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Sharing Common Ground on Western Rangelands: Proceedings of a Livestock/Big Game Symposium

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This proceedings includes 37 papers and posters presented at the "Sharing Common Ground" symposium. The information represents the progress made in livestock/big game management since the 1991 symposium with the theme of "Seeking Common Ground." The broad range of topics includes the rangeland resource, the science of livestock/big game interactions, the human dimension, and the success stories from the seeking common ground partnership demonstration projects.

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Contents

Introduction and Keynote Address

Welcome to a Celebration!

Herb Manig

Welcome to the Sharing Common Ground symposium. The rewarding turnout during these troubled budget times is a clear indication that the interest is still high and we are committed to finding solutions to livestock/big game issues. I predict this exchange of information, the strengthening of current partnerships, and the building of new partnerships will significantly add to the successes of the future. Some years ago, a dairy company erected a sign along a highway in Florida that exclaimed, "Our milk comes from discontented cows—they're always striving to do better!" Better than anything else that comes to my mind, this description characterizes the attitude of those who have confronted the issue of livestock/big game interactions in nonconfrontational ways. That description undoubtedly fits every one of you, for your participation is a testimonial to your striving to do better.

The theme of our second livestock/big game symposium is "Sharing Common Ground." That theme is very significant! It proclaims that progress is being made. When the first symposium was held over 4 years ago, the theme was, "Seeking Common Ground." Yes, that theme did recognize the efforts of some to resolve livestock/big game conflicts, but it also conveyed the point that as animals increasingly found common ground, the human stakeholders found less and less of it.

Let's travel back in time to May, 1990. Eleven stakeholders representing the Forest Service, wildlife interests, and the livestock industry gathered as a team to address the increasing conflicts between livestock grazing and Western big game populations. They gathered to assess the conflict between livestock and big game on National Forest System lands and affected private lands. This team spent 2 weeks in the Intermountain and Southwestern Regions of the Forest Service, visiting over 100 individuals and examining all aspects of resource management on eight National Forests.

Yes, they encountered polarity among user groups and government agencies, and they found sufficient blame for all to share. But they also found unanimous agreement that the basic soil, water, and vegetation resources need to be maintained while providing a variety of uses and values. They agreed that rangelands and a sound range management program provide livestock forage, wildlife habitat, enhanced recreation opportunities, stable watersheds, and many other benefits and values.

Their report concluded that we can argue about how range is used, but range condition must be the governing factor that controls all management and use. As range condition improves, there is more flexibility for all uses to be perpetuated. All, human and nonhuman, can be winners if range is properly managed, however, all will lose if it isn't. One of the specific recommendations contained in the report was direction to organize a special educational event involving all the stakeholders. If there were to be win-win results, then we had to be able to demonstrate the desire to seek common ground and communicate ideas to demonstrate that we knew or could determine how to find it. Hence the "Seeking Common Ground" symposium of September, 1991.

The overwhelming participation in that symposium and the commitment of attendees to work together to improve the range were tremendously gratifying to the symposium steering committee members—and I'm sure to all stakeholders. We also concluded that our responsibilities were not going to end when everyone returned home from the symposium, so we all rolled up our sleeves and agreed that we were going to continue with the effort to support those who were making a positive difference on the ground.

This support came with promotion and publicity, and it came with limited financial assistance to 10 demonstration projects out of the 40 that applied. Various levels of funding came from the Rocky Mountain Elk Foundation, the National Fish and Wildlife Foundation, the Forest Service, the Bureau of Land Management, and the American Farm Bureau Research Foundation.

In the many months between the first symposium and this celebration of successes, much dedication and hard work has been accomplished, trust levels among project stakeholders have risen, lessons on what to do have been learned, lessons on what not to do have been experienced, resource improvements have been celebrated, and demonstration projects have hosted many other stakeholders, many of them in positions of influence.

Now it's time to share—time to share these valuable lessons, time to share optimism and vision for the future, time to "Share Common Ground!" Let me first share with you the identities of some of the people who have made special contributions with their time and dedication. We also thank the organizations employing these individuals. Without "company" support in the form of time and money, the symposium plans would have failed.

Heading up the list of significant contributors is Kevin Lackey, Rocky Mountain Elk Foundation, for putting together an outstanding program. L. Jack Lyon, Intermountain Research Station, Forest Service, is our poster session chairman and has worked long hours to organize and implement a poster session that will be the "watering hole" where we will all gather to exchange information and form partnerships for the future. Keith Evans, Intermountain Research Station, Forest Service, has agreed to coordinate the publishing of the proceedings for the symposium—his work is just starting. Most of all, we owe a great deal of gratitude and appreciation for the untiring efforts of Betsy Macfarlan, Executive Director of the Nevada Cattlemen's Association, in her essential role as symposium steering committee executive secretary and symposium logistics coordinator. Thank you Betsy, Kevin, Jack, Keith and all the other steering committee participants for this excellent program.

As we share common ground with each other today and tomorrow, let's ask ourselves what we should be prepared to do in the future to continue the momentum you have generated and enhance the successes of the future. Remember, you are helping to shape the future, decide future activities, and set objectives beyond those accomplished with this symposium.

Ladies and gentlemen, let the celebration begin!

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Keynote Address—Working Together, Winning Together

Dan Dagget

It's election time again, but I have to admit I've been staying away from politics. While many of my friends have been indulging in the biennial bloodletting we call the campaigning, I've been spending as much time as possible out in the world of trees and grass and bugs and streams with sleeves rolled up, sweating and joking with one of several groups of ranchers, vegetarians, Wise Users, and Earth Firstlers with whom I've been working for a few years now. Together, we've been making a difference quite unlike the difference one can make in the political arena. It's a difference we can see and touch and hear and smell. And we've been celebrating successes that can be measured in restored meadows, healing riparian areas, and increased biodiversity.

For me, working with these diverse groups has been a life-changing experience. Having been a soldier in the environmental army—with the Sierra Club, Earth First!, Audubon—for so long (20-plus years), I had forgotten how uplifting it can be to be part of a group of people who don't all think the same, who don't stand around talking about doom and gloom, painting the world in shades of guilt, and looking for someone else to blame. The members of these groups—by being able to work together in spite of the fact that we are of widely diverse political, religious, and cultural stripes—have affirmed that our common concern for the environment, and for each other, is more important to us than differences over which people have gone to war.

Think of how powerful a statement that is.

We still have our differences, and in many cases they are big differences. But we also have enough concerns in common about creating a positive future for ourselves and for other living things to convince us that, if we can help one another achieve some of the goals we share, the gulf between us will narrow.

And we're finding that we are right.

The process we use to forge these common ground solutions isn't magical. It isn't even complex, although it still isn't easy. It's something each of us uses every day when we put in a day's work—doing our job, planting a garden, raising a family. More often than not we work with people we don't agree with politically, but we still get the job done. And we get better results than politicians have ever got of solving our problems for us.

This realization, that we humans have two separate approaches to solving problems, one based on competition, confrontation, and control and the other based on collaboration, community, and trust has really been one of the most eye-opening realizations of my life. I've spent a lot of time thinking about these two approaches or paradigms or whatever you choose to call them; about their strengths and weaknesses; about why we choose one rather than the other.

The confrontational approach is based on dominance. (That seems obvious enough.) Its tools are the political process, legislation, regulation, litigation, blaming, crime and war. (Winston Churchill said that war is just politics with bullets.) To use this approach well we must be independent, suspicious, controlling, adversarial. This approach is process-oriented. "What we need is 'new leadership,'" the candidates tell us, or more jobs, or a balanced budget, or stricter immigration laws, or a flat tax, or good growth, but they never tell us what kind of society they are trying to create for us. And we never tell them what kind we want them to create.

The confrontational approach is based on the assumption that the world is a place of scarcity, and that all actions need to be seen in that light. "Aren't they doing that just to get more grass for their cattle?" people asked when I was describing range restoration programs. Under this paradigm every action demands an equal and opposite reaction.

The collaborative approach is based on working toward a goal, getting a job done. Its tools include teamwork, cooperation, communication, community, and common ground. To use it well, we must be interdependent, trustful, respectful. We must hold ourselves and each other in high esteem. This approach is goal directed. It operates on the assumption that abundance can be created—that the whole is greater than the sum of its parts.

Which is more powerful? Which works best?

The best thing I can do here is give an example. The best one I know of is the one that caused me to see the Jekyll and Hyde character of our problem-solving capabilities.

It was about 2 years ago, during the last election. I had just pulled into my driveway and was listening to "All Things Considered" on National Public Radio. The newscaster was talking about World War II. It was some kind of an anniversary, of D-Day or something. I remember that it was the beginning of a flurry of anniversaries, of V-E Day and V-J Day. And he talked about the veterans who had lived through those days of hell on earth—old men now going back to visit the place where, in their youth, they had achieved superhuman feats, surviving mines, machine guns, terror. I sat in the car and let the radio play. The next report was about the Soviet *Mir* space station and how the American space shuttle had docked with it, and an American astronaut had climbed on board. The astronauts were now orbiting the Earth together. As I listened, I was struck by how so very different were these two examples of human endeavor, and a wave of awakening washed over me.

I thought of a friend of mine and his favorite quote (he attributes it to Desmond Morris, author of the *Naked Ape*) that we humans remain little more than cave men although we have replaced our stone axes with nuclear weapons. And I thought of that quote in a new light. That we humans have

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developed the practical side of our problem-solving capability to the extent that it now stands ready to take us to the stars, even, in some cases, in the same ships as some of our enemies, or former enemies. And in spite of this, our political side still has us raping and murdering our neighbors in Bosnia, and Rwanda, in Iraq, in Oklahoma City.

Which method works the best?

There are those who argue (convincingly, I think) that war has yet to solve its first problem. Germany and Japan fought World War II, in part at least, to increase their economic and political power and their influence over their part of the world. Having applied the ultimate expression of confrontation their score in achieving those goals was less than zero, and in the process they killed 17 million combatants and 18 million civilians. In Germany one out of every three buildings was destroyed.

The postwar reconstruction that followed World War II was, on the other hand, a classic win/win solution—identify a goal that benefits all parties and work together to achieve it (build a factory, build a house, put people to work rebuilding their communities). While the war killed tens of millions, the postwar reconstruction gave hundreds of millions a new life by giving them jobs. While the war left scores of millions homeless, the postwar miracle, as we have come to call it, put roofs over their heads, and spurred an unprecedented period of prosperity and relative peace.

Which way works best?

Does the win/win process of identifying a goal and helping one another achieve it work on problems that threaten wildlife, habitat, human communities? You bet it does! Teams I have worked with have made significant headway against problems that have stymied the process of solution by blaming for over a century. We have achieved things that many have said were impossible. I wrote a book about some of them. Many of you have read it.

In northern Montana, a group that goes by the name of the Devil's Kitchen Group brought people from the Forest Service, the Montana Department of Fish Wildlife and Parks, the Bureau of Land Management, the Montana State Lands Department, sportsman's groups, and ranchers together to "dream a larger vision of mutually shared management" and forged a ground-breaking decision in one of the most contentious environmental issues in the West—the argument over whether the grass belongs to ranchers or to wildlife, to elk or to cattle. It was a decision in favor of collaboration, of win/win or no deal. "There was some controversial stuff in that package," remembers one team member. "The organized groups would never have gone along with it if their representatives had not been part of the process." But now cattle and elk graze together on the land; and the land and the community are healthier for it.

In central Nevada, an association of ranchers, government land managers, and just plain citizens named the Toiyabe Wetlands and Watersheds Management Team has made progress reversing the effects of more than a century of overgrazing and other mismanagement. These abuses have reduced the once productive grasslands of the western slopes of the Toiyabe Mountains to little more than sagebrush flats and gullies deepening with every rainfall. Though the Federal government had plowed truckloads of money into this land, it had continued to worsen until this team began its program of collaborative stewardship in 1989. That stewardship has covered 80 percent of what had become bare dirt with green and growing plants, and water is once again flowing regularly in streams that had become little more than desert storm drains. Wildlife is returning.

On the northern Arizona ranch that belongs to the family of Secretary of Interior Bruce Babbitt, a team of local environmentalists, scientists, ranchers, and students is studying better ways to sustainably manage grasslands of the arid Southwest. On a 5 acre study plot we have increased by 75 percent the number of young plants available as food to both wildlife and livestock while actually increasing grazing pressure.

These groups have come together outside the political process, almost in spite of it. Their gatherings are not mandated by law nor forced by lawsuit. These people are here because they want to be. They could just as easily have manned the ramparts and kept on fighting. Instead they chose to work together and to work close to the land.

That brings us to the last and perhaps most important point I'd like to make today. It involves opportunity and money.

Wars and politics are notorious for spending money and for wasting it. Consider what happens to the dollars so many of us on both sides of these issues send off to fight our fights through the channels of politics, regulation, and litigation. How much of that money actually makes it to the land? How much actually ends up being spent to improve habitats and restore ecosystems, to improve the well-being of wildlife populations that, in the last analysis, improves our own well being? Very little? Almost none? Most of it goes to politicians, lobbyists, lawyers, fund raisers, and media people who give us battles not biodiversity, standoffs not solutions.

Look at what the Devil's Kitchen Group has done, at what the Tiptons have done, at what the Deseret Ranch has done in Utah, increasing elk numbers from 300 to 2,000. Wouldn't it make sense to use more of our money to encourage achievements like that? And I'm not talking about handouts, I'm talking about markets. About rewarding people for achieving goals. How do we get some of the hundreds of millions of dollars that are being spent out of concern over our Western lands to the people who can actually restore those lands, to the people who can produce healthy habitats, functioning ecosystems, healed watersheds?

The first challenge we face during and after this conference is to find more effective ways to come together in collaborative teams. To get larger and more diverse groups of people working together by doing whatever it takes—by attracting more effective facilitators or training them if need be; by getting more groups to adopt and support collaborative methods over confrontative ones.

The second challenge is to find more ways to make good stewardship a marketable commodity, so it can be rewarded. The idea Steve Rich of Jacob Lake, AZ, came up with—of marketing beef that has been certified to have been produced in an environmentally positive way is one of those ways. Grants for ecosystem restorations or for buying conservation easements to valuable habitat may be another.

I believe there is so much potential in what we have come here to discuss that we are unable to imagine it yet. I have seen what it can do on the ground. I have heard the enthusiasm and hope in the voices. I have seen old enemies embrace. I hope you have a wonderful two days here, I hope you learn a lot, make a lot of new friends, bust a few paradigms, and I hope you go back home primed and ready to start win/winning the range war.

Sharing Common Ground—A Way Toward Common Solutions

Jack Ward Thomas

Abstract—This paper looks at the evolution of livestock/big game conflict resolution on Western rangelands since the advent of the "Seeking Common Ground" initiative in 1991. Land use and management problems facing public and private land managers are discussed as is the quest to find the balance between the needs of wildlife and livestock interest groups. Discussion of the Owl Mountain, CO, Devil's Kitchen, MT, and Bruneau River Projects, NV, are provided as examples of on-the-ground successes. Emphasis is placed on the collaborative and partnership nature of the "Seeking Common Ground" program and the importance of sustainable management of public rangelands. Identification of common elements of success and potential action items for the future are identified.

In 1991, I stood before you not as Chief of the Forest Service, but "from the field" with mud on my boots and the air of the Blue Mountains in my lungs. I thought things were pretty tough and charged back then. I talked of the differences between *messes*, which must be **endured**—such as inherent conflicts between users; private, State, and Federal interests; and division of responsibilities between agencies—and *problems*, which can be **solved**. I also spoke of mistrust, aggravation, and animosity.

Many of those forces and feelings I addressed then are still with us. If anything, now with roadsalt on my shoes, and the air of the nation's capital in my lungs, things seem hotter than ever most days. Divisiveness and debate over the fate of public lands, the place of livestock grazing on those lands, issues of public interest and private property rights, and indications that our publics have low faith in the government's and commercial public land users' ability to be responsive to the public could lead one to despair.

But today, as I look out at this group and visualize what has—and what *can* and *will* happen—I cannot but be encouraged by finding new ways to work together, to reason together, and to build trust—with the idea of doing the right thing for the land. In fact, I renew my soul and my mission by leaving Washington and getting with people close to the ground. Not because everything is great, but because those people care—and care deeply—and many are trying to find common ground and to do the right things. I am here today to talk about some of your outstanding successes, and to offer some ideas on moving forward to share more common ground.

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The 1991 symposium was nationally sponsored by Federal agencies and organizations interested in wildlife and livestock use of public lands. The goal was to bring together people with diverse interests to define problems and find solutions. Some of these groups established the Seeking Common Ground Steering Committee and have been the driving force responsible for launching the demonstration area program and for planning this symposium. Thanks to all of you that have been, and continue to be, part of this outstanding effort.

In 1993, the first Seeking Common Ground Demonstration projects were selected. They were locally based—where the problems exist—and each group member had an *equal* seat at the table. Finding solutions through consensus was the process. These groups were not driven by civil servants, although they often had a place at the table. I am excited today about what's been accomplished in just 3 years. The quest to find a mutually satisfactory balance between conservationists and wildlife interests who seek what they consider to be a more equitable consideration of wildlife on Western rangelands, and ranchers who seek to continue their proud way of life, continues. I feel that balance is closer today. Better yet, the path not taken 3 years ago has footprints—big ones—on it.

The land use and management problems facing public and private land managers are usually similar and often identical—only the point of view is different. The decisions made by one will often affect the other. Graziers have their livelihood and way of life at stake; conservationists have appropriate concerns with condition of rangelands. Private landowners rely on grazing on public lands to round out their operations on private land; conservationists know that proper stewardship of public lands is crucial to sustaining grazing for both livestock and wildlife. In many cases, private landowners support increasing big game numbers on their land. It is important that folks interested in big game on Western rangelands not take this lightly nor for granted. Allied livestock interests and wildlife advocates can produce win-win solutions to problems.

Even though Federal budgets continue to shrink, our commitment to meeting people's needs, while ensuring the health and diversity of ecosystems, has increased. The Seeking Common Ground projects exemplify our joint commitment to combining resources, including people's spirit and talents, to achieve mutual goals more effectively and efficiently. And both the land and the people prosper.

The demands for livestock, big game, water, fisheries, other wildlife, and recreation must be met jointly from rangelands maintained in acceptable condition. The components cannot be separated. The separations are artificial. The same land produces all renewable natural resources.

This is the recognition that has begun to be called ecosystem management—and that such an approach is more about people than anything else.

Increasing demands from the American people, coupled with a static or shrinking resource base, inevitably produce conflict. There is just so much land and we need to make decisions to manage that land in a fashion that assures sustainability.

There will always be a need for more research, but we cannot wait for research to provide the definitive solution—because it never will—that insulates us from exercising our judgment as natural resource managers. Let us make the best decisions we can, based on the science, experience, wisdom, and information available—from whatever source.

A common thread runs through all of the Seeking Common Ground projects: *collaborative* solutions to conflict. Long hours of discovery and negotiation build trust and make consensus possible. Many of these groups have met regularly for several years. They are committed to continued work to monitor their decisions. There are many successes—and some failures. Let us ignore the failures—except to learn from those failures. Let us celebrate the successes—and put more people on that path.

For example, in Colorado in 1994, the Owl Mountain Seeking Common Ground partners worked diligently to figure out how to meet the needs of one permittee whose requested animal unit months (AUM) seemed in conflict with the Federal agency mission to improve management of adjoining wetland and upland habitat. Before the summer of 1995, when the permittee was due to go on his allotment, the partners reached consensus and submitted to the Bureau of Land Management (BLM) a grazing system designed to accomplish both goals. The BLM accepted the plan. Cattle grazed and habitat improved. Two weeks after livestock left the allotment, full regrowth had occurred.

In Montana, the cooperative efforts of the Devil's Kitchen Project resulted in increased public access to private lands and greater hunting opportunity across all ownerships. Many ranchers in this area are also private outfitters concerned about protecting the hunting available on their lands. But the wildlife did not cooperate and migrated to areas of solitude, mostly Federal lands where access was difficult at best. The patchwork nature of landownerships limited the ability of either group to affect change. Access to one area often requires crossing over the other. Using the collaborative process, the project reached consensus on two hunting season plans that were submitted to the Montana Department of Game and Fish. The plans were adopted and later used as prototypes during development of legislation creating the Governor's Private Land/Public Wildlife Advisory Council. Was this easy? Absolutely not! But if you were to ask them, "Was it worth it?"—the answer would be a resounding YES!!

A local project of interest is the Bruneau River Project. Although parts of this effort existed prior to formal designation as a Seeking Common Ground demonstration area, it is a shining guiding star for land management in Nevada. In the late 1980's, the Nevada Department of Wildlife proposed the reintroduction of elk to historic habitat in the Bruneau River area. Around this time the Forest Service determined that rangelands in the Bruneau were in desperate need of rehabilitation. Part of that solution was a cut in grazing permits. Now you can imagine how popular these decisions were with the local ranchers. However, there is a happy ending. The Rocky Mountain Elk Foundation seized the opportunity to purchase a ranch that held the access to public lands that lie beyond it. They subsequently transferred over half of the ranch to the State of Nevada and sold the rest. After forming a committee of interested parties, their first official act was to relinquish their grazing permits back to the Forest Service. The Forest Service agreed to a request to reallocate one-half of these permits to Bruneau ranchers who would have been affected by the cuts in AUM's. The collaborative process had begun; with many interests at the table consensus was reached and the results are remarkable. While the original purchase consisted of just under 5,000 acres, this partnership allowed for a joint effort to map, classify, and inventory 150,000 acres of upland habitat and 120 miles of riverine and riparian habitat along the Bruneau River. Cattle allotments have been realigned and no permits were cut. Elk have been reintroduced with no appeals filed—and now the public has access to some great fishing and public lands. Populations of a species at risk, the red-band trout, are also increasing.

We have other stories just as successful in Utah, Arizona, and Wyoming. Other projects in North Dakota are just beginning. In addition, many other examples of successes don't necessarily have a "Seeking Common Ground" designation. In 1993, I challenged you to seek common ground, and thank God so many of you took the challenge and found success. But we all know there is still much to do. We have many miles to go before we sleep.

Some of you may have heard me relate before how, as a boy growing up in Texas, no public lands were available to me. I roamed the fields and hills of privately owned lands—all at the largess of the owner. Later, when I was 32 years old, I discovered public lands, a new notion to me! From then on, I maintained a vision of what public lands could mean for people and all wild things. Since I have been in my job in Washington, DC, I have discovered that many people in this country have strong feelings for their lands. They have told me of those feelings. Of the many messages, two stand out loud and clear. First, they have told us that they love their National Forests and Grasslands. They love them for the many ways they enrich their lives. Sometimes people want competing products from the land, but they value the public land and, despite what some in Congress want to do, the people we hear from, by the vast majority, want the National Forests and Grasslands to stay under Forest Service management. Second, they have told us that the government should not and will not dictate management on private lands—I strongly agree. To get at some of the challenges we collectively face in this symposium and into the future, we know we must look across the fence and rely on one another. You—we—are essential to any solutions that will work.

Partners like you help us blend the needs of people and environmental values in such a way that National Forests and Grasslands support diverse, healthy, productive, and sustainable systems—including wildlife and livestock. Collectively we in this room have some of the best talent around to resolve issues at the ground level. The people involved with the Seeking Common Ground projects collaboratively

and jointly are implementing land management decisions that will result in productive lands for future generations while sustaining lifestyles and family values that are part of our culture.

The concept inherent in a search for "common ground" implies cooperation between concerned groups, individuals, and agencies—no matter how guarded or how small the first steps. The first essential stride on that path little traveled is the recognition of legitimate issues and concerns on the part of all parties involved.

At this symposium, during the formal sessions and in the hallways, you will hear about problems that were partially or fully solved by various dedicated individuals. These folks did not wait for solutions to their particular problems to arrive packaged and ready for use from the marbled halls of government, nor did they wait on solutions from centers of power. Dedicated individuals of talent and goodwill are the best hope—perhaps the only hope—for continued improvement in dealing with resource issues.

Much of a positive nature has happened to collaboratively deal with resource issues since the 1991 conference. This effort continues despite the mounting lawsuits, legislative proposals, and the polarization hyped in the media. I have faith that a dedicated, persistent, incremental collaborative approach to solutions is the best for everyone in the long run. We are drowning in conflict. I am sick of it. In my heart and soul—I am sick of it. Only we can treat this illness. No matter what others may do—I will do all I can to do better and feel better. The alternative is despair. I reject that and know you do as well.

I want you to know that the Forest Service is strongly committed to expanding day-to-day application of the concepts embraced by "Seeking Common Ground" and other collaborative efforts. We must not allow the momentum to slow at the end of this conference. We must pick up the pace.

I suggest that after this conference you consider convening representatives from each of the cosponsors and other interested parties. Their mission should be to chart a course for the future built on what we share and learn in this symposium. "Seeking Common Ground" is too important to slow down. Some of the items this group might consider are:

- Substantially improving the awareness of the demonstration areas. In my view their demonstration value has not been used anywhere near their full potential.
- Consider ways to gain a more formal commitment to a westwide effort to continuing "Seeking Common Ground." This will help keep things on track as individuals within organizations change. Whatever you do, however, don't turn the effort into a highly structured bureaucracy. Don't let process take the place of progress. Keep energy focused on action.
- Identify the barriers that are getting in the way of more effective actions. Gain commitment from those who can help reduce the barriers to take action to do so.
- Find ways to expand the support base and the resources available to carry out projects.
- And finally, to continue to open the doors of free discourse among all affected groups.

In 1991, we came here **seeking** common ground. Since then, all of us have found ways to **share** common ground in many places. Let it be clear: the Forest Service will work side-by-side with you to build on what has already been started. We will not be satisfied until the concepts embodied in "Seeking Common Ground" are a common way of doing business.

It has been a pleasure to visit with you today. I look forward to what we can learn together, and most important, to strengthening our collective commitment to build on our successes.

Setting the Symposium Stage: Past, Present, and Future Sharing of Common Ground

Mike Dombeck

I can see from the attendance at this symposium that the interest in resolving conflicts between livestock and big game on our Western rangelands is stronger than ever. This is all about people working together. Identifying and implementing solutions to these conflicts is a process that is appropriately called *seeking and sharing common ground.* And the public lands managed by the BLM are, quite literally, common ground to all Americans, because they are owned by the people in this room and all the American people. Under Federal law, the BLM's mission is to manage the public lands—on behalf of all Americans—for multiple uses. Since these uses often conflict with one another, that's no easy task.

Federal law also requires the BLM to ensure the health and productivity of the public lands. That means managing to meet the needs of current and future generations of Americans—and that's a tall order. To fulfill its land-management mission, the BLM recognizes that it must work more effectively with everyone who uses or cares about the public lands—the citizen-owners of the public lands. And that's why understanding each others' concerns and finding and building consensus is so important. That's why meetings like this are so critical.

My assignment is to help set the stage for this symposium. I'd like to do this by discussing how and why we got here, take note of what's going on now, and then look at what the future appears to hold.

This symposium is a follow-up to the Livestock/Big Game symposium that was held here in Sparks in September 1991. That symposium was co-sponsored by 13 public and private organizations. It was the first time that such a diverse group of interests came together in the spirit of cooperation to focus on solutions. A result of that symposium was a "leadership committee" made up of the heads of the original sponsoring organizations and agencies. In the spring of 1992 the leadership group met and agreed to provide direction to actively address livestock/big game issues through partnership efforts. They agreed to:

1. Develop and follow a set of common principles to guide future national cooperative efforts.
2. Identify and provide some additional funding for demonstration projects that would actively focus on solutions to livestock/big game conflicts.
3. Evaluate the opportunities for holding a follow-up national level symposium.
4. To communicate progress in implementing many of the actions recommended in the first National Symposium and share what we have learned.

This symposium is a follow-up of the agreements made in the spring of 1992. After careful review of the situation, we took a hard look at what we could do to improve conditions on the land for both people and animals. Since then, numerous private organizations, communities, and individuals have worked with local, State, and Federal agencies to *improve and maintain the health of the land,* which is BLM's top priority.

During the past 5 years we have learned a lot. We have applied the best techniques and knowledge at our disposal, finding out what works and what doesn't. And now the people who care are back in Sparks so we can take stock of and build on our accomplishments. The accomplishments of the past 5 years tell me that the dollars going into Sharing Common Ground are among the most efficiently used of any spent by the Bureau of Land Management. The funds earmarked for this program go directly to the ground, bypassing the usual red tape and layers of bureaucracy. The positive results from this direct approach are evident in the improvements we can see on the land, in wildlife habitat, livestock productivity, water quality, and riparian areas.

Now if those were the only benefits of this program, that would be reason enough to rejoice. But even more important are the positive relationships that have been formed as diverse groups work together to achieve common land-management goals.

What are those common goals? One of them is to ensure that public lands are managed in a way that recognizes the needs of communities—communities that depend on the public lands for recreational, spiritual, or economic purposes. In concrete terms, that means—among other things—that the BLM find ways to accommodate both wildlife and livestock on the public lands. In broader terms, it means the BLM must work with its stakeholders to manage the public lands in a manner that goes beyond Old West-New West conflict—you know, the one that pits commodity-based users against hunters and other recreationists. Sharing Common Ground addresses this conflict by taking into account the condition of the land and the people who use this land.

We should be very proud of what has happened in places like Owl Mountain, Muddy Creek, Monroe Mountain, Jarbridge Mountains, and elsewhere. Not only have we improved conditions on the land, but we have done it in a way that has encouraged people to work better together. Allow me to give you a few examples of how we have Shared Common Ground to Improve the Health of the Land:

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Owl Mountain, located in north-central Colorado includes over 30 partners, among them, numerous ranchers, and agencies such as the BLM, Forest Service, NRCS, Fish and Wildlife Service, Park Service, Colorado Division of Wildlife, Colorado Land Board, and Colorado State University. This project focuses on the application of ecosystem management on a 245,000 acre block of mixed ownership land including developing better management plans, implementing on-the-ground improvements, facilitating cooperation between interest groups and using the area as a prototype for extension to other conflict areas in the region.

The Jarbidge Bruneau River area contains some of Nevada's premier mule deer and bighorn sheep habitat. This project area was the site of riparian habitat work, water developments, and habitat inventories involving twelve partners including the Rocky Mountain Elk Foundation, Nevada Bighorns Unlimited, Nevada Division of Wildlife and Division of Environmental Protection, and the Newmont Gold Company.

The Upper Muddy Creek Watershed Project in Wyoming is a project where the Wyoming Department of Agriculture, Wyoming Game and Fish, and Department of Environmental Quality, Wyoming Water Development Commission, University of Wyoming, Natural Resources Conservation Service and Environmental Protection Agency, Ducks Unlimited, Trout Unlimited, Rocky Mountain Elk Foundation, and others are working cooperatively on restoration and stream improvement on this 390,000 acre watershed.

The Monroe Mountain project in Utah is working with groups as diverse as the Boy Scouts and the Utah State Prison, wildlife groups, to resolve major conflicts between big game and livestock and enhance the ecological integrity of the demonstration area, while providing for human values, products and services. They have done this by using prescribed fire to rejuvenate sagebrush/aspen habitat, while improving the composition of forbs and grasses. This area has also been involved in modern techniques of radio telemetry for elk monitoring, for wildlife research, and for aspen research.

These examples are just four of numerous approaches to seeking, finding, and sharing common ground while living on and improving the land.

And let me say: feel free to undertake any and all cooperative initiatives that will improve the land. Call it Coordinated Resource Management, Seeking Common Ground, or just good coordination and cooperation. As long as it works—and isn't illegal—*just do it!*

I've talked about the past and the present. Now I'll peer into the crystal ball and try to tell you about the future. Actually, it's crystal clear that budgets are going to be tight. And that will affect much of what we do at the BLM. Both funding and the number of employees will decrease. To deal with these constraints, we need programs that stretch our dollars further, like Seeking Common Ground.

So let's keep a good thing going—by keeping up all your good work!

The Rangeland Resource

Natural Resource Monitoring for the Daubenmire Disadvantaged

Clayton B. Marlow
Warren P. Clary

Abstract—While successful natural resource management relies on monitoring, few land managers, public or private, engage in regular evaluation of ecosystem response to wildlife and livestock management efforts. This probably occurs because conventional thinking leads us to believe that monitoring requires extensive training and time commitments. Unfortunately, this handicaps efforts to maintain or improve rangeland and wildlife habitat. Objective monitoring does not have to be avoided because of limited time, resources, or personnel. Use of permanently established lines for collecting frequency measures or as a reference point for photographs requires less time than many realize. Located within each of the major soil/vegetation complexes of the management unit, these lines can be a source of reliable information for evaluation of management practices. Frequent review of management outcomes on the basis of monitoring data promotes the sustainability of range or forest ecosystems.

Assessment of ecosystem response to management practices is fundamental to the success of any conservation goal whether the activity is carried out on private or public land. As early as 1979 wildlife management professionals stated that judicious use of natural resources necessitated monitoring before and after a management activity was undertaken. Because private landowners must often bear the full cost of implementing new practices, monitoring is critically important to avoid escalating costs from repeated failures or marginal improvements. In spite of this need and the years of experience many private operators have in recording and using livestock progeny performance records, very few monitor rangeland, riparian or wildlife response to their ranch management efforts. A survey of ranchers from 50 of Montana's 53 counties indicated fewer than 10 percent had a permanent record of the trend in water quality, riparian or range condition on their ranches. Federal and State agencies may have more monitoring records than private landowners, but the utility of these records for evaluating the effects of grazing management, forestry practices, or recreation on ecosystem processes varies dramatically from district to district.

