elevations. After 1900, there was a gradual increase in grazing on forest range and an increase in hay production and fencing. Season-long grazing was the general practice for cattle, whereas horses grazed yearlong.

During the war years of 1914 to 1918, ranchers were encouraged to increase beef production, cattle numbers increased, and the grasslands suffered. Following the war there was an increasing awareness of overgrazing on the grasslands. Hay production, herding, fencing, and irrigation increased and beef cattle numbers increased from 100,000 in 1915 to 190,000 in 1917. Grasshoppers, abandoned horses, and droughts added to the problems already present on the grasslands during the interval between wars. Ranchers were now fully aware of the deteriorated condition of the grasslands but the solutions were less evident. Assistance was requested from governments, which resulted in the opening of the range research substation at Kamloops in 1935. Several reports on range conditions were prepared and partial solutions to the problems were presented. An abundance of timber milk vetch, a native plant with poisonous qualities, was identified about this time. Its abundance in the forest discouraged the use of forest ranges by cattle. Much of the best grassland was invaded by annual cheatgrass (also known as downy brome) at this time and burning was undertaken to control it. Cattle numbers remained relatively static during the depression years of the thirties, but domestic sheep numbers increased rapidly as access was opened to subalpine and alpine ranges for summer grazing. The population of horses also increased during this period and contributed to the yearlong grazing.

During the war of 1939 to 1945, ranchers were again encouraged to increase beef production. Authorized use of public range by yearling and mature cattle increased from 101,000 head in 1940 to 156,000 in 1945. The authorized season of use on the public lands was usually 6 months. Cattle were grazed on private lands for a further 1 to 6 months depending upon location. In more recent years, the grazing of horses on public grazing lands in the Southern Interior has become insignificant, and cattle numbers have remained almost static. Horses are now generally confined to private lands where native range and pasture is supplemented with hay and grain. Stricter administration of the public rangelands has resulted in a shortening of the grazing season. The Forest Service has become very efficient at wildfire control in recent decades, which has resulted in significantly increasing forest density and encroachment into the grasslands. This trend has been partially offset by tree harvesting. The condition of the grasslands has gradually improved as better range practices, such as rotation grazing systems, have come into common use. Large native cool-season bunchgrasses now dominate most of the grasslands and extensive

areas of downy brome are no longer found. Deer, moose, elk, bighorn sheep, and mountain goats still graze in the Southern Interior. Elk, moose, and bighorn sheep all appear to have significantly increased in local areas since 1800.

The Central and Northern Zone

In 1793, Alexander Mackenzie led a party of men from Eastern Canada to the Pacific Ocean at present day Bella Coola. He traveled up the Peace River, which drains to the Arctic Ocean and crossed the continental divide onto the Fraser River system, which drains to the Pacific. He reported an abundance of bison, elk, and deer east of the Rocky Mountains but scarce wildlife on the Pacific slope. He makes no mention of horses and he and his party were forced to carry their goods on their backs where it was impossible to travel by canoe. Most of his travels in BC were in the Central and Northern zone where he found dense forests, wet weather, and little wildlife. The native people depended on fish for meat.

Very little agriculture is practiced in the Central and Northern zone except in the vicinity of Prince George and northwesterly along the Canadian National Railway to the Coast Mountains. The Lakes District, which lies in the geographical center of BC, was settled about 1907 around the time the railway was being built. Native meadows provided some winter feed for horses, which were needed for the development of homesteads, surveys, road and railway construction, etc. Although ranching has been carried on in central BC for almost a century, its development has been slow. This seems to be because of the long feeding season, which lasts for 5 to 6 months, and the distance to markets. The native forage of grass and forbs is of excellent quality and locally abundant, but September frost severely reduces its value.

Throughout the whole of the Central and Northern zone there are occasional breaks in the forest canopy where ungulates may forage. Water is abundant in the form of creeks, rivers, and lakes and a little forage is frequently available in the adjacent riparian areas. Numerous mountains rise above the forest zone and forage is found in subalpine and alpine locations.

Scattered populations of deer, mountain goats, caribou, and stone sheep were present before the arrival of Europeans and may still be found. Moose were rare or absent when Europeans arrived but became abundant about 1930 and are still common. Horses are commonly kept on private lands for use on the ranches, for recreational purposes and for packing hunting and recreational parties in the mountains.

The Peace River Zone

Alexander Mackenzie was employed by the North-West (fur trading) Company in 1793 when he canoed up the Peace River into what is now northeastern BC. His objective was to explore the country for fur-bearing animals. Later, forts were built where traders were stationed to trade goods to the natives for the furs they delivered. One of the early forts was named Fort St. John, which is now the largest city in the Peace River zone. The business of fur trading was about the only commerce carried on in the Peace River zone for over a century after establishment of the first forts. The area was cut off from the remainder of BC by the Rocky Mountains and it was not until 1952 that a decent road was built from Prince George through the Pine Pass to Chetwynd and the Peace River country.

Mackenzie saw large numbers of elk and bison grazing among the aspens along the Peace River in 1793. Moose were also common in the Peace River zone at that time. The bison seem to have disappeared about the same time as they did elsewhere. Elk, bighorn sheep, deer, and moose are still locally common and bison have been reintroduced.

Settlement of the Peace River zone started in the 1920s. At first the access was from Alberta over muddy trails. The extension of the Northern Alberta Railway to Dawson Creek, BC, in 1931 greatly improved access and the opportunity to export farm products to Edmonton, Alberta, and markets farther south and east. Grain-growing proved difficult because of the short growing season and unreliable harvesting weather. However, grain is still grown abundantly despite the problems of harvesting.

During the 1950s, community pastures were reserved on public lands with marginal agricultural potential. Their purpose was to promote the production of livestock and diversification of agricultural production. They were also intended to provide summer grazing at a reasonable cost and to reduce burning of the forest. Burning was a general practice used to clear the forest and improve pasturage for livestock and wildlife. Forest fires were greatly reduced in the farming area after this time but were continued in the mountains to maintain or improve wildlife habitat. The abundance of game animals and the spectacular scenery in the mountains have attracted worldwide attention from hunters and tourists. Many horses are used by guides to pack the hunters and tourists into the mountains. Horses were formerly used extensively in the development of farms and in the construction of roads and railways. Machinery has replaced horses on the farm and for construction but they are still in demand for recreation, packing, and herding.

Rangelands in the Peace River Zone are primarily under an aspen canopy. Nonforested range is present on some

south-facing slopes at low elevations and on the eastern slopes of the Rocky Mountains where forest cover is reduced or absent because of frequent fires and high elevation.

Cattle and horses graze the improved pastures on both public and private lands as well as in the aspen lands where the canopy is not too thick. Cattle numbers have been increasing steadily for the past 50 years in the Peace River zone, which now constitutes an important part of the beef production in BC.

Author is Range Specialist with 50 years' experience, retired from the BC Ministry of Agriculture and Lands, Kamloops, British Columbia, Canada.

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Tenth in a Series: Insight From SRM's Charter Members

The Society for Range Management (SRM) History Committee has conducted interviews with many of the Society's charter members to capture their perspective of events leading to and subsequent to the formation of the American Society of Range Management in 1947–1948. Interviews from several of these individuals will be shared for today's SRM members to enjoy and learn from.

SRM Charter Member–Charles E. Poulton

Editor's Note: Dr Charles E. "Chuck" Poulton, PO Box 2081, Gresham, OR 97030-0601, responded to the interview questions in writing in detail (8 pages). This is a synopsis with emphasis given to Chuck's perspectives of SRM and advice for people entering range and related resource fields.