The limited usefulness of Federal or State agency ecosystem records arises from the use of sophisticated monitoring methods. Such methods require highly trained professionals who devote the majority of their work day to the collection of vegetation, hydrologic, or wildlife data. The very nature of these monitoring efforts makes agency data collection vulnerable to reductions in manpower availability. The personnel problem is further complicated by the level of training necessary to collect and interpret the data in an objective manner. Consequently, budget reductions coupled with an ever-increasing number of congressional and legislative mandates restrict the amount of ecosystem sampling that can be conducted, compiled, and interpreted each year. In the end, the availability of objective information about ecosystem health across a district is, often, little better than what would be available on neighboring private lands.

Without a reliable and unbiased measure of ecosystem response to human action, natural resource conservation issues will be costly to resolve. Because of all the previously listed reasons, private operators, sportsman groups, environmental organizations, and the various State and Federal agencies continue to substitute conflict resolution and legal action for effective ecosystem monitoring. This behavior perpetuates polarization among management, conservation and private interests without accomplishing much in the way of ecosystem protection and improvement. Ironically, both the courts and coordinated resource planning committees turn to ecosystem monitoring as the first step in the solution of a natural resource controversy. The root of this unprofitable behavior has two dimensions; both concern time commitments of the responsible management parties.

Faced with the task of operating a ranch, public land, district or school trust lands, many individuals place monitoring as a low priority because of (1) the time required to be trained in a monitoring method and then (2) the amount of time required to actually record and summarize field data. While there are a number of monitoring methodologies, the real inducement for land owners and managers to engage in monitoring will be the availability of a method or methods that could be completed in a short period of time and would not require several weeks of training to use. However, professional land managers and university academics will probably be skeptical of any quick and dirty monitoring method because it may not be precise enough to stand up to scientific scrutiny or public debate. Criticism of monitoring precision would then cause some to question the credibility of the results and bring resource users back to ground zero; decisions based on opinion and rhetoric.

Monitoring Fundamentals

To be credible, monitoring must be done with a method that is repeatable and provides a way to separate natural variation from changes caused by management activities. The importance of repeatability in monitoring methods can be illustrated by the use of scorecards or rating systems to

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evaluate streambank stability under livestock grazing. A generalized rating system could consist of three condition classes; 3 = streambanks improving, 2 = no change, 1 = streambanks declining. Technicians or the landowner could be field trained to recognize the different conditions and research has shown that there will be a high degree of consistency (agreement) between the evaluations made by each observer. However, the evaluations are not repeatable from one year to the next (Platts and others 1987) because the score or rating is based on an observation rather than a measurement. Consequently, apparent changes in streambank stability derived from a scorecard, such as the one described in this example, have little credibility because the rating is not repeatable from one year to the next. Rather than completely ignoring scoring systems for monitoring ecological changes it is important to keep in mind that scorecards can be credible if the criteria in the card have been defined in measurable terms.

It is equally important to have some way to screen the information within your monitoring record to identify changes in plant community diversity, forage productivity, or range condition that are caused by shifts in environmental conditions that you cannot or have not tried to manage. Full time researchers use something called a control treatment to separate the effects of weather or grazing on the plant community from the specific management technique they are investigating. The control is a range site, forest stand or stream reach similar to the one you want to affect with your new management plan. This site is not subjected to your management but is monitored the same way and at the same time as you monitor the treated area or site. If you do not record any changes in range condition, forage production, or plant diversity over several years on the control site but find changes on the treated site, you can be fairly confident that the management is having an effect. Grazing exclosures are a common example of a control treatment. Such a control was used in an effort to determine the success or failure of a double-rest rotation grazing system for improving riparian condition on a National Forest allotment in southwestern Montana (Marlow and others 1996).

Before the grazing season began, two 2.5 acre (1 hectare) exclosures were constructed on sites that represented the most common riparian communities in the allotment. Both were designed to exclude grazing by big game and cattle. A third, larger exclosure was constructed to exclude only cattle. Vegetation cover was measured inside and outside the exclosures at the same time over a 5-year period. Repeatability was achieved by recording cover along a permanently identified line (Schmidt and Rasmussen 1996). This allowed the technicians to return to the same spot every 2 years to make a repeat measurement. Because the same area was remeasured each time, changes in riparian vegetation under full grazing protection (exclosures) could be attributed to changes in weather while changes outside the exclosures would represent the effects of grazing and weather. Comparison of changes in the completely protected areas with changes in the cattle exclosure made it possible to separate the effects of wildlife use from cattle use. If there were no differences between the protected areas and the grazed areas, it was reasonable to believe that neither livestock grazing nor wildlife use were driving the changes in riparian vegetation composition or diversity.

By using a control treatment (the exclosures), making measurements of plant cover and re-measuring the same lines (repeatability) the monitoring effort produced credible results. While this specific approach may be too time consuming and too expensive for many private operators or Federal and State agencies if applied to all allotments in a district, there are other alternatives that can provide credible monitoring results.

The Gordian Knot of "we need monitoring but can't afford to do it" can be untangled through a little bit of planning before undertaking an improvement project or a change in management practice. Planning or just thinking ahead about the information one needs will help to minimize costs, training and the time to actually make the measurements. Organization of informational needs is critical if the monitoring data are to meet the requirement of credibility.

Starting the Monitoring Plan

First decide what details will be required to evaluate the effect of the proposed management practice on both the budget and the local ecosystem. Start by answering these questions:

A. What changes are desired? (management outcomes)

B. How small a change needs to be detected? (number of sites to gather information from and amount of time necessary to accomplish monitoring)

C. What nontarget species or environmental characteristics need to be protected? (other details that need to be measured)

Description of the amount of change to be accomplished should be the focus of planning efforts because each objective or outcome must be measurable. If this is not done, the entire monitoring effort will be a waste of time, effort, and resources. The difficulties resulting from a poorly formed objective can be illustrated by a project that had as one of its outcomes an improvement in riparian condition.

A new grazing management practice was implemented in an effort to improve riparian conditions without sacrificing the already high condition of adjacent uplands. However, development of the management objective only went as far as the statement; this action should improve riparian condition. Even though as many as 16 separate riparian vegetation transects were sampled at 2-year intervals, the success or failure of the practice was not apparent because a measurable change had not been established and agreed on as the monitoring objective. Evaluation of the results was, therefore, open to interpretation. It would have been far more useful (and better for the resource) to have stated that the objective was to increase sedge (*Carex* sp.) cover by 5 percent over a 5-year period. Had such an objective been in place, comparison of the 1995 cover data with those originally measured in 1991 would have given an unbiased view of whether the practice had been successful or not. The manager would have had a credible basis for evaluating the utility of the grazing practice to accomplish an increase in sedge cover.

The level or amount of change to be detected will dictate how many measurements must be made each time. Researchers have long recognized the need to have a large number of samples (the physical places where you measure vegetation cover, streambank stability) to take into account the natural variation in the landscape. Because slope, aspect, soil type, and historic uses can differ over a relatively

short distance, the number of samples measured must be high enough to capture all of these differences for the monitoring record. If the number of samples is not large enough, evaluation of management outcomes is unreliable. The differences measured from one year to the next may be due to what has been done or may be variations in vegetation from one place to the next. Several range scientists have recommended taking 400 samples or measures when monitoring range, riparian, or forest understory communities to make sure most of the differences resulting from slope, aspect, soil type, and past grazing or logging history are included. Large sample sets also provide the opportunity to detect small changes (15 percent or less) in vegetation, soils or wildlife/livestock use levels. At first glance, a monitoring program that requires 400 samples would appear to exceed the capabilities of most ranchers and many land managers.

A reasonable alternative that is both cost and time efficient is to obtain a soil map of the ranch, public land allotment, or lease from the local Natural Resource Conservation office. Because range and forest plant communities are dictated by climate and soils, major differences in soils lead to differences in the type and number of plants occurring on a specific soil type. Consequently, monitoring time can be reduced by making sure there are at least four measurement sites in each soil unit to be affected by the management practice. If 100 measures are made at each site, most of the natural variation in the soil mapping unit and its representative plant community will be covered. Depending on how diverse the soils area are, locate a minimum of 5 sites for effective monitoring. This is a definite trade-off between sensitivity or the ability to detect small changes across the landscape and the amount of time devoted to monitoring. However, additional monitoring sites can be placed in areas that need protection, such as new tree plantings or important wildlife habitat. If changes smaller than 10-15 percent within in large land area, need to be detected, consider using the services of a natural resource consultant to gather the monitoring data.

Monitoring Methods

Once a soils map of the area is obtained and a decision made on how many lines are needed to account for natural variation, select the actual method to measure changes in the soil or plant community. The two most important criteria for selecting a monitoring method are repeatability and the time required to make the actual measurement. For most ranchers and land managers the two methods that meet both criteria are frequency measures and photo plots.

Frequency

Frequency involves the number of hits on vegetation, litter, and bare ground along a permanently located line (transect). Repeatability is gained by stretching a 100 ft (30 m) tape between two steel or fiberglass stakes and then recording what the tape touches at each 1 ft (30-cm) interval. This method produces 100 measures because each hit represents a measure of vegetation, litter, or bare ground. Thus, with four 100-ft lines in a particular soil mapping unit you will have recorded the recommended 400 measures. Objective measurements can be accomplished by using a $\frac{1}{8}$" diameter rod dropped vertically at each interval and recording what the tip of the rod touches. By leaving the stakes and returning to them for subsequent measures, this approach produces objective measures from year to year and from one person to the next. In this way, changes noted between years can be attributed to climate or management effects, not to differences caused by different technicians or measurements made in a slightly different spot than the year before. The influence of climate can be dealt with through the use of frequency measures from a site protected from the management treatment (a control).

In addition to providing an unbiased, repeatable measure of the plant community, the actual count of species recorded along the tape can be used to monitor species richness or biodiversity (Moir and Bonham 1995). The number of hits for each category divided by 100 equals the frequency of occurrence at that site for the individual species, bare ground or litter. Frequency measures can then be compared from one year to the next to determine if a change has developed. Changes in the frequency of vegetation, litter, or bare ground along the transect line may signal a shift in range, riparian or watershed condition.

The usefulness of the frequency method for private landowners can be increased if the information being recorded is condensed into life-form categories, as shown below:

Life-Form Categories to be Measured in Frequency Monitoring

Riparian areas	Upland areas
Bunchgrass	Bunchgrass
Sod-former	Sod-former
Sedge	Annual grass
Forb	Forb
Willow	Shrub
Shrub	Litter
Litter	Clubmoss
Bare ground	Bare ground

Use of these generalized categories rather than individual species greatly reduces both training time and the amount of time necessary to record data along each permanent line. Data summary and comparisons could still be done as explained above. It is important to realize that many range scientists and ecologists are critical of the frequency approach because there is no clear relationship between frequency measures of species or life-forms and other plant community characteristics such as canopy cover, biomass production, or range condition (West 1983). However, measurement of plant canopy cover by species or production is both time consuming and requires considerable training. It should also be noted that the fundamental criticism of frequency measures involves the relationship between the density or size of plants and the size of sampling plots, used to collect the frequency data. Consequently, the use a plotless method (permanent line) as described above eliminates the confusing relationship between frequency and vegetation cover. This allows substitution of percent frequency for vegetation cover.

An effective compromise would be to have an extension agent, NRCS range conservationist or private consultant help with the initial data collection. After the frequency measures are made the trained specialist can determine species composition and range/riparian condition from either plant cover data or biomass productivity along the same

line. These measures can be filed and subsequent annual monitoring would be just the frequency measures. If, however, changes in frequency measures are noted several years later, the detailed plant community data can be repeated by the trained specialist. This second data set can be compared to the original species composition to determine whether the changes noted by the frequency measures developed because of a change in the amount of bare ground, plant species cover, or litter. Even if frequency is used as the primary method for tracking change in range, riparian or watershed condition, taking 100 hits along four lines in each major soil unit will require some time. Another method that is less time consuming is the creation of a photographic record of changes on your land.

Permanent Photoplots

Permanent photoplots are just that, permanently identified areas that are photographed annually as a means of detecting change. Some land managers and livestock producers feel they can discern changes in the plant community and soil surface more readily from a photograph than from numerical data generated through frequency measures. Photographs of a site can be taken even more quickly than frequency measurements; this enables the rancher or land manager to monitor even more sites. But, even with the low cost and increased number of monitoring sites for time invested, research scientists are skeptical of interpretations made from photographs.

The fundamental criticism of photos as a monitoring method is that the effort produces no actual measures. The photo is an image; there is no way to objectively assess the changes recorded over time. A further concern with the use of photographs is that they can be manipulated to produce predetermined results. Even though the frequency method requires more time to conduct, it at least produces a repeatable measure that is difficult to falsify. Nonetheless, photographs can be useful and fairly objective if they are produced in the following manner.

A minimum of four permanent photo-points should be located in each soil mapping unit as would be done for frequency monitoring. At each location to be photographed drive a fiberglass or steel stake into the ground until 8" (20 cm) remain above the soil surface. This stake will be the photo-point for all subsequent photographs. The view from the photo-point should not only contain the object or feature to be monitored but also contain some physical feature that is likely to remain in the same spot throughout the monitoring period. Large, lone trees, very large boulders, or buttes and mountains are good identifying features to use in monitoring photos. In the event that natural landmarks are not available, it will be necessary to drive a second stake some distance from the first to reorient subsequent photographs. Use of natural features in combination with the permanent photo-point not only facilitates relocation of the same view each year (repeatability) but, also guarantees others the opportunity to evaluate your interpretation for themselves.

The most informative and objective photos are made with the same photo distance year after year. Photo distance means the length from the photo-point to the object. For example, when monitoring the effect of a new grazing system on willow recovery, measure the distance from the photo-point to the willow or willows. Next year take the next photo from the same distance. That way differences recorded between the two years are due to climate or grazing management not differences in photo distance. Relative changes can be derived from photographs through the use of a photo board.

Photo boards provide scale (size) in the photograph. Commercially produced photograph scales like the Robel Pole can be used, or make one from a 1" (2.5 cm) x 6" (14 cm) x 96" (240 cm) piece of lumber. Alternating 6" (14 cm) black and white blocks are painted the length of the board. The 1 x 6 scale or Robel Pole is placed at or near the predetermined photo distance from the permanent photo-point so, it can be included in the photograph. The presence of a scale in the photo provides the opportunity to estimate sapling, shrub, or grass height. This estimate can be used to compare similar information from previous years' photos of the same location.

It is also important to record the date the photo was taken on the back of the print. To limit variation due to climate, photos should be taken within 1 to 2 days of the original date each year. The type of film (color or black and white) probably is not as important as is consistency; always use the same type of film each year. In cases where grazing by wildlife or livestock is the management practice to be monitored, photos should be taken before grazing or browsing occurs. Photos taken after wildlife or livestock have used the area are difficult to interpret because current utilization levels mask or confound the long-term effects of herbivory. Photographs can also be part of a frequency monitoring program.

One end of a frequency line can be used as the permanent photo-point and the opposite end would represent the photo distance. A photo board can also be included to expand the amount of information taken along the transect each year. Thus, changes in frequency might be explained by the accompanying photograph.

Application of Monitoring Data

Regardless of the method, use the information collected. Use of monitoring data to evaluate the success (or failure) of management practices not only reduces waste but, will also alert the manager to unintended impacts to nontarget plants or animals. Jones (1986) described monitoring as a cyclic effort in which data collection is followed by reevaluation of earlier management decisions. This is why the first step in effective monitoring is to set measurable objectives. Objectives are the yardstick to measure progress. If the level or rate of improvement has not been reached, review the earlier plan and make necessary adjustments. It is at this point in the evaluation process that the importance of monitoring data from a control site becomes clear. Comparison of the pattern or rate of change in the protected area to that in the treated areas provides an objective view of how the soil surface or plant community is responding to the management practice. If adjustments are necessary, they can be implemented, monitoring is then resumed and after several years of data collection management outcomes are again evaluated. It is critical to remember that monitoring data have to be used if the time and expense of data collection are to have any real value.

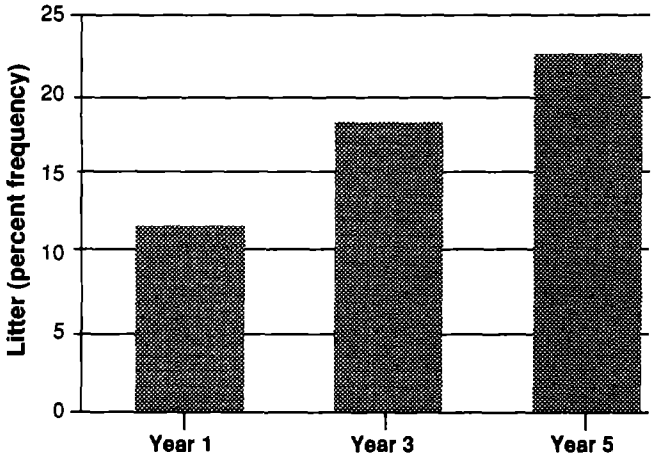

Figure 1—Sample bar graph indicating rise in litter frequency.

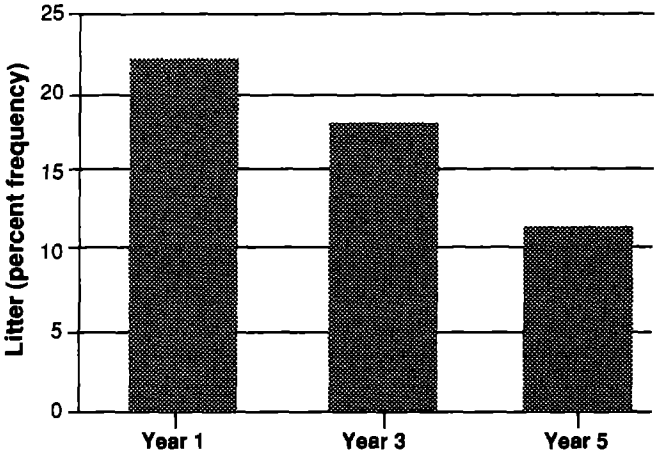

Figure 2—Sample bar graph indicating litter decrease.

The most straightforward way to summarize frequency measures for evaluation purposes is to construct a bar graph of several years data for a particular site. One of the data sets should be the measures made at the control or nontreated site. If the bars produce an upward trend (fig. 1) the parameter (litter in this example) is increasing. Bars growing smaller from one sampling period to the next would indicate a downward trend (fig. 2). While the relationship between management and the trend or direction of change observed at the site may appear obvious, credibility is fostered by always making comparisons with the trend on the control site. If the control site exhibits little change in litter cover, for example, but litter is decreasing on all the sites under the current management practice, the practice is having a negative impact. Conversely, an upward trend on the treated sites with a static trend on the control sites would suggest that the management practice was a positive influence. Consequently, use of controls will allow a more detailed and unbiased review of the management practice.

Summary

Because monitoring is the objective part of natural resource management (Schmidt and Rasmussen 1996), no one responsible for land and resource stewardship should be without a monitoring program. However, many monitoring programs try to use methods that require extensive training in plant or animal identification and statistical analysis. This requirement limits the monitoring effort by both public land agencies and private landowners because both groups have too little time and too few personnel to meet the level of natural resource stewardship demanded by local, State and Federal regulations. Lack of unbiased and reliable information about how a species or ecosystem is responding to production or recreation pressures causes polarization and conflict among user groups and public land managers. Because of the inevitable legal action resulting from this conflict, more and more natural resources are being managed by the courts rather than trained professionals.

While very few private lands are under court-ordered management, monitoring is equally important to ranchers and farmers. Integrated into the farm or ranch planning effort, monitoring can produce economic benefits for private landowners. As with progeny performance records, effective monitoring can produce substantial savings when used to identify management practices which may be costing more than they produce.

Even though monitoring is important, it can be costly in terms of resources and time if not based on measurable management objectives. Costs will escalate further if a control has not been provided and monitoring methods are not repeatable. To avoid costly mistakes and incorrect evaluations we recommend:

A. The development of measurable management outcomes or objectives,

B. Use of soil maps to identify monitoring sites,

C. The establishment of four permanently marked 100 ft lines within each monitoring site,

D. Identification of those permanent lines that will not be impacted by the proposed management practice for use as controls,

E. Recording hits on individual life-form categories at 1 ft intervals along each permanent line or,

F. When time available for monitoring is very limited, the use of permanent photo-points.

Frequency data are compiled by recording hits on vegetation, bare ground, or litter at 1-ft intervals along each 100 ft line. This approach will produce the requisite number of measures (400) to account for natural variation in soils, vegetation and precipitation. The number of hits for each plant species encountered along the line can also be used to evaluate biodiversity under the newly implemented management. Frequency measures can be made quite quickly if vegetation is grouped into life-form categories such as bunchgrasses and forbs. However, even use of life-form categories will not generate the savings in time that can be gained from monitoring with photographs.

Photos taken from a permanent photo-point can be a rapid means of monitoring changes following management action. The drawback to using photographs is that they do not provide measurable differences. However, this can be partially overcome by including a photographic scale, such as a

Robel Pole, in each photograph. Another advantage to permanent photographs is the opportunity to monitor more sites in the same amount of time.

Monitoring data from several years (4-6) can be summarized in graphical form and compared with data from the control site to determine whether changes are management induced or the result of climatic patterns. Management objectives are then reviewed and changes made to correct negative impacts or enhance outcomes. Amendment of management practices on the basis of credible monitoring will produce positive economic benefits and maintain the inherent ability of the ecosystem to perpetuate itself.

Continuous, well thought-out monitoring by land users, even though not highly sophisticated, will likely be more useful than very technical monitoring plans that are poorly maintained or abandoned.

References

Jones, K. Bruce. 1986. The inventory and monitoring process. In: Cooperrider, Allen Y.; Boyd, R. J.; and Stuart, H. R., eds. 1986. Inventory and monitoring of wildlife habitat. U.S. Dept. Inter., Bur. Land Manage. Service Center. Denver, CO: 1-10.

Marlow, Clayton B.; Sherwood, H.; Rhodes, B. J.; and Manukian, M. 1996. Response of *Poa pratensis* and various *Carex* sp. inhabiting a *Salix geyeriana/Carex rostrata* habitat type to double rest rotation grazing management. Abstracts. 49th Annual Meeting. Society for Range Management. February 10-15, 1996. Wichita, KS. p. 65

Moir, W. H. and Bonham, C. D. 1995. Diversity indices applied in desert grassland communities of Otero Mesa, New Mexico. In: West, Neil E., 1995. Biodiversity in rangelands. Natural Resources and Environmental Issues. Vol. IV. College of Natural Resources, Utah State Univ., Logan, UT: 42-49.

Platts, William S.; Armour, C.; Booth, G. D.; Bryant, M.; Bufford, J. L.; Cuplin, P.; Jensen, S.; Lienkaemper, G. W.; Minshall, G. W.; Monsen, S. B.; Nelson, R. L.; Sedell, J. R.; Tuhy, J. S. 1987. Methods for evaluating riparian habitats with applications to management. U.S. Dept. Agric., For. Serv. Intermount. Res. Sta. Gen. Tech. Rep. INT-221. Ogden, UT: 87-96.

Schmidt, Lisa and G. A. Rasmussen. 1996. Comparing four monitoring methods in a wetland community. Abstracts. 49th Annual Meeting Society for Range Management. February 10-15, 1996. Wichita, KS. p. 48.

West, Neil E. 1983. Choice of vegetation variables to monitor range condition and trend. In: Bell, J. F. and Atterbury, T. eds. 1983. Proceedings of an International Conference on Renewable Resource Inventories for Monitoring Changes and Trends. Oregon State Univ. Corvallis, OR.

Differences in Plant Composition in Cattle and Wild Ungulate Exclosures in North-Central Montana

Kris Hurlburt
Don Bedunah

Abstract—The effects of mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and cattle (*Bos taurus*) grazing on plant communities was investigated using cattle and wildlife exclosures on the Theodore Roosevelt Memorial Ranch, near Dupuyer, MT. The exclosures created treatment areas that were (1) not grazed for a period of 7 years, (2) grazed by deer and elk only and, (3) grazed by all species. Relative frequency of species grouped as increasers differed between treatments in the bluebunch wheatgrass (*Pseudoroegnaria spicata* [Pursh] Love) ($p < 0.01$), moist hay meadow ($p < 0.01$), and dry hay meadow ($p < 0.001$) communities. Relative frequency of species grouped as decreasers was significantly different between treatments in the aspen (*Populus tremuloides* Michx.) ($p < 0.01$), shrubby cinquefoil (*Potentilla fruticosa* L.)/Parry's danthonia (*Danthonia parryi* Scribn.) ($p < 0.001$), moist hay meadow ($p < 0.05$), and shrub ($p < 0.001$) communities. Relative frequency of species grouped as invaders differed between treatments in the bluebunch wheatgrass ($p < 0.01$), shrubby cinquefoil/Parry's danthonia ($p < 0.001$), moist hay meadow ($p < 0.001$), dry hay meadow ($p < 0.001$), and shrub ($p < 0.001$) communities.

Managing lands for multiple use is growing in importance as demands on land grow and diversify. For Montana ranches, this often means producing livestock while maintaining wildlife habitat and balancing the influences that domestic and wild ungulates have on each other's habitat. The effects of livestock grazing on wildlife habitat have been well documented in several studies (Anderson and Scherzinger 1975; Mackie 1978; Longhurst and others 1982; McLean and Willms 1982; Neal 1982; Urness 1982; Jourdonnais 1985; Austin and Urness 1986). Livestock influence wildlife habitat by modifying: (1) plant biomass, (2) structural components such as plant height and cover, and, (3) plant species composition (Kie and Loft 1990). Typical changes in plant composition are an increase in less palatable species, reduction of species that are palatable, and change in vegetative structure.

Wild ungulates, such as deer and elk, can also affect the amount of forage available for livestock as well as plant community composition and structure (Smith 1949; Hall 1955; Harvey 1980; Kie and Loft 1990; Jorgansen 1991). Grazing impacts by livestock and wild ungulates vary by site due to the different plant and animal communities present, type and numbers of livestock and grazing management, size of wild ungulate populations, and site-specific biotic and abiotic conditions. Variables that can be controlled to better manage for wildlife are livestock stocking rate, duration, distribution and season of grazing. To manage land for livestock production and wildlife conservation, the effects of grazing on vegetation by both groups must be understood.

The Theodore Roosevelt Memorial (TRM) Ranch (fig. 1) is located near Dupuyer, MT, along the Rocky Mountain Front. In addition to producing livestock, the ranch provides habitat for large herds of wild ungulates. The ranch owns and grazes approximately 120 cow-calf pairs during the summer months and leases summer grazing for an additional 200 cow-calf pairs. Elk numbers on and around the ranch range from 200 during the summer months to 600 in the fall and winter months. Mule deer, white-tailed deer, and elk use the ranch extensively, primarily in the winter. During the winter, mule deer use the ranch and surrounding areas heavily, with numbers ranging from 2,000 to 3,000 head. The ranch is dedicated to research, education, and demonstration of shared land use that includes livestock grazing. Little quantitative research on the responses of plant communities to grazing has been conducted along the Front. The objective of this study was to determine the influence of cattle and wild ungulate grazing on plant species of the TRM Ranch as grouped by increasers, decreasers, and invaders as categorized by the National Resource Conservation Service (NRCS). Future analyses will examine effects of cattle and wild ungulate grazing on individual plant species and develop management options that best meet the goals of the ranch.

Study Site

The 6,000-acre TRM Ranch is located on the eastern slope of the Rocky Mountains. Vegetation of the TRM Ranch is diverse and includes fescue prairie, limber pine, and Douglas-fir forests. Precipitation averages 50 cm annually.

Methods

In 1987, 4 paired exclosures and 1 unpaired exclosure were established on the ranch to monitor change in vegetation due to exclusion of grazing. The paired exclosures were split into two sections: one section excluded cattle and the other section excluded both cattle and wild ungulates. The

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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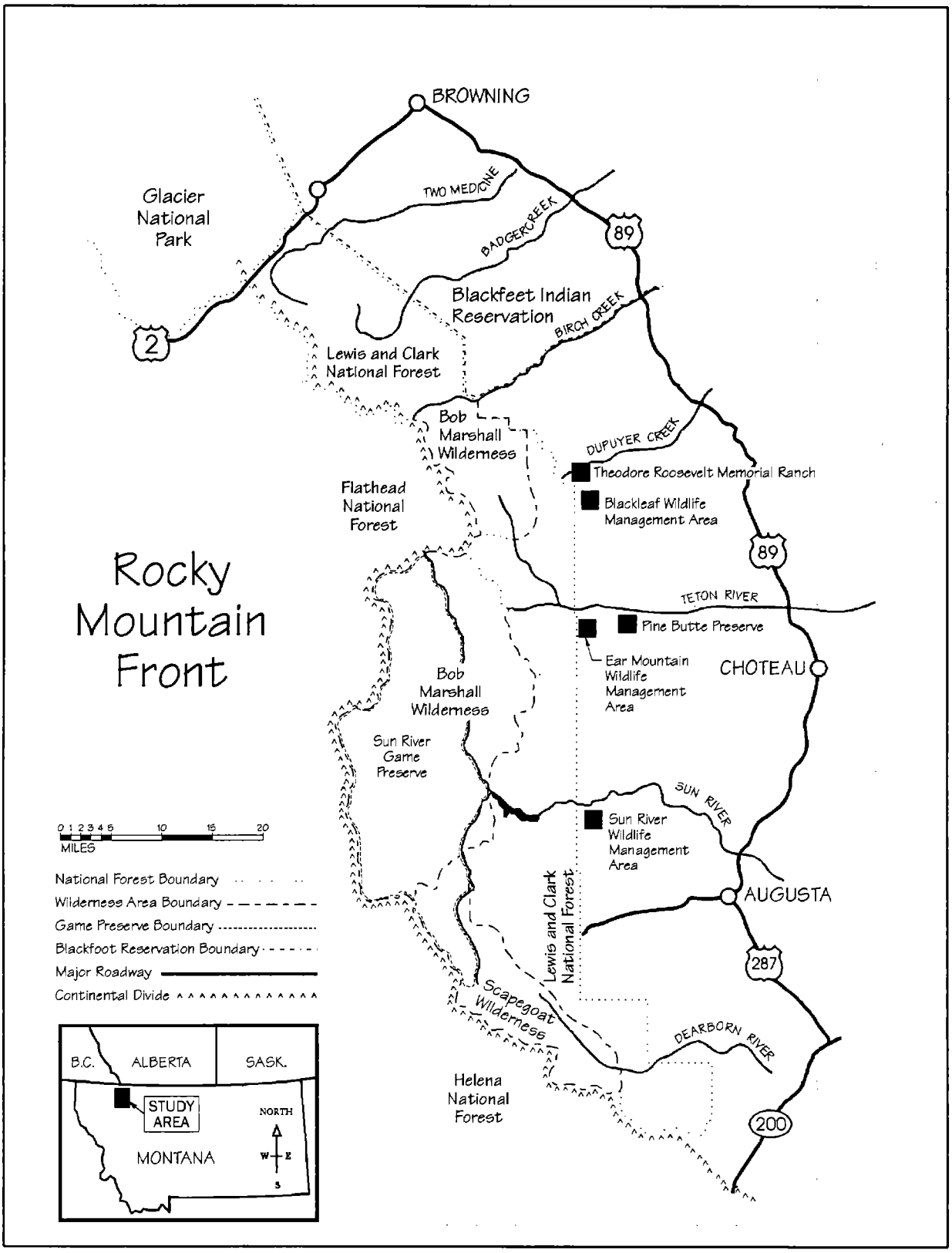

Figure 1—Study area on Rocky Mountain Front.

Table 1—Most common increasers, decreasers and invaders for seven plant communities on the TRM Ranch, Dupuyer, Montana. Species are listed by abundance.