Chuck Poulton is an Idaho native. In 1935, he enrolled in Forestry at the University of Idaho but switched to the Range Management option in Forest Management after 1 year. R. J. Beacraft was Professor of Dendrology and advisor for the Range Management option. However, Chuck received his BS in 1939 under Professor Vernon Young. He worked for the US Forest Service before and after military service in the Navy. During the academic year 1946–1947, Chuck started an MS program at Montana State College and taught Harold Heady's range courses while Harold was finishing his PhD at the University of Nebraska. For the 1947–1948 academic year, Chuck received a teaching assistantship at the University of Idaho as Professor Ed Tisdale's colleague and finished his MS in Range Management and Animal Nutrition. In 1949, Chuck was hired to organize and lead a new bidepartmental program in Range Management at Oregon State University (OSU). His research focused on phytosociology, veg-etation–soil–landform relationships and, from the late 1960s, on remote sensing in resource analysis and monitoring. Chuck continued his graduate work at Washington State University, conducting field research in plant–soil relations in northern Oregon rangeland receiving the PhD in Plant Ecology and Soils under Rex Daubenmire in Ecology and Henry Smith in Soils.

In 1967–1968, Chuck did 1 year of postdoctoral study and research in remote sensing as part of Dr Bob Colwell's team at the University of California, Berkeley. He continued this emphasis at OSU with National Aeronautics and Space Administration (NASA) funding for several years, organizing and leading the Environmental Remote Sensing Applications Laboratory. After 25 years at OSU, Chuck resigned to become heavily involved in international consulting in a large variety of remote sensing activities, an effort growing out of the NASA Earth Resources program. This work, over several years, led Chuck to work in 18 countries and 5 continents.

From Chuck's Writing:

I went with Ed Tisdale, new Professor of Range Management at the University of Idaho, to the first organizational meeting for the ASRM. The ad-hoc organizing committee led by Joe Pechanec and Harold Heady laid a wonderful platform from which to move forward. They guided the meeting with superb skill. Discussions were lively, sometimes emotional; but all facets were visited with positive thinking and no private agendas.

My recollection is that the meeting was cosmopolitan with a few wildlife people and ranchers participating. Most participants were federal, with some state agency and university personnel who were involved in rangeland resources research, extension, or management. An excellent foundation was laid for the Society in all its aspects with a committee structure that was very effective. Election of Joe Pechanec as first President could not have been a wiser choice.

Before the meeting, I had strong reservations about further separation among the 3 renewable natural resource pro-

fessions—forestry, range, and wildlife. Vegetation–landform–soil ecosystems were our common denominator, and I had experienced need for closer collaboration by these 3 professions. Millions of acres of rangeland and wildlife habitat are forested.

I arrived uncertain that a new Society was the way to go. I was a member of the Society of American Foresters, a former Chairman of the Range Management Section of the Society, and had served on a number of Committees within SAF concerned about grazeable resources. The meeting convinced me of the potential for a professional society for range management.

At meeting's end, there was only one thing that caused me concern. It was the Trail Boss symbol. Even being born and growing up on a cattle ranch in southern Idaho and being personally dedicated to keeping the western livestock industry viable as a renewable resource user, I was opposed to casting our new Society in the image of the Trail Boss—great as Charley Russell was as a Western artist and Fred Renner as an expert and proponent of Russell's art.

I spoke my piece and lost. In retrospect, it was okay, but it branded us with the wrong iron and limited the public and lay perception of what SRM stands for and does. When I checked into SRM's first Web page, my concerns were rekindled, and I expressed my concern to the leadership.

On balance, is it time to revisit the question? What logo, if any, would most accurately portray SRM in the 21st century? Do we talk too much to our own pride and Western tradition? To be effective, professionally and politically, in the years ahead, how must we be perceived both within and outside our membership? First impressions still count! The purpose of a logo is to set that first impression, the focal point of recognition!

My initial expectations of ASRM and SRM have reasonably been met; but they aren't being maintained. The Society has had a tremendously beneficial and positive impact on rangeland resources management, education, and practice in North America and, to a commendable extent, in many pastoral regions of the world.

I had high expectations that SRM would be a strong and effective force to improve and maintain acceptable standards of qualification, employment, and performance in our profession. We were very effective through the 1960s and into the early 1970s. However, as uninformed, environmental extremism prevailed by manipulation in the legal system in the late 1970s and 1980s, we have lost all that our country had gained by the creation of the competitive Civil Service idea plus all gains fostered specifically by SRM!

Regarding SRM activities, I don't recall that I served as an officer of the PNW Section, but I did serve on some committees. At the national level, I served 1 term on the National Board of Directors; I don't recall which years. I also served as Chairman of the Rangeland Resources Education Council, the Committee on International Relations, and the Summer Camp Committee for the PNW Section; maybe others, but I don't remember.

Somehow I feel that our toughest problems are ahead of us, and I'm deeply concerned by some of the trends I see within the renewable natural resource agencies and in education. When an agency hires people to do rangeland resource evaluation and documentation who literally don't know one plant from another, something is drastically, yes, unbelievably, WRONG!

When Condition and Trend data sheets repeatedly show multiple "Unknowns" per data sheet, including the most frequent/prominent species, and the supervisor admits he hasn't checked the year-old data sheets, you can decide for yourself where the problem lies. Situation confirmed. Why this unfortunate turn of events? Why have we lost ground in such an important area as professional standards?

One fundamental reason is that some SRM members feel, probably rightly or through their own interpretation of related events, which they are not free to become involved in a discussion or vote if the outcome is not in line with agency policy. To the extent that this does exist, it is most unfortunate for SRM and for the persons involved. My own interpretation would be that, if an agency, subtly or intentionally, encouraged the attitude/feeling, it could constitute an insidious denial of the right of free speech. If, on the other hand, a person is representing an organization that, in and of itself, is a member of SRM, then that agency's representative is duty-bound to present or clarify the policies and views of his or her member agency.

I have always held that any member of a professional organization like ours should be free to express a personal opinion on any relevant topic whether it fits the current mold or not. Progress is never created by conformity. Blind conformity produces lethargy and suffocation. Progress results from divergences of thinking, imagination and new ideas, perceptions that are different, divergent, or even in direct opposition. Progress arises from the common ground, the resolution of difference, and the amalgamation of the good or innovative in each contributor's thinking. Here is a case in point that needs to be told now that many years have passed.

When I was on the Board of Directors, we were considering an important issue (I don't remember specifically what it was). There was significant divergence of opinion, but all discussions were a model of civility. We were seeking a common ground where all could agree or live with the consequences. We finally got there, and a vote was called. One of our Directors said, "I'm sorry, I can't vote on that issue, it is contrary to my Agency's policy." More than I were shocked that a person who had been voted into an important office by his peers with the assumption that he would bring his best professional judgment as an individual member to bear on the matter of guiding the Society would feel pressed to make such a statement. Why didn't he just say, "I abstain"? Think about it.

I went home and wrote a short, philosophical article on the subject, "The Hats We Wear." It mentioned no names or agencies nor referenced any specific topic. I made the theme

point that when one joins a Professional Association as an individual, he or she should have all rights of independent, personal expression and is expected to perform as a peer on equal footing. Then I discussed some the potential impacts of the Hat We Individually Wear as members and especially as Officers of the Society. My thrust was that an individual as a member of a nonprofit, professional organization should be completely free to speak as an individual on organization matters, especially when in elective office.