Plant community	Increasers	Decreasers	Invaders
Aspen	*Populus tremuloides*	*Salix bebbiana*	*Phleum pratense*
	Symphoricarpos albus	*Cornus stolonifera*	*Arctium minus*
	Rosa woodsii	*Lathyrus ochroleucus*	*Taraxacum officinale*
Bluebunch wheatgrass	*Balsamorhiza sagittata*	*Vicia americana*	*Phleum pratense*
	Symphoricarpos albus	*Pseudoroegnaria spicata*	*Alyssum alyssoides*
	Pascopyrum smithii	*Prunus virginiana*	*Cerastium arvense*
Shrubby winquefoil/ rough fescue	*Danthonia parryi*	*Festuca scabrella*	*Phleum pratense*
	Galium boreale	*Agropyron caninum*	*Cerastium arvense*
	Potentilla fruticosa	*Trifolium longipes*	*Poa pratensis*
Shrubby cinquefoil/ Parry's danthonia	*Danthonia parryi*	*Festuca scabrella*	*Orthocarpus luteus*
	Selaginella densa	*Liatris punctata*	*Monarda fistulosa*
	Festuca idahoensis	*Vicia americana*	*Plantago lanceolata*
Moist hay meadow	*Pascopyrum smithii*	*Stipa viridula*	*Phleum pratense*
	Galium boreale	*Geranium viscosissimum*	*Festuca pratensis*
	Juncus balticus	*Trifolium longipes*	*Taraxacum officinale*
Dry hay meadow	*Pascopyrum smithii*	*Stipa viridula*	*Bromus inermis*
	Carex species	*Trifolium longipes*	*Cynoglossum officinale*
	Achillea millefolium	*Vicia americana*	*Taraxacum officinale*
Shrubs	*Rosa woodsii*	*Amelanchier alnifolia*	*Urtica dioica*
	Symphoricarpos albus	*Prunus virginiana*	*Monarda fistulosa*
	Balsamorhiza sagittata	*Geranium viscosissimum*	*Phleum pratense*

exclosures created treatment areas that were: (1) not grazed for a period of 7 years, (2) grazed by deer and elk only and, (3) grazed by all species. The cattle and wildlife grazing treatment will hereafter be referred to as "combined grazing" in the text. Exclosures varied from 1 to 4 acres in size.

The major plant communities represented in the exclosures were aspen (*Populus tremuloides* Michx.), bluebunch wheatgrass (*Pseudoroegnaria spicata* [Pursh] Love), shrubby cinquefoil (*Potentilla fruticosa* L.)/rough fescue (*Festuca scabrella* Torr.), shrubby cinquefoil/Parry's danthonia (*Danthonia parryi* Scribn.), moist hay meadows, dry hay meadows, and a shrub community dominated by serviceberry (*Amelanchier alnifolia* Nutt.), and chokecherry (*Prunus virginiana* L.) (Offerdahl 1989).

Five transects were established in each grazing treatment. Plot frames (0.44 m^2), divided into 100 equal squares, were used to measure frequency. Species were counted as present or absent within each square and presence was totalled to give a frequency count. Five plot frames were placed along each transect. Forty transects were sampled in aspen stands, 9 in the bluebunch wheatgrass communities, 30 in the shrubby cinquefoil/rough fescue communities, 15 in the shrubby cinquefoil/Parry's danthonia communities, 25 in the moist hay meadows, 10 in the dry hay meadows, and 25 in the shrub communities. The number of transects sampled within each community was determined by size and the number of communities sampled.

Relative frequency was analyzed by grouping the species according to grazing response (increaser, decreaser, and invader) as described in the Natural Resource Conservation Service range site guides (NRCS 1983). Increasers are species that are expected initially to increase with grazing, decreasers are species that are expected to decrease with grazing, and invaders are species that are expected to invade with grazing (table 1). Data were analyzed for differences in relative frequency (frequency of each grazing response grouping divided by total frequency of all groups along the transect) among grazing treatments and plant communities. Differences between treatments were determined using an orthogonal contrast (Sokal and Rohlf 1995).

A one-way ANOVA was used to analyze differences in relative frequency as influenced by grazing treatment for each community. When necessary, the data were transformed to meet the assumptions of an ANOVA using either a natural log, log base 10, square root, square, reciprocal of square root, cube, or arcsine transformation (Sokal and Rohlf 1995).

Results

The effects of grazing treatment on relative frequency of increasers, decreasers, and invaders varied among plant communities. Protection from grazing affected the relative frequency of species in three communities. Changes in the relative frequency of increasers, decreasers, and invaders occurred in the bluebunch wheatgrass ($p < 0.05$), shrubby cinquefoil/Parry's danthonia ($p < 0.10$), and moist hay meadow communities ($p < 0.10$) (figs. 2, 3, and 4). Relative frequency of invaders was typically lower when protected from grazing while relative frequency of increasers and decreasers was higher.

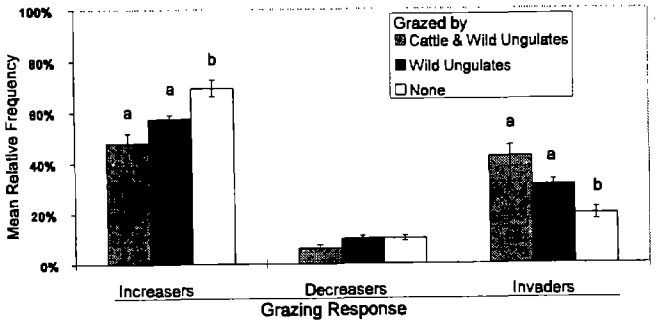

Figure 2—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in bluebunch wheatgrass communities. (Bars with different letters over them are significantly different ($p < 0.05$)).

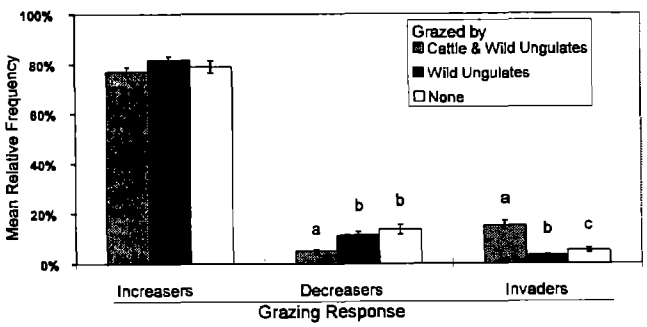

Figure 3—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in shrubby cinquefoil/Parry's danthonia communities. (Bars with different letters over them are significantly different ($p < 0.10$)).

Combined grazing affected relative frequency of species differentially compared to grazing by just wild ungulates in four communities. Aspen ($p < 0.10$), shrubby cinquefoil/Parry's danthonia ($p < 0.10$), moist hay meadow ($p < 0.10$), and shrub communities ($p < 0.001$) were affected significantly by different types of grazing. Relative frequency of increasers was higher in the areas grazed solely by wild ungulates in the moist hay meadow communities (fig. 4). Decreasers responded to combined grazing by having a lower frequency than in areas grazed solely by wild ungulates in the shrubby cinquefoil/Parry's danthonia and shrub communities (figs. 3 and 5). However, in the aspen communities, relative frequency of decreasers was lower in the areas grazed only by wild ungulates (fig. 6). Relative frequency of invaders was higher in areas subject to combined grazing (figs. 3, 4, and 5). Figures 7 and 8 show the relative frequencies of species occurrence on shrubby cinquefoil/rough fescue and on dry hay meadow communities.

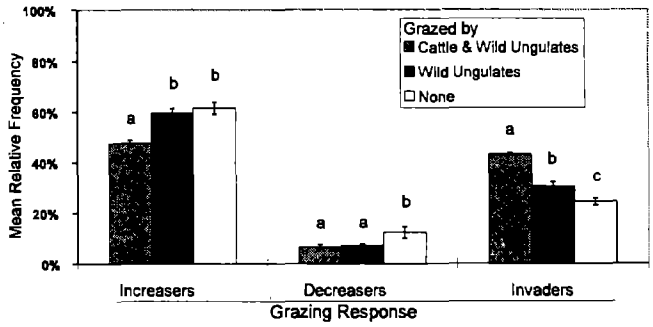

Figure 4—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in moist hay communities. (Bars with different letters over them are significantly different ($p < 0.10$)).

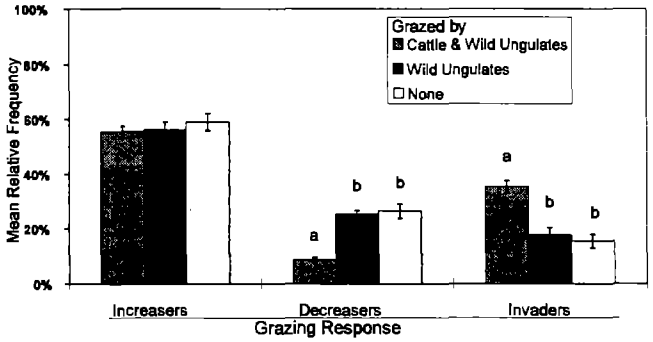

Figure 5—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in shrub communities. (Bars with different letters over them are significantly different ($p < 0.001$)).

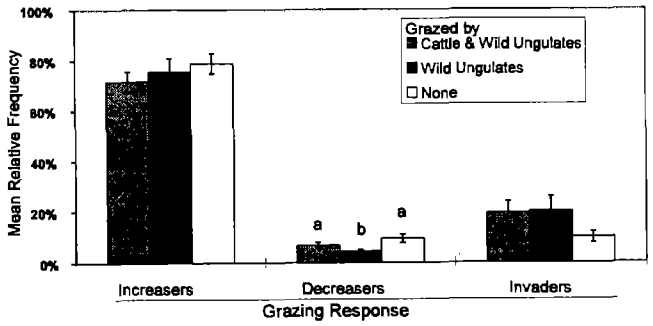

Figure 6—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in aspen communities. (Bars with different letters over them are significantly different ($p < 0.10$)).

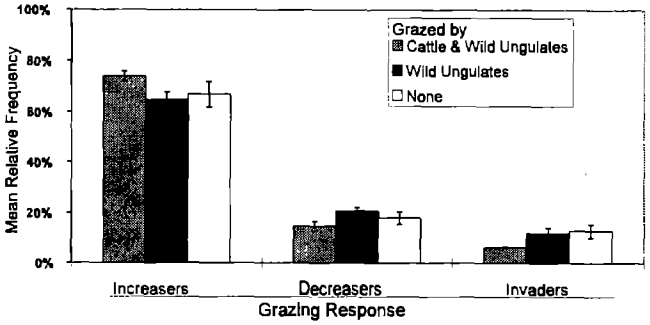

Figure 7—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in the shrubby cinquefoil/rough fescue communities.

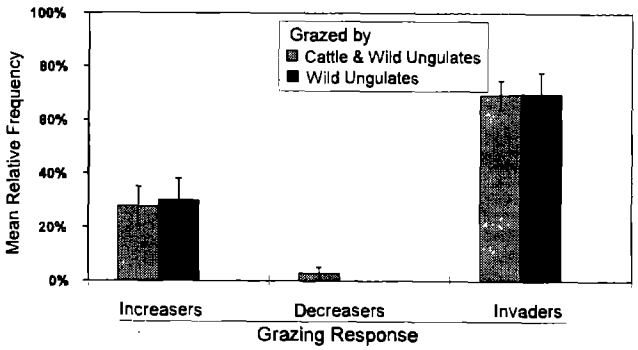

Figure 8—Mean relative frequency (± 1 S.E.) of species grouped as increasers, decreasers and invaders as influenced by grazing treatment in the dry hay meadow communities.

Discussion

The findings of this study indicate that grazing, by both cattle and wild ungulates, has affected plant community composition as grouped by increasers, decreasers, and invaders on the TRM Ranch. Grazed areas increased in proportion of invaders present and decreased in proportion of both increasers and decreasers. The change in frequency for invaders and decreasers is similar to results seen elsewhere (Johnston and others 1971; Smoliak 1965; Jorgansen 1993). However, the decline in increasers was unexpected; increasers tend to initially increase with grazing pressure. The high proportion of highly palatable increasers, including western wheatgrass (*Pascopyrum smithii* [Rudb.] A. Love), aspen, and arrowleaf balsamroot (*Balsamorhiza sagittata* (Pursh) Nutt.) (Mueggler and Stewart 1980) may have lead to concentrated, intense grazing pressure, thus leading to an overall decline in frequency.

Generally, those species considered decreasers for these sites by the NRCS decreased with grazing. Jorgansen (1993) found that the proportion of rough fescue present, the dominant decreaser, decreased significantly with elk grazing on the Sun River Wildlife Management Area. In southeastern Alberta, Smoliak (1965) found that grazing decreased the proportion of green needlegrass (*Stipa viridula* Trin.) present. Johnston and others (1971) reported a decrease of rough fescue and an increase in Parry's danthonia with livestock grazing in southwestern Alberta. On the TRM Ranch, the majority of decreasers were species that are very palatable to both cattle and elk, including rough fescue, American vetch (*Vicia americana* Muhl.) and sticky geranium (*Geranium viscosissimum* F. & M.) (Mueggler and Stewart 1980).

As expected, areas grazed by both cattle and wild ungulates increased in proportion of invaders in all plant communities. Species grouped as invaders typically are not palatable or preferred, thus they tend to increase with grazing (Evanko and Peterson 1955) as the more palatable plants become less competitive because they are being selectively grazed. Despite the palatability of some invasive species, the physiology of invaders allows for rapid growth and expansion, especially after soil disturbance by grazing opens up resource niches (Pieper 1994). On the TRM Ranch, some invader species, including common timothy (*Phleum pratense* L.), common dandelion (*Taraxacum officinale* Weber), and Kentucky bluegrass (*Poa pratensis* L.), are very palatable species. The increase in palatable forage, however, is not desirable if this increase suppresses frequency of more nutritional species such as bunchgrasses which provide forage for wintering ungulates.

Under combined grazing, decreasers typically had a lower frequency than in areas subjected to wild ungulate grazing only. Decreaser species such as rough fescue, American vetch and serviceberry are typically very palatable to both cattle and wild ungulates (Mueggler and Stewart 1980) and the high grazing pressure exerted by both groups may have caused the decline in frequency. Invader species were significantly more abundant in areas grazed by both animal groups. The intense grazing pressure, in addition to the trampling, may have created more bare ground and therefore more space for these species in the community.

Because classification of plant species into a grazing response category is difficult and varies according to the composition of the plant community, further analyses will be done to determine specific changes in individual species cover, as well as community diversity and richness. The results from these analyses should provide more detailed information on the effects of cattle and wild ungulate grazing on the plant communities of the TRM Ranch.

Conclusions and Implications

The effects of cattle and wild ungulate grazing on plant community composition varied by each community, but some general trends were apparent. Grazing led to an increase in the proportion of invaders present and a decrease in the proportion of increasers and decreasers present. Although both cattle and wild ungulates affect community composition, the proportional effect varies by community. For example, cattle and wild ungulate grazing led to a significantly different community composition in the shrub community; whereas, grazing solely by wild ungulates dramatically influenced the aspen community. Grazing by domestic animals should be managed to maintain the productivity and vigor of the most sensitive or important communities in a pasture.

For ranches on the Rocky Mountain Front that are interested in managing for both livestock production and wildlife habitat, grazing regimes should be designed with these effects in mind. From this research, we suggest that cattle grazing be managed carefully in the bluebunch wheatgrass, shrubby cinquefoil/Parry's danthonia, moist hay meadow, and shrub communities, where they are having the most effect. Ultimately, the goal is to implement a grazing regime for the TRM Ranch that will maintain quality wildlife habitat and productive livestock forage. Through demonstration of successful integration of both products, we hope to provide a model for other ranches on the Rocky Mountain Front.

References

Anderson, E. W. and R. J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. J. of Range Manage. 28: 120-125.

Austin, D. D. and P. J. Urness. 1986. Effects of cattle grazing on mule deer diet and area selection. J. of Range Manage. 39: 18-21.

Evanko, A. B. and R. A. Peterson. 1955. Comparisons of protected and grazed mountain rangelands in southwestern Montana. Ecology 36: 71-82.

Hall, John M. 1955. Livestock and big game relationships. J. of Range Manage. 8: 4-6.

Harvey, S. J. 1980. The potential and current vegetation of the Sun River Game Range. Montana Department of Fish, Wildlife and Parks, Helena. 82 p.

Johnston, A.; J. F. Dormaar; S. Smoliak. 1971. Long-term grazing effects of fescue grassland soils. J. of Range Manage. 24: 185-188.

Jorgansen, H. 1991. Wildlife management area vegetation monitoring. Montana Department of Fish, Wildlife and Parks, Bozeman, MT. 218 p.

Jorgansen, H. 1993. Wildlife management area vegetation monitoring. Montana Department of Fish, Wildlife and Parks, Bozeman, MT. 75 p.

Jourdonnais, C. S. 1985. Prescribed fire and cattle grazing influences on the vegetation and elk use of a rough fescue community. University of Montana, Missoula. 100 p. Thesis.

Kie, J. G. and E. R. Loft. 1990. Using livestock to manage wildlife habitat: some examples from California annual grassland and wet meadow communities. In: Can livestock be used as a tool to enhance wildlife habitat? Forty third annual meeting of the society of range management, Feb 13, 1990; Reno, NV. Gen Tech. Rep RM-194: 7-24.

Longhurst, W. M.; R. E. Hafenfeld; G. E. Connolly. 1982. Deer-livestock interrelationships in the western States. In: J. M. Peek; P. D. Dalke, eds. Wildlife-livestock relationships symposium, Proceedings 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, ID: 409-420.

Mackie, R. J. 1978. Impacts of livestock grazing on wild ungulates. Trans. North Amer. Wildl. Nat. Resour. Conf. 43: 462-476.

McLean A. and W. Willms. 1982. Competition between cattle and mule deer on winter range in British Columbia. In: J. M. Peek and P. D. Dalke, eds. Wildlife-livestock relationships symposium, Proceedings 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, ID: 479-484.

Mueggler, W. F. and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service GTR INT-66. Intermountain Forest and Range Experiment Station. 154 p.

Natural Resource Conservation Service. 1983. Guide for determining range condition and initial stocking rates for the foothills and mountains 15"-19" precipitation zone east of the continental divide. Natural Resource Conservation Service Technical Guide Section II-E-4.

Neal, D. L. 1982. Improvement of Great Basin deer winter range with livestock grazing. In: J. M. Peek and P. D. Dalke, eds. Wildlife-livestock relationships symposium, Proceedings 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, ID: 61-73.

Offerdahl, R. 1989. Description of the major plant communities on the Theodore Roosevelt Memorial Ranch. University of Montana, Missoula. 107 p. Thesis.

Pieper, R. D. 1994. Ecological implications of livestock grazing. In: M. Vavra, W. A. Laycock and R. D. Pieper, eds. Ecological implications of livestock herbivory in the west. Society for Range Management, Denver, CO: 177-211.

Smith, A. D. 1949. Effects of mule deer and livestock upon a foothill range in northern Utah. J. of Wildl. Manage. 13: 421-423.

Smoliak, S. 1965. A comparison of ungrazed and lightly grazed *Stipa-Bouteloua* prairie in southeastern Alberta. Can. J. Plant Sci. 45: 270-275.

Sokal, R. R. and F. J. Rohlf. 1995. Biometry. W. H. Freeman and Company, New York. 887 p.

Urness, P. J. 1982. Livestock as tools for managing big game winter range in the intermountain west. In: Peek, J. M.; Dalke, P. D., eds. Wildlife-livestock relationships symposium, Proceedings 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, ID: 20-31.

Implications of Bison-Grassland Coevolution for Management of Elk on Montana's Rocky Mountain Front

Thomas R. Baumeister
Don Bedunah
Gary Olson

Abstract—The attributes of the fescue prairies of Montana's Rocky Mountain Front developed in response to annual buffalo migrations to the area. Researchers have now documented the need for seasonal grazing impacts that replicate those of the buffalo to maintain the vegetative balance of the area. Studies at the Sun River Game Range, Blackleaf Wildlife Management Area, and Theodore Roosevelt Memorial Ranch have all provided information that season-specific cattle grazing improves availability and quality of forage for elk, and therefore improves elk grazing response, on those same areas. Cooperative efforts between public land managers and cattle owners have accomplished objectives sought by both sides.

For both viewing and hunting, elk (*Cervus elaphus*) is one of the most highly valued species on Montana's Rocky Mountain Front (Front); the very presence of elk has brought national renown to this region (Posewitz 1991). On the Front (fig. 1), elk herds have grown since the early 1980's and new herds have established permanent residence (Olson and others 1994). This increase in resident elk is due to a number of factors including: spill-over from areas in the interior mountains, where elk are often subject to heavy hunting pressure (Brown 1986; Olson and others 1994); favorable habitat conditions due in part to low-intensity livestock grazing (Baumeister 1994); mild winters; and conservative hunting seasons. In fact, the abundance of elk has spawned a new sector of the local economy based on services revolving around wildlife. As a result, local communities have benefited from these wildlife-oriented businesses.

Changes in land use practices on private lands—from ranching to either residential housing developments or more intensive agriculture—threaten the availability of suitable habitat for elk and the diversity of other wildlife species. About 78,000 acres of prime elk habitat (47 percent) are located on private lands; lands, incidentally, which are not necessarily irrevocably committed to providing habitat for elk. The viability of elk within the 58,000 acres of existing wildlife conservation areas (34 percent) scattered along the Front depends on the matrix of both private lands and the 32,000 acres of State school trust lands (19 percent) that connect them. This land ownership pattern prevents sufficient connectivity to secure the value of most of these areas, especially if private lands are shifted to incompatible uses.

The challenge, then, for land managers, county planners, and local residents, is to balance competing interests in a way that neither impairs the ecological capability of land nor leaves people without an economic foundation for livelihood (Boone and Crockett Club 1993). This requires an ecosystem-based approach that incorporates socio-economic realities into the search for sustainable solutions to natural

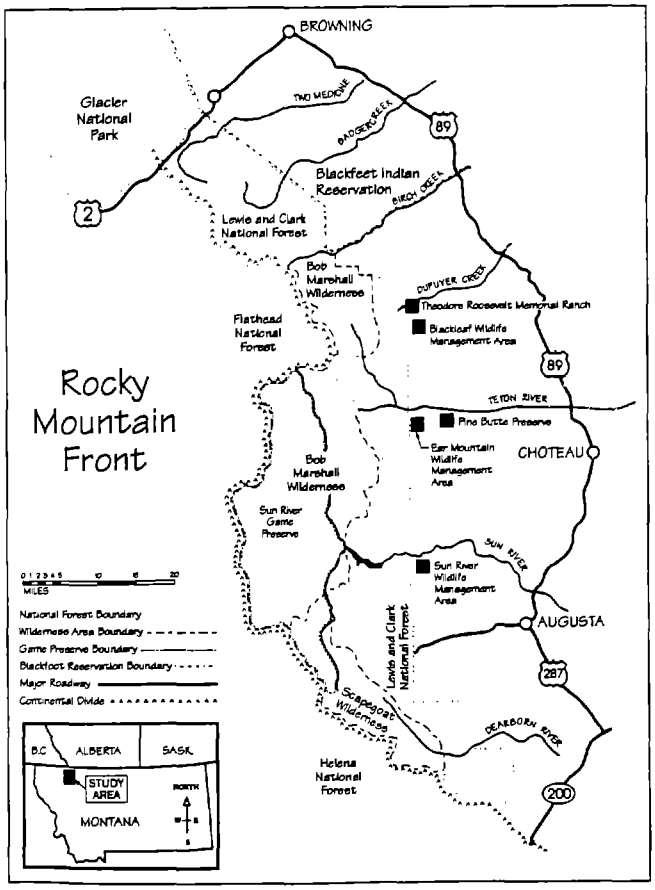

Figure 1—Montana's Rocky Mountain Front.

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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resource management. Only recently has the mix of conservation strategies on the Front begun to embrace all the key factors of ecosystem-based management (Baumeister and others 1996).

This move toward ecosystem-based management must be supported by a shift in the scientific focus, from that of sustained yield, single-use management to that which integrates all ecosystem components and processes, including human interactions. In this paper, we employ the concept of ecosystem-based management as a guiding principle toward the goal of maintaining and restoring ecosystem processes and dynamics on the Front landscape. We seek to reveal causation for variation in ecological systems by analyzing wildlife populations and their ecosystems through space and time. We propose that an understanding of the coevolution between bison (*Bison bison*) and fescue prairie on the Front is essential before assessing the consequences of alternative management strategies on elk and other wildlife resources. For this purpose, we synthesize historic descriptive and experimental research to supplement the foundation for decisionmaking in ecosystem-based elk management.

The Front

The Front ecosystem is geographically delineated as the narrow interface zone between agricultural lands of the Great Plains and the Rocky Mountains in northcentral Montana. It is a topographically diverse region characterized by a mix of foothill prairie grasslands interspersed with patches of coniferous forest and dissected by streams with riparian vegetation. Most of the western portion of the Front is publicly owned, whereas the eastern portion is mostly privately owned. Most private land is used for moderate livestock grazing and hay production. Further east these uses are replaced by intensive agriculture. To the west, all agricultural land uses ease as the foothills merge into the rugged mountains of the Bob Marshall-Scapegoat Wilderness complex.

The Front is drier, windier, and colder than most regions west of the Continental Divide. The climate is characterized by long, cold winters and short, warm summers. Southwesterly winds are especially strong along the faces of the limestone formations. Terrain is an important factor in precipitation patterns on the Front. The Continental Divide causes a rain shadow effect along the east side of the Divide. Precipitation ranges from 30-40 cm (12-16 inches) along the limestone reefs to 150-200 cm (59-79 inches) or more in the high alpine zone along the Continental Divide (Thompson 1981). Temperatures vary considerably from one area to the next and can range from –40 to 32 °C (–30 to 100 °F) annually (Aune and Kasworm 1989). Snow accounts for 45-75 percent of annual precipitation and may fall during any month of the year. Typically, winter storms arrive from the west and create down-slope winds. Winter and spring Chinook winds often raise the temperature dramatically in a matter of a few hours and can deplete much of the snow in the foothills and plains (BLM 1992). These warm winds interact with the topography with the result that snow cover is distributed differentially over the area. The growing season varies from approximately 110 days at Choteau to 50 days in areas north of the Teton River (DuBois 1984).

The landscape of the Front is characterized by a diversity of plant communities ranging from fescue prairie in the east to coniferous forests in the west. Detailed descriptions and geographic distribution of major plant communities and land classifications of the Front are given by Harvey (1980), Kasworm (1981), Thompson (1981), Lesica (1982), and Offerdahl (1989) among others. The eastern portion of the Front, between agricultural lands to the east and limestone formations to the west, is dominated by prairie grasslands and limber pine (*Pinus flexilis*) savannas. Cottonwood-dominated (*Populus* spp.) riparian areas bound springs, streams, creeks and rivers. Forests to the west of the limestone reefs are composed of either Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), or subalpine fir (*Abies lasiocarpa*) communities, depending on landform and elevation.

The Nature of Fescue Prairie

The Front is characterized by a combination of both open- and closed-canopied vegetation that provides wildlife, especially elk, with valuable sources of forage in proximity to hiding and thermal cover. The availability of forest stands, however, is a recent development largely in response to decades of fire suppression on the Front. Photographs from the turn of the century show that large areas along the Front, now occupied by coniferous forests, were formerly grasslands with scattered patches of primarily limber pine (Gruell 1983). The relative absence of fire for the last 90 years or more has allowed coniferous tree species to regenerate and establish on what were historically grasslands (Ayers 1996). Grassland fires are estimated to have occurred historically at intervals of 5 to 10 years (Arno 1980).

The grasslands that characterize the landscape on the Front are part of the fescue prairie forming the western edge of the Northern Great Plains (Barker and Whitman 1988). Climate is the most important environmental factor controlling the regional extent and botanical composition of fescue prairie. Compared to the mixed prairie, which it borders to the east, the fescue prairie is only found in regions with high soil moisture such as the foothills on the Front (Mueggler and Stewart 1980). Here, conditions are relatively more favorable due to lower temperatures and greater amounts of precipitation than further east. Locally, botanical composition and productivity are modified by soil type and topography (Offerdahl 1989). The amount and timing of spring precipitation largely determines the duration and amount of plant growth, although fall moisture can be extremely important in some years (Stout and others 1981).

On the Front, winters and summers are drought periods, especially at times of high winds. The influence of snowmelt on soil moisture is minimal except in areas that receive moisture from melted snow drifts (Moeckel 1995, personal communication). Most of the annual precipitation occurs between April and July, but growth of rough fescue (*Festuca scabrella*)—the characteristic grass species of fescue prairie—is most rapid in early spring. The great variation in amounts and timing of spring precipitation from year to year, however, is characteristic for fescue prairie; years of high precipitation often follow years of low precipitation (Montana Department of Fish, Wildlife and Parks 1994). Like other

cool season grasses such as Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*), spring growth of rough fescue is about a month earlier than warm season grasses such as blue grama (*Bouteloua gracilis*) that occur further east on the Northern Great Plains. However, by July, warm air temperatures and frequent strong winds dry soils and, as a result, plants temporally terminate growth. Throughout the summer months, rough fescue seeds ripen and cure. Sometimes fall precipitation is sufficient to replenish soil moisture to a level at which rough fescue and other cool season species respond with additional growth (Stout and others 1981).

Fescue Prairie: Historic Bison Wintering Grounds

Fescue prairie evolved with frequent wildfires (Arno 1980) and heavy grazing by large ungulates. Rough fescue is also known as "buffalo bunchgrass" because it provided the primary winter diet of bison on the Northern Great Plains. With the onset of winter, buffalo migrated from summer habitats located on the Northern Great Plains to the fescue prairie along the Front and similar regions in Alberta and Saskatchewan (Moodie and Ray 1976; Morgan 1980) (fig. 2), where they fed on the year's growth while plants were in the dormant stage. This type of grazing, and frequent fires, were integral components of the fescue prairie prior to settlement by Euro-Americans in the 1860's (Shaw and Carter 1990).

Wintering bison, with their predictable seasonal behavior patterns, became an integral part of the Front ecosystem. These patterns developed in response to opportunities provided by fescue prairie which in turn, adapted to timing and intensity of grazing by bison. Each year in early autumn, soon after the summer rut, the large plains herds split into smaller units, and bison migrated to wintering grounds. An understanding of the bison's physiology and morphology explains the adaptive benefit of this migration to the Front, an environment, in some ways, equally harsh in winter conditions as the plains. Migration was fueled by three energy requirements fundamental to winter survival of large ungulates in the northern temperate zone (Bamforth 1987). These include the need to: (1) deposit fat reserves prior to onset of winter, (2) utilize a winter diet of energetically adequate forage, and (3) ensure access to a protein-rich, easily digestible spring diet. Fescue prairie supplied the necessary resources to meet all of these needs better than any other grassland of the Northern Great Plains.

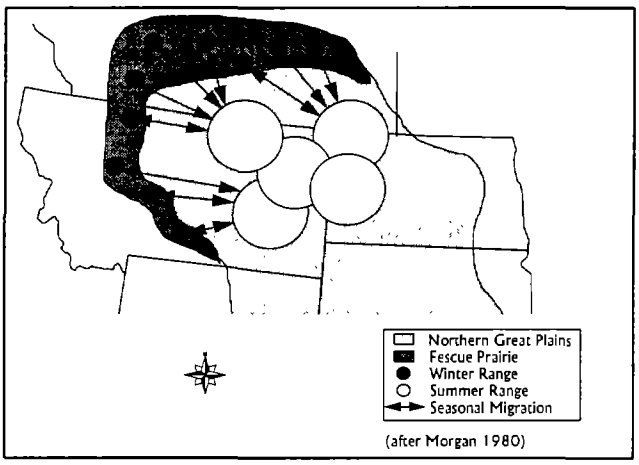

Figure 2—Historic bison distribution on the Northern Great Plains.

In early autumn, bison migrated westward in search of sufficient forage to accumulate the large fat reserves necessary for winter survival (Morgan 1980). This was best accomplished by minimizing intra-specific competition with other bison and by maximizing forage intake on a highly productive range. By early fall, most forage on summer ranges had either been consumed or was of too low a quality to meet the nutritional demands of bison. Migration to the Front was particularly attractive since autumn precipitation often stimulated additional fall growth of fescue prairie. The high productivity of fescue prairie also offered an excellent winter diet for bison.

For thousands of years, bison were an integral part of the Front landscape, and their grazing must have exerted significant impacts on the fescue prairie. This, combined with other behavioral traits such as wallowing, trampling, and rubbing resulted in substantial local and regional impacts on the landscape. However, as long as these impacts were restricted to winter and early spring, forage productivity and flora were well adapted to withstand these pressures. Indeed, the pattern of seasonal migration was instrumental in maintaining the productivity of these ranges since grasses recovered rapidly when left ungrazed throughout most of the growing season (Hanson 1984).

On the Front, market hunting and rapid settlement by Euro-Americans in the 1880's terminated bison migration, shifting the relationship between grazers and fescue prairie (Brownell 1987). Soon after first settlement, thousands of cattle and sheep were brought in to replace the vanishing bison herds in the foothill habitats (Picton and Picton 1975). Domestic livestock, however, were grazed not only in winter, but also throughout the growing period. The consequence of yearlong grazing was first felt in the severe winter of 1886/1887, when most ranchers lost the majority of their herds to starvation. Despite losses following this extreme event, yearlong grazing practices continued, effectively preventing depleted ranges from recovering. At the turn of the century, the situation had intensified to the point at which forage became so limited in the foothills that many ranchers were forced to drive livestock into the headwaters along the Continental Divide to forage in alpine meadows (Picton and Picton 1975).

The Sun River Game Range: A Lesson Learned

Though bison no longer roam the foothills, the physiological and morphological adaptations of fescue to heavy grazing pressure and fire are still visible. Only recently have researchers documented the intricate grassland-grazer relationship (Jourdonnais 1985), and recognized the need for

either grazing or fire to maintain productive fescue prairie. The impetus for research was a management problem that had developed on the Sun River Game Range on the Front, a former bison wintering ground. The 20,000 acre property, which was acquired by Montana Department of Fish, Wildlife and Parks in 1947, was originally purchased to accommodate migratory elk during winter and to draw elk away from private lands, in an effort to alleviate game damage. Soon after the acquisition, livestock grazing was terminated and fires suppressed with the objective of maximizing forage productivity. Initially, elk responded favorably by using these lands more frequently and game damage to private property decreased. However, on a few sites, especially adjacent to roads, elk use was too low to prevent rough fescue plants from accumulating large amounts of standing litter. As a result, palatability and productivity of forage declined, and elk use shifted back to private lands.