I submitted the article for publication by SRM. It was summarily turned down with the comment, "Not suitable," and without suggestions for revision or modification that would make it suitable. I still have the article as a memento of a sad day in the history of SRM.

I see SRM at a critical crossroad mostly in matters of professional standards and fundamental science requirements. The Society has as much obligation, possibly more, to be involved in these matters and in Civil Service certification when that process adversely affects personnel qualification and the quality of performance and accomplishment in matters relating to Rangeland Resources research, extension, analysis and monitoring, and management practices. We can't dictate to the employers, but we can negotiate. Are we?

The Society's leadership and members can choose to aggressively reassert leadership and influence from a new position and platform based on collective mastery of fundamental plant taxonomy and ecology, earth, zoological, and human sciences that are the foundations of principle and practice for our profession. This is more than a 1-person task, but SRM can function better as the catalyst that refocuses the profession on mastered fundamentals. Failing in this is to accept oblivion in the 21st century with Human Society and Mother Earth as the losers while leadership remains with superficially educated and trained "Environmental Managers" and with management decisions remaining in the hands of the courts.

The best thought I can leave for future generations is that a science-based career in the judicious use and scientifically sound management of all renewable natural resources will become increasingly important and be needed as long as there are people and animals on earth. Innovation, ingenuity, and your cognitive skills—not conventional practice—will rule.

Superficial training and any old course in ecology doesn't cut it. Don't fall for the line, "In today's complexity, we need generalists who can put it all together." If you don't know the pieces and their characteristics, you can't put the puzzle together.

Make sure, at each step in your education, that you can say, "Here, in this area/discipline I have the potential of an expert by virtue of my fundamental understanding of related science and my skills and ability." With this core, you can generalize your education to your heart's content. Well-chosen generalization can improve your communication skills: step 1 being "Listen with Respect."

It is your responsibility to become adequately educated, trained, and experienced in the basic sciences upon which your profession is based, ie, plant taxonomy and phytosociology coupled with soil morphology, genesis, and classification; vegetation–soil–landform relationships; and how to translate this information into a fundamental ecosystems context that accurately characterizes each landscape.

Learn to read landscapes in terms of homogeneous vegetation–soil–landform ecosystems. If you can't do this, you are not qualified to lay out Condition and Trend transects or to take meaningful data on vegetation change, the key to your success or failure as a resource manager.

Prepare yourself well, and don't spring the trap by assuming that your education ever stops. My experience has convinced me that the following quote from Albert Einstein is as appropriate today as when he stated, "We cannot solve our problems with the same level of thinking that created them."

Back in the 1950s and 1960s, I used to tell my students, "When on the job, if you don't do a excellent job of informing your general public about what, how, and why you do what you do in renewable natural resources use and management, you will see the day when your management decisions are made for you in the Court of Law." I didn't think it would come so quickly.

Now that it is here and thoroughly entrenched, you are doubly obligated to be highly professional, impeccably accurate, and scientifically defensible in everything you do. Get on the speaking circuit. *Take the offensive with information, irrefutable scientific fact, plus careful explanations of How and Why you do What you do, and the* ***consequences of alternative courses****.*

From this initiative, build your support in a contingent of people willing or convinced to listen. Don't overlook school kids, 4th grade and up, and their teachers. They are a viable audience well worth the investment. Teachers lack materials, scientific facts, and an understanding of ecological principles and processes to teach about what environment really means and especially the concept of "renewable natural resources"—the power of recovery in native vegetations and the folly of trading renewable resources for steel studs.

Don't buy into the radical environmentalists' and their lawyers' game by saying, "I don't have time. I have to prepare for the next court case." That's right where they want you to be and to stay. Remember that the strategy of the opposition in this white or black (not ethnic) arena is to build emotion not reason, to discredit, to obscure and confuse, cloud the facts, and capitalize on half-truth, which are even wrong when it has the "right" impact.

To all the young professionals in renewable natural resources use, management, and rational sustainability—May your career be enjoyable, challenging, and rewarding in satisfaction. May the Earth and its resources, its people, societies, and economies be healthier because of the decisions each of you make in your personal Journey of Discovery and Service—the World a better place because you walked by.

SRM Charter Member–Gene F. Payne

Editor's Note: Dr Gene Payne, 127 N. 25th Ave., Bozeman, MT 59718-2603, was interviewed by Tracy Brewer in December 2002. This is an abstract from the lengthy and comprehensive interview. Dr Payne is a retired Professor of Range Management from Montana State University.

While at the University of Idaho in 1943 doing my MS thesis, there was talk of forming some kind of professional range management organization. This was, of course, in World War II, and there were few MS candidates. My first knowledge about what was to become the Society was at a meeting in Moscow, Idaho, in spring 1943, when perhaps 30–40 people came together who were interested in the establishment of some kind of professional organization. They met at the School of Forestry at the University of Idaho. My major professor, Dr Vernon Young, insisted that I take some time from my thesis writing and do a little research on rangelands in the southeast. He gave the group a job on the need for this society nationwide, and so my interest in it started at that early stage. The group that met at Moscow was essentially the same group that finally established the Society in the meeting in Salt Lake City, Utah. I was unable to attend that meeting, but since then, I have been closely involved in committees up until my retirement in 1979. That is a period of some 32 years.

Activities were varied in those early days. We met primarily in western locations, and the meetings were generally pretty much the format used in meetings now, ie, technical papers, and the people who were attending the meetings were primarily university and state and federal personnel. That didn't last very long as the primary focus because there were a number of ranchers who got interested in the Society. They came in with a strong influence in looking at the science of range management, as it would apply to private operators' operations.

Sections weren't formed immediately. But, within 2 annual meetings the idea of Sections was pretty well established. They first were on an informal basis but soon were formalized with their own officers. In Montana, we included North Dakota, South Dakota, and Wyoming, knowing that few people in the Society who came from that area. There were a good many meetings about what Sections should form and what the boundaries should be. In the Montana situation, we had several very active and influential ranchers who had their input, and the big question was "Should Sections be by state or should they be by natural rangelands boundaries?" It ended up very shortly as a tug-of-war between what we might call the mountain range managers and the plains range managers. Two ranchers particularly, one was Dan Fulton, were very influential in finally pushed the idea of biosections, in essence, and so a group got together and set a line of western and eastern Montana as a boundary between the Northern Great Plains (NGP) Section and the International Mountain Section. Wyoming chose to stay as its own group. The membership of the Northern Great Plains Section included North Dakota; South Dakota; Montana, east of the Rockies; and a little later, the Canadian group from the plains of Alberta, Saskatchewan, and Manitoba. In that group, we had a large area that did encompass pretty well the northern Great Plains bio-area.

The Section problem was an interesting one. The ranchers who were so influential were from eastern Montana, and their approach was that western Montana had its school at University of Montana at Missoula (school of forestry that had a range program), and Montana State University (MSU), although west of the boundary that had been set, was the best representative of the plains agriculture. They pushed very hard in getting MSU to establish a student group attached to the NGP Section, although we were west of that boundary. I was quite in favor of it, although it was an odd situation. Also, most of the students in those very early days of 1947, 1948, 1949, and into the 1950s came from the plains area east of the boundary that had been set. So, I was quite in agreement with those ranchers and where we were for a good many years. The student group here was officially in the NGP Section. Over time, that kind of fizzled out as an official connection with the advent of many students who came from outside of the NGP Section. Apparently, the direction has been to let students be in whatever Section they wanted to be in. By and large, the staff just assumed as staff changes came along, with the exception of me, that because we were west of the boundary, they were International Mountain members. For many years, some of the faculty were International Mountain Section members and some were NGP Section members. It was a matter of geography. The artificial boundary was through Stillwater and Sweetgrass counties, which put us not too far from the boundary. I don't know by now what the official relationships are.

My expectations of the ASRM early on were that it was a place to prevent us from becoming too provincial in developing curricula and attitudes that would leave an institution with a too restricted view of the science, for one thing. And, for another, I thought it was extremely valuable if we could get students involved, which did happen. That led to development of teams of one sort or another that would go to the national/international meetings.

We talked a great deal about advances in range science, and this was extremely important in avoiding provincialism that can deaden curricula. The other important thing was how involved the Society should be in political questions related to the management of rangelands. This was touchy because the membership in general wanted or seemed to want to use the Society primarily as the means of getting a broader horizon than that of the agencies that they were working in or the ranching industry as such. So, in general, the attitude was, don't get involved in politics, at least, not in any significant way.

I started out at the University of Montana at Missoula in the mid-1930s, and times were pretty tough. I was in and out of school and that depended on the kind of summer jobs and

that sort of thing. I started out in Forestry and was somewhat intrigued with the botanical side. I had a couple of quarters of work as a major in Botany and then moved back into the Forestry/Range Management program there. By rather peculiar circumstances, I decided to make the move to the University of Idaho to finish up my BS in Forestry with a major in Range Management. I graduated in the spring of 1941 and then went to work for the Soil Conservation Service until the fall of 1941 when the war disturbed everything. At that time, I was able to take a graduate assistantship at University of Idaho and completed that in 1943. I spent a little time at the Jornada range station in New Mexico. Rather than be drafted, I volunteered in an engineering unit in the US Army. As any WWII veteran would tell you, you could volunteer for almost anything and be sure you would do it. So, I ended up after basic training in an administrative position, clerical-type stuff, and stayed in that for the remainder of the war, most of it in England.

After the war, I came back to the SCS in eastern Washington before finally coming to the job in Bozeman, Montana, at MSU. I arrived here in the fall of 1947. I was in the program that Dr Harold Heady, a very influential person in the Society, had started near the beginning of the war and finally had to abandon it as a major source of study because there simply were not the students for the subject. At the end of the war, he was able to turn his attention to development of the curriculum. Then, he went off to Texas A&M and then the University of California. Dr Chuck Poulton, also one of the early pioneers in the Society and outspoken proponent of Society development, was here for a year. He further developed the curriculum, so I had a fairly good base from which to work. (*Gene is modest. He earned a PhD in Range Management in 1957 from Texas A&M University with major professor Dr Vernon Young. Ed.*)

I was involved in several committees in SRM but especially at the Section level. In the early days, the Secretary of the Society was a volunteer essentially from the membership. He was not paid anything except for actual expenses for key records, paper expenses, etc. The Secretary was totally voluntary, although often pressured to take the job. The year that Dan Fulton, a rancher from eastern Montana, was President of the Society, he appeared on campus and talked to the head of Animal and Range Science and the Dean about the importance of my being Secretary while he was President. So, I spent a year in the Secretary position. Then there were several committees of one sort or another of which I was a member. Eventually, I was deeply involved in the formation of the committee on range management education. I don't remember the exact name of the committee, but essentially it was getting the range teaching staffs together as a committee to talk about curriculum content and student development, things of that sort, which finally evolved into the Range Management Education Council. I was deeply involved with the NGP Section and committees and was President of the Section twice.

I have been concerned about the Society and the problem of membership. I'm not in a position to attend all the national meetings after my retirement from the university, but I have been trying to keep up with problems that are expressed in the *Journal* and particularly in *Rangelands* and any other information I can get. The Society has a drop in membership that concerns me. I think it was a complex thing. One of the factors was the tendency of agencies that normally had taken range management students on their staffs to look more to students from schools that teach a less well-defined curriculum in general, ie, conservation. I believe this agency perspective considerably eroded the need for professional range people. This began to have an effect on the Society. There were other things also that were involved, quite a number of them.

As time went on, more and more, the SRM seemed to be looked upon as a Society for private rangeland management. The interesting thing was that, with the exception of a few very deeply interested ranchers, the Society still was depending on the various governmental agencies as a source of membership.

I think that perhaps the master philosopher on the whole problem of membership and the direction of the Society was Dr Thad Box from Utah State University. One of the things I think we ought to be proud of as a Society is that a number of people were concerned about the problem and were looking at the whole question of membership and how to get members interested in the management of rangelands and what was really meant by the term "rangelands." All of these sorts of things are finally coming to the fore. I am encouraged by the time that has been spent looking at the functions of the Society. The philosophical problems that arise in a Society like ours include trying to set some boundaries from within which the Society could contribute most. I think that is being worked through in a very commendable fashion.

The series of articles by Dr Box has outlined the problems that need to be faced and the attitudes that need to be evaluated. For example, there is a real question as to whether the Society has been wrong in maintaining the man on a horse as the dominant symbol for the Society. That may seem rather a picky thing, but symbols like this very often categorize a Society like ours. There are any number of people who still look at our Society as a Society to help the ranchers and to have little application elsewhere. This, of course, is the problem. It is not a Society that is predominantly concerned with private property or public property but is interested in rangelands as part of the environment. Livestock, game, recreation, and water, all of these things are critical problems in our society. So, this broad viewpoint has to be brought out. It cannot be symbolized with a cowboy on a horse. We are far beyond this sort of thing today. But, it is hard to symbolize something like that. I am pleased that we are getting more wildlife people involved. More of the literature in rangeland publications deals with items other than ranchers' problems. I think the Society is coming into a new configuration when it comes to the membership and understanding of all the broad facets of rangelands management.

One of the things that happened, as far as I personally was concerned, is that SRM provided an opportunity to see rangelands and rangelands management in a broad sense, a broad point of view. In other words, the tendency, I think, among people in rangelands related areas can, if they don't go to SRM meetings, if they don't go to technical sessions, tend to get a little bit too provincial in the curriculum in the schools, in the development of rangeland management technology. Probably the most important thing I got from SRM was broadening of experience and attitudes and thinking about the educational side of rangelands.

I'm biased, but I think rangelands educational programs in most of the schools have been broadening. As such, students are being developed who better understand the real complexities of rangelands management. Also, they are getting a much better point of view about all the peripheral things that are so important to our society. They need to learn more about ecology and economics and how this relates to the development and sustaining of our rangelands. The touchy problem of recreation and its influence on rangelands, and on decisions about various uses of rangelands, and in the various kinds of rangelands, eg, when rangelands are intimately tied into forestlands—the administration of such intermixtures is rather complex, as are the decisions about what has predominance in a lands situation involving water, recreation, and wildlife and how all these things tie together.

Finally, I hope members of the Society will continue to think about philosophical as well as practical questions. What is the Society supposed to do? That should be an ongoing question. It was the question when the Society was established; it was a question that was a part of Society deliberations. It should be ongoing.