Scientific investigation by researchers from the University of Montana revealed that by eliminating livestock grazing and suppressing fires, fescue prairie had accumulated dead plant material in amounts that significantly impaired productivity and elk use (Jourdonnais and Bedunah 1990). Grazing intensity by wintering elk was insufficient to remove enough litter to prevent plants from becoming decadent. As a consequence, the palatability of fescue declined to such a degree that elk had shifted use to livestock-grazed pastures on adjacent private lands. Scientifically based knowledge on the ecological relationships of grasslands and grazers on the Sun River Game Range opened new doors for integrative management (fig. 3). In response to this new insight, management was changed to incorporate additional livestock grazing. Soon after a controlled grazing system during the dormancy phase of plant phenology had been developed, the attractiveness of the area improved, and, as a result, elk redistributed differently such that the Sun River Game Range was used more effectively and use of private lands declined again to acceptable levels (Jourdonnais and Bedunah 1990).

The Sun River management policy that precipitated the conflict over elk and fescue prairie was a management problem that was ultimately caused by a lack of understanding of the role grazers and fires had played historically in sustaining grassland productivity. Over the course of thousands of years, the phenology and productivity of fescue prairie adapted to intensive grazing pressure by bison. This adaptation ultimately became a dependency; removal of litter, either through grazing or burning, was essential if plants were to maintain productivity. A positive feedback mechanism of grazing and stimulated plant growth had evolved.

Implications of Coevolution Between Fescue Prairie and Bison

For centuries, bison modified the potential of fescue prairie, set by climate, topography, fire, and soils, through a positive feedback mechanism of grazing and of forage productivity and palatability. High seasonal forage yields, favorable phenology of plant growth, and the availability of shelter attracted thousands of bison to the east slopes of the Rockies. At a regional scale, use of different areas by bison was influenced largely by previous intensities and timing of grazing. This pattern subsequently affected growth, palatability and availability of forage. Other behavioral traits of bison such as wallowing, rubbing and trampling kept tree invasion to a minimum, a characteristic that helped maintain the character of fescue prairie. Over time, intensive use by bison had resulted in a selective pressure for the adaptation of grasses to grazing.

Ranching permanently altered the historic interrelationship of bison and grasslands (fig. 4). The early failures previously mentioned were attributed largely to overgrazed grasslands during the open range days when there was little

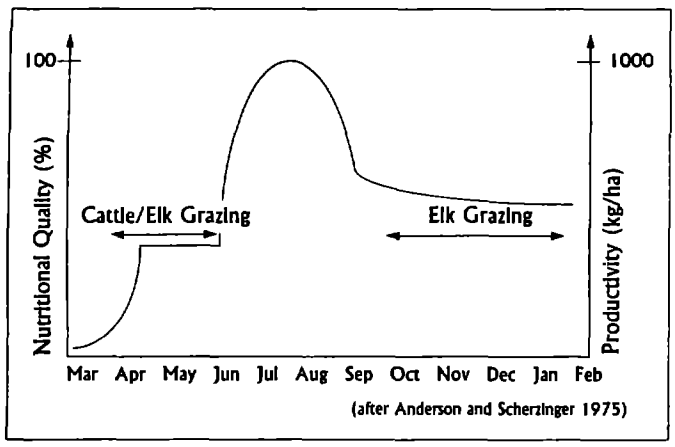

Figure 3—Nutritional quality and productivity of fescue prairie with ungulate grazing.

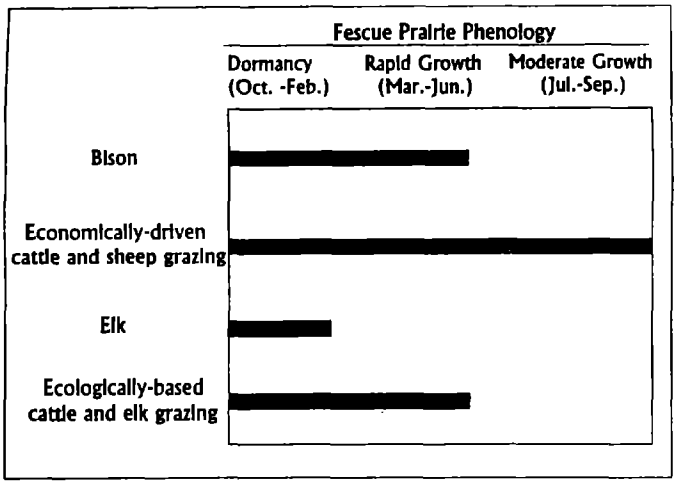

Figure 4—Seasonal use of fescue prairie under different grazing regimes by ungulates.

recognition of the need for rest from grazing during the growing period (Picton and Picton 1975). As research has shown, both domestic and wild ungulates can fulfill the historic role of grazers if managed within the ecological limits of productivity. Impacts on the landscape are best minimized by mimicking the historical patterns of bison, that is, by restricting grazing primarily to the dormant period and early in the growing season. Under summer-long grazing or under grazing exclusion, rough fescue tends to be replaced by other, more grazing tolerant species (Hurlburt 1996). Also, heavy grazing throughout the growing season, reducing plant height of a few inches, can result in plant mortality (Stout and others 1981). Survival is higher when grazing ceases before the end of leaf growth, in early July, because photosynthetic plant material is retained.

Application of New Information in Ecosystem-based Elk Management

Rough fescue is the prime winter-spring forage plant for elk on the Front (Jourdonnais and Bedunah 1990). The high palatability of this grass, however, may lead to overuse by both livestock and elk, which will subsequently reduce availability. When overused, rough fescue is gradually replaced by Idaho fescue, bluebunch wheatgrass, and Parry's Danthonia, all less desirable forage species for ungulates (Jourdonnais and Bedunah 1990). The condition of fescue prairie, therefore, is a function of the combined influence of both domestic and wild ungulate grazing.

Next, we present two case studies on how livestock grazing can be managed in accordance with historic grassland-grazer adaptations to result in moderate and seasonal land use that provides quality habitat for wildlife and people. These case studies include the State-owned Blackleaf Wildlife Management Area (Blackleaf WMA) and the privately owned Theodore Roosevelt Memorial Ranch, both of which are essential in maintaining current elk herds on the Front.

Blackleaf Wildlife Management Area

On the Front north of Teton River the long-term goal of elk management is to sustain a herd of roughly 500 elk while minimizing game damage to private lands. This has required balancing animal requirements with landowner tolerance. In the late 1970's, Montana Department of Fish, Wildlife and Parks acquired Blackleaf WMA to provide elk with quality winter range. Following the purchase, livestock grazing was terminated to reduce competition between elk and livestock. Although elk initially used grasslands on Blackleaf WMA extensively, adjacent landowners continued to report elk damage on their lands (Olson 1990). Surveys documented that elk were, in fact, frequently using private lands, especially during spring "green-up."

Following the research conducted on the Sun River Game Range, it become apparent that exclusion of livestock and fire from grasslands had allowed accumulations of large amounts of dead plant material on Blackleaf WMA, resulting in lower grass productivity. Of greater importance, the dead material mixed with the new growth made the forage less attractive to elk than that on nearby ranches. Elk foraged less on ungrazed State-managed areas and more on privately owned lands, where livestock grazing continued to remove sufficient amounts of annual growth to allow for the palatable regrowth that attracted elk.

As a result, management was modified to use livestock grazing as a tool to enhance the quality of fescue prairie for elk. Starting in 1990, after 10 years of rest, a rest-rotation cattle grazing system was implemented to stimulate regrowth of palatable bunchgrasses by removing accumulated dead forage. This grazing system allows plants to recover and new plants to establish following grazing. On Blackleaf WMA the system includes four pastures, each 600-700 acres in size. One pasture is grazed each spring to remove the previous year's growth and then rested from grazing for a 3-year period. Preliminary results on range conditions suggest that this system has allowed grass seedlings to establish and litter to accumulate sufficient for soil building and water retention, but not to build up before grazing occurs again. Up to 400 privately owned cattle from a nearby ranch are used to graze the area with the landowner paying lower grazing fees than charged on other State lands. In addition to promoting private/public cooperation across ownership boundaries, expanding grazing to State lands improved the economic well-being of the landowner and relieved some of the grazing pressure on private lands. As a result of this cooperative management program, elk use of the area has increased fourfold in the grazed pastures compared to ungrazed pastures (Olson 1995). This increase in use, in turn, has generated additional hunting opportunities for the public as well as eased the elk depredation problem on nearby ranches. Also, moderate activities associated with natural gas exploration have been successfully integrated with the character and use of the land by people and wildlife since 1980.

Theodore Roosevelt Memorial Ranch

The Theodore Roosevelt Memorial Ranch (TRM Ranch), located at the base of rugged mountains east of the Bob Marshall Wilderness, is one of the private lands that plays an important role in the distribution of elk on the Front. The Boone and Crockett Club purchased the 6,000 acre ranch in 1986 as a field station for research and demonstration, within the Club's Wildlife Conservation Program at the University of Montana in Missoula.

The landscape pattern on TRM Ranch is typical of the Front, with fescue prairie, irrigated hay meadows, and alfalfa fields in the central portion that grade into limber pine savanna and Douglas-fir dominated coniferous forests to the west and southwest. Elk use on the ranch is high, especially in the western portion adjoining the Lewis and Clark National Forest. Results from a radiotelemetry study indicate that 15 percent of elk in this region use the ranch even though the property comprises only 3 percent of the land area available to these elk (Olson and others 1994). The study also documents the importance of rough fescue grasslands in influencing elk distribution. These grasslands are part of the 1,800 acres of land currently managed as part of the cattle operation.

Since the late 1980's, 100-125 cow/calf pairs have grazed annually on these 1,800 acres from mid-May through the end of June. Starting in early July, pairs are moved onto a National Forest grazing allotment, located west of the ranch. By late September, cattle are gathered and moved back to the ranch. Calves are sold in October and cows are then winter-fed in a pasture on alfalfa and hay grown on the ranch. This combination of a low cattle stocking rate, spring grazing system, and summer grazing on National Forest allotments has promoted quality habitat for elk on the ranch, especially during winter and spring. The key to livestock management has been to terminate spring grazing while rough fescue is still in the growing phase; this allows plants to recover and mature in between late spring and fall, depending on soil moisture. Each spring, cattle and elk combined remove enough of the previous year's growth to maintain productive grasslands.

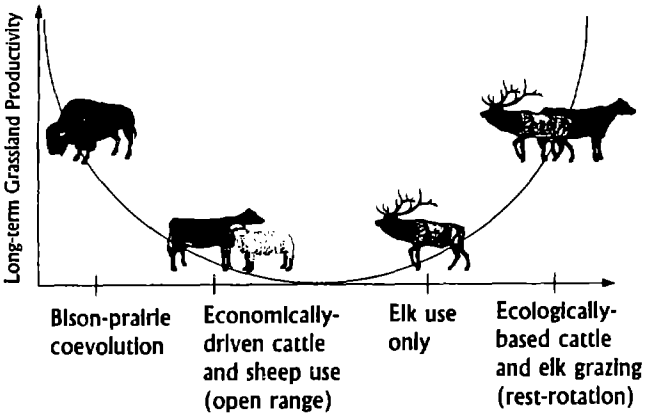

Figure 5—Relationships between long-term productivity of fescue prairie and ungulates on Montana's Front.

Discussion

The Rocky Mountain elk is one of the wildlife species that has brought fame to Montana's Front. Recognition was earned for the successful conservation of elk at the turn of the century through the historic creation of state-managed winter ranges (Picton and Picton 1975). However, without extensive use of private lands, current elk numbers could not be maintained as public lands lack sufficient seasonal habitats. The continued suitability of the Front as elk habitat depends on the availability and proximity of highly used and preferred habitat components in a matrix that can effectively be used by elk both in time and space, in other words, preferred vegetation at preferred elevations in the absence of intensive agriculture and other human developments. Changes in land use practices on both private and public lands that might lead away from preferred fescue communities that are either grazed moderately and periodically burned or that might put more human activities on the landscape will likely affect the ability of elk to use the Front in the future.

Recent studies of range ecology on the Front provide unexpected alternatives to old dilemmas: livestock grazing need not be incompatible with the creation and maintenance of elk habitat (fig. 5). In fact, improved grassland productivity and forage conditions as a result of cattle grazing redistributed elk, reduced the risk of large-scale fire, and reestablished the importance of conservation areas for elk, alleviating some of the depredation problems on adjoining private lands. Conservationists, resource managers, and ranchers now recognize that the best habitats currently available to elk on the Front are those seasonally grazed by cattle (Baumeister 1994; Olson and others 1994; Dagget 1995). Not only do fire suppression and no-grazing practices reduce grassland productivity, these policies also communicate the wrong message about the relationship between ranching practices and the quality of elk habitat. This information, in turn, has provided the scientific basis for voluntary agreements between public resource management agencies and private landowners—privately owned cattle accomplish state management objectives while public lands help accomplish private objectives. Carefully managed livestock grazing maintains habitat condition for elk and diversifies the economic foundation for ranchers living on the Front. The strategies could also be extended to other ranching operations and may accomplish similar results without the high cost of land purchase. This task is best accomplished through responsible stewardship built on a thorough understanding of the ecological adaptations of fauna and flora to each other and to the abiotic conditions of ecosystems over time.

References

Anderson, E. W. and R. J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. J. Range Manage. 28:120-125.

Arno, S. F. 1980. Forest fire history in the Northern Rockies. J. For. 78(8): 460-465.

Aune, K. and W. Kasworm. 1989. Final report of the East Front grizzly bear study. Mont. Dept. Fish, Wildl. and Parks, Helena. 322 p.

Ayers, D. M. 1996. The Rocky Mountain Front: a landscape in transition. Fair Chase. Winter (in press).

Bamforth, D. B. 1987. Historical documents and bison ecology on the Great Plains. Plains Anthropologist. 32: 1-16.

Barker, W. T., and W. C. Whitman. 1988. Vegetation of the Northern Great Plains. Rangelands. 10(6): 266-272.

Baumeister, T. R. 1994. Sustaining elk herds: the importance of private lands. Home Front. 2(3): 9-10.

Baumeister, T. R.; H. Salwasser; A. L. Preston. 1996. The role of elk conservation in sustainable development: past, present, and future on Montana's Rocky Mountain Front. Paper presented at the 61st North American Wildlife and Natural Resources Conference, Tulsa, Oklahoma, March 1996. In press in the proceedings of the conference.

Boone and Crockett Club. 1993. A strategic plan for the Boone and Crockett Club in its second century. Boone and Crockett Club, Missoula, MT. 5 p.

BLM. 1992. Blackleaf Environmental Impact Statement. U.S. Dept. of Interior, Bureau of Land Management, Lewiston District Office. 366 p.

Brown, B. 1986. Wilderness elk hunting: the Bob Marshall complex. Western Wildlands. 12(2): 2-7.

Brownell, J. L. 1987. The genesis of wildlife conservation in Montana. M.A. Thesis in History, Montana State Univ., Bozeman. 93 p.

Dagget, D. 1995. Team from the Devil's Kitchen. Range. Fall: 6-10.

DuBois, K. 1984. Rocky Mountain Front raptor survey, December 1982-August 1984. Mont. Dept. Fish, Wildl. and Parks, Helena. 147 p.

Gruell, G. E. 1983. Fire and vegetative trends in the Northern Rockies: Interpretations from 1871-1982 photographs. USDA Forest Service Gen. Tech. Rpt. INT-158.

Hanson, J. R. 1984. Bison ecology in the Northern Plains and a reconstruction of bison patterns for the North Dakota Region. Plains Anthropologist. 29: 93-113.

Harvey, S. J. 1980. The potential and current vegetation of the Sun River Game Range. Allen Found. and Fed. Aid in Wildl. Restor. Proj. 2-130-R. Mont. Dept. Fish, Wildl. and Parks, Helena. 85 p.

Hurlburt, K. 1996. Influence of cattle and wild ungulate foraging on Theodore Roosevelt Memorial Ranch vegetation. M.S. Thesis, The Univ. of Montana, Missoula. (In prep.).

Jourdonnais, C. S. 1985. Prescribed fire and cattle grazing influences on the vegetation and elk use of a rough fescue community. M.S. Thesis, The Univ. of Montana, Missoula. 100 p.

Jourdonnais, C. S. and D. J. Bedunah. 1990. Prescribed fire and cattle grazing on an elk winter range in Montana. Wildl. Soc. Bull. 18: 232-240.

Kasworm, W. 1981. Distribution and population characteristics of mule deer along the East Front, northcentral Montana. M.S. Thesis, Montana State Univ., Bozeman. 73 p.

Lesica, P. 1982. Vegetation of the wetland and riparian areas of the Pine Butte Preserve, Teton County, Montana. Rept. to The Nature Conservancy, Helena, MT. 50 p.

Mueggler, W. F. and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service Gen. Tech. Rpt. INT-66. 123 p.

Montana Department of Fish, Wildlife and Parks. 1994. Wildlife Management Area vegetation monitoring. Mont. Dept. Fish, Wildl. and Parks, Helena. 32 p.

Moodie, D. W. and A. J. Ray. 1976. Buffalo migrations in the Canadian Plains. Plains Anthropologist. 21: 45-52.

Morgan, R. G. 1980. Bison movement patterns on the Canadian Plains: an ecological analysis. Plains Anthropologist. 25: 142-160.

Offerdahl, R. J. 1989. A description of the major plant communities on the Theodore Roosevelt Memorial Ranch. M.S. Thesis, The Univ. of Montana, Missoula. 106 p.

Olson, G. 1995. Analysis of vegetation transects on Blackleaf Wildlife Management Area: 1979-1987-1993. Mont. Dept. Fish, Wildl. and Parks, Great Falls. 15 p.

Olson, G.; L. Marcum; and T. R. Baumeister. 1994. Theodore Roosevelt Memorial Ranch elk study. Montana Dept. of Fish, Wildlife and Parks and The Univ. of Montana, School of Forestry. Great Falls, Montana. 115 p.

Olson, G. 1990. Bulls on the TRMR. Montana Outdoors, November/December 21(6): 16-20.

Olson, G. 1981. Effects of seismic exploration on summering elk in the Two Medicine-Badger Creek Area, northcentral Montana. Mont. Dept. Fish, Wildl. and Parks, Helena. 24 p.

Picton, H. D. and I. E. Picton. 1975. Saga of the Sun: a history of the Sun River elk herd. Mont. Dept. Fish, Wildl. and Parks, Helena. 65 p.

Posewitz, J. A.; J. J. Fraley; G. L. Joslin; and S. J. Riley. 1991. Fish and wildlife plan: the Bob Marshall wilderness complex. Mont. Dept. Fish, Wildl. and Parks, Helena. 177 p.

Shaw, J. H. and T. S. Carter. 1990. Bison movements in relation to fire and seasonality. Wildl. Soc. Bull. 18: 426-430.

Stout, D. G.; A. McLean; and D. A. Quinton. 1981. Growth and phenological development of rough fescue in Interior British Columbia. J. Range Manage. 34(6): 456-459.

Thompson, M. J. 1981. Mountain goat distribution, population characteristics and habitat use in the Sawtooth Range, Montana. M.S. Thesis, Mont. State Univ., Bozeman. 79 p.

Spotted Frog: Catalyst for Sharing Common Ground in the Riparian Ecosystems of Nevada's Range Landscape

Jamie K. Reaser

Abstract—This paper outlines an action plan to empower multi-sector partnerships for the purpose of identifying rangeland management strategies that are compatible with the needs of both the regional biota and human populace. The spotted frog (*Rana pretiosa*), a Candidate 1 for protection under the Federal Endangered Species Act, is a "sensitive species" that can serve as a valuable indicator for riparian ecosystem health and, therefore, will be used as a catalyst for cooperation between sustainable resource users and managers. This plan is placed in context with a review of issues pertaining to threatened riparian ecosystems, grazing and the loss of biodiversity, and amphibians as indicators of ecosystem health. Findings from 2 years of amphibian surveys in Nevada are reported.

Threatened Riparian Ecosystems

Riparian habitats (rivers, creeks, streams and their associated banks) make a contribution to the structural diversity and species richness of natural communities that far exceeds the relative spatial extent of such habitats (Warren and Schwalbe 1985); they are the most productive habitats in western North America (Johnson and others 1977). The U.S. Environmental Protection Agency has, however, concluded that conditions of riparian areas throughout the West are now the worst in United States history (Chaney and others 1990).

The importance of riparian areas for maintaining biodiversity in Nevada is evident: more than 75 percent of all wildlife species in the Great Basin depend on riparian habitat. Riparian corridors are a landscape feature with substantial regulatory controls on associated ecosystem quality (Naiman 1992). As well, human activities such as livestock grazing, mining, and recreation are concentrated along riparian corridors. These land uses have relatively unquantified effects on floral and faunal communities.

Nevada is the fastest growing State in terms of human population and is among the top 10 States in the nation with regards to the number of native species that are either extinct or threatened with extinction. More than 140 species and subspecies are listed as threatened or endangered, are candidates for listing, or have been proposed for listing in Nevada.

The risk of natural, localized extinction, combined with the current trends of resource consumption in Nevada, is resulting in a State-wide decline of riparian biodiversity. The loss of species and alterations of riparian ecosystems in Nevada further endanger more widespread organisms on a regional basis. Species that exist as metapopulations across the region are linked by processes of extinction and mutual recolonization, and are thus interdependent over ecological time (Harrison and others 1988). For example, populations of such taxa as amphibians, which may be poor dispersers and colonizers, have narrow habitat requirements, or depend on a highly ephemeral/variable resource base, are particularly sensitive to environmental disturbances.

Grazing and the Loss of Biodiversity

Rangelands have received surprisingly scant attention from North American ecologists and conservation biologists. Despite the recent flourish in applied biodiversity-oriented research, rangelands have been virtually ignored as dynamic landscapes hosting diverse biological communities and critical ecosystems (Noss 1994). The impacts of rangeland management have both intensive and extensive implications for biodiversity conservation. Livestock grazing is the land use with the most widespread influence on native ecosystems in North America (Wagner 1978; Crumpacker 1984). Approximately 70 percent of the 11 western States of the United States (Montana, Wyoming, Colorado, New Mexico, and westward) are grazed by livestock (Council for Agricultural Science and Technology 1974; Crumpacker 1984). Grazing occurs on the majority of Federal lands in the West; approximately 165 million acres (94 percent) of U.S. Bureau of Land Management (BLM) property and 103 million acres of National Forest land are grazed by 7 million head of livestock, primarily cattle (U.S. General Accounting Office 1988, figure for 16 states). Of the Federal Wilderness Areas, 35 percent have active livestock allotments (Reed and others 1989; figure from nationwide survey, West is probably higher). Cattle grazing and haying occur on 123 National Wildlife Refuges, occupying up to 50 percent of refuge funds and 55 percent of staff time.

Congressional investigations into rangeland conditions on BLM and National Forest lands revealed that more than

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50 percent of public rangelands administered by these agencies are in "poor" or "fair" condition (U.S. General Accounting Office 1991). Based on BLM's own definition of habitat quality, more than 68 percent of its lands are in "unsatisfactory" condition (Wald and Alberswerth 1989; U.S. General Accounting Office 1991). According to Dregne (1983), approximately 464 million acres of United States rangeland have been degraded so far as to have undergone some degree of desertification.

It is especially surprising that rangelands have received so little attention since livestock grazing on public lands is rapidly becoming one of the most contentious environmental issues in the United States (for example, Larson 1995; Noss 1994). Some conservationists claim that livestock have done more damage to the native biodiversity of western North America than all other forms of destruction combined (Noss 1994). Wuerthner (1994), for example, argued that agriculture, especially livestock production, has had a much greater influence on the ecosystems of western North America than suburban development, and conservationists should be cautious in advocating cattle over suburbia. However, the seemingly clear picture of grazing's pillage of the western landscape is in reality opaque. Generalizations that "grazing is bad" are not scientifically defensible given our current levels of quantitative knowledge.

Various studies have implicated livestock grazing in alterations in the physical habitat structure (for example, soil erosion and compaction, channel morphology), species composition (for example, loss of native vegetation, introduction of exotic vegetation), population densities (for example, eradication of native predators and prairie dogs, disease transmission), community organization, ecosystem structure, and ecosystem functioning (for example, nutrient cycling and succession) (Rauzi and Smith 1973; Wagner 1978; Platts 1979; Mosconi and Hutto 1982; Ohmart and Anderson 1982; Platts 1983; Kauffman and Kruger 1984; Szaro and others 1985; Abdel-Magid and others 1987; Platts and Nelson 1989; Quinn and Walgenbach 1990; Kovalchik and Elmore 1992; Fleischner 1994; Noss 1994). Changes in riparian areas due to grazing may be subtle, but cumulative over a long time (Elmore and Beschta 1987; Marlow 1988). In effect, grazing induced changes in water quality (Buckhouse and Gifford 1976), chemistry (Jeffries and Kloptek 1987), and temperature (Van Velson 1979) can create an entirely new aquatic ecosystem (Kauffman and others 1984).

Some conservation biologists can aptly cite examples of successful coexistence of wildlife and livestock (Brussard and others 1994). Several investigators have concluded that, properly managed, livestock grazing is generally compatible with wildlife (for example, Kauffman and others 1984; Elmore and Beschta 1987). In some instances, wildlife may even be dependent on, or benefit from grazing. In Scandinavia the green toad (*Bufo viridis*) seems to prefer the very open nature of grazed fields and tadpoles seem to favor the eutrophic conditions resulting from cattle defecation in ponds (Tramontano 1995). The latter also holds true for the Syrian spadefoot toad (*Pelobates syriacus*) (Heinrich 1995). Grazing impact studies vary greatly in numerous livestock management variables (for example, grazing intensity, livestock species, seasonality of grazing, degree of active management), historical and current status of other land uses, and biome type. Therefore, the findings may not be directly comparable or relevant among sites. For example, Elmore and Beschta (1987) believed grazing to be a problem, but hypothesized that some watershed problems may have occurred initially because fur trappers removed beaver, and dams no longer maintained released water and sediment, leading to channel downcutting. Because management history of many sites is unknown and current records often do not accurately reflect actual livestock use levels and schedules, the relationship between grazing management and the environment is virtually intangible. Grazing is "the great uncontrolled experiment." Scientists have failed to provide policy makers and resource managers with adequate data on which to make quantitatively informed decisions. We need to test graduated grazing management alternatives to the currently popular policies, including sufficient controls where grazing is excluded. Most importantly, we need to identify and monitor indicators of ecosystem integrity for the riparian zone of rangelands. Management for maintenance or toward recovery is an unattainable goal without such measures.

Amphibians as Indicators of Riparian Ecosystem Health

Theoretically, amphibians should be excellent indicators of riparian ecosystem health. Substances in the environment are readily absorbed through amphibian skin, making them highly sensitive to changes in chemistry (Pierce 1985), moisture levels (Corn and Fogleman 1984), and radiation (Blaustein 1994). In addition, amphibians sample both aquatic and terrestrial habitats. Amphibians consume vegetation, invertebrates and other vertebrates, and in turn, are eaten by numerous predators. Therefore, amphibians influence not only what they eat, but what eats them (Blaustein and Wake 1990). Amphibians are vital components of the world's ecosystems, sometimes constituting the highest percentage of vertebrate biomass (Burton and Likens 1975). This measure may be positively correlated with an organism/taxon's contribution to ecosystem function; it is one indication of its importance to maintaining the system's integrity. Amphibians can be sampled inexpensively, with little technological assistance, and by nondestructive means (Heyer and others 1994).

Contemporary studies indicate that some amphibian population trends are positively correlated with environmental quality (Wyman 1990; Blaustein 1994). Research indicates that although many amphibian populations are stable (Jaeger 1980), others are declining (Jaeger 1980; Sherman and Morton 1993; Bradford and others 1993), some are seemingly extinct (Corn and Fogleman 1984; Pounds and Crump 1994), and ranges are greatly reduced for many species (Blaustein and Wake 1990; Wyman 1990). While natural population fluctuations can account for some of the local declines (Pechmann and others 1991; Weitzel and Panik 1993), other losses have been attributed to succession (Beebee 1977), pathogens (Sherman and Morton 1993; Blaustein and others 1994), excessive collecting, the introduction of predators and competitors (Hayes and Jennings 1986; Bradford and others 1993), the presence of numerous toxic compounds (Pierce 1985; Wyman 1988), habitat destruction (Blaustein and Wake 1990), climate disturbance (Sherman and Morton 1993; Pounds and Crump 1994), and increases in UV-B

radiation (Blaustein and others 1994). Amphibians are apparently declining even in seemingly pristine, protected areas worldwide (Blaustein and Wake 1990).

Amphibian Research and Conservation Initiative

In June of 1994, I initiated a multi-tier project, the goals of which are to: (I) develop and conduct standardized, repeatable surveys (transect-based, area-time constrained searches) of amphibians in the Toiyabe Range in conjunction with concurrent bird, fish, and butterfly studies; (II) assess the status of amphibian species with respect to regional, State, and Great Basin trends; (III) design and initiate a research plan to investigate the mechanisms that underlie amphibian distributions in Nevada; and (IV) develop a recovery plan, including a monitoring program for species of special concern.

I. Toiyabe Range Surveys

The spotted frog (*Rana pretiosa*) was the only amphibian species encountered during 2 months of surveys in the summer of 1994. Of the 14 drainages (28 sites total) and two valleys surveyed, it was located in only four sites. Only one "population" showed evidence of recruitment in the last 4 years. This population consisted of approximately 300 individuals. No more than 10 individuals could be located at other sites. The spotted frog was not detected at six locations (three drainages and three valley ponds) where it had been previously recorded (voucher records of California Academy of Sciences and University of Michigan; unpublished records of Turner, Stebbins, Hovingh, Ports). Two Great Basin spadefoot toads (*Scaphious intermontanus*) were recorded within the region, but not as part of the riparian zone surveys.

II. Amphibian Status Assessment

One July 21, 1995, I initiated extensive amphibian surveys in Nevada following the protocol established in 1994. More than 100 intensive surveys and 200 spot checks were conducted from July 21 through September 29, 1995, on property managed by the U.S. Forest Service and Bureau of Land Management. Locales in the Toiyabe Range and associated valleys that historically had spotted frog populations, had spotted frog populations in 1994, or that were noted in 1994 as having habitat characteristics suitable for spotted frog reproduction, were revisited at least once. All frog populations located in 1994 were relocated. The Great Basin spadefoot toad was found to be abundant in one drainage and along several small creeks within the Reese River Valley.

Outside the Toiyabe Mountain region, aquatic sites were extensively surveyed in White Pine, Humboldt, Elko, and Nye Counties. Although historical records exist for all of these counties, spotted frogs were only detected in six drainages of Elko County. No population consisted of more than five adult animals. Three populations had 14 or fewer subadults or larvae present. A few isolated populations of Pacific tree frogs (*Hyla regilla*), leopard frogs (*Rana pipiens*; possibly introduced), and introduced bullfrogs (*Rana catesbiena*) were also located during the surveys. The former two species showed extreme range reduction (see Stebbins 1985). The Great Basin spadefoot toad was encountered frequently.

The spotted frog is listed as a Candidate 1 species, being considered for protection under the Federal Endangered Species Act. The U.S. Forest Service classifies the spotted frog as a "sensitive species," meaning that it is particularly vulnerable to habitat degradation. Hovingh (1991) stated that in Nevada, as in Utah, the number of sites where amphibians occur has been declining rapidly; the spotted frog seems to disappear from an additional 90 percent of its sites every 30 years.

III. Mechanisms Underlying Spotted Frog Distribution

Water Availability—The spotted frog is a highly aquatic species, believed to be much more dependent on water than other frogs (Dumas 1966). The spotted frog requires aquatic habitats for breeding, feeding, hibernation, and escape from predators (Turner 1960; Morris and Tanner 1969). Analysis of the site characteristics associated with the presence of the spotted frog indicates that they require open-canopy, pooled water with floating vegetation and some emergent vegetation for reproduction. Such pooled water may be in the form of oxbows along stream courses, seeps in wet meadows, or beaver-created ponds. Annual precipitation patterns in the Great Basin are likely to contribute to the distribution potential of spotted frogs. For example, heavy rains in the summer of 1995 resulted in the "blow out" of beaver dams in Arc Dome Wilderness Area, and the subsequent loss of ponds with which spotted frogs had been associated the previous summer (Brack, personal communication). However, our findings also indicate that flooding may enable the broad dispersal and colonization of frogs into regions to which they do not have access when conditions are dry (Reaser, in press). Water is a scarce, highly valued resource in the Great Basin; diversion for irrigation and development poses a significant threat to the spotted frog.