What is going on in SRM now in trying to decide on its responsibilities, its areas of concern, and how to improve its membership, which is very important in trying to spread the fundamental philosophy of rangelands management? All of these things are being examined rather closely. I am certainly hoping that the people in rangelands education are continuing to examine their curricula and to support and participate in the Range Science Education groups. They need to realize that all of the education today is spread out over a much wider view of what range management and rangeland science is and that they are more and more getting nontraditional students, ie, not from a ranch background. The approach to educational challenges now is different. One needs to recognize that the world is different today. I have not noticed as much in range management and range science literature about education as there was in earlier times. I'm trying to think about any articles recently that tackled the educational system and detailed the course content and curriculum. I am curious about how the Range Science Education Council is doing and what they are achieving in terms of better or more appropriate curricular/course additions/deletions. Are we really looking at the education side of SRM as thoroughly as schools should be doing? These are questions and concerns that I trust are being addressed. ◆

Thad Box

Holding the World Together—Our Life and Our Place

"Then this land ain't good for nothing but to hold the world together."
—Dee Box, February 9, 1995

If we and past aeons of scholars have not yet begun to understand the power of self organization as a source of order, neither did Darwin. . . . We may be finding new foundations for the order that graces the living world. If so, what a change in our view of life, and our place, must await us.—Stuart Kauffman, 1996

On Dad's 90th birthday, a month-and-a-day before he died from lung cancer and emphysema, I took him for a ride around Las Cruces, New Mexico. We moved him from his beloved Texas Hill Country to our home in New Mexico 2 years earlier. His prognosis was less than a year to live. The dry New Mexico air and not having to take care of Mother and himself allowed him to live almost 3 years. A series of small strokes affected his mind. He enjoyed our farm in Mesilla, but he was never able to adjust to the desert landscape.

On that last ride, he asked the same predictable questions he usually asked on our weekly drives. Questions were prompted by familiar things from his past life. At a cotton field, he asked how many bales per acre the crop would make. A pecan orchard prompted thoughts about threshing poles and picking up pecans.

Though Dad raised livestock all his life, he was more puzzled by the rangelands than the farms. As we drove out of the irrigated valley and into the desert on his last outing, he asked if the land was government land or if somebody owned it. Then, he asked what the land was good for. I patiently answered, as I had on so many previous drives, that desert ranges, though low in carrying capacity, were used to grow cattle.

"How many acres does it take to run a cow," he asked. I said people in dry areas usually didn't think in terms of acres per cow but cows per square mile. Much desert land took a section to run 4 or 5 cows.

"Then this land ain't good for nothing but to hold the world together," Dad said. This was his last comment on land before we buried him in granite gravel under a post oak tree in Llano County, Texas. He lies near where his father raised 9 kids on less than 200 acres.

Today, I sat staring at my computer like a junior high student with an English assignment. My head ached as I tried to tie the topics of this issue of *Rangelands* together: "Small Acreage Management and Marketing Rangeland Products." Linking those topics suggests a couple of standards that have haunted the range management profession from the beginning: 1) that some optimum size exists, and 2) that rangelands must provide an economic product.

Neither is a comfortable fit for the concept that range management is a land care profession concerned primarily with the health of land. They refer us back to questions I asked when discussing exurban sprawl: How small a chunk of rangeland will we defend? Will we claim

rangelands only if they produce a commodity? And, they validate Dad's concept that unless land produces goods in adequate amounts, it is only fit to hold the world together.

> *The most obvious differences between different animals are differences of size, but for some reason the zoologists have paid singularly little attention to them … yet it is easy to show that a hare could not be as large as a hippopotamus, or a whale as small as a herring. For every type of animal there is a most convenient size, and a large change in size inevitably carries with it a change of form.—J. B. S. Haldane, 1928*

Traditionally, we have measured size of rangeland units in terms of the income they could generate; something we call an economic unit. Let us assume rangeland is used to raise cattle, and 500 cows are needed for an economic unit. On the prairies of the Gulf Coast, small acreage might mean properties of under 2,000 acres. But in desert rangelands, anything less than 750,000 acres could be considered small acreage.

If range management limits itself to an "economic unit" concept, then the profession will serve a minuscule and declining portion of the landscape. And it will die. The trend toward larger farms has reversed, at least in Utah. The Salt Lake Tribune analyzed census data from 1997 to 2002. They found a 6.9% increase in farms under 50 acres and a decrease in those over 500 acres.

A drive through the hinterland tells what is happening. Big, new houses sit centered on lots of one to 10 acres. Food production and wildlife habitat are lost. "Agricultural" water grows ornamental grass. Fossil fuel powers lawn mowers and motorized toys. Oil is burned as cars drive further to work, and refrigerated trucks bring food to the land that once prided itself on raising its own. Change in size changes interrelationships of all components in the system.

The topic of marketing rangeland products recognizes that size of an economic unit, like size of Haldane's animals, changes with its form. By increasing demand for products not now valuable, economic unit size is reduced. Even if the price of grass-fed or organic meat could be doubled, and 250 mother cows could support a ranch family, our profession would still serve a small and declining percentage of the land. Our demise would only be postponed.

If marketing can create a demand for other products—wood, medical herbs, wildlife, photographs, what have you—the focus is still on stuff that can be extracted from the land rather than the land itself. This leaves range management as something other than a land care profession, something more akin to a commodity association.

> *The properties and modes of action of higher levels are not explicable by the summation of the properties and modes of action of their components taken in isolation; if, however, we know the ensemble of the components and the relations existing between them, then the higher levels are derivable from the components.—Ludwig von Bertalanffy, 1952*

The strength of a land care profession is not in the kinds or amounts of products that we can extract from the land but in keeping options open for future generations. Kevin Kelly, in his futurist book "Out of Control" states:

> *The billion-footed beast of living bugs and weeds, and the aboriginal human cultures which have extracted meaning from this life are worth protecting if for no other reason than the postmodern metaphors they still have not revealed. Destroying a prairie destroys not only the reservoir of genes but also a treasure of future metaphors, insight, and models for a neo-biological civilization. (p. 4)*

Our long suit, as stewards and scientists, is understanding the interrelations in systems and relating those to the interconnectedness that sustains our culture. It is not the ability of land care professionals to extract more and better products from the land that makes us valuable, but our ability to understand the system, identify destructive connections, and develop guidelines for sustaining our culture.

Our role is to listen to all lands manageable by ecological concepts—those as small as a sombrero or as large as a continent. We become spokespersons for their sustainability, even when they function just to hold the world together. How we treat such lands affects whether the entire global system functions properly. If, as Stuart Kaufmann says, we find new foundations for the order that graces the living world, what a change in our view of life, and our place, must await us. ◆

Letters to the Editor

Hi Abbey,

My name is Armando Nieto. I'm a 2nd-year veterinary student at Colorado State here in Fort Collins, Colorado. I'm also a subscriber to *Rangelands* magazine, and I just wanted to drop you a line to tell you how much I enjoyed your story about your internship experience in South Africa. I just returned last month from a similar experience in Mexico, where I lived for 6 weeks with the family of another HM [Holistic Management] Certified Educator—Ivan Aguirre—at their ranch in the Sonoran Desert.

I had learned just enough to make me curious about Holistic Management a little over a year ago when I was in graduate school, and the more I learned, the more I realized that there is a lot more to animal health than just healing the sick ones (or sending them down the road).

Ivan and his wife Martha showed me a new way of looking at animal health and productivity that incorporates a whole slew of other factors like the health of the land, biodiversity from insects to deer and grass to trees, and most especially the commitment and lifestyle of the people managing the whole show—all the same things you learned and wrote about.

Working with this family that was really living the philosophy of HM really put a lot of things in perspective that I had been trying to reconcile in my head for a while now—issues of sustainability, and animal health and welfare, and food production, and water use and desertification, and rural community health, and so on. I came back to the states preaching this new philosophy (new to me, anyway) to my friends and family here, and I mostly got a lot of semi-blank stares.

So I was completely blown away when I got home and found this magazine in my mailbox talking about how you worked toward getting to Africa, and how you got down on your hands and knees to get a better feel for the land, and how the people there took you in like family, and especially the opening sentence about Allan Savory changing your life—it was like I was reading a story about my own experience.

Anyway, I'm typically not one for sending random E-mails off to people I don't know, and I don't imagine you're much more accustomed to receiving them. I just wanted to let you know that I thought your story was great for a number of reasons, one of which is that this is the first article about Holistic Management that I've read by anyone under about age 40…. Maybe our generation is starting to get the message.

So good luck in your current endeavors, and thanks again for the great article,

Armando Nieto

Editor's Note: This letter was sent to the author, Abbey Kingdon (Volume 27, No. 4, August 2005, "After Africa: Finding Home Again"). The writer of the letter, Armando Nieto, and Abbey graciously agreed to allow the letter to be published.

The Recipe Corner

Editor's Note: There are many "family" recipes that are passed from generation to generation that are never seen by outsiders. Many of these recipes would be enjoyed by others. This column has been established to present some of these recipes so others can enjoy them. The following recipe was originally published in the Trail Boss's Cowboy Cookbook, published by the Society for Range Management in 1985. This recipe is from the late Johneta Jackson, of the Peter V. Jackson Ranch, Harrison, Montana.

Grandma McLean's Coconut Fudge

Pete Jackson's grandmother, Lilla McLean, brought this recipe to Virginia City, Montana, as a young bride. She cooked it for Christmas treats. Coconut was a special treat then.

2 cups white sugar
2 cups coconut, shredded
2 tablespoons white Karo syrup
2 cups sour cream (minimum of 30% butterfat, best if 60% butterfat)
1 teaspoon vanilla
2 tablespoons butter

Mix first 4 ingredients in a heavy saucepan. Begin cooking on medium heat to keep from scorching, stirring well till all sugar is dissolved. Cook to a soft ball stage. Cool. Add butter and vanilla, beat until thick and creamy. Pour into the pan and cut into squares. A layer of milk chocolate spread over the squares makes a very good Mounds-type candy.

Jeff Mosley

Browsing the Literature

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

Animal Ecology

Cattle grazing in a national forest greatly reduces nesting success in a ground-nesting sparrow. C. E. Walsberg. 2005. *Condor* 107:714–716. (School of Life Sciences, Arizona State University, Tempe, AZ 85287). In open ponderosa pine forests and pine savannas of northern Arizona, cattle grazing in late June and July significantly reduced nesting success by Dark-eyed Juncos.

Nest-site selection patterns and the influence of vegetation on nest survival of mixed-grass prairie passerines. S. K. Davis. 2005. *Condor* 107:605–616. (Canadian Wildlife Service, 300-2365 Albert Street, Regina, SK S4P 4K1, Canada). In southern Saskatchewan, Chesnut-collared Longspurs selected nest sites where the vegetation was relatively short and sparse, whereas Western Meadowlarks selected nest sites where vegetation was relatively tall and dense. Nest sites for Sprague's Pipits, Savannah Sparrows, and Baird's Sparrows were intermediate in vegetation height and density. All 5 species preferred to build their nests where there was more litter and less bare ground.

Sonoran pronghorn use of anthropogenic and natural water sources. J. R. Morgart, J. J. Hervert, P. R. Krausman, J. L. Bright, and R. S. Henry. 2005. *Wildlife Society Bulletin* 33:51–60. (P. Krausman, School of Natural Resources, University of Arizona, Tucson, AZ 85721). Contrary to published reports, Sonoran pronghorns regularly drink from livestock water developments, and water developments may be an important tool for recovering the endangered Sonoran pronghorn.

Grazing Management

Effects of summer grazing strategies on organic reserves and root characteristics of big bluestem. E. M. Mousel, W. H. Schacht, C. W. Zanner, and L. E. Moser. 2005. *Crop Science* 45:2008–2014. (Department of Agronomy and Horticulture and School of Natural Resources, University of Nebraska, Lincoln, NE 68583). Grazing at the elongation stage of big bluestem should be rotated among paddocks in successive years and the recovery period following grazing at internode elongation should exceed 40 days.

Foraging ecology of goats and sheep on wooded rangelands. T. G. Papachristou, L. E. Dziba, and F. D. Provenza. 2005. *Small Ruminant Research* 59:141–156. (National Agricultural Research Foundation, Forest Research Institute, Thessaloniki 57006, Greece). Discusses how knowledge of plant defense mechanisms and diet selection by small ruminants can be integrated into grazing management strategies for shrublands, savannas, and grazable woodlands.

Herbage nitrogen recovery in a meadow and loblolly pine alley. D. M. Burner and C. T. MacKown. 2005. *Crop Science* 45:1817–1825. (USDA-ARS, Dale Bumpers Small Farms Research Center, 6883 South State Highway 23, Booneville, AR 72927). In loblolly pine–tall fescue silvopastures, annual fertilizer applications should not exceed 89 pounds of nitrogen per acre in shaded areas and 267 pounds of nitrogen per acre in unshaded areas.

Hydrology/Riparian

Patterns of willow seed dispersal, seed entrapment, and seedling establishment in a heavily browsed montane riparian ecosystem. E. A. Gage and D. J. Cooper. 2005. *Canadian Journal of Botany* 83:678–687. (D. Cooper, Department of Forest, Rangeland, and Watershed Stewardship, Colorado State University, Fort Collins, CO 80523). Excessive elk browsing reduced seed production by willows in Rocky Mountain National Park.

Plant/Animal Interactions

Effect of pocket gophers on aspen regeneration. S. T. Coggins and M. R. Conover. 2005. *Journal of Wildlife Management* 69:752–759. (Department of Forest, Range, and Wildlife Science, Utah State University, Logan, UT 84322). Results indicated that the effect of pocket gophers on aspen regeneration is minimal compared to the effects of browsing by wild and domestic ungulates.

Effects of conifers and elk browsing on quaking aspen forests in the central Rocky Mountains, USA. M. W. Kaye, D. Binkley, and T. J. Stohlgren. 2005. *Ecological Applications* 15:1284–1295. (School of Forest Resources, The Pennsylvania State University, University Park, PA 16802). Conifer encroachment and elk browsing both decreased aspen recruitment, and heavy elk browsing decreased overall aspen growth by 30%.

Evaluating lek occupancy of Greater Sage-grouse in relation to landscape cultivation in the Dakotas. J. T. Smith, L. D. Flake, K. F. Higgins, G. D. Kobriger, and C. G. Homer. 2005. *Western North American Naturalist* 65:310–320. (Box 212, Lawton, IA 51030). Rangeland lost to cultivation from 1972 to 2000 was not related to lek abandonment by Sage-grouse in North and South Dakota.

Grassland songbird nest-site selection and response to mowing in West Virginia. K. A. Warren and J. T. Anderson. 2005. *Wildlife Society Bulletin* 33:285–292. (U.S. Fish and Wildlife Service, Wertheim National Wildlife Refuge, P.O. Box 21, Shirley, NY 11967). In a comparison of mowed and unmowed grasslands on the Canaan Valley National Wildlife Refuge, there was no difference in nest success for the 4 dominant grassland songbirds (ie, Bobolinks, Savannah Sparrows, Red-winged Blackbirds, and Eastern Meadowlarks). Mowing may provide long-term advantages to grassland bird nesting success by suppressing encroachment of trees and shrubs.