Introduced Fish—Several studies in the western United States reveal a non-overlapping distribution of native frogs and introduced fish, particularly salmonids. Introduced fish are believed to negatively influence amphibian populations through predation, competition, and disease transmission (see review by Reaser 1996). Fish were present at 58 percent of the sites surveyed. Fish and frogs coexisted in 16 percent of the sites (4 percent with salmonids, 2 percent with unidentified species, 10 percent with nonsalmonids), and 9 percent of the sites had frogs but no fish. Spotted frogs were found to reproduce during 1995 in association with native fish, but not introduced salmonids or mosquito fish.

Cattle Grazing—Frogs were found in the presence of livestock (one cow) at only one location. Livestock grazing may influence spotted frogs in several ways: (1) direct frog mortality may result from trampling; (2) indirect frog mortality may result from an increase in fecal coliform bacteria causing frogs to develop bacterial infections, especially if they are under stress from other environmental alterations;

(3) frog growth rates may be reduced and indirect mortality be incurred if the invertebrate prey base is reduced as a result of soil compaction and changes in water quality; and (4) frog reproduction may be compromised through the destruction of pools through trampling, increases in water velocity and flooding as a result of deep channelization, and changes in water temperature and chemistry resulting from vegetative loss and soil erosion.

IV. Spotted Frog Recovery

Recovery of Riparian Areas—Riparian conditions adequate for spotted frog survival, reproduction, and recruitment are similar to those critical for a wide variety of other organisms, such as native fish (Platts 1990, personal observation), some butterflies (Fleishman, personal communication), molluscs (Hovingh 1993), arthropods, and mammals such as shrews (Quigley and others 1989) and beaver. Spotted frog predators such as snakes (Reaser and Dexter 1996), birds, and mammals (Turner 1960) also benefit from the presence of healthy spotted frog populations. Thus, since spotted frogs are sensitive to the presence of cattle in riparian zones and other organisms rely on, or reflect the condition of spotted frog populations, managing the recovery of the spotted frog in Nevada can serve as a critical tool in developing condition evaluation, recovery, and management plans for rangeland riparian ecosystems.

The U.S. General Accounting Office (1988) reviewed riparian restoration efforts on BLM and National Forest lands in the West and concluded that even severely degraded habitats can be successfully restored, but that successful techniques and time to recovery vary from site to site. In numerous studies of riparian grazing impact, investigators concluded that total removal of livestock was necessary to restore ecosystem health (Ames 1977; Dahlem 1979; Chaney and others 1990; Fleischner 1994) and offered the strongest ecosystem protection (Kovalchik and Elmore 1992). Warren and Anderson (1987) documented dramatic recovery of marsh and riparian vegetation within 5 years of livestock removal. However, total removal of livestock may not meet the multiple use objectives of public lands, nor adequately address social and economic concerns of the rangeland populace. The reduction of stocking numbers is a common practice and some believe utilization levels are the most important grazing consideration (Clary and Webster 1989). It is, however, only successful when reduction is one component of a multifacetted management program and when adequate studies have been undertaken to determine local habitat carrying capacity of livestock.

Marlow (1988) believes the length of time livestock have access to riparian areas may be more important than total animal numbers. But the implementation of specialized time-constrained grazing strategies requires detailed information that is often not available and, although it may improve uplands, rarely benefits riparian areas. Improving livestock distribution is a management intensive exercise that requires constant herd attention and is exceptionally difficult to achieve as livestock are attracted to riparian zones. Changing the season of forage use without adequate information on season to season implications for stream morphology, vegetation, and wildlife can have disastrous consequences. Changing livestock type from cattle to other animals such as sheep that concentrate less in riparian zones holds some promise, but more information is needed on the impacts of optional grazers and their management needs.

As well, changing livestock requires a fundamental shift in ranching operations, which would be difficult for most ranching communities. Replanting riparian systems may be necessary in some systems, but cannot be accomplished successfully unless the causative factors leading to the damage have been adequately addressed through one or more of the previously mentioned strategies.

Fencing riparian zones to create cattle exclosures offers the best chance for ecosystem protection and improvement without entirely eliminating grazing (Platts 1984; Platts and Rhine 1985) and is the most effective tool in keeping livestock out of riparian areas (Platts 1990). Fencing may encourage equitable use of all forage and can control intensity of riparian zone use (Platts and Nelson 1985). No grazing system other than fencing can ensure proper use of small riparian meadows within extensive upland range (Eckert 1975; Skovlin 1984). Mahogany Creek, NV, showed major improvement in fisheries habitat after only 2 years of cattle exclosure (Dahlem 1979). Properly designed by experimental standards, cattle exclosures provide a before/after grazing comparison and can be monitored for multitaxa recovery and compared with adjacent grazed sites. Kauffman and his colleagues (1985) learned that late season grazing led to significantly greater streambank loss compared to exclosed areas. Keller and Burhnam (1982) found trout prefer stream areas in ungrazed, fenced habitat over grazed; number and size of trout were greater in ungrazed areas. Beaver and waterfowl returned to Camp Creek, OR, within 9 years of cattle exclosure (Winegar 1977).

Unfortunately, grazing exclusion may be socially and economically difficult to implement. Exclosure fencing costs approximately $6,000-6,500 per mile ($2,000 materials, $4000 labor; Platts and Wagstaff 1985; Brack, personal communication). If local resource users, including recreationists, do not respect the exclosure option, fences may be damaged or destroyed and fail to function accordingly. Fencing can create obstacles for, and be damaged by, wildlife such as mule deer and pronghorns. Generally, wildlife related problems can be alleviated if the behavioral patterns of local animals are considered during exclosure design (Kindschy 1982).

Addressing the social costs of any grazing management option is at this moment a tumultuous topic across the western landscape of North America. The politics of the moment and the trends of human/resource conflicts in the West must be examined thoroughly if management plans are going to be successfully implemented as riparian conservation measures.

Apostles of the county supremacy (Larson 1995) and environmental movements believe that wildlife, cattle, cowboys, and the Federal Government cannot co-exist. Ranchers and conservation biologists do, however, share a common ground, but rarely come there in unison. If the conservation of riparian rangelands is to be achieved, these parties (as well as other resources users) must learn to work cooperatively in the open-minded exchange of knowledge and experience. Formal partnerships in applied research to investigate livestock management options and develop protocols

for monitoring riparian health are a must. Scientifically defensible data and an atmosphere of mutual trust are of paramount importance to those who must cope with present and future threats to rangelands.

Action Plan

The following summarizes an action plan for empowering multi-sector partnerships for the purpose of identifying rangeland management strategies that are compatible with both the needs of the regional biota and human populace. Because the spotted frog can be a valuable indicator of riparian ecosystem health, recovery of the species in Nevada is used as a catalyst for cooperation between sustainable resource users and managers. Funds and technical assistance to support the implementation of this plan are being sought from the National Fish and Wildlife Foundation, Nevada Mining Association, U.S. Forest Service, Nevada Cattleman's Association, Boy Scouts of America, and the Yomba Shoshone Tribe.

A. Find Common Ground for Frogs and Cattle

In response to a preliminary report issued by this investigator in 1994 and findings made throughout the 1995 field season, the U.S. Forest Service has expressed considerable concern over the status of spotted frog populations in Nevada, and particularly within the Toiyabe Range. Regional biologists are willing to suggest that the U.S. Forest Service no longer issue grazing permits in drainages occupied by the spotted frog. If funds can be found, however, the same biologists are willing to promote cattle exclosures as an experimental, alternative livestock management strategy in the effort to recover spotted frog populations. Based on surveys conducted in 1994-95, it is apparent that frogs often cluster in appropriate habitat and, excluding cattle from riparian stretches may permit the formation of oxbows, enabling frogs to breed. Fencing seeps and springs may permit the formation and maintenance of spotted frog breeding pools. The larger the exclosed area, the greater the potential for the recovery of frog populations due to the extent of riparian zone restoration. Grazing permittees also receive long-term benefits from large exclosures, because the exclosures could eventually function as pastures (MacFarlan, personal communication). Utilizing the exclosures as pastures in future years (based on a controlled experimental design), would enable the testing of grazing intensity and timing questions relevant to the long-term maintenance of spotted frog populations where grazing is to co-occur.

Full recovery of oxbow and seep ponds is a process that may take several years. No spotted frog in the Toiyabe Range has been found to exceed 4 years of age (Dexter and Reaser, in preparation), and therefore interim restoration measures must be tested. Many species of frogs can use artificial garden ponds or human-excavated pools for breeding (author personal observation). Ponds placed in such a manner as to create oxbows and wet meadow pools might be colonized by spotted frogs and used as breeding sites. As well, artificial pools are unlikely to be colonized by salmonids, and therefore may serve as aquatic refuges for spotted frogs. To keep cattle from destroying the ponds, each pond would have to be fenced or surrounded by a 1 m wide circle of rocks (Brack, personal communication). Ponds should be inoculated with a handful of native, floating vegetation. Frog populations that persist at numbers too low to be detected by standard visual encounter surveys, may target the pools as optimal habitat and establish at these sites. In such a case, artificial pools could serve as tools in the inventory and long-term monitoring of spotted frog populations.

B. Design Recovery Plan

Assembling all the information available on which to base a spotted frog recovery plan that can be implemented in conjunction with the state's existing natural resources management guidelines (for example, multiple use of public lands, Lahontan cutthroat trout recovery), and in spite of limited financial resources, will require multi-sector input and active involvement. A Spotted Frog Working Group of interested parties (including representatives from Federal and State agencies, private interest groups and corporations, university-based biologists, the Yomba Shoshone Tribe, and concerned citizens) should convene at least one meeting per year to exchange existing knowledge on the species throughout the State (possibly the range) and identify information and effort gaps. The findings of this meeting could provide the basis for development of a spotted frog recovery plan.

A critical component of this plan must be a long-term monitoring protocol for spotted frog populations, which emphasizes spotted frog population status as a measure of riparian ecosystem health. The Spotted Frog Working Group should identify an outside panel of plan reviewers and identify one or more agency personnel, under the directive to manage candidate species, who will coordinate and implement the recovery plan. To guarantee the success of its mission, the Spotted Frog Working Group should remain in place to evaluate and consult upon recovery program success.

C. Transfer Information

Natural resource managers and users require scientifically based information to sustainably carry forth riparian ecosystem management in the rangeland landscape. Federal land managers, with responsibility for the stewardship of roughly 75 percent of the land in the Great Basin, are mandated to integrate not only the human but also the "biological and physical dimensions of natural resource management" (Thomas 1994). The Humboldt and Toiyabe National Forests, which oversee approximately 30 percent of the uplands in the State of Nevada, are outstanding in their commitment to the ecosystem-level managerial approach (Nelson 1995). The sooner they, and other agencies, are provided with relevant data on biotic diversity, the sooner they can act to conserve that diversity in a changing environment.

Livestock grazing is now considered to be one of the main threats to western riparian biodiversity. If, when properly

managed, livestock grazing can be shown to preserve diversity and ecological integrity at the landscape level, the reasons for opposing grazing become limited (Cooperrider 1990) and the "traditional rural life-style" of the West is less threatened. Many ranchers have already come to this realization and have shown impressive initiative in developing a holistic approach to management of the lands they own or use (for example, Southworth 1993).

Others could benefit greatly from the transfer of scientifically defensible information. The availability of such information will become even more important to both resource managers and users should the county supremacy movement succeed in transferring large areas of land from Federal to State or local jurisdiction.

Findings regarding the spotted frog recovery and its broad range implications can be made readily available by circulating reprints from scientific journals to Nevada's agency personnel, representatives of private interest groups and corporations, university-based biologists, and concerned citizens. Findings should be presented at professional meetings, such as those sponsored by the Society for Conservation Biology, Ecological Society of America, and National Herpetologists League, as well as regional organizations such as the Nevada Cattleman's Association. Abstracts published in (for example) the Nevada Biodiversity Initiative Newsletter; *Froglog*, the newsletter of the IUCN Declining Amphibian Population Task Force (DAPTF); and *Update*, the newsletter of the Center for Conservation Biology, could be reprinted for further distribution by groups, such as the Nevada Cattleman's Association, and resource agencies.

D. Recognize Multi-Sector Partnerships

Nevada resource management and conservation projects implemented in multi-sector partnerships deserve recognition. Outstanding multi-sector partnerships whose unions have contributed significantly to the sustainable management of riparian ecosystems in the rangeland landscape should be rewarded. With the permission of the site landowners, signs can be posted on appropriate fences, clearly identifying the associated project as a joint initiative and giving recognition to all the parties involved. Organizations such as the Society for Conservation Biology, Nevada Cattleman's Association, and Nevada Mining Association should outline an award nomination process, define a project review committee, and recognize selected awardees in formal ceremony at the national meeting of an appropriate organization.

E. Market Objectives and Accomplishments

Scientific defensibility is critical to supporting decisions that favor long-term resource conservation and sustainability. When the required information is collected in the partnership of agencies and members of the local resource-using populace, actions on which it is based are likely to be broadly supported. The forces powering the Nye County rebellion are those resculpting the political and social landscape of the United States at large. Other regions are closely watching what happens in Nye. Proving that a common ground exists and can serve as a platform for partnerships that meet the goals of currently conflicting audiences has the potential to galvanize support and following.

Articles in various forms of nontechnical media are critical to marketing the spotted frog action plan objectives and accomplishments as a model for the recovery and management of riparian rangelands throughout the western United States. Review articles should be submitted to numerous periodicals, such as *Grassroots International Magazine*, *Sierra*, *Outside*, *National Wildlife*, *Range*, *Beef*, *Nevada Cattleman*, and the *Western Livestock Journal*. Press releases should be sent to science writers at a broad spectrum of newspapers, including regional presses such as *Reno Gazette-Journal*, *Reno News and Review*, *Nevada Appeal*, and *Elko Daily Free Press*, topical presses such as *Wild Forest Review* and *High Country News*, and national presses such as the *Washington Post* and *New York Times*.

Conclusions

In developing this action plan, I have consulted numerous parties who have a vested interest in the conservation of biodiversity and/or the sustainable use of natural resources in Nevada. I have been extremely impressed with, and encouraged by, the enthusiastic support expressed both by the staff of Federal agencies (particularly the U.S. Forest Service) and private interest associations (for example, Nevada Mining Association, Nevada Cattleman's Association), as well as local grazing permittees (Tipton, personal communication). These reactions lead me to believe that the region's creative leadership can be effectively harnessed to develop a working group dedicated to implementing constructively the objectives outlined in this plan.

As the plan progresses and word spreads regarding the success of scientifically defensible livestock grazing studies conducted in multi-party cooperation, that indicate long-term potential benefits to sustainable resource users, it is expected that the number of project participants will increase. Yomba Shoshone Indian Reservation lands exist in patches throughout the Reese River Valley and Toiyabe Range. These lands have not been extensively surveyed, but are known to be inhabited by spotted frogs (author personal observation; Yomba Shoshone Tribe members, personal communication). The Yomba expressed interest in multi-taxa surveys conducted in the Toiyabe Range in 1994 and 1995, and it is hoped that they will become formal project partners in 1996. There are also several private land owners in the region who have been practicing holistic resource management and who could benefit from the results of this initiative. Expansion of the project to include their private holdings may be plausible (Tipton, personal communication).

The applications of this plan are multi-facetted and broad reaching. Not only will we be able to scientifically evaluate the potential for spotted frogs to recover in association with livestock grazing, but the cooperative nature of the project will have long-term implications for the productive association of resource users and managers throughout the Toiyabe National Forest. Applying this model to other regions of the State, such as the Humboldt National Forest, and throughout the extensive range of the spotted frog, should be feasible wherever open-minded, innovative leaders exist.

References

Abdel-Magid, A. H.; M. J. Trlica; and R. H. Hart. 1987. Soil and vegetation responses to simulated trampling. Journal of Range Management 40:303-306.

Ames, C. R. 1977. Wildlife conflicts in riparian management: Grazing. Pages 49-51 in R. R. Johnson and D. A. Jones, technical coordinators. Importance, preservation, and management of riparian habitat: A symposium. General Technical Report RM-43. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Blaustein, A. R.; D. G. Hokit; R. K. O'Hara; and R. A. Holt. 1994. Pathogenic fungus contributes to amphibian losses in the Pacific Northwest. Biological Conservation 67:251-254.

Blaustein, A. R. 1994. UV repair and resistance to solar UV-B in amphibian eggs: A link to population declines? Proc. Natl. Acad. Sci. 91:1791-1795.

Blaustein, A. R. and D. B. Wake. 1990. Declining amphibian populations: A global phenomenon? Trends in Ecology and Evolution 5:7.

Bradford, D. F.; F. Tabatabai; and D. M. Graber. 1993. Isolation of remaining populations of the native frog, *Rana muscosa,* by introduced fishes in Sequoia and Kings Canyon National Parks, California. Conservation Biology 7:883-888.

Brussard, P. F.; D. D. Murphy; and C. R. Tracy. 1994. Cattle and conservation biology—Another view. Conservation Biology 8: 919-922.

Buckhouse, J. C. and G. F. Gifford. 1976. Water quality implications of cattle grazing on a semi-arid watershed in southeastern Utah. Journal of Range Management 29:109-113.

Burton, T. M. and G. E. Likens. 1975. Salamander populations and biomass in the Hubbard Brook Experimental Forest, New Hampshire. Copeia 1975: 541-546.

Chaney, E. W.; W. Elmore; and W. S. Platts. 1990. Livestock grazing on western riparian areas. U.S. Environmental Protection Agency Document.

Clary, W. P. and B. F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. Gen. Tech. Rep. INT-263. USDA-FS, Ogden, UT.

Cooperrider, A. Y. 1990. Conservation of biological diversity on western rangelands. Pp. 451-461, in Trans. 55th N.A. Wildl. & Nat. Res. Conf. R. E. McCabe, ed.

Corn, P. S. and J. C. Fogleman. 1984. Extinction of montane populations of the northern leopard frog (*Rana pipiens*) in Colorado. Journal of Herpetology 18:147-152.

Council for Agricultural Science and Technology. 1974. Livestock grazing on Federal lands in the 11 western states. Journal of Range Management 27:171-181.

Crumpacker, D. W. 1984. Regional riparian research and a multi-university approach to the special problem of livestock grazing in the Rocky Mountains and Great Plains. Pages 413-422 in R. E. Warner, and K. Hendrix, editors. California riparian systems: Ecology, conservation, and productive management. University of California Press, Berkeley, California.

Dahlem, E. A. 1979. The Mahogany Creek watershed—with and without grazing. Pages 31-34 in O. B. Cope, editor. Proceedings of the forum—grazing and riparian/stream ecosystems. Trout Unlimited, Denver, Colorado.

Dregne, H. E. 1983. Desertification of arid lands. Harwood Academic Publishers, Chur, Switzerland.

Dumas, P. C. 1966. Studies of the *Rana* species complex in the Pacific Northwest. Copeia 1966:60-74.

Elmore, W. and R. L. Beschta. 1987. Riparian areas: perceptions in management. Rangelands 9:260-265.

Fleischner, T. L. 1994. Ecological costs of livestock grazing in western North America. Conservation Biology 8:629-644.

Harrison, S.; D. D. Murphy; and P. R. Ehrlich. 1988. Distribution of the Bay checkerspot butterfly, *Euphydras editha bayensis*: evidence for a metapopulation model. The American Naturalist 132:360-382.

Hayes, M. P. and M. R. Jennings. 1986. Decline of ranid frog species in western North America: Are bullfrogs (*Rana catesbiena*) responsible? Journal of Herpetology 20:490-509.

Heinrich, M. 1995. Amphibian Decline. Internet discussion as transmitted by G. Fellers 27 December 1995.

Heyer and others 1994. Measuring and Monitoring Biological Diversity Standard Methods for Amphibians. Smithsonian Institution Press, Washington, DC.

Hovingh, P. 1993. Zoogeography and paleozoology of leeches, molluscs, and amphibians in Western Bonneville Basin, Utah, USA. Journal of Paleolimnology 9:41-54.

Hovingh, P. 1991. Status report to the U.S. Fish and Wildlife Service.

Jaeger, R. G. 1980. Density-dependent and density independent causes of extinction of a salamander population. Evolution 34: 617-621.

Jefferies, D. L. and J. M. Klopatek. 1987. Effects of grazing on the vegetation of the blackbrush association. Journal of Range Management 40:390-392.

Johnson, R. R.; L. T. Haight; and J. M. Simpson. 1977. Endangered species vs. endangered habitats: A concept. Pages 68-79 in R. R. Johnson and D. A. Jones, technical coordinators. Importance, preservation, and management of riparian habitat: A symposium. General Technical Report RM-43. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Kauffman, J. B. and W. C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications: A review. Journal of Range Management 37:430-437.

Kauffman, J. B.; W. C. Krueger; and M. Vavra. 1985. Impacts of cattle on streambanks in northeastern Oregon. J. Range Management 36(6):683-685.

Keller, C. R. and K. P. Burnham. 1982. Riparian fencing, grazing and trout habitat preference on Summit Creek, Idaho. N.A.J. of Fish Manage. 2:53-59.

Kindschy, R. R. and others 1982. Wildlife habitats in managed rangelands - The Great Basin of southeastern Oregon - Pronghorns. Gen. Tech. Rep. PNW-145. USDA-FS.

Kovalchik, B. L. and W. Elmore. 1992. Effects of cattle grazing on willow dominated plant associations in central Oregon. Pages 111-119, in Symposium: Ecology and management of riparian and shrub communities. GTR INT-289. USDA-FS.

Marlow, C. B. 1988. Mitigating livestock impacts to streambanks within Northern Rocky Mountain foothills riparian zones. Pages 147-150 in Issues and Technology in management of impacted wildlife. Proc III, Thorne Ecol. Inst.

Morris, R. L. and W. W. Tanner. 1969. The ecology of the western spotted frog, *Rana pretiosa* Baird and Girard, a life history study. Great Basin Naturalist 24:45-81.

Mosconi, S. L. and R. L. Hutto. 1982. The effect of grazing on the land birds of a western Montana riparian habitat. Pages 221-233 in L. Nelson; J. M. Peek; and P. D. Dalke, editors. Proceedings of the wildlife-livestock relationships symposium. U.S. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, Idaho.

Naiman, R. J. 1992. New perspectives for watershed management: balancing long-term stability with cumulative environmental change. pp. 3-11 in Naiman, R. J. (ed.) Watershed Management: balancing sustainability and environmental change. Springer-Verlag, New York.

Noss, R. F. 1995. Cows and conservation biology. Conservation Biology 8:613-616.

Ohmart, R. D. and B. W. Anderson. 1982. North American desert riparian ecosystems. Pages 433-479 in G. L. Bender, editor. Reference handbook on the deserts of North America. Greenwood Press, Westport, Connecticut.

Orr, H. K. 1960. Soil porosity and bulk density on grazed and protected Kentucky bluegrass range in the Black Hills. Journal of Range Management 13:80-86.

Pechmann, J. H. K., and others 1991. Declining amphibians: The problem of separating human impacts from natural fluctuations. Science 253:892-895.

Pierce, T. K. 1985. Acid tolerance in amphibians. BioScience 35: 239-243.

Platts, W. S. 1979. Livestock grazing and riparian/stream ecosystems—an overview. Pages 39-45 in O. B. Cope, editor. Proceedings of the forum—grazing and riparian/stream ecosystems. Trout Unlimited, Denver, Colorado.

Platts, W. S. 1983. Riparian-stream habitat condition on Tabor Creek, NV, under grazed and ungrazed conditions. Pages 162-174 in Proc. 63rd West. Assoc. Fish and Wildlife Agencies.

Platts, W. S. 1990. Managing fisheries and wildlife on rangelands grazed by livestock: A guidance and reference document for biologists. Unpublished document, Nevada Department of Wildlife.

Platts, W. S. and R. L. Nelson. 1985. Impacts of rest rotation grazing on stream banks in forested watersheds in Idaho. N. A. J. of Fish Manage. 5:547-556.

Platts, W. S. and R. L. Nelson. 1989. Characteristics of riparian plant communities and streambanks with respect to grazing in northeastern Utah. Pages 73-81 in R. E. Greswell; B. A. Barton; and J. L. Kershner, editors. Practical approaches to riparian resource management: An educational workshop. Bureau of Land Management, Billings, Montana.

Platts, W. S. and J. N. Rhine. 1985. Riparian and stream enhancement management and research in the Rocky Mountains. N. A. J. of Fish Manage. 5(2):115-125.

Platts, W. S. and F. J. Wagstaff. 1984. Fencing to control livestock grazing of riparian habitat along streams: is it a viable alternative? N. A. J. of Fish Manage. 4:266-272.

Pounds, J. A. and M. L. Crump. 1994. Amphibian declines and climate disturbance: The case of the golden toad and the harlequin frog. Cons. Bio. 8:72-85.

Quigley, T. M.; H. R. Sanderson; and A. R. Tiedemann. 1989. Managing Interior Northwest Rangelands: The Oregon Range Evaluation Project. GTR PNW-238. USDA-FS.

Quinn, M. A., and D. D. Walgenbach. 1990. Influence of grazing history on the community structure of grasshoppers of a mixed-grass prairie. Environmental Entomology 19:1756-1766.

Rauzi, F. and F. M. Smith. 1973. Infiltration rates: Three soils with three grazing levels in northeastern Colorado. Journal of Range Management 26:126-129.

Reaser, J. K. In press. Casting shadows: the legacy of fish introductions and amphibian declines. Amphibian and Reptile Conservation.

Reaser, J. K. and R. E. Dexter. In press. Spotted frog (*Rana pretiosa*) Predation. Herpetological Review.

Reed, R.; G. Hass; F. Beum; and L. Sherrick. 1989. Non-recreational uses of the National Wilderness Preservation System: A 1988 telephone survey. Pages 220-228 in H. Freilich, compiler. Wilderness benchmark 1988: Proceedings of the national wilderness colloquium. General Technical Report SE-51. U.S. Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina.

Sherman, C. K. and M. L. Morton. 1993. Population declines of Yosemite toads in the eastern Sierra Nevada of California. Journal of Herpetology 27:186-198.

Skovlin, J. M. 1984. Impacts of grazing on wetlands and riparian habitat: a review of our knowledge. Pp. 1001-1104 in Developing strategies for rangeland management - a report prepared by the committee on developing strategies for rangeland management. National Research Council/National Academy of Sciences. Westview Press, Boulder, CO.

Southworth, J. 1993. Riparian enclosures worth taking a chance on. Capital Press, Feb. 19, 1993.

Stebbins, R. C. 1985. Western reptiles and amphibians. Houghton Mifflin Company, Boston.

Szaro, R. C.; S. C. Belfit; J. K. Aitkin; and J. N. Rinne. 1985. Impact of grazing on a riparian garter snake. Pages 359-363 in R. R. Johnson; C. D. Ziebell; D. R. Patton; P. F. Ffolliott; and F. H. Hamre, technical coordinators. Riparian ecosystems and their management: Reconciling conflicting uses. General Technical Report RM-120. U.S. Forest Service, Rocky Mountain Forest and Range Station, Fort Collins, Colorado.

Tramont, R. 1995. Amphibian Decline. Internet discussion as transmitted by G. Fellers 27 December 1995.

Turner, F. B. 1960. Population structure and dynamics of the western spotted frog, *Rana p. pretiosa* Baird & Girard, in Yellowstone Park, Wyoming. Ecol. Monog. 30:251-278.

U.S. General Accounting Office. 1988. Public rangelands: Some riparian areas restored but widespread improvement will be slow. GAO/RCED-88-105. U.S. General Accounting Office, Washington, DC.

U.S. General Accounting Office. 1991. Rangeland management: Comparison of rangeland condition reports. GAO/RCED-91-191. U.S. General Accounting Office, Washington, DC.

Van Velson, R. 1979. Effects of livestock grazing upon rainbow trout in Otter Creek, Nebraska. Pages 53-55 in O. B. Cope, editor. Proceedings of the Forum—grazing and riparian/stream ecosystems. Trout Unlimited, Denver, Colorado.

Wagner, F. H. 1978. Livestock grazing and the livestock industry. Pages 121-145 in H. P. Brokaw, editor. Wildlife and America. Council on Environmental Quality, Washington, DC.

Wald, J. and D. Alberwerth. 1989. Our ailing public rangelands: still ailing. Condition Report 1989. National Wildlife Federation and Natural Resources Defense Council, Washington, DC.

Warren, P. R. and L. S. Anderson. 1987. Vegetation recovery following livestock removal near Quitobaquito Spring, Organ Pipe Cactus National Monument. Technical Report No. 20, Cooperative National Park Resources Studies Unit, University of Arizona, Tucson, Arizona.

Warren, P. L. and C. R. Schwalbe. 1985. Herpetofauna in riparian habitats along the Colorado River in Grand Canyon. in Riparian ecosystems and their management: reconciling conflicting uses. First North American Riparian Conference. Tucson, Arizona pp. 347-354.

Weitzel, N. H. and H. R. Panik. 1993. Long-term fluctuations of an isolated population of the Pacific chorus frog (*Pseudacris regilla*) in northwestern Nevada. Great Basin Naturalist 53:379-384.

Winegar, H. H. 1977. Camp Creek channel fencing—plant, wildlife, soil, and water responses. Rangeman's Journal 4:10-12.

Wuerthner, G. 1994. Subdivisions versus agriculture. Conservation Biology 8:905-908.

Wyman, R. L. 1990. What's happening to the amphibians? Conservation Biology 4:350-352.

Applications of Butterfly Ecology to Cooperative Land Management in the Great Basin

Erica Fleishman

Abstract—Butterflies are excellent models for scientifically and politically expedient research on species/environment interactions across the Great Basin. Several ongoing projects are presented that support cooperative management of western landscapes to support both the native biota and desired uses. Research focuses on identification and modeling of natural constraints on species' distributions at several spatial and temporal scales. These data contribute to the framing of realistic management goals and alleviate logistic demands of biotic diversity assessment in poorly sampled areas. Projects further demonstrate that landscape scale perspectives in research and management often can alleviate the need for species listings.

Research on the ecology of butterflies can assist public and private constituencies in managing landscapes to maintain not only the native biota but also desired uses, including livestock grazing. Since 1993, butterfly research in the central Great Basin has provided opportunities for collaboration among university scientists, State and Federal resource managers, and local communities. In this paper, I present an overview of several ongoing projects whose unifying goal is to support public and private partners in their efforts to implement ecologically based land stewardship.

These projects answer calls for rigorous scientific contribution to urgent management issues. They emphasize that not only human activities, but also natural variability in topography and climate, significantly affect organisms. Management implications of both factors are explored. Documentation and mapping of the distribution patterns of butterflies across space and time, for example, identify natural constraints on species distributions. Managers may benefit from clarification of environmental controls on species distributions when setting realistic preservation and restoration goals and assessing whether various natural and human disturbances are impacting the native biota. Similarly, studies of the population dynamics of the riparian obligate Apache silverspot butterfly (*Speyeria nokomis apacheana*) facilitate development of management strategies for landscapes fragmented by both natural events and human uses. The project also demonstrates that landscape scale perspectives in research and management can alleviate the need to list species as endangered and restrict human activities.

Although butterflies are attractive and enjoy unusually strong public favor (particularly for an insect), the reasons for their selection as a focal taxon may not be immediately apparent. Butterflies often have been used as model organisms for research in ecology, conservation, and management. They have figured prominently in studies of coevolution (Ehrlich and Raven 1965; Janzen 1966), speciation (Gilbert and Singer 1973; Brussard and others 1985), abundance and rarity (Cappuccino and Kareiva 1985; Thomas and Mallorie 1985; Harrison and others 1992; Prendergast and others 1993), biogeography (Austin and Murphy 1987; Nelson 1994), metapopulation dynamics (Harrison and others 1988; Murphy and others 1990), indicator species (Kremen 1992; Pearson and Cassola 1992), and reserve design (Murphy and Wilcox 1986; Ehrlich and Murphy 1987a; Weiss and others 1988).

Butterflies also are well suited to field study. They are a moderately diverse and taxonomically well-known group of organisms, and are fairly easy to identify in the field (Thomas and Mallorie 1985; Scott 1986; Murphy and Wilcox 1986; Morris 1987; New 1991; Kremen 1992; Pollard and Yates 1993). Furthermore, members of the suborder are generally diurnal, conspicuous, and can be visually surveyed and censused with simple transect techniques (Pollard 1977; Pyle and others 1981; Thomas 1983; Murphy and Wilcox 1986; Ehrlich and Murphy 1987b; New 1991, Pollard and Yates 1993).

Study Area

The field research described in this paper is based in several central Great Basin mountain ranges, principally the Toiyabe, Shoshone, Toquima, and Monitor. Although the central Great Basin is an area of substantial biological interest, relatively little is known about regional species-level biotic patterns, let alone the mechanisms driving those patterns. This dearth of information currently encumbers scientifically defensible land use planning.

While the distribution of several taxa in the Great Basin, including mammals, birds, and fishes, received attention from naturalists and biogeographers throughout the 1900's (for example LaRivers 1962; Hubbs and others 1974; Brown 1978; Austin and Murphy 1987; Grayson 1987), most studies focused on the biologically richer periphery of the region. Species patterns in the interior have attracted comparatively little notice.

During the Pleistocene, the arms of Lake Lahontan and Lake Bonneville isolated the mountain ranges in the central Great Basin. Dispersal generally was restricted to organisms actively or passively transported by air or water; ecological specialization and speciation enabled other taxa to persist. In the wake of the Pleistocene, the central Great Basin has experienced more than 10,000 years of increasing

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aridity and general warming. The region is currently one of the most austere environments in North America. Research in the area facilitates deeper understanding of how organisms persist in habitats in which precipitation is low, temperatures fluctuate greatly, and climatic variability is high. The central Great Basin presents opportunities for working with and learning from public and private groups including the U.S. Forest Service (USFS), Native Americans, and ranchers in rural communities.

Management Issues

The native butterfly fauna of the central Great Basin is rugged, yet it is not invincible. It is widely accepted within the scientific community that Earth will experience an average increase in temperature of two to five degrees centigrade over the next century (Schneider and others 1992). Shifts in such variables as timing of the seasons (Schneider 1995) almost certainly will impact many taxa. The Great Basin is expected to become increasingly warm and dry; montane vegetation in the region is predicted to move upward 500 m in elevation in response to a three degree rise in average temperature (Murphy and Weiss 1992). The butterfly fauna on mountain ranges in the Great Basin is expected to decline by 23 percent in the face of regional and global climate change (Murphy and Weiss 1992).

At the same time, human occupation of the region is soaring. With a population increasing in size by roughly 7 percent per year, Nevada is currently the nation's fastest growing State and ranks among the top 10 States in the number of its native species that either are extinct or are threatened with extinction. Federal land managers in the Great Basin, with responsibility for the stewardship of roughly 75 percent of the region, have been mandated to integrate not only the human but also the "biological and physical dimensions of natural resource management" (Thomas 1994). The sooner managers are provided with relevant data on biotic patterns, the sooner they can act to conserve simultaneously the native biota and human land uses in a changing environment.

Objectives

1. Conduct systematic, spatially and temporally extensive butterfly surveys in the Toiyabe, Toquima, and Monitor Ranges and Shoshone Mountains in the central Great Basin. This objective addresses the major shortcoming of most existing faunal data sets for the region: failure to standardize survey effort or to record environmental correlates with species presence. Standardized, comprehensive sampling increases markedly our ability to model species distributions.

2. Develop protocols, using Global Positioning Systems (GPS) and Geographic Information Systems (GIS), for linking standardized field surveys with physiographic databases.

3. Using butterflies as a model system, quantify relationships between species distributions and physiographic variables. This facilitates identification of background biogeographic patterns in the butterfly fauna of the central Great Basin and examination of the extent to which observable patterns are dependent on the spatial and temporal scale of sampling.

4. Develop computer models that predict butterfly species distributions across physiographically characterized but otherwise unsurveyed montane areas, and test the generalizability of predictive models based upon extensive data from single mountain ranges to nearby and ecologically similar mountain ranges.

5. Test the hypothesis that the distribution of butterfly species in the Great Basin can serve as an indicator of ecosystem viability.

6. Using the Apache silverspot butterfly as a model organism, develop a synthetic understanding of how species can persist across landscapes and years in naturally extreme environments. Component null hypotheses include:

   a. Across the landscape, the number and size of patches of suitable habitat for the Apache silverspot butterfly is static.

   b. All suitable habitat in a given season is occupied by the butterfly.

   c. Distance between patches does not affect patch occupancy.

   d. Spatially explicit predictions of the presence of suitable habitat for the butterfly can be generated on the basis of field surveys and GIS models.

7. Establish cooperative, goal-oriented networks of Federal land managers, field scientists, computer experts, and land users.

Methods

Broadscale Surveys

Within target mountain ranges, butterfly survey areas (generally canyons) are selected according to the following criteria: (1) paucity of existing survey data, (2) physiographic similarity to surveyed areas in neighboring ranges, and (3) accessibility. Each canyon is surveyed on at least 4 days spread across the adult flight season (usually May through September). Numerous steps are taken to minimize sampling bias. Personnel are familiar with the regional fauna, and canyons are surveyed with an equal person-hour effort corrected for area. In addition, surveys are restricted to times when environmental conditions most conducive to flight prevail (Thomas and Mallorie 1985; Pollard and Yates 1993). Sampling is especially unbiased when skies are mostly sunny (Shapiro 1975; Pollard 1977; Swengel 1990; Kremen 1992), winds are light (Swengel 1990; Pollard and Yates 1993), and temperatures are at least moderately warm (Pollard 1977; Swengel 1990). Overcast skies are less problematic if air temperature is high (Shapiro 1975; Pollard 1977; Pollard and Yates 1993).

Each canyon surveyed is divided into 100-m vertical elevational bands from its base to its crest. Elevation is measured by pocket altimeters and verified by differentially corrected GPS. Within each elevational band, the presence of all butterfly species seen is recorded. When necessary, individual butterflies are caught and either identified at the site or held for later identification. Quantification of the abundance of all species in a regional butterfly fauna is "virtually futile" (Shapiro 1975, p. 175) and therefore is not attempted; estimation of butterfly abundance is confounded by factors including interspecific variation in population

structure and vagility (Shapiro 1975), staggered emergence, and protandry (the emergence of males before females during the season).

Existing GIS databases for the central Great Basin are built around standard USGS 1:24,000 scale Digital Elevation Models with a horizontal resolution of 30 m. Hydrology, roads, and trails were incorporated from USGS 1:100,000 Digital Line Graphs (DLG-3), while base geology was taken from the 1:500,000 Digital Geological Map of Nevada (Turner and Bawiec 1991). Derived grids include slope; aspect; topographic exposure (calculated with a quantitative index (Weiss and others 1996) that compares the elevation of a target point with the mean elevation of a specified neighborhood around that point); insolation for any day, calculated with the Arc Macro Language program SOLARFLUX (Hetrick and others 1993); and 1:100,000 vegetation data from the Nevada GAP analysis program (GAP data for central Nevada are expected to be released in early 1996). Species composition data and environmental values for each survey locality are maintained on microcomputers using Microsoft Excel and FoxPro software, then linked to the spatial locations within the GIS.

Linking the GPS locality data with the GIS permits biological and physiographic characterization of survey areas within their immediate neighborhood. Neighborhood characterization is particularly important because it integrates environmental values experienced by non-sedentary organisms. Entire canyons, mountain ranges, and drainages can also be characterized with respect to the diversity of their biotic, physiographic, and geologic features. This process creates a matrix of locality-specific environmental and species composition data that is analyzed by multivariate statistical methods including canonical correspondence analysis, a powerful form of gradient analysis that focuses on the environmental basis for major patterns of variation in community composition and is an excellent technique for generation of testable hypotheses (ter Braak and Prentice 1988; Kremen 1992; Palmer 1993).

After relationships between species distributions and environmental variables are quantified for physiographically characterized areas whose biota has been particularly well sampled, species distributions are predicted for nearby, ecologically similar areas whose physiography is characterized but whose biotas have not been well sampled. The confidence level of model predictions is assessed with systematic butterfly surveys in the field.

Analyses of elevational distribution incorporate Spearman rank correlations and linear regression. Nestedness analyses are performed with the computer model NESTCALC (Wright and Reeves 1992; Wright and others 1990).

Population Dynamics of the Apache Silverspot Butterfly

Mark-recapture efforts are conducted in each of the eight canyons or isolated sites in which Apache silverspot butterflies have been found. In each of the mark-recapture canyons, definable discrete or contiguous sites in which either (1) Apache silverspot butterflies were present in previous years or (2) soils are moist and suitable host plants and nectar sources are present ("potential sites") are established prior to the flight season. Sites also are added during the flight season on the basis of Apache silverspot butterfly presence. Each butterfly captured in the canyons is given day and unique location marks. All site boundaries are recorded with differentially corrected GPS.

In each patch, floristic and environmental variables are quantified. These include host plant presence and abundance, availability and species composition of nectar sources, species composition and height of the dominant plant community, groundwater level, and patch physiography.

Annual species presence surveys and site boundary records test whether (1) the number and size of patches of suitable habitat for the Apache silverspot butterfly are static and (2) all suitable habitat in a given season is occupied by the butterfly. GIS models, presence surveys, and mark-recapture methods are employed to determine whether distance between habitat patches affects patch occupancy. Groundtruthing of GIS model output addresses the hypothesis that explicit predictions of the presence of suitable habitat for the butterfly can be generated.

Preliminary Results

Broadscale Surveys

During 1994 and 1995, extensive butterfly survey efforts centered in the Toiyabe Range, Lander, and Nye Counties, NV. Rising some 1,920 m from the Reese River and Big Smoky Valleys to the summit of Arc Dome Peak at 3,593 m, the Toiyabe Range is one of the largest and most striking mountain ranges in the central Great Basin. Roughly 40 percent, or 80 km, of its crest lie above 3,040 m. In area (3,126 km^2), the Toiyabe Range far surpasses its nearest neighbors, the Shoshone Mountains to the west and the Toquima Range to the east. Not only the baseline physiography of the Toiyabe, but also its companion climate affect the biota of the range. Mean annual precipitation in the town of Austin, NV, 10 km south of the northern end of the range, is 388 mm—70 percent greater than the statewide mean (NOAA climatological data). Snow often remains on the higher peaks until well past the summer solstice.

Systematic surveys have been conducted in a total of 16 riparian canyons and one dry canyon, eight on the west slope and nine on the east slope of the Toiyabe Range. Four canyons were surveyed in 1994 but not 1995 and another four were only surveyed in 1995. In 1995, surveys were stratified by elevation: the presence of all butterfly species in each successive 100-m elevational band in each canyon was recorded. Species presence records from an additional 15 canyons (Austin and others, in preparation) have been incorporated into the rangewide data set.

During 1994 and 1995, 86 butterfly species were recorded from the Toiyabe Range. Over the past 60 years, a total of 99 species have been recorded. None are endangered or threatened; none of the butterflies known to occur in the State of Nevada are listed under the Endangered Species Act. Twenty-five of the 99 species are stray, partly migrant, or fully migrant to the Toiyabe Range.

Species composition data and environmental values have been linked for the 69 elevational bands systematically surveyed in 1995. Total species richness per band ranged between 10 and 59. Midpoint elevation, area, and mean topographic exposure of the band within a 300-m neighborhood

together explained more than 50 percent of the between-band variance in species richness ($F = 32.902$, $P < 0.0001$, $r^2 = 0.554$). Not only spatial but also temporal species distributions are significantly associated with physiographic variables. For example, elevation was significantly ($\alpha = 0.05$) related to initial adult emergence in roughly a quarter of the species recorded from the range, explaining up to 56 percent of the variance in date of first sighting. Such robust and quantifiable relationships are key to the success of predictive modeling efforts.

Butterflies as Indicators of Ecosystem Viability

An ecosystem may be considered viable if (1) it provides desired services, such as flood control, maintenance of native plants and animals, and recreational opportunities; (2) current uses do not jeopardize the ability of the system to provide the desired services in the future; and (3) the system can recover from disturbance and return to its current or desired state (Brussard and others, in press).

Examination of the potential of butterfly species distributions to serve as an indicator of ecosystem viability in the Great Basin was in part prompted by the interest of the USFS in finding animal taxa whose distributions coincide with their categories of riparian ecosystem health. USFS defines a healthy site as one that is greater than 70 percent of Potential Natural Community (PNC). PNC is based on soil moisture, type, and compaction; rooting depth; and plant species composition and abundance. The concept of PNC is founded upon the assumption that plant communities follow a predictable successional pathway to climax. In theory, assessment of ecosystem health using diurnal, conspicuous, and well known animal taxa should be less difficult, time consuming, and expensive than other methods, such as measuring plant cover or digging soil pits.

Butterflies have specific habitat requirements, and as a rule are sensitive to habitat modification. It is unclear, however, whether butterflies and humans have similar definitions of ecosystem viability. If butterflies do respond in a predictable manner to natural disturbances and human land uses of interest, then the presence of certain individual species or groups of species may indicate that a system is viable. If butterfly responses are not predictable, the opportunity remains to gain a better understanding of factors that influence butterfly distributions in a highly variable environment.

In 1994, I tested the null hypothesis that distribution of butterfly species in the central Great Basin is not significantly correlated with habitat type and condition as defined by USFS. Species lists were compiled for 21 riparian point sample sites in the Toiyabe Range. The point sample sites represented three ecological types—aspen, wet meadow, and willow—and two ecological conditions, high and low.

Spearman rank correlations were used to test whether the presence of each butterfly species was significantly correlated with USFS seral stage as defined by site-specific vegetation assemblage and site-specific soil structure. For species found to be strongly correlated with seral stage ($P > 0.15$), the null hypothesis that species presence is not a strong predictor of seral stage was tested with logistic regression. The null hypothesis could not be rejected for any species: none reliably predicted habitat condition as defined by USFS.

Population Dynamics of the Apache Silverspot Butterfly

The Apache silverspot butterfly is a naturally uncommon animal that occupies permanent seeps, springs, and riparian areas in the western and central Great Basin. The butterfly is largely confined to areas in which its larval host plant, a violet (*Viola sororia*), and its most important adult nectar source, thistles (*Cirsium* spp. and *Carduus* spp.), co-occur. Patches of suitable habitat for the butterfly are sometimes separated by tens of km of unsuitable vegetation. Although Apache silverspot butterflies are physiologically capable of dispersal over at least several km (Fleishman and others, in preparation), individuals have been observed leaving or outside of their habitat only rarely.

Prior to 1994, the Apache silverspot butterfly was known from approximately 15 sites in the Great Basin and eastern California, only three of which are located in the central Great Basin. Research on the genetic isolation of the butterfly across the Great Basin was initiated in the early 1900's (Britten and others 1994). During the same time period, a number of experienced lepidopterists reported that the butterfly was declining across the region, and several populations were lost to agricultural development.

Research on the Apache silverspot butterfly was prompted both by the fact that it is an excellent model organism for studies of population persistence in severe environments and by concerns that it might be appropriate to pursue listing the subspecies under the Endangered Species Act. In 1994, during the course of broadscale butterfly distribution surveys in the Toiyabe Range, Apache silverspot butterflies were recorded not only from two historic localities but also from seven additional canyons or isolated habitat patches in the Toiyabe Range.

Distribution records from 1994 suggested that either (1) isolated populations of the Apache silverspot butterfly boom in favorable weather years, with individual dispersal outside of habitats in which they can survive and reproduce, or (2) the butterfly exists as a metapopulation (a set of local populations which interact via individuals moving among populations [Hanski and Gilpin 1991]) in the Toiyabe Range. In 1995, a landscape-scale mark-recapture experiment was initiated to address the latter hypothesis.

Individual riparian canyons have between one and ten or more patches of habitat, ranging in size from less than 1 km^2 to several km^2, that appear suitable for the Apache silverspot butterfly. Not every patch of suitable habitat is occupied on any given day or in any given year.

Although environmental data (for example distance between habitat patches, patch physiography) have not yet been incorporated into analyses of the population dynamics of the Apache silverspot butterfly, several trends have emerged. Examination of daily abundance curves, particularly for larger and relatively heterogeneous canyons, suggests that males may undergo a second period of emergence that coincides with the majority of the female emergences.

It also appears that the incidence of dispersal in canyon populations depends in part on the spatial distribution of

suitable habitat. The average dispersal rate in canyons with discrete sites was 18 percent. The average dispersal rate in canyons with at least two contiguous sites, by contrast, was 55 percent. Maximum dispersal distances do not appear to vary across canyons; mean dispersal distances and sex-specific dispersal patterns await analysis.

Discussion

Broadscale Surveys

Spatially explicit predictive models of species distributions respond to the needs of land managers by alleviating current time- and labor-intensive demands of biotic diversity assessment in poorly sampled areas. By increasing the efficiency with which managers can compile databases on ecosystem composition, function, and structure, research described here will support implementation of scientifically defensible management strategies on Federal lands. The management implications of the research are not restricted to butterflies. Similar modeling protocols could contribute to efficient assessment of any taxon for which species-environment relationships can be quantified with reasonable certainty. Amphibians and sensitive plants, for example, are strong candidates for predictive modeling (Weiss and others 1996; Reaser and others, in preparation).

The Toiyabe Range has been surveyed for butterflies more extensively than have most Great Basin mountain ranges. In upcoming field seasons, predictions of butterfly species distributions will be tested across physiographically characterized but otherwise unsurveyed areas both in the Toiyabe Range and in the Shoshone, Toquima, and Monitor Ranges. Initially, the confidence limits of predictions tested in the Toiyabe Range likely will be narrower than those tested in nearby mountain ranges. However, our ability to predict reliably species distributions across increasing spatial scales promises to increase through iterative field testing and model refinement. Use of both traditional and electronic media to distribute data sets, metadata, analyses, and information products will make these products widely accessible to land managers and other interested parties.

Butterflies as Indicators of Ecosystem Viability

There are several possible explanations why the distribution of butterflies in the central Great Basin does not coincide appreciably with categories of riparian ecosystem health as defined by USFS. For instance, the scale at which USFS evaluates vegetation and soils is often smaller than the home range sizes of butterflies. Another possibility is that natural environmental variability in the central Great Basin influences butterfly communities more strongly than does present variability in land management.

Our current approach toward testing whether the distribution of butterfly species in the Great Basin can serve as an indicator of ecosystem viability is to (1) identify species whose presence in an area can reasonably be expected on the basis of biogeographic analyses and predictive models, (2) test whether those species are indeed present, and (3) consider both natural and human influences that might result in unexpected species absences. The absence of many species reasonably expected to be present might indicate land degradation on a scale at which butterflies are affected. Such an unexpected pattern could also be the result of natural factors, such as a severe spring storm that occurred at a critical period in the development of the butterflies in question. The presence of most of the species expected in an area, on the other hand, might suggest that the effects of local land management are not altering natural environmental conditions at the scales experienced by butterflies.

Population Dynamics of the Apache Silverspot Butterfly

The Apache silverspot butterfly in the Toiyabe Range likely functions as a metapopulation of canyon and isolated site populations linked by occasional dispersal between canyons. Movement of individuals within canyons appears sufficient to facilitate gene flow between canyon subpopulations during each flight season. Although movement between canyons has not yet been documented, maximum dispersal distances and sporadic sightings of individual Apache silverspot butterflies well outside of their known habitat argue for occasional intercanyon dispersal. It seems unlikely that populations as small as those found at some isolated sites (fewer than 10 individuals) can persist over numerous generations in a stressful environment without emigration or recolonization.

Future research efforts will use field surveys and GIS models to examine habitat suitability in greater detail. For example, we will test whether the presence of larval host plants, adult nectar sources, and topographic heterogeneity serve as reliable predictors of the presence or movements of the butterfly. Correlations between climate and the size and location of suitable habitat patches will be used to examine the conditions that cause habitat to contract or expand. Field and remote methods will be employed to determine whether distance to nearest neighboring habitat patch affects whether a given patch is occupied.

The distribution of both suitable habitat and Apache silverspot butterflies is spatially and temporally variable. Therefore, maintenance of suitable but currently unoccupied habitat may be critical to the butterfly's persistence—and to preventing its endangerment.

Acknowledgments

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References

Austin, G. T.; Fleishman, E.; Murphy, D. D. [In preparation.] Isolation by endurance: The rugged butterflies of the central Great Basin.

Austin, G. T.; Murphy, D. D. 1987. Zoogeography of Great Basin butterflies: patterns of distribution and differentiation. Great Basin Naturalist 47:186-201.

Britten, H. B.; Brussard, P. F.; Murphy, D. D.; Austin, G. T. 1994. Colony isolation and isozyme variability of the western seep fritillary, *Speyeria nokomis apacheana* (Nymphalidae), in the western Great Basin. The Great Basin Naturalist 54(2):97-105.

Brown, J. 1978. The theory of insular biogeography and the distribution of boreal mammals and birds. Great Basin Naturalist Memoirs 2:209-228.

Brussard, P. F.; Ehrlich, P. R.; Murphy, D. D.; Wilcox, B. A.; Wright, J. 1985. Genetic distances and the taxonomy of checkerspot butterflies (Nymphalidae: Nymphalinae). Journal of the Kansas Entomological Society 58(3):403-412.

Brussard, P. F.; Reed, J. M.; Tracy, C. R. In press. Ecosystem management: what is it really? The Environmental Professional.

Cappuccino, N.; Kareiva, P. 1985. Coping with a capricious environment: a population study of a rare Pierid butterfly. Ecology 66(1):152-161.

Ehrlich, P. R.; Murphy, D. D. 1987a. Conservation lessons from long-term studies of checkerspot butterflies. Conservation Biology 1(2):122-131.

Ehrlich, P. R.; Murphy, D. D. 1987b. Monitoring populations on remnants of native vegetation. Pages 201-210 in Saunders, D. A.; Arnold, G. W.; Burbidge, A. A.; Hopkins, A. J. M., editors. Nature Conservation: The role of remnants of native vegetation. Surrey Beatty and Sons Pty Limited, Chipping Norton, New South Wales, Australia.

Ehrlich, P. R.; Raven, P. H. 1965. Butterflies and plants: a study in coevolution. Evolution 18(4):586-608.

Gilbert, L. E.; Singer, M. C. 1973. Dispersal and gene flow in a butterfly species. The American Naturalist 107:58-73.

Grayson, D. K. 1987. The biogeographic history of small mammals in the Great Basin: observations on the last 20,000 years. Journal of Mammalogy 68:359-375.

Hanski, I.; Gilpin, M. 1991. Metapopulation dynamics: brief history and conceptual domain. Biological Journal of the Linnean Society 42:3-16.

Harrison, S.; Murphy, D. D.; Ehrlich, P. R. 1988. Distribution of the Bay checkerspot butterfly, *Euphydryas editha bayensis*: evidence for a metapopulation model. The American Naturalist 132(3):360-382.

Harrison, S.; Ross, S. J.; Lawton, J. H. 1992. Beta diversity on geographic gradients in Britain. Journal of Animal Ecology 61: 151-158.

Hetrick, W. A.; Rich, P. M.; Barnes, F. J.; Weiss, S. B. 1993. GIS-based solar radiation flux models. Amercian Society for Photogrammetry and Remote Sensing Technical Papers 3:132-143.

Hubbs, C. L.; Miller, R. R.; Hubbs, L. C. 1974. Hydrographic history and relict fishes of the north-central Great Basin. Memoirs of the California Academy of Sciences 7:1-259.

Jansen, D. H. 1966. Coevolution of mutualism between ants and acacias in Central America. Evolution 20(3):249-275.

Kremen, C. 1992. Assessing the indicator properties of species assemblages for natural areas monitoring. Ecological Applications 2(2):203-217.

LaRivers, I. 1962. Fishes and fisheries of Nevada. Nevada State Fish and Game Commission, Reno, Nevada.

Morris, M. G. 1987. Changing attitudes to nature conservation: the entomological perspective. Biological Journal of the Linnean Society 32:213-223.

Murphy, D. D.; Freas, K. E.; Weiss, S. B. 1990. An environment-metapopulation approach to population viability analysis for a threatened invertebrate. Conservation Biology 4(1):41-51.

Murphy, D. D.; Weiss, S. B. 1992. Effects of climate change on biological diversity in western North America: species losses and mechanisms. Pages 355-368 in Peters, R. L.; Lovejoy, T. E., editors. Global Warming and Biological Diversity. Yale University Press, New Haven, Connecticut.

Murphy, D. D.; Wilcox, B. A. 1986. Butterfly diversity in natural habitat fragments: a test of the validity of vertebrate-based management. Pages 287-292 in Verner, J.; Morrison, M. L.; Ralph, C. J., editors. Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates. The University of Wisconsin Press, Madison, Wisconsin.

Nelson, C. R. 1994. Insects of the Great Basin and Colorado Plateau. Pages 211-237 in Harper, K. T.; St. Clair, L. L.; Thorne, K. H.; Hess, W. M., editors. Natural History of the Colorado Plateau and Great Basin. University Press of Colorado, Niwot, Colorado.

New, T. R. 1991. Butterfly conservation. Oxford University Press, Melbourne, Australia.

Palmer, M. W. 1993. Putting things in even better order: the advantages of canonical correspondence analysis. Ecology 74(8): 2215-2230.

Pearson, D. L.; Cassola, F. 1992. World-wide species richness patterns of tiger beetles (Coleoptera: Cicindelidae): indicator taxon for biodiversity and conservation studies. Conservation Biology 6(3):1992.

Pollard, E. 1977. A method for assessing changes in the abundance of butterflies. Biological Conservation 12:115-134.

Pollard, E.; Yates, T. J. 1993. Monitoring butterflies for ecology and conservation. Chapman and Hall, London.

Prendergast, J. R.; Quinn, R. M.; Lawton, J. H.; Eversham, B. C.; Gibbons, D. W. 1993. Rare species, the coincidence of diversity hotspots and conservation strategies. Nature 365:335-337.

Pyle, R.; Bentzien, M.; Opler, P. 1981. Insect conservation. Annual Review of Entomology 26:233-258.

Schneider, D. February 1995. Global warming is still a hot topic. Scientific American 272(2):13-14.

Schneider, S. H.; Mearns, L.; Gleick, P. H. 1992. Climate-change scenarios for impact assessment. Pages 38-55 in Peters, R. L.; Lovejoy, T. E., editors. Global warming and biological diversity. Yale University Press, New Haven, Connecticut.

Scott, J. A. 1986. The butterflies of North America. Stanford University Press, Stanford, California, USA.

Shapiro, A. M. 1975. The temporal component of butterfly species diversity. Pages 181-195 in Cody, M. L.; Diamond, J. M., editors. Ecology and evolution of communities. The Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Swengel, A. G. 1990. Monitoring butterfly populations using the Fourth of July butterfly count. American Midland Naturalist 124:395-406.

ter Braak, C. J. F.; Prentice, I. C. 1988. A theory of gradient analysis. Advances in Ecological Research 18:271-317.

Thomas, C. D.; Mallorie, H. C. 1985. Rarity, species richness and conservation: butterflies of the Atlas Mountains in Morocco. Biological Conservation 35:95-117.

Thomas, J. A. 1983. A quick method for estimating butterfly numbers during surveys. Biological Conservation 27:195-211.

Thomas, J. W. 3 February 1994. New directions for the Forest Service. Statement presented before the Subcommittee on National Parks, Forests, and Public Lands and the Subcommittee on Oversight and Investigations, Committee on Natural Resources, U.S. House of Representatives. Washington, D.C.

Turner, R. M.; Baweic, W. J. 1991. Geology of Nevada: A Digital representation of the 1978 geologic map of Nevada. U.S. Geological Survey Digital Data Series DDS-2.

Weiss, S. B.; Murphy, D. D.; White, R. R. 1988. Sun, slope, and butterflies: topographic determinants of habitat quality for *Euphydryas editha*. Ecology 69(5):1486-1496.

Weiss, A. D.; Weiss, S. B.; Galo, A. T.; Nachlinger, J.; Pritchett, D. 1996. Integrating stratified sampling, canonical correspondence analysis, and GIS for predictive vegetation modeling in the Spring Mountains of southern Nevada. Presented at the Third International Conference/Workshop on Integrating GIS and Environmental Modeling.

Wright, D. H.; Reeves, J. H. 1992. On the meaning and measurement of nestedness of species assemblages. Oecologia 92:416-428.

Wright, D. H.; Reeves, J. H.; Berg. 1990. NESTCALC version 1.0: a BASIC program for nestedness calculations.

Elk Herbivory, Rest-Rotation Grazing Systems, and the Monroe Mountain Demonstration Area in South-Central Utah: A "Seeking Common Ground" Initiative

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Abstract—In 1993, the Monroe Mountain Livestock/Big Game Demonstration Area was selected to facilitate the resolution of conflicts between livestock and big game interests in south-central Utah. In cooperation with the Monroe Mountain Common Ground initiative, range-wildlife scientists from Utah State University determined elk (*Cervus elaphus*) distribution and forage utilization within a rest-rotation grazing system on Monroe Mountain. Elk were not observed to consistently prefer rested grazing units during the 1993, 1994, and 1995 domestic grazing seasons. Elk forage utilization ranged from 9.5 to 30.2 percent and 12.0 to 18.6 percent on two grazing units during the June and August sampling periods, respectively. Although elk forage utilization within the Koosharem grazing allotment was greater in 1995 than in 1994, 41.6 to 57.1 percent more June to August forage regrowth occurred within this allotment during the relatively wet year of 1995. The interspecific relationships of cattle (*Bos taurus*) and elk within the sampled rest-rotation grazing system appear to be other than competitive.

Range and wildlife management in the United States advanced by the mid-20th century in response to previous, unregulated use of rangeland resources and game. Principles developed during this era (grazing systems and sustainable yield, for example; see Leopold 1933; Stoddart and Smith 1943) pervade current management activities and extant natural resource policy. Today, many real and perceived conflicts arise because of (1) diverging values associated with the use of natural resources, (2) dynamic resource bases, and (3) the management and policy decisions imposed by our Federal and State governments.

In 1993, a site on the Richfield District of the Fishlake National Forest and the Bureau of Land Management, in south-central Utah, was recognized by sponsors of the "Seeking Common Ground" initiative as a national demonstration area for the resolution of conflicts between livestock and wildlife interests in this region. The Monroe Mountain Livestock/Big Game Demonstration Project is administered by a steering committee composed of private landowners (including representatives from the Utah Farm Bureau and the Sevier Wildlife Federation) and land management agencies (the U.S. Forest Service, the Bureau of Land Management, and Utah's Department of Natural Resources).

The intent of the Monroe Mountain Livestock/Big Game Demonstration Project is to develop an integrated management strategy while ignoring the Federal, State, and private ownership boundaries of this area. In an effort to resolve some issues separating livestock and big game interests, the interspecific relationship of cattle (*Bos taurus*) and elk (*Cervus elaphus*) was studied within a domestic grazing allotment on the Demonstration Area. This report summarizes the goals of the Demonstration Project and the affiliated research regarding elk distribution and forage utilization within a rest-rotation grazing system on Monroe Mountain.

Project Goals

The goals of the Monroe Mountain Demonstration Project are the following:

1. Resolve many of the conflicts between livestock and big game interests within the project area.
2. Improve overall cooperation among involved constituencies, including private landowners, livestock producers, sportsmen, and natural resource management agencies.
3. Apply sound management to improve resource quality, both on private and public ground. (According to project objectives, management activities should improve the availability and quality of food and cover for both livestock and wildlife.)
4. Develop understanding of livestock/big game interactions within the Demonstration Area.
5. Support a quality elk management unit for both consumptive and nonconsumptive uses.
6. Contribute to an economically viable livestock grazing program in the area.

Affiliated Research

Several of the issues to be resolved by the Monroe Mountain Demonstration Project are associated with the potential conflict between local livestock and wildlife interest groups. The fear that increasing elk populations will cause a decrease in permitted livestock use, and/or the elimination of livestock grazing on Federal rangelands, exists among many livestock producers involved with the Demonstration Area. Contrastingly, wildlife interests fear that Federal

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land management agencies responsible for regulating domestic livestock grazing on extensive tracts of land will not appropriately recognize the needs of game species. In response to these fears, and in cooperation with the Monroe Mountain Common Ground initiative, range-wildlife scientists from Utah State University determined elk spatial distribution and the degree of elk forage utilization within a rest-rotation grazing system. This research was supported by Utah's Division of Wildlife Resources and the Fishlake National Forest (Richfield District).

Rest-Rotation Grazing Systems

Much of the extant rangeland in the western United States was severely impacted by unregulated livestock grazing during the 19th and early 20th centuries (Ratliff and others 1972). Improved "grazing management was needed to arrest and then reverse the downtrend in range condition, increase range livestock production, and enhance other range values" (Ratliff and others 1972). In response to these needs, U.S. Forest Service employee A. L. (Gus) Hormay developed a system of grazing management called rest-rotation (Hormay and Evanko 1958).

After monitoring the effectiveness of this system, Hormay and Talbot (1961) suggested "range deterioration" was caused by repeated selective grazing of foraging areas and forage species. Thus, the rest-rotation system may counteract the harmful effects of selective grazing by restoring plant vigor and promoting seed production and seedling establishment by periodic, season-long rest from domestic herbivory (Hormay and Talbot 1961).

Ratliff and others (1972) suggested livestock producers and land management agencies using rest-rotation grazing systems realize a greater average annual cost (9.4 percent more per animal unit month, or AUM) than if allotments were continuously grazed. Thus, the use of a rest-rotation grazing system is an "investment in range health aimed at either preventing future cuts in permitted use or providing increased future income" (Ratliff and others 1972).

History of Utah's Elk Management

Prior to and during European settlement, elk herds were common in northern and central Utah. With the exception of an indigenous herd in northern Utah's Uinta Mountains, unrestricted elk hunting facilitated the extirpation of most populations by the early 20th century. Interstate elk transplants occurred between 1912 and 1925 to reestablish and supplement Utah's herds. During this period, elk from Yellowstone National Park were transplanted to several areas in Utah, including the Fishlake National Forest (Utah Big Game Annual Report 1994).

In 1925, Utah's Board of Elk Control (currently the Board of Big Game Control) authorized the State's first elk hunting season in response to "deteriorating range conditions and agricultural damage problems" and to "cope with problems of the rapidly increasing elk herds" (Utah Big Game Annual Report 1994). Data suggest Utah's elk populations have increased since this time; 125 elk were harvested in 1931 and 11,461 elk were harvested during Utah's 1993 rifle, archery, and muzzleloader seasons (Utah Big Game Annual Report 1994).