Plant Ecology

A comprehensive ecological land classification for Utah's West Desert. N. E. West, F. L. Dougher, G. S. Manis, and R. D. Ramsey. 2005. *Western North American Naturalist* 65:281–309. (Department of Forest, Range, and Wildlife Science, Utah State University, Logan, UT 84322). Presents a hierarchical land classification that incorporates Ecological Sites into ECOMAP, a national land classification system endorsed by the Federal Geographic Data Committee that is designed to improve communication across ownership boundaries.

Beginnings of range management: Albert Potter, first Chief of Grazing, U.S. Forest Service, and a photographic comparison of his 1902 forest reserve survey in Utah with conditions 100 years later. D. A. Prevedel and C. M. Johnson. 2005. *USDA Forest Service R4-VM 2005-01*. 94 p. (Publications Distribution, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526). This bulletin documents the accomplishments of Albert Potter, the first Chief of Grazing and later Associate Chief of the U.S. Forest Service. Comparisons between recent photos and photos taken by Potter in 1902 illustrate conifer encroachment into sagebrush–grass and aspen communities.

Biology, ecology, and management of western juniper. R. F. Miller, J. D. Bates, T. J. Svejcar, F. B. Pierson, and L. E. Eddleman. 2005. *Oregon State University Agricultural Experiment Station Technical Bulletin 152*. 77 p. ($3; order by phone 1-800-561-6719). Synthesizes current knowledge about the history, biology, ecology, and management of western juniper. Western juniper woodlands occupy 9 million acres in central and eastern Oregon, northeastern California, southwestern Idaho, and northwestern Nevada, with a few outlying stands in southern Washington.

Canopy dynamics and human caused disturbance on a semi-arid landscape in the Rocky Mountains, USA. D. J. Manier, N. T. Hobbs, D. M. Theobald, R. M. Reich, M. A. Kalkhan, and M. R. Campbell. 2005. *Landscape Ecology* 20:1–17. (Natural Resource Ecology Lab, Colorado State University, 200 West Lake Street, Fort Collins, CO 80523). Repeat photography illustrates that conifers increased in savannas and shrub steppe of western Colorado from 1937 to 1994.

Douglas-fir's effect on mountain big sagebrush wildlife habitats. A. J. Grove, C. L. Wambolt, and M. R. Frisina. 2005. *Wildlife Society Bulletin* 33:74–80. (Montana Fish, Wildlife and Parks, White Sulphur Springs, MT 59645). As Douglas-fir canopy cover increased beyond 20%, mountain big sagebrush canopy cover declined to less than 15%. When Douglas-fir canopy increased beyond 35%, mountain big sagebrush canopy cover declined to less than 5%.

Multi-scale impacts of crested wheatgrass invasion in mixed-grass prairie. D. C. Henderson and M. A. Naeth. 2005. *Biological Invasions* 7:639–650. (Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2H1, Canada). In crested-wheatgrass–invaded grasslands of Alberta and Saskatchewan, native midgrasses and forbs were less abundant; shortgrasses were unaffected; plant biomass and litter were greater; and belowground organic matter and soil organic carbon, nitrogen, and phosphorus were unaffected.

Structure of historic vegetation on Kerr Wildlife Management Area, Kerr County, Texas. F. H. Wills. 2005. *Texas Journal of Science* 57:137–152. (11322 Two Wells, San Antonio, TX 78245). "Grassland has disappeared from the area over the past 120 years, being replaced by woodland and forest in the contemporary landscape."

Rehabilitation/Restoration

Differential physiological responses of Dalmation toadflax, *Linaria dalmatica* L. Miller, to injury from two insect biological control agents: Implications for decision-making in biological control. R. K. D. Peterson, S. E. Sing, and D. K. Weaver. 2005. *Environmental Entomology* 34:899–905. (Department of Land Resources and Environmental Science, Montana State University, Bozeman, MT 59717). A stem-boring weevil, *Mecinus janthinus*, had more impact on Dalmation toadflax than did a defoliating moth, *Calophasia lunula*.

Fire and litter effects on seedling establishment in western Oregon upland prairies. M. P. Maret and M. V. Wilson. 2005. *Restoration Ecology* 13:562–568. (M. Wilson, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331). In these winter-moist grasslands, litter inhibited seedling establishment. Prescribed burning followed by seeding can be an effective restoration technique.

Grazing management and nitrogen fertilization effects on vaseygrass persistence in limpograss pastures. Y. C. Newman and L. E. Sollenberger. 2005. *Crop Science* 45:2038–2043. (L. Sollenberger, Department of Agronomy, University of Florida, Gainesville, FL 32611). Continuous grazing by steers to a 6-inch stubble height reduced vaseygrass (an undesirable grass) and increased limpograss (a desirable grass), and continuous grazing was more effective than rotational grazing.

Socioeconomics

Commentary: wildlife ranching in North America—arguments, issues, and perspectives. M. J. Butler, A. P. Teaschner, W. B. Ballard, and B. K. McGee. 2005. *Wildlife Society Bulletin* 33:381–389. (Department of Range, Wildlife and Fisheries Management, Texas Tech University, Lubbock, TX 79409). Discusses the advantages and disadvantages of fee-hunting and wildlife farming and husbandry.

Soils

Spatial and temporal variation in islands of fertility in the Sonoran Desert. J. D. Schade and S. E. Hobbie. 2005. *Biogeochemistry* 73:541–553. (University of California, Angelo Coast Range Reserve, 42101 Wilderness Lodge Road, Branscomb, CA 95417). Soil organic matter, nitrogen cycling, and microbial biomass were greater under canopies of velvet mesquite trees, regardless of where the trees were found across the landscape.

HIGHLIGHTS

Rangeland Ecology & Management, November 2005

Effects of Nitrogen Deposition on an Arid Grassland in the Colorado Plateau Cold Desert

Susanne Schwinning, Benjamin I. Starr, Nathan J. Wojcik, Mark E. Miller, James E. Ehleringer, and Robert L. Sanford Jr.

Rising atmospheric N deposition will impact ecosystems worldwide. This study investigated the effects of spring and summer NH_4^+ and NO_3^- inputs on 2 rangeland grasses (C3 and C4) on the Colorado Plateau. Both grasses took up N derived from NH_4^+ or NO_3^- in spring, but only the C3 grass increased in cover, while a summer-active annual invader had the greatest growth response overall to summer-applied NO_3^-. Simultaneously declining N inputs from biological crusts in spring and increasing atmospheric N deposition at any time of year may weaken the resilience of this ecosystem to change and promote invasion by weedy summer annuals.

Resilience of Willow Stems After Release From Intense Elk Browsing

Bruce W. Baker, H. Raul Peinetti, and Michael B. Coughenour

The resilience of willow stems released from intense elk browsing was quantified with a retrospective study that compared biomass, number, and length of stem segments located inside and outside elk exclosures. Segment biomass increased by about 3–12 g/y on browsed stems and 10–27 g/y on protected stems. Protected stems had more long segments and fewer short segments than browsed stems for the first 3 years but then increased their number of short segments as stems became tall and bushy. Short-hedged willow stems are highly resilient and can rapidly recover height and vigor after protection from intense elk browsing.