Research Justification

While observing elk distributions within rest-rotation grazing systems in Montana, Idaho, and Utah, several investigators have noted elk preference for rested units (Knowles and Campbell 1981; Frisina 1992; Yeo and others 1993; Clegg 1994). Livestock producers, State game agencies, and rangeland managers have expressed their concerns regarding the potential effects of wild (particularly elk) herbivory on grazing units rested from domestic herbivory. If forage utilization by elk is significant on rested units within rest-rotation grazing systems, Hormay's principles regarding the restoration of plant vigor and seedling establishment by rest may be negated. Thus, given the investment realized by establishing a rest-rotation grazing system and the apparent increasing trend in Utah's elk populations (in other words, a plausible limitation to the effectiveness of a domestic grazing system), the purpose of this research was to determine elk distribution and forage utilization within a rest-rotation grazing system on Monroe Mountain.

Study Area

The Monroe Mountain Livestock/Big Game Demonstration Area is located southeast of Richfield, UT, on the northern half of the Sevier Plateau. The Demonstration Area is approximately 130,000 ha (greater than 300,000 acres) in size and is administered by the Fishlake National Forest (65 percent), the Bureau of Land Management's Richfield District (26 percent), and Utah's Division of State Lands and Forestry (7 percent; State School Trust Lands). The remainder of the Demonstration Area is owned by Utah's Division of Wildlife Resources, the Piute Indians, and private landowners.

The Koosharem grazing allotment is located on the Fishlake National Forest, in Sevier and Piute Counties, and forms part of the eastern boundary of the Demonstration Area. Sampling within the Koosharem allotment was preferable, as this allotment is managed with a previously established rest-rotation system. Plant-herbivore and interspecific herbivore interactions may not be apparent within a newly initiated grazing system. The Koosharem allotment is approximately 14,250 ha (greater than 35,000 acres) in size and is a six-unit, four-treatment rest-rotation system. This allotment is grazed by cattle from June 1 to October 15.

Within the Koosharem grazing allotment, elk forage utilization was estimated in the Burnt Flat and Koosharem Canyon grazing units. Of the Koosharem allotment's six grazing units, two are used for spring grazing. According to the U.S. Forest Service's management program, 2 full years of rest in the lower (2,200 to 2,900 m or 7,200 to 9,500 ft elevation) spring grazing units (including the Koosharem Canyon unit) will supply the needed rest period for seed development and seedling establishment within these units. Between 2,700 and 3,050 m (9,000 to 10,000 ft) elevation, summer range grazing units (including the Burnt Flat unit) are grazed by cattle either following "flowering" or "seedripe" of dominant forage species.

Methods

Distribution of Elk Use

As part of the Monroe Mountain Livestock/Big Game Demonstration Project, Utah's Division of Wildlife Resources agreed to provide information regarding elk distribution, habitat use, migration routes, and seasonal range use on and adjacent to the Demonstration Area. After securing elk from nine trapping locations surrounding Monroe Mountain, a total of 89 elk were fitted with telemetry collars between 1990 and 1995. Relocation flights were made at approximately 2-week intervals. A Cesna 185 fixed-wing aircraft, equipped with Loran C instrumentation, was used for relocation flights. Elk relocation data from the Burnt Flat and Koosharem Canyon grazing units were used to analyze the cattle-elk interactions within the Koosharem allotment from 1993 to 1995.

Elk Forage Utilization

The degree of elk utilization of grasses and forbs within the Burnt Flat and Koosharem Canyon grazing units was estimated using the paired cage method. The paired cage, or cage comparison method (Bonham 1989) involves clipping and weighing the phytomass within areas subjected to and protected from herbivory. Percent forage utilization was estimated by comparing the phytomass clipped within and outside grazing exclosures, or caged plots.

Twenty paired cage plots were established on the two grazing units sampled within the Koosharem allotment. The distance between caged and uncaged areas (each 0.5 m^2) was less than 10 m (less than 33 ft). Paired plots were placed within the interface, or ecotone, between aspen-conifer forest and grass-forb-shrub vegetational communities. As elk preference for these ecotones has been repeatedly observed, it was assumed that forage utilization within these strata represented liberal elk use, or a "worst case scenario" in terms of elk forage utilization.

Samples were clipped from a 0.4 m^2 frame placed within paired cages to reduce possible sampling error attributable to cage edges (Owensby 1969). Each cage (20 per unit, per sample) and its respective uncaged pair were clipped to a 1 cm stubble height. Cages were returned after clipping and samples were dried (at 60 °C [140 °F] for 12 hours), weighed to the nearest gram, and stored for subsequent analyses. Cages were moved less than 10 m within the sampling strata between the 1994 and 1995 growing seasons to reduce possible floral "stagnation" due to prolonged exclosure (Tueller and Tower 1979).

Elk forage utilization was estimated during June 1994, August 1994, June to July 1995, and August 1995. All utilization data were collected during periods of nonuse by domestic livestock (in other words, prior to cattle grazing or during years of rest; see table 1 for 1993 to 1995 grazing schedules). Each sampling period (two per year) was conducted within 30 days to ensure data comparability.

Elk forage utilization estimates per individual grazing unit were calculated by averaging the positive differences of phytomass (in grams) clipped from within and adjacent to caged plots (n = 20). Since negative forage utilization (when uncaged phytomass exceeds caged phytomass) is meaningless with respect to this study, negative differences between phytomass clipped within and adjacent to caged plots were considered zero (0 percent) forage utilization.

Table 1—Domestic grazing schedules for the Burnt Flat and Koosharem Canyon grazing units of the Koosharem allotment in south-central Utah.

Year	Burnt Flat grazing treatment	Koosharem Canyon grazing treatment
1993	Grazed July to October (post-flowering)	Rested
1994	Grazed July to October (post-flowering)	Rested
1995	Grazed mid-Aug. to October (post-seedripe)	Grazed June to October (seasonal)

June-to-August Forage Regrowth

During the 1994 grazing season, each of the 20 plots established within the Koosharem Canyon grazing unit received two cages to allow sampling within the rested unit during the June and August sampling periods. This scheme was applied to the Burnt Flat grazing unit in 1995, as the August sample was conducted prior to cattle entry on this unit during the 1995 grazing season. Thus, June and August elk forage utilization was estimated by comparing the phytomass clipped from one caged pair during the June sample and the remaining caged pair during the August sample. By comparing the phytomass clipped from plots in June with subsequent regrowth clipped from the same plots in August, June-to-August forage regrowth was determined for the Koosharem Canyon and Burnt Flat grazing units in 1994 and 1995, respectively.

Results

Distribution of Elk Use

Forty-three elk were relocated within the Burnt Flat grazing unit from May 1993 to January 1996. Fifty-eight elk were relocated within the Koosharem Canyon grazing unit during the same period. No elk were relocated from February to April of 1993. Since elk relocations were fewer than 15 per 3-month sampling period, conclusions regarding elk distribution have been limited to presence/absence analyses rather than quantitative comparisons between grazing treatments, seasons, or units.

With the exception of the August to October sampling period, radio-marked elk were observed within both the rested grazing unit and the unit receiving domestic herbivory after flowering of dominant forage species during the 1993 grazing season (fig. 1).

Elk were observed within both the Burnt Flat and Koosharem Canyon grazing units from November 1993 to July 1995 (figs. 1, 2, and 3).

No radio-marked elk were observed within the Burnt Flat grazing unit from August 1995 to January 1996 (fig. 3). Elk

were observed within all units receiving concurrent cattle use from July 1993 to July 1995. Elk were not observed to consistently prefer rested grazing units during the 1993, 1994, and 1995 domestic grazing seasons.

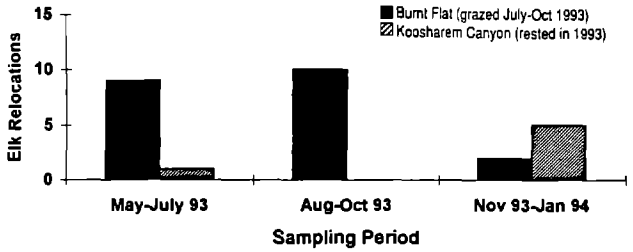

Figure 1—Distribution of elk use within the Burnt Flat and Koosharem Canyon grazing units of the Monroe Mountain Livestock/Big Game Demonstration Area, in south-central Utah, from May 1993 to January 1994.

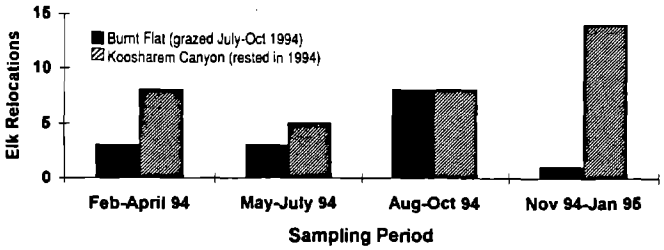

Figure 2—Distribution of elk use within the Burnt Flat and Koosharem Canyon grazing units of the Monroe Mountain Livestock/Big Game Demonstration Area in south-central Utah from February 1994 to January 1995.

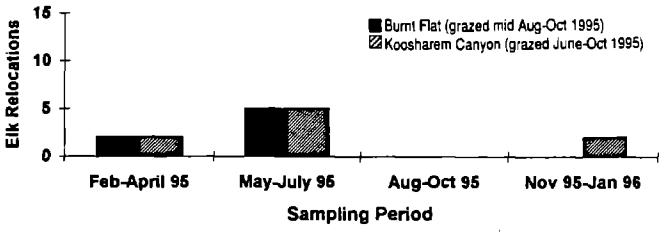

Figure 3—Distribution of elk use within the Burnt Flat and Koosharem Canyon grazing units of the Monroe Mountain Livestock/Big Game Demonstration Area in south-central Utah from February 1995 to January 1996.

Elk Forage Utilization

Elk forage utilization ranged from 9.5 to 14.2 percent and from 21.3 to 30.2 percent during the June 1994 and June-July 1995 sampling periods, respectively (fig. 4). The difference between phytomass clipped from within and adjacent to caged plots was statistically significant ($\alpha = 0.1$, Student's T) for the Burnt Flat and Koosharem Canyon grazing units during the June-July 1995 sampling period.

By the August 1994 sampling period, average elk forage utilization was 12.0 percent on the rested grazing unit. Similarly, average utilization on the Burnt Flat grazing unit during the August 1995 sampling period (prior to cattle use) was 18.6 percent.

Average elk forage utilization within the Koosharem allotment during the 1995 grazing season was greater than the average 1994 utilization. When comparing the increase in elk forage utilization between the June 1994 and June-July 1995 sampling periods for the Burnt Flat and Koosharem Canyon grazing units, elk forage utilization was 13.9 percent greater in 1995 than in 1994 within the Koosharem allotment.

June-to-August Forage Regrowth

The average forage regrowth within the Burnt Flat grazing unit was 80.6 percent in caged plots and 100.5 percent in uncaged plots. The average regrowth within the Koosharem Canyon unit was 39.0 and 43.4 percent for caged and uncaged plots, respectively (fig. 5).

Average June-to-August forage regrowth within the Koosharem grazing allotment was greater during the 1995 grazing season. Significantly more June-to-August forage regrowth was observed within uncaged plots. Upon comparing the June-to-August forage regrowth during the 1994 and 1995 grazing seasons, 41.6 and 57.1 percent more regrowth occurred during the 1995 season within caged and uncaged plots, respectively.

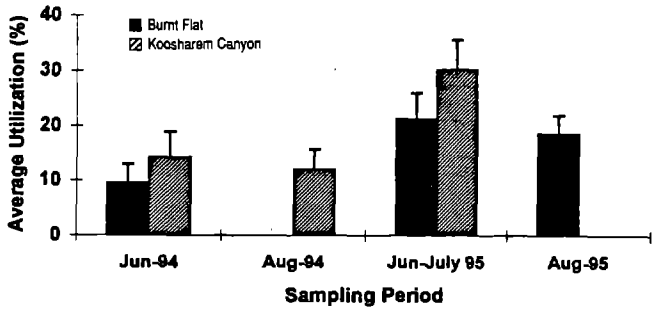

Figure 4—Average (± SE) elk forage utilization for June and August of 1994 and 1995 within the Burnt Flat and Koosharem Canyon grazing units of the Monroe Mountain Livestock/Big Game Demonstration Area in south-central Utah.

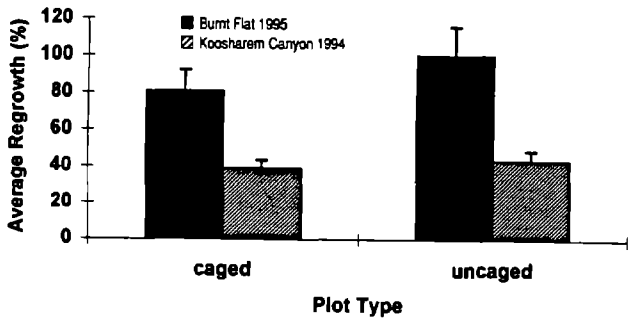

Figure 5—Average (± SE) forage regrowth between June and August for the 1994 and 1995 domestic grazing seasons within the Burnt Flat and Koosharem Canyon grazing units of the Monroe Mountain Livestock/Big Game Demonstration Area in south-central Utah.

Discussion

Distribution of Elk Use

Since elk were not observed to consistently prefer rested grazing units during the 1993, 1994, and 1995 domestic grazing seasons, these results are in variance with those of previous investigators in Montana, Idaho, and Utah (Knowles and Campbell 1981; Frisina 1992; Yeo and others 1993; Clegg 1994). Elk spatial preferences appeared to be influenced by elevation and foliage "greenup," or transhumance (see Senft and others 1987), rather than domestic grazing treatments within the Koosharem allotment. These results are consistent with elk distributions observed within Idaho's Lemhi Mountains, where Kelly and Merrill (1995) observed significantly fewer elk within a rested grazing unit on the Lee Creek allotment in 1993 and 1994.

Elk Forage Utilization and Forage Regrowth

In south-central Utah, the 1995 grazing season began with a late snowmelt. This season progressed as a relatively wet year. Elk were generally concentrated on the spring-summer transitional range (including this study's sampling strata) for approximately 3 weeks longer during the 1995 grazing season than during the spring of 1994. Increased duration of elk use and increased forage availability during the 1995 grazing season may explain the increase in elk forage utilization during this year.

While considering plant requirements for "prudent grazing," Caldwell (1984) suggested foliage regrowth capacity is dependent on the availability of active meristemmatic tissue and the proportion of shoots and tillers produced that possess productive, photosynthetic foliage. While labile carbon pools are not always "effective indicators of plant survival and growth following defoliation" (Briske and Richards 1994), most photosynthetic carbon gain occurs in a brief 2 month period in spring, when soil moisture and other photosynthetic conditions are sufficient (Caldwell 1984).

Although elk forage utilization was 13.9 percent greater in 1995 than in 1994 within the Koosharem grazing allotment, 41.6 and 57.1 percent more June to August regrowth occurred within caged and uncaged plots, respectively, during the relatively wet year of 1995. Thus, although elk forage utilization ranged from 12.0 to 21.3 percent on units ostensibly rested from herbivory, moderate defoliation occurring early in a wet season may not negate Hormay's principles regarding the restoration of plant vigor and seedling establishment by rest (Hormay and Talbot 1961).

Interspecific Herbivore Interactions

Although the overlap of forage and/or habitat use between cattle and elk may exist at varying degrees, the interaction between these herbivores may be other than resource use competition. Elk distribution observed within the Koosharem rest-rotation grazing allotment during the 1993, 1994, and 1995 grazing seasons is best explained by benign rather than competitive behavioral interactions between cattle and elk. Furthermore, these data fail to support the hypothesis that negative behavioral interactions between cattle and elk significantly influence elk spatial preferences within rest-rotation grazing allotments.

Considering the hypothetical relationship of herbivore behavior and forage availability and quality, positive interspecific interactions are possible within rest-rotation grazing systems. The results of this study suggest a commensal relationship (Odum 1959) may exist between elk and cattle within the Monroe Mountain Livestock/Big Game Demonstration Area. Provided the relative forage (and/or cover) availability within the rested unit, a favorable relationship between elk and cattle (+, 0) may exist while these herbivores are interacting within the Koosharem rest-rotation grazing allotment. When these herbivores are not interacting within the current Koosharem grazing scenario, or without the rested unit, an unfavorable relationship (–, 0; or –, –) may exist.

While attempting to explain the selection of spring feeding sites in Montana's Elkhorn Mountains, Grover and Thompson (1986) noted that elk selected sites that were grazed by cattle during the previous growing season. Spring forage utilization may be enhanced by removing standing dead litter late in the preceding grazing season (Willms and others 1981). Similarly, early cattle grazing treatments may "help establish high quality early spring foraging habitat for elk the following spring" (Frisina 1992). Thus, domestic and/or wild herbivory during one year may affect subsequent forage availability, forage quality, and/or herbivore diet selection and patch choice of cattle and elk in the following grazing season. In time, the relationship between cattle and elk within the Koosharem allotment may become favorable, but not obligatory, to both herbivores. This relationship, or protocooperation (Odum 1959), may result from improved forage availability and/or quality from either domestic or wild herbivory during the preceding grazing season.

References

Bonham, C. D. 1989. Measurements for terrestrial vegetation. NY: John Wiley and Sons 338 p.

Briske, D. D.; Richards, J. H. 1994. Physiological responses of individual plants to grazing: current status and ecological significance. In: Vavra, M.; Laycock, W. A.; Pieper, R. D., eds. Ecological implications of livestock herbivory in the west, symp. proc.; Soc. Range Manage., Denver, CO: 147-176.

Caldwell, M. M. 1984. Plant requirements for prudent grazing. In: Developing strategies for rangeland management. Westview Press, Boulder, CO: 117-152.

Clegg, K. 1994. Density and feeding habits of elk and deer in relation to livestock disturbance. M.S. thesis, Utah State University, Logan. 43 p.

Frisina, M. R. 1992. Elk habitat use within a rest-rotation grazing system. Rangelands 14: 93-96.

Grover, K. E.; Thompson, M. J. 1986. Factors influencing spring feeding site selection by elk in the Elkhorn Mountains, Montana. J. Wildl. Manage. 50: 466-470.

Hormay, A. L.; Evanko, A. B. 1958. Rest-rotation grazing...a management system for bunchgrass ranges. U.S. Department of Agriculture, Forest Service, California Forestry and Range Experiment Station Misc. Paper 27. 11 p.

Hormay, A. L.; Talbot, M. W. 1961. Rest-rotation grazing...a new management system for perennial bunchgrass ranges. U.S. Department of Agriculture, Forest Service, Res. Rep. 51. 43 p.

Kelly, S. M.; Merrill, E. H. 1995. Elk and cattle range relations on the Lemhi mountains, Idaho. In: Western States and provinces joint deer and elk workshop. Sun Valley, ID. 100 p.

Knowles, C. J.; Campbell, R. B. 1981. Distribution of elk and cattle in a rest-rotation grazing system. In: Peek, J. M.; Dalke, P. D., eds. Wildlife-livestock relationships symposium: Proc. 10. Moscow, ID: Univ. of Idaho: 47-60.

Leopold, A. 1933. Game management. NY: Scribner. 481 p.

Odum, E. P. 1959. Fundamentals of ecology. Philadelphia, PA: W. B. Saunders Co. 546 p.

Owensby, C. E. 1969. Effect of cages on herbage yield in true prairie vegetation. J. Range. Manage. 22:131-132.

Ratliff, R. D.; Reppert, J. N.; McConnen, R. J. 1972. Rest-rotation grazing at Harvey Valley... range health, cattle gains, costs. U.S. Department of Agriculture, Forest Service, Res. Paper PSW-77. 24 p.

Senft, R. L.; Coughenour, M. B.; Bailey, D. W.; Rittenhouse, L. R.; Sala, O. S.; Swift, D. M. 1987. Large herbivore foraging and ecological hierarchies. Biosci. 37: 789-799.

Stoddart, L. A.; Smith, A. D. 1943. Range management. NY: McGraw Hill Book Co. 547 p.

Tueller, P. T.; Tower, J. D. 1979. Vegetation stagnation in three-phase big game exclosures. J. Range Manage. 32: 258-263.

Utah Big Game Annual Report. 1994. Utah Dept. Nat. Resources-Division of Wildl. Resources. Pub. No. 94-6.

Willms, W.; Bailey, A. W.; McLean, A.; Tucker, R. 1981. The effects of fall defoliation on the utilization of bluebunch wheatgrass and its influence on the distribution of deer in spring. J. Range Manage. 34: 16-18.

Yeo, J. J.; Peek, J. M.; Wittinger, W. T.; Kvale, C. T. 1993. Influence of rest-rotation cattle grazing on mule deer and elk habitat use in east-central Idaho. J. Range Manage. 46: 245-250.

Sheep Use in British Columbia to Control Competing Vegetation

H. L. Lange

Abstract—The successful development of sheep as a vegetation management tool in British Columbia was the result of: (1) ability of sheep to effectively remove unwanted vegetation, (2) improvements in the quality of shepherds and livestock dogs, (3) cooperation of all stakeholders, (4) mandatory sheep health protocol, (5) interministry guidelines to help mitigate risk to the environment, and (6) continued monitoring and annual reviews. Since 1990, sheep have removed the competing vegetation from approximately 80,000 acres of reforestation land in British Columbia with minimal losses.

Since the turn of the century, the Moilliette family used the alpine range in the southern interior of British Columbia for grazing sheep. Forest encroachment gradually reduced the available grazing, and by the early 1980's over grazing resulted. Also, in the southern interior, Albert Smith was seeking grazing areas for his Sheep Producer Association. These two individuals were the first producers to request permission to graze forestry sites with sheep.

In 1984, the Moilliette range was expanded to include a logged site that provided 80 percent of the forage and a semi-open site that provided the balance. The major difference between these two sites was the abundance of fireweed that had been mechanically windrowed on the logged site.

Hendrix Lake in the southern interior was identified as a trial grazing site for Albert Smith's group. An additional trial was started 2 years later in the southern interior with the Thompson Nicola Sheep Producers Association.

Background

In 1987 the benefits of sheep grazing on vegetation competing with planted seedlings was evident. In 1989 Sharrow and others reported that brush and grass species grew much faster than conifer seedlings, resulting in a reduction of conifer seedling survival. They also concluded that forestry sites provided 10 to 15 years of good nutritional grazing for some years following timber harvest. Sites with dense fireweed growth required prompt control with followup for 3 to 5 years for good seedling survival and growth (Lindeburgh 1995).

Projects in northern Alberta indicated that sheep can suppress competing vegetation in forest plantations (Bailey 1990). On the Moilliette and Thompson Nicola sites, Ellen (1990) reported tree planting estimates were reduced by 25 percent on grazed areas. Regrazing the site 40 to 70 days later resulted in improved sheep weight gains while providing the maximum damage to competing vegetation (Ellen 1990).

Sheep grazing may increase the quality of forage available for grazing wildlife (Kistner and Smith 1983). Livestock may maintain or increase forage production (Jensen and Urnes 1979). Wildlife survival is limited by quality of food rather than quantity (Rhodes and Sharrow 1990). Grazing increases crude protein content and dry matter digestibility of most forbs and grasses (Rhodes and Sharrow 1990; Smith and others 1979).

The Ministry of Forests (MF) concluded that sheep grazing was an effective method of controlling competing vegetation. Sheep grazing resulted in little damage to spruce seedlings (O'Brien and Bailey 1987). Ellen (1990) reported total height increased by 5 percent, leader height increased 13 percent, and basal diameter increased by 14 percent, when compared to controls after 2 years of grazing. Sharrow and others (1989) reported that seedlings grazed for 3 years were 5 percent taller and 7 percent greater in diameter than trees in non-grazed controls. However, mechanical damage due to trauma decreased seedling survival by 5 percent in the grazed areas (Ellen 1990). In 1990, this vegetative management tool had become operational in the southern interior of British Columbia.

Intense public scrutiny of herbicide use was reported by Ellen (1990). Restrictions were imposed on some crown lands (Leininger and Sharrow 1987; Greiman 1988). This resulted in other foresters initiating sheep grazing trials.

Difficulties With Sheep Grazing

Opposing opinions were expressed regarding the use of domestic livestock in wilderness areas, citing disruption of the wilderness ecosystem (Cole 1989). The British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch (MELP) voiced concerns of disease transmission between domestic sheep and wildlife. Studies in the 1930's showed that *Corynebacterium ovis* was established in the British Columbia deer population. Kistner and Smith (1983) reported that soremouth did not transmit to black-tailed deer following an outbreak. Footrot was not identified in collected deer specimens, nor was lameness observed in deer. Producers also had misgivings about the 2 to 10 percent mortalities due to predators, the presence of reported sheep footrot, and reduced sheep performance.

Kistner and Smith (1983) reported ewe losses of 3 percent and lamb losses of 5 percent in an Oregon study. Losses arose from poor candidate-animal selection and subsequent

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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mismanagement. This was attributed to the following problems: (1) sheep footrot, (2) poor bodily condition, (3) financially strapped producers, (4) the use of cull-ewes, (5) inadequate parasite control (fecal analysis revealed 50 to 300 eggs per gram), (6) lambing on site, (7) soremouth outbreaks, (8) inadequate shepherd qualifications, and (9) inadequately trained sheep dogs.

Inter-Ministry Committee

An inter-Ministry committee was formed to ensure proper and safe use of sheep on these sites. This vegetation management tool represented an opportunity for sheep industry development, increased employment, and increased reforestation efficiency. The primary discussion among MF, MELP and British Columbia Ministry of Agriculture, Fisheries and Food centered on flock management and issues of disease. After lengthy discussions the stakeholders concluded that voluntary flock health guidelines would not ensure producer compliance. Following a review of the pertinent diseases and risk assessment, a mandatory Sheep Flock Health Protocol was drafted.

Sheep Flock Health Protocol

The protocol was drafted to maintain health status of sheep and protect wildlife on these demanding sites. All qualifying sheep were subject to on-farm veterinary inspection. All sheep must be: (1) individually identified, (2) vaccinated for clostridial diseases and caseous lymphadenitis, (3) have a minimum body condition score of 2 (range of 0-5), (4) treated with an effective broad spectrum anthelmintic, having larval and adult efficacy, (5) hoof trimmed and foot-soaked in 20 percent zinc sulphate for 1 hour, (6) treated twice for external parasites with a 2-week interval, (7) shorn with at least 1 inch of cover-wool to be present at certification, (8) lambs must be a minimum of 1 month of age and be a minimum of 50 pounds at the time of certification, and (9) certified animals must be kept separate from noncertified sheep or goats following certification.

Inter-Ministry Guidelines

Inter-Ministry guidelines for the use of domestic sheep for vegetation management in British Columbia were set up to help foresters mitigate risk to the environment and improve efficacy of forestry grazing by planning and on-site grazing management. Emphasis on detailed precautions regarding protection of the environment included: (1) native carnivores, (2) ungulates, and (3) other wildlife species and their habitats. In addition, the use of domestic animals must follow recognized standards for humane care and livestock husbandry.

General planning occurs at the pre-harvest stage. Foresters must review and predict the need for vegetation management, including: (1) site evaluation, (2) site specific restrictions, (3) site size and location, (4) vegetation, (5) water, (6) corral and campsites, (7) staging sites, (8) road access, (9) topography suitability for sheep, (10) wildlife using the site, (11) maps, (12) sheep health requirements, and (13) level of contractor experience.

Project planning, after the harvest has been completed, must include the following considerations: (1) an application to MELP for approval 1 year in advance, (2) projects are contracted according to provincial silviculture practices, (3) application for special use permit or range permit is completed, (4) compliance with the current Sheep Health Protocol, and (5) an evaluation of the site for quantity and quality of vegetation.

The contract includes the following provisions for on-site management: (1) adequate sheep health management expertise, (2) documentation of sheep health certification at the farm of origin within 30 days of start-up by an authorized veterinarian, (3) on-site veterinary inspections, (4) on-site standards and management, (5) shepherd's training, (6) communication equipment, (7) flock management facilities, (8) dog health and welfare, (9) avoidance of carnivore interactions, (10) protection of watercourses, and (11) long-term monitoring.

Contracts are let by invitational tender (experienced and qualified contractors) or open tender to all contractors. Contractors are required to view the site the previous fall. Most contracts are awarded following a complete review of the contractor's proposal that includes previous experience, references, and facilities. Other contracts are based on the lowest bid price. In November through March contracts are awarded with a tentative start-up date. The exact start-up date is set according to the vegetation growth on the site.

The sheep are tightly herded to graze from morning to evening. Some contractors will allow the sheep to bed down on the site; others return them to the corral for a rest period. All sick and injured animals are removed from the flock and are treated on a daily basis. Sheep that require long-term treatment are removed to an off-site treatment area. Daily records are mandatory on the sites. Water, salt, and minerals are supplied in the night pen.

The shepherd must be aware of the forester's desired result. Some foresters doing site preparations for planting want the competing vegetation removed to allow 10 to 20 percent remaining cover. For planted sites, 25 to 35 percent remaining cover is the desired outcome with less than 2 percent tree damage. If tree damage is greater than 5 percent, the contractor is penalized for reforestation costs.

Results in British Columbia

Generally, the costs to remove the competing vegetation with sheep can be up to twice the costs of herbicides and approximately half of manual brushing. Ellen (1990) demonstrated that aerial seeding of grasses and legumes will reduce the contractor's costs for vegetation removal.

After 2 years of grazing the seedlings were 5 percent taller, had 13 percent longer leader length, and had 14 percent larger basal diameter when compared to controls. Since 1990, sheep have removed competing vegetation from approximately 80,000 acres of reforestation lands.

During the experimental stages, 1985 (3,300 sheep) to 1989 (5,000 sheep), producers covered herding and trucking costs. In 1990 the number of sheep used increased to 10,000 and continued to increase to 44,500 by 1993. From 1992 to 1994, contractors were short 5,000 sheep each year.

Total sheep mortality is significantly less than on most farms. During the experimental period, loss was between

3 to 10 percent. During the initial contracting period (1990-93) it ranged between 2.4 and 4.6 percent, and in 1995 the total loss was less than 1 percent. On-site predation is minimal; in 1995 it was less than 0.1 percent. The areas with high predator interactions were sites close to ranches with livestock. These results coincide closely with the Oregon results indicating highest losses occurred near poorly managed sheep farms.

Continuing success of the program requires close monitoring, annual reviews, and collaboration between all stateholders involved. A 10-year review of all the data is currently being done.

I would like to leave you with a quotation from The Science Council of Canada, "sustainable agrifood systems are those that are economically viable, and meet society's needs for safe and nutritious food, while conserving and enhancing...natural resources and the quality of the environment for future generations." All parties involved are striving to meet this objective.

References

Bailey, Arthur W. Simulated grazing and sheep grazing for vegetation control within a white spruce plantation: Final report. 1990. Unpublished consultant's report submitted to Alberta Forestry, Lands and Wildlife. Edmonton, Alberta.

Cole, David N. Viewpoint: Needed research on domestic and recreational livestock in wilderness. 1989. Journal of Range Management, 42:84-86.

Greiman, Harley L. Sheep grazing in conifer plantations. 1988. Rangelands, 10:99-102.

Ellen, Geoff. 1990. An examination of the cost benefit of sheep grazing to significantly reduce competing vegetation on conifer plantations in Clearwater forest district. Unpublished report. BC Ministry of Forests.

Jensen, Charles H.; Philip J. Urnes. Winter cold damage to bitterbrush related to spring sheep grazing. 1979. Journal of Range Management, 32:214-216.

Kistner, T. P.; Smith S. P. 1983. The effect of grazing sheep on clearcuts in Oregon's coast range and its impact on big game habitat: animal parasite exchange study. United States Department of Agriculture, Forest Service Contract no. 30-262-5345.

Leininger, Wayne C.; Steve H. Sharrow. Seasonal browsing of Douglas-fir seedlings by sheep. 1989. Western Journal of Applied Forestry, 4:73-76.

Lindeburgh, Scott. 1995. Effects of fireweed and associated vegetation on conifer survival and growth in the southern interior-fifth year results. FRDA Research Memo. no.226.

O'Brien, John; Arthur Bailey. Sheep grazing for vegetation control in coniferous plantations-Calling Lake area. 1987. Unpublished progress consultants' report prepared for Alberta Forestry, Lands and Wildlife, Alberta Forest Service. Edmonton, Alberta.

Rhodes, Bruce D.; Steven H. Sharrow. Effects of grazing by sheep on the quantity and quality of forage available to big game in Oregon's coast Range. 1990. Journal of Range Management, 43: 235-237.

Sharrow, S. H.; W. C. Leininger; B. Rhodes. Sheep grazing as a silvicultural tool to suppress brush. 1989. Journal of Range Management, 42:2-4.

Smith, Michael A.: John C. Malechek; Kenneth O. Fulgham. Forage selection by mule deer on winter range grazed by sheep in spring. 1979. Journal of Range Management, 32:40-45.