Classification of Willow Species Using Large-Scale Aerial Photography

Steven L. Petersen, Tamzen K. Stringham, and Andrea S. Laliberte

Accurately identifying and mapping willow distribution for multiple species over large areas is generally impractical in the field. We utilized high-resolution color and color-infrared aerial photography and geospatial classification and analysis (using GIS) to accurately classify and map all 3 willow species located in a riparian ecosystem in southeast Oregon. Of the classification methods examined, a supervised classification with spectral signatures developed from a polygon delineation technique was most effective in reducing classification error associated with other image features (82% accuracy). These methods make it possible to gather precise data over greater spatial and temporal extents, reducing the time and cost required to obtain similar results in the field.

Quantifying Vegetation Change by Point Sampling Landscape Photography Time Series

Patrick E. Clark and Stuart P. Hardegree

Quantitative assessment of vegetation change using repeated oblique or landscape photography has not been possible. The purpose of this study was to develop sampling and analysis techniques for using a time series of digitized landscape photography to quantify vegetation change on rangeland landscapes. Digital images created from black-and-white landscape photographs (1917, 1962, and 2000) were spatially registered to each other using control points and a polynomial transformation algorithm. Changes in image cover of each cover type and direction of cover-type conversions were successfully determined for each intervening time period.

Detection-Threshold Calibration and Other Factors Influencing Digital Measurements of Ground Cover

D. Terrance Booth, Samuel E. Cox, and Douglas E. Johnson

Measuring bare ground from nadir rangeland photographs at hundreds per minute may reduce the time and costs of rangeland ecological assessments if human errors and inconsistencies in setting detection thresholds can be reduced. We developed a calibration procedure that makes threshold adjustment less subjective, and we tested our calibration by

comparing manual and automated measurements. In 3 tests, measurements by calibrated software did not differ from manual measurements by more than 7%—compared to a 10%–26% difference without calibration—suggesting the potential for computers to significantly reduce the cost of ecological monitoring.

Infiltration and Sediment Rates Following Creosotebush Control With Tebuthiuron

Steven R. Perkins and Kirk C. McDaniel

Although the use of herbicides to control creosotebush is a common management practice, little is known about the long-term effects of herbicide treatments on rangeland hydrology. We conducted rainfall simulations in areas treated with the herbicide tebuthiuron 5–9 years ago, 15–18 years ago, and untreated areas. We found that infiltration rates were highest in areas treated 5–9 years ago, intermediate in untreated areas, and lowest in areas treated 15–18 years ago. Sediment yield was not significantly different among treated or untreated areas. Results from the study will assist land managers in understanding long-term effects of chemical creosotebush control on rangeland hydrology.

Hydrologic Response of a Central Nevada Pinyon-Juniper Woodland to Prescribed Fire

Benjamin M. Rau, Jeanne C. Chambers, Robert R. Blank, and Wally W. Miller

This study was conducted to determine the effect of prescribed fire on surface hydrology in Great Basin pinyon-juniper woodlands. Before burning, the infiltration and saturated hydraulic conductivity rates on interspace and shrub canopy microsites were less than on tree canopy microsites at the midelevation sites. Following burning, the microsites with intermediate tree cover had greater infiltration rates than interspace microsites, and all other microsites were similar to each other. Burning increased water repellency of surface soils (0–3 cm) for all cover types. Spring burning in pinyon-juniper woodlands may produce a hydrologic response depending on surface soil texture and vegetation cover.

Water Quality at Wildlife Water Sources in the Sonoran Desert, United States

Steven S. Rosenstock, Vernon C. Bleich, Michael J. Rabe, and Carlos Reggiardo

Does poor water quality pose a risk to animals utilizing artificial and modified natural water sources developed for desert wildlife? Water quality parameters were sampled at guzzlers, tinajas (natural rock basins), wells, and developed springs in the Sonoran Desert of Arizona and California. Three of 21 measured chemical parameters (pH, alkalinity, and fluoride) occasionally exceeded recommended guidelines by relatively small margins. Pathogenic organisms (*Trichomonas gallinae*) and blue-green algal toxins were not found. Water quality at all sites was deemed suitable for animal use and unlikely to cause health problems alleged by critics of wildlife water development programs.

Conditioning Sheep to Graze Duncecap Larkspur (*Delphinium occidentale*)

Michael H. Ralphs

Sheep are more resistant than cattle to larkspur poisoning and thus may be used as a biological tool to graze larkspur to prevent cattle poisoning. Ewes were fed larkspur plants, then dosed with glucose to provide a positive nutritional response. The positive conditioning enhanced larkspur consumption in the pen, but ewes preferred other forages in the field until late in the grazing season, when larkspur matured and other forages were depleted. Even though the positive-conditioned sheep grazed more larkspur than the untreated control group, the amount consumed and the timing of consumption were not sufficient to potentially prevent cattle poisoning.

Effect of Ruminal Incubation on Perennial Pepperweed Germination

Michael F. Carpinelli, Christopher S. Schauer, David W. Bohnert, Stuart P. Hardegree, Stephanie J. Falck, and Tony J. Svejcar

Grazing may be used to control perennial pepperweed where chemical and mechanical methods are inappropriate because of proximity to water; however, grazing animals may introduce perennial pepperweed to uninfested areas via fecal pats. We studied how digestion by cattle affects perennial pepperweed germination. Germination of seeds that were digested by cattle greatly increased compared to seeds that were not digested by cattle. These results suggest that livestock that have grazed seed-bearing perennial pepperweed plants should be held on weed-free forage for about 1 week prior to being moved to uninfested areas, or, preferably, grazing should occur prior to seed set.

Long-Term Grazing Effects on Genetic Variability in Mountain Rough Fescue

Yong-Bi Fu, Don Thompson, Walter Willms, and Mairi Mackay

Mountain rough fescue (*Festuca campestris* Rydb) is a dominant grass species in the montane grasslands of western Canada, but little is known about its genetic diversity and the effects of long-term grazing on population genetics. Genetic diversity of fescue plants in adjacent grazed and protected areas for 3 populations was evaluated. Comparisons between grazing and nongrazing samples revealed variable and relatively small impacts of the long-term grazing on the genetic diversity of the grazed populations. If developing diverse

germplasm for rangeland seedings is desired, one should sample across geographic space rather than combining materials with and without historical grazing pressure.

Herbage and Seed From Texan Native Perennial Herbaceous Legumes

James P. Muir, Judy Taylor, and Sindy M. Interrante

There are few native herbaceous legume species commercially available for planting in the southern Great Plains. This study collected seed of 15 herbaceous legumes in north-central Texas and evaluated them for herbage yield, nutritive value, and, in the case of 8 species, their seed production potential in small plots. Herbage yields ranged over 100 g/plant/y, seed reached over 20 g/plant/y, NDF values ranged below 35%, while CP values exceeded 20%, in some cases. A promising range of native herbaceous legume germplasm exists in the southern Great Plains that needs to be commercially developed for rangeland reseeding, roadside planting, pastures, wildlife feed, and ornamental horticultural.

Research Note: Use of Felled Junipers to Protect Streamside Willows From Browsing

Casey A. Matney, Chad S. Boyd, and Tamzen K. Stringham

Browsing by livestock and wildlife species can negatively impact willow size and abundance. We examined the use of felled western juniper trees (*Juniperus occidentalis* Hook) as cover to protect streamside willow shrubs. In August 2003, 1-year posttreatment, the average growth of willows in covered treatments was 25 cm (480%) greater than in noncovered treatments, and by October 2003 (posttreatment), more shrubs were browsed in noncovered (84%) compared to covered (39%) treatments. Our data suggest that covering small willow shrubs with felled western juniper is an effective deterrent to browsing and may provide a useful alternative to fencing. ◆