Enhancing Rangeland Forage Production and Biodiversity with Tebuthiuron

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Abstract—The Bureau of Land Management, Farmington, NM, and the University of Wyoming, Laramie, are thinning big sagebrush (*Artemisia tridentata*) with the herbicide tebuthiuron to improve livestock grazing and wildlife habitat. In both states, native grass production progressively increased with higher tebuthiuron applications. In Wyoming, plant and small mammal community diversity was highest on tebuthiuron plots receiving 0.31 lbs ai/acre (12 percent sagebrush cover) and lowest at 0.94 lbs ai/acre (2 percent sagebrush cover). Small mammal diversity increased with increasing plant community diversity. Thinning big sagebrush increases forage production for livestock grazing, enhances wildlife habitat, promotes biodiversity, and reduces runoff, erosion, and sedimentation.

Big sagebrush (*Artemisia tridentata*) is the dominant shrub on more than 100 million acres of North American rangeland where livestock grazing is the primary commercial use (Vale 1974). Large expanses of dense, monotypic stands of big sagebrush provide limited forage for livestock grazing and less than optimum habitat for wildlife. However, when big sagebrush is combined with a balanced mixture of grasses and forbs, this major rangeland habitat can provide optimum forage for livestock grazing and diversified cover for wildlife production.

Resource managers across the West have consistently tried a variety of range improvement practices to achieve a diverse mixture of forbs, grasses, and shrubs within big sagebrush habitat to benefit livestock, wildlife, and other rangeland uses. A promising new management tool to enhance big sagebrush communities is the herbicide tebuthiuron. When applied at reduced application rates, this soil-active herbicide causes selective thinning of big sagebrush by inhibiting photosynthetic activity (Whitson and Alley 1984). Perennial grasses and forbs produce two to four times as much forage following big sagebrush thinning by utilizing the additional moisture available.

Rangeland resource managers must explore new management techniques to reduce dense, monotypic stands of big sagebrush. The Bureau of Land Management in Farmington, NM, and the University of Wyoming in Laramie, are actively investigating the use of tebuthiuron as a rangeland management tool to enhance forage production for livestock grazing, to improve vegetative diversity to increase wildlife habitat quality, and to promote better grazing distribution to improve range condition.

The objectives of this project were to: (1) achieve a balanced mixture of grasses, forbs, and shrubs within dense, monotypic big sagebrush ecosystems to enhance multiple-use management on western rangelands; (2) enhance herbaceous forage production for livestock grazing while simultaneously improving vegetative structure to improve wildlife habitat; (3) improve overall plant and animal biodiversity by altering plant community composition through prescribed range improvement manipulations; and (4) develop an environmentally compatible and more cost-effective alternative management practice to enhance big sagebrush rangelands for multiple uses.

Historical Background

Historical evidence suggests that prior to European settlement, big sagebrush was an important component of western rangelands (Vale 1974). Intensive grazing during the late 1800's and early 1900's, along with recent wildfire control efforts, has allowed highly competitive big sagebrush to become the dominant plant species on western rangelands (Miller 1991; Pieper 1991).

In New Mexico, vegetation within grazing exclosures constructed on public lands administered by the Bureau of Land Management (BLM) Farmington District has shown no improvement in herbaceous production or ecological condition over the past 20 years. The dominance of big sagebrush continues within exclosures despite the absence of livestock grazing. Reduced grazing under a deferred rotation grazing system outside exclosures has likewise little effect on improving herbaceous production or ecological condition. A similar scenario exists for Wyoming's 52 million acres of sagebrush rangeland.

Big sagebrush has little forage value to cattle. Because big sagebrush aggressively competes with desirable herbaceous plant species important for livestock grazing, traditional control projects commonly include mechanical methods (plowing, cutting), prescribed burning, and chemical (2,4-D) treatments aimed at long-term eradication of big sagebrush. Conversion of big sagebrush communities to grass/forb monocultures increases forage for livestock grazing and reduces wildlife populations and biodiversity (Schroeder and Sturges 1975; Swenson and others 1987; Zou and others

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1989). Heavy use of the herbicide 2,4-D can eliminate many forb plant species as well as big sagebrush, which also degrades wildlife habitat quality.

Early efforts by the BLM Farmington District to improve herbaceous forage production on big sagebrush-dominated rangeland included chaining, railing, rotary brush cutting, cabling, and plowing/reseeding treatments. Inadequate amounts of fine fuels and numerous archaeological sites precluded the use of prescribed burning. High costs associated with 2,4-D applications discouraged the use of herbicides. With few exceptions, the areas treated during the 1950's, 60's and 70's using mechanical methods have all reverted back to a big sagebrush-dominated plant community.

Current Work

Study Areas and Methods

New Mexico—In 1982, tebuthiuron was applied at the rate of 0.5 lb active ingredient per acre (ai/acre) to 243 acres of public land within the Rosa Community Allotment (Rosa #1) near Gobernador, NM. The treatment area was a loamy range site dominated by Wyoming big sagebrush. Average annual precipitation is 12-15 inches. Following treatment, all grazing use was deferred for two growing seasons (April 1-September 30), and then the area was grazed as part of a deferred rotation grazing system.

A subsequent tebuthiuron treatment of 0.5 lb ai/acre was applied to an additional 629 acres within the Rosa Community Allotment (Rosa #2) in 1990. In addition to these two plots, tebuthiuron was applied at the rate of 0.5 lb ai/acre to 1,230 acres on a different allotment, the North Kaime unit, in 1986.

In August of 1993, the BLM Farmington District collected data on vegetative production and cover from the three different aged tebuthiuron treatments and two untreated areas adjacent to the treatment plots. Vegetative production data were evaluated by using the weight estimate (Pechanec and Pickford 1937) and double sampling method (Wilm and others 1944), utilizing 9.6 ft^2 sample hoops. Vegetative cover was determined by running a 100-point pace point transect adjacent to the production transects.

Wyoming—In 1978, tebuthiuron was applied at 0.94, 0.67, and 0.31 lb ai/acre to single, 10-acre plots in homogeneous big sagebrush stands in northcentral Wyoming near Ten Sleep. In 1992, before sampling, a control plot was established near the treatment plots. Soils on the treatment area were predominately sand and silt with a 2.3 percent organic matter content. Average annual precipitation is 12-15 inches.

Four vegetation sampling transects 230 ft long were randomly located in each plot. Ten 2.8 ft^2 quadrats were sampled at even intervals along the length of each transect to assess plant density and cover. Weight estimate and double sampling methods were used to determine biomass production for each species. Importance values (Curtis and McIntosh 1951) were calculated from these data for each species to identify dominants within the plant community.

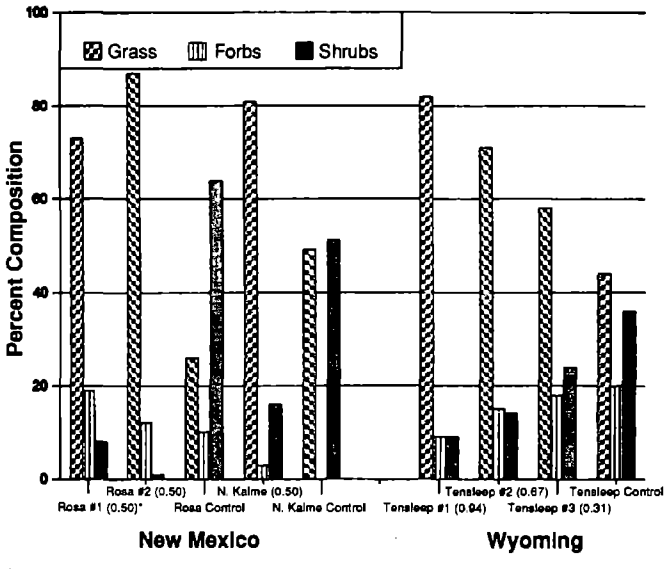
In addition to plant community data, small mammal populations were sampled on each treatment plot for abundance and diversity using mark-and-recapture trapping techniques. A 10- by 10-station grid, 11 yd between stations, with one aluminum livetrap per station, was established in each plot. Trapping was conducted for five consecutive 24-hour periods in July 1992. Captured individuals received unique toe-marking codes, using fingernail polish, for positive identification. Mark-and-recapture data were analyzed using the Schnabel estimator (Krebs 1989) to assess abundance of small nongame mammals.

Importance values for plant species and Schnabel estimates of abundance for small nongame mammal species were used to calculate a Shannon-Wiener diversity index for those communities in each plot.

Vegetative Composition

In New Mexico, a comparison of the tebuthiuron-treated plots to the control plots for both the Rosa and North Kaime areas revealed a substantial increase in the percent of all grass species on treated plots (fig. 1). At an application rate of 0.5 lb ai/acre, the percent of shrub species (primarily big sagebrush) was reduced significantly while the percent of forbs increased only slightly. Tebuthiuron-treated plots in New Mexico changed from a plant community dominated by big sagebrush to one dominated by grasses. There was little effect on the forbs.

In Wyoming, a similar change in vegetative composition occurred when tebuthiuron-treated plots were compared to the untreated plot (fig. 1). Percent shrub composition was greatest on the control plot and reflected progressively decreased percent composition with increasing rates of tebuthiuron application. Likewise, percent grass composition was lowest on the control plot and increased with heavier tebuthiuron application rates. Forbs displayed small declines in percent composition with increased tebuthiuron rates.



*Application rate (lb ai/acre)

Figure 1—Percent composition of grasses, forbs, and shrubs on New Mexico and Wyoming sites treated with tebuthiuron at different application rates.

Table 1—Percent composition of dominant plant species on Tensleep, WY, sites treated with various levels of tebuthiuron (lb ai/acre) in 1978.

Species	Percent composition of dominant plants			
	Site #1 (0.94)	Site #2 (0.67)	Site #3 (0.31)	Site #4 (Control)
Western wheatgrass	64	51	39	23
Sandberg bluegrass	9	7	9	6
Prairie junegrass	7	9	7	11
Woolly loco	2	4	6	4
Big sagebrush	5	12	18	35
Number species present	23	23	24	20

When evaluating dominant plant species only, as identified from importance values, big sagebrush comprised 35 percent of the composition on the untreated plot, and correspondingly decreased to 5 percent composition on the plot with heaviest tebuthiuron application (table 1). Likewise, among dominant grasses, western wheatgrass (*Pascopyrum smithii*) increased significantly in percent vegetative composition with increasing application rates of tebuthiuron. The lowest percent composition of western wheatgrass occurred on the untreated plot. Other dominant grass species showed little response to different tebuthiuron rates. Plant species richness, or the number of species present, was lowest in the untreated plot.

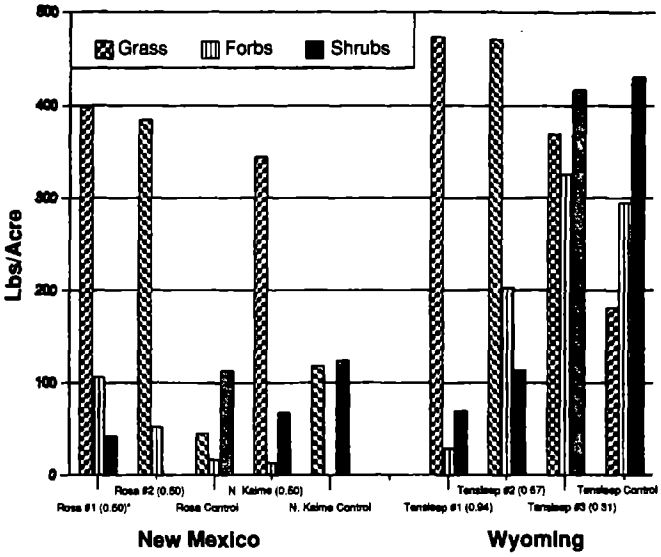
In both New Mexico and Wyoming, tebuthiuron is an effective management tool to reduce big sagebrush dominance and enhance grasses, with little effect on forbs.

Biomass Production

Vegetative production on New Mexico sites was significantly greater among grass species on tebuthiuron-treated areas compared to the control areas (fig. 2). There was some increase in forb production following treatment, although the production increases were not as great compared to grasses.

An interesting observation is the uniformity of grass production among the treated areas regardless of differences in treatment years. This would imply that tebuthiuron promotes long-lasting effects in maintaining production.

On Wyoming sites, production of all grasses combined also increased significantly as big sagebrush was thinned with tebuthiuron (fig. 2). Grass production increased progressively



*Application rate (lb ai/acre)

Figure 2—Biomass production (lbs/acre) on New Mexico and Wyoming sites treated with tebuthiuron at different application rates.

with heavier tebuthiuron application rates while forb and shrub production decreased.

An evaluation of biomass production changes among dominant grass species reveals that western wheatgrass was the primary species that consistently responded to increased levels of big sagebrush thinning (table 2). The two other predominate grass species, prairie junegrass (*Koeleria cristata*) and sandberg bluegrass (*Poa sandbergii*), were inconsistent in biomass production changes with different levels of tebuthiuron application.

There is a direct relationship on both New Mexico and Wyoming sites between the amount of grass biomass production and level of big sagebrush thinning. On the New Mexico sites, blue grama (*Bouteloua gracilis*) and galleta (*Hilaria jamesii*) were the primary species accounting for the increased biomass production among grass species. In Wyoming, the increased biomass production was primarily from western wheatgrass. This observation indicates that tebuthiuron enhances biomass production of both warm and cool season grasses. Personnel from the BLM Farmington District estimated that a four-fold increase in stocking rates occurred on the tebuthiuron-treated areas compared to the control sites.

Table 2—Biomass production (lbs/acre) of major grass species on Tensleep, WY, sites following different tebuthiuron application rates in 1978.

Sample sites	Application rate (lb ai/ac)	Biomass Production (lbs/ac)		
		Western wheatgrass	Prairie junegrass	Sandberg bluegrass
Tensleep #1	0.94	730	41	48
Tensleep #2	0.67	656	89	28
Tensleep #3	0.31	409	71	102
Tensleep control		272	83	16

Table 3—Estimates of small mammal abundance on Tensleep, WY, sites treated with tebuthiuron at different application rates (lb ai/acre) in 1978.

Species	Site #1 (0.94)	Site #2 (0.67)	Site #3 (0.31)	Site #4 (control)
		(no./acre)		
Wyoming ground squirrel	26	25	24	12
White-footed deer mouse	4	7	5	6
Northern grasshopper mouse	1	2	5	0
Total all species	31	34	34	18

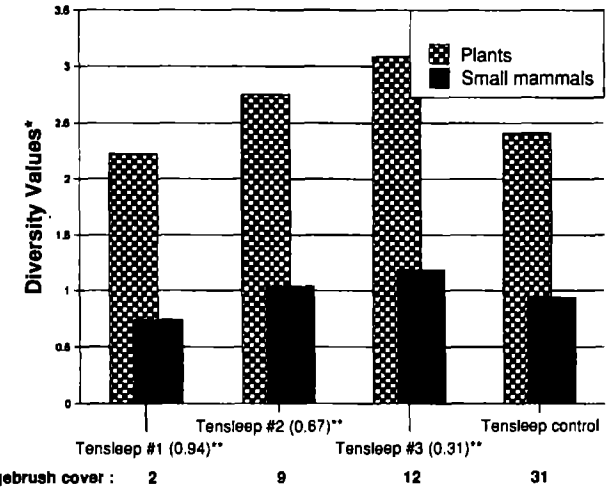
Small Mammal Relationships

Small mammals are particularly sensitive to habitat alterations (Frischknecht and Baker 1972; Zou and others 1989) and can be used as a barometer for assessing overall biodiversity of an area. For this reason, small mammal populations were evaluated on the Wyoming sites to determine the relationship between vegetative diversity and small mammal abundance and diversity.

Estimates of small mammal populations from mark-and-recapture efforts showed that the Wyoming ground squirrel (*Spermophilus elegans*) increased in abundance as the level of big sagebrush thinning increased (table 3). Conversely, the white-footed deer mouse (*Peromyscus maniculatus*) was least abundant in the heavy treatment (0.94 lb ai/acre) area. Overall species richness, or the number of small mammal species, was lowest in the untreated plot.

Diversity indices, calculated for both plant communities and small mammal populations, reflect higher values at lower thinning rates of big sagebrush (fig. 3). There is a progressive decrease in plant and animal diversity as thinning levels increase. Plant community and small mammal diversity was lowest in areas treated with the heaviest tebuthiuron application rates. Conversely, plant and animal diversity was highest in the plot receiving the lowest tebuthiuron application rate.

A comparison of the relationship between vegetative diversity and small mammal diversity illustrates a close association between these factors (fig. 3). As plant community diversity increases, small mammal population diversity also increases, indicating the importance of habitat quality for wildlife.



*Shannon-Wiener Index. Larger numbers signify higher diversity.
**Application rate (lb ai/acre)

Figure 3—Plant community and small mammal population diversity on Wyoming sites treated with tebuthiuron at different application rates in 1978.

Management Implications

Information from the work in New Mexico and Wyoming illustrates that moderate thinning of big sagebrush with tebuthiuron can increase herbaceous forage production for the benefit of livestock and wildlife, and also increase plant and animal diversity. The increase in dominance of grasses on both New Mexico and Wyoming sites supports the suggestions by Vale (1974) and Frischknecht and Baker (1972) that big sagebrush competes with cattle-preferred herbaceous forage, and big sagebrush control improves desirable forage production.

Resource managers from the BLM Farmington District have established a long-term objective of maintaining an overall composition of 65 percent perennial grasses, 15 percent forbs, and 20 percent shrubs in big sagebrush-dominated areas. This ratio is not a uniform mix on every acre, but rather a mosaic of various communities. This diverse plant community composition will provide optimum conditions for livestock grazing, wildlife habitat, and protection of watershed systems.

Resource managers generally recognize that ideal habitat for antelope and sage grouse consists of big sagebrush with associated stands of other shrubs, grasses, and forbs in a variety of cover types from dense brush to grassy openings. In New Mexico, Hooley (1991) reported that antelope heavily used tebuthiuron-treated areas, especially during non-winter periods, to take advantage of the available grasses and forbs. The BLM Farmington District purposely leaves large tracts of untreated big sagebrush for winter use by antelope when browse demands are higher.

Elk populations in the BLM Farmington District have also increased dramatically since tebuthiuron treatments were implemented 11 years ago. In 1982, the first year of tebuthiuron treatments, 284 elk licenses were issued for the game management area encompassing the BLM Farmington District. The number of elk licenses issued in 1993, 11 years later, was 1,130 (Culp 1993). Within a year or two following the initial tebuthiuron treatments, elk were observed in areas previously unoccupied in recent times or where infrequent occurrences were prevalent.

Since the initiation of tebuthiuron treatments, BLM Farmington District resource managers have observed reduced runoff, erosion, and sedimentation from watersheds. Increased vegetative production has improved soil moisture content and stabilized soil movement during runoff events. The percent vegetative cover on Rosa and North Kaime tebuthiuron-treated areas averaged 78.5 and 67 percent, respectively, compared to 44 and 43 percent, respectively, on adjacent untreated areas (table 4). The amount of water in earthen catchment basins downstream from treated areas

Table 4—Percent ground cover on New Mexico sites treated with tebuthiuron (0.50 lb ai/acre) compared to control sites in 1993.

Sample sites	Ground cover (%)						
	Grass	Forb	Shrub	Rock	Litter	Bare ground	Tree
Rosa #1	57	20	3	0	14	5	1
Rosa #2	66	9	2	0	14	9	0
Rosa Control	24	5	15	1	24	31	0
North Kaime	61	2	4	0	10	23	0
North Kaime Control	23	0	20	0	15	42	0

has also dropped due to greater absorption of precipitation on treated areas.

In addition to increasing forage production for herbivore grazing, enhancing wildlife habitat, and protecting against watershed erosion, thinned big sagebrush areas attract livestock away from riparian habitat. Several ranchers already using tebuthiuron report that livestock spend less time in riparian areas, preferring to graze the more palatable and nutrient-rich herbaceous forage produced on thinned big sagebrush uplands. This management technique offers a promising tool to protect and improve valuable riparian areas across the West.

Skeletons of big sagebrush remaining after treatment with tebuthiuron provide perch sites for a variety of avian wildlife and trap blowing snow, further improving moisture availability for plant production. In some areas of heavy herbivore grazing, skeletons of big sagebrush offer some protection to herbaceous understory vegetation normally subjected to intensive utilization. The increase in grasses and forbs associated with big sagebrush thinning also reduces the amount of wind-caused soil erosion.

Treatment Costs

In 1995, the BLM Farmington District treated 9,700 acres of big sagebrush-dominated public rangeland with tebuthiuron. The average cost per acre using a fixed wing aircraft to apply 0.3 lb ai/acre was $9.98. Based on an estimated 20-year expected benefit, tebuthiuron treatments cost only $0.50 per acre per year. Considering the limited beneficial period from past mechanical treatments in New Mexico, tebuthiuron applications offer an attractive cost-benefit range improvement alternative.

Summary

Determining the appropriate prescribed application rate of tebuthiuron to achieve optimal multiple-use benefits on western rangelands dominated by big sagebrush has been an evolutionary process to this point. However, applications ranging from 0.3 to 0.5 lb ai/acre are cost effective prescriptions to achieve a mixed plant community. This range of application appears to provide maximum benefits to herbivores and a wide variety of wildlife, as well as additional benefits to the watershed. Tebuthiuron treatment of western rangelands is a win-win situation for both agricultural producers and natural resource managers whose primary interest is more efficient multiple-use management of our rangelands.

References

Culp, R. 1993. Conservation Officer, New Mexico Game & Fish Department. Personal communication.

Curtis, J. T.; R. P. McIntosh. 1951. An upland forest continuum in the prairie-forest border region of Wisconsin. Ecology 32:476-496.

Frischknecht, N. C.; M. F. Baker. 1972. Voles can improve sagebrush rangelands. Journal of Range Management. 25(2): 466-468.

Hooley, C. 1991. Pronghorn antelope use of tebuthiuron treated areas in northwestern New Mexico. Paper presentation, 15th Biennial Pronghorn Antelope Workshop, Rock Springs, WY.

Krebs, C. J. 1989. Ecological methodology. Harper and Row, Publishers, New York, NY. 645 p.

Miller, R. F. 1991. Effects of livestock grazing the sagebrush steppe. In: Ecological Implications Of Livestock Herbivory In The West. Symposium: 42nd AIBS Annual Meeting of Scientific Societies, San Antonio, TX, August 4-8. Abstract.

Pechanec, J. F.; G.D. Pickford. 1937. A weight estimate method for determination of range or pasture production. Journal of Agronomy. 29:894-904.

Pieper, R. D. 1991. Ecological implications of herbivory. In: Ecological Implications Of Livestock Herbivory In The West. Symposium: 42nd AIBS Annual Meeting of Scientific Societies, San Antonio, TX, August 4-8. Abstract.

Schroeder, M. H.; D. L. Sturges. 1975. The effect on Brewer's sparrow of spraying big sagebrush. Journal of Range Management. 28(4):294-297.

Swenson, J. E.; C. A. Simmons; C. D. Eustace. 1987. Decrease in sage grouse (*Centrocercus urophasianus*) after ploughing of sagebrush steppe. Biological Conservation. 41:125-132.

Vale, T. R. 1974. Sagebrush conversion projects: An element of contemporary environmental change in the Western United States. Biological Conservation. 6(4):274-284.

Whitson, T. D.; H. P. Alley. 1984. Tebuthiuron effects on *Artemisia* spp. and associated grasses. Weed Science. 32:180-184.

Wilm, H. G.; D. F. Costello; G. E. Klipple. 1944. Estimating forage yield by the double sampling method. Journal of Agronomy. 36:194-203.

Zou, J.; J. T. Flinders; H. L. Black; S. G. Whisenant. 1989. Influence of experimental habitat manipulations on a desert rodent population in southern Utah. Great Basin Naturalist. 49(3):435-448.

Improving Rangeland Health by Thinning Dense Sagebrush Stands With Tebuthiuron (Spike 20P)

Garth Baxter

Abstract—Large expanses of dense sagebrush create a monotypic vegetative situation that adversely affects the diversity of both plants and animals in the sagebrush-grass ecosystem. Forage production, ground cover, and overall health of the site are reduced. Eradicating sagebrush and creating monocultures of grass also adversely affects the biodiversity of the range and wildlife values. It has recently been discovered that the sagebrush-grass ecosystem can be made more healthy, diverse, and productive by "thinning" dense stands of sagebrush with reduced rates of tebuthiuron (Spike 20P—a trademark of DowElanco). Observation of sites thinned with tebuthiuron 10-17 years previously shows sustained benefits to wildlife habitat, forage production, ground cover, and soil stability.

One of the more controversial issues between livestock and wildlife interests is management of sagebrush range. It is generally accepted that although big sagebrush (*Artemisia tridentata*) has always been present on much of the western rangeland, its density has increased as a result of past grazing abuse (Cottam 1947; Hull and Hull 1974; Christensen 1963; Passey and Huggie 1963; Blaisdale 1958). Sagebrush increases at the expense of herbaceous grasses and forbs, affecting the health, diversity, and productivity of the range. As sagebrush cover increases, soil moisture is reduced, resulting in lowered water tables, reduced waterflow in springs and seeps, and depletion of riparian areas. The extensive root system of sagebrush competes with herbaceous vegetation for moisture and nutrients.

Dr. Alma Winward is a Plant Ecologist for the Intermountain Region of the U.S. Department of Agriculture, Forest Service, and a leading authority on the sagebrush-grass ecosystem. His opinion is that more acres of sagebrush-grass lands in the Western United States were held in low ecological status the past decade due to abnormally high sagebrush cover and density than currently occurring due to livestock grazing. He notes that when big sagebrush cover reaches 12 to 15 percent, the understory production of other plants decreases as canopy cover increases. This results in increased bare ground and a reduction of forage for livestock and wildlife. Dr. Winward estimates that over 80 percent of the sagebrush-grass ecosystem has an imbalance in favor of sagebrush over the natural understory of grass and forbs. He goes on to say that there is essentially no way to reestablish a native or introduced herbaceous cover without first removing some of the dense sagebrush canopy. Only when sagebrush crowns are spaced far enough apart to allow "open" microsites, do we get successful recovery of the understory (Winward 1991).

Many livestock exclosures have been established in sagebrush sites through the years. Where livestock grazing has been excluded in dense sagebrush over 40 years, it is common to see no detectable improvement in understory grasses and forbs due to competition of sagebrush.

Traditional sagebrush control practices have been directed at trying to convert sagebrush to grass. In some cases, this has created grass monocultures, often provoking wildlife interests who understand that some sagebrush in the community is essential to the well-being of certain wildlife species and biodiversity of the plant and animal community. Grass monocultures also lack the habitat for predatory insects that keep the black grass bug in check.

Chaining or plowing and seeding projects are costly, harsh on the environment, and tend to eliminate forbs in preference to grasses. In many instances, these efforts have actually increased sagebrush density by covering existing sagebrush seed.

The use of 2,4-D, although effective in controlling sagebrush, impacts many of the brush and forb species desirable for wildlife. Use of 2,4-D is coming into disfavor, due to drift and volatilization problems, as well as perceived human health and environmental hazards.

Burning is a good tool when used properly, however, it usually kills all sagebrush in its path, and may leave the soil bare and unprotected for a season. Burning is being scrutinized more closely because of air pollution concerns. Burning attempts are sometimes aggravated by insufficient understory to carry the fire and by uncooperative burning weather or problems with fire containment. Improper use of fire can damage soil and desirable plant species, or result in the proliferation of rabbitbrush, which is more difficult than sagebrush to control.

Range managers have always noticed an attraction of large herbivores such as cattle, elk, deer, and antelope to areas where sagebrush has been controlled. This attraction is due to increased palatability and nutrient content of herbaceous vegetation after the competition from brush has been reduced. With increased interest in ecosystem management and improvement in biodiversity, the concept of thinning sagebrush, rather than trying to eradicate the species is much more acceptable.

Tom Whitson, Rich Olson, and Kris Johnson, of the University of Wyoming, recently studied long-term changes occurring in plant and animal communities when big sagebrush is thinned with tebuthiuron. They found that big

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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sagebrush can, in fact, be thinned by using reduced rates of tebuthiuron (Spike 20P) herbicide. When big sagebrush live canopy was reduced from levels of 36 percent or more to approximately a 15 percent level, greatest diversity in plant community was achieved and small mammal numbers and diversity were also the greatest. They point out that small mammal populations and density are an indicator of wildlife populations. Their studies also show that the density of thinned sagebrush did not increase during the 10-year study time (Johnson and others 1995).

The thinning concept regards sagebrush as an integral component of the plant community and recognizes that many plant and animal life forms depend on its presence. It also acknowledges the significance of a "land ethic" for western rangelands and the growing concept of "holistic resource management."

Spike 20P is a clay pellet consisting of 20 percent tebuthiuron. It is applied to the soil by aerial or ground application equipment. The roots of the sagebrush take up the product and translocate it to the shoots. Photosynthesis is inhibited and defoliation of the plant occurs over a 1-3 year period. Because Spike 20P is pelleted, it is not subject to drift and volatilization as is 2,4-D and can be applied anytime the soil is not frozen. At rates recommended for thinning sagebrush, tebuthiuron has little or no impact on grasses, forbs, or desirable wildlife brush species such as bitterbrush, winter fat, or serviceberry.

The University of Wyoming work shows considerable increase in the production of associated herbaceous vegetation when sagebrush density is controlled. This increase in herbaceous vegetation improves a site's richness of species as well as the production of grass and forbs that benefit wildlife and other grazing animals. Because forbs are insect pollinated, they attract more insects than either sagebrush or grass, which are wind pollinated. Insects provide an important protein source to birds, especially chicks and nesting females. The skeletons of dead brush provide perches for songbirds and tend to trap blowing snow which, along with reduced transpiration from the brush, increases soil moisture and waterflow in springs and seeps. Increases in small mammals benefit predatory birds and animals. It has been suggested that due to the increased palatability of forage species in the treated areas, livestock and wildlife may be attracted to them and away from riparian areas.

The past 2 years a number of sites treated with tebuthiuron were visited in Utah, Idaho, Nevada, and Wyoming. Basic observations were made on those areas treated at thinning rates of 0.2-0.5 lbs ai of tebuthiuron (1-2.5 lbs of Spike 20P product) per acre. The following five figures illustrate some of the findings.

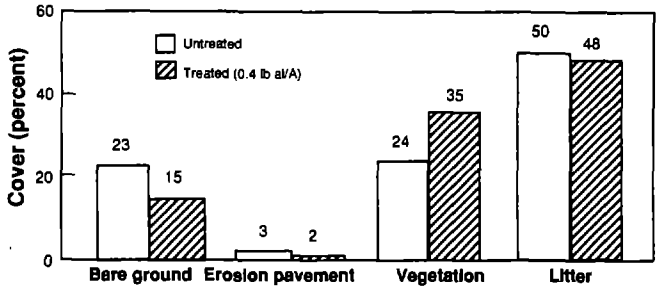

Figure 1—Comparison among bare ground, erosion pavement, vegetation, and litter at Albion, ID, 17 years following treatment with tebuthiuron. Note when sagebrush overstory was decreased from 28 to 11 percent, bare ground decreased from 23 to 15 percent, erosion pavement remained about the same, plant density increased from 24 to 35 percent, and the litter remained about the same.

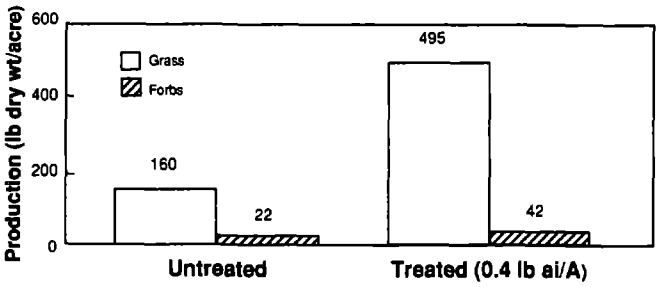

Figure 2—Comparison between the production of grass and forbs at the Albion, ID, site after treatment with tebuthiuron. Note when the sagebrush overstory was decreased from 28 to 11 percent, grass production increased from 160 to 495 lbs dry wt per acre and forb production increased from 22 to 42 lbs dry wt per acre.

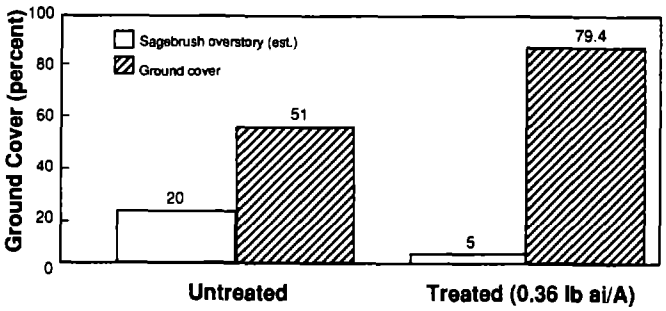

Figure 3—A comparison of sagebrush overstory and bare ground at Woodruff, UT, 10 years following treatment with tebuthiuron. Note where sagebrush overstory was reduced from 20 to 5 percent, bare ground decreased from 49 to 20.6 percent or in other words, the ground cover was increased from 51 to 79.4 percent.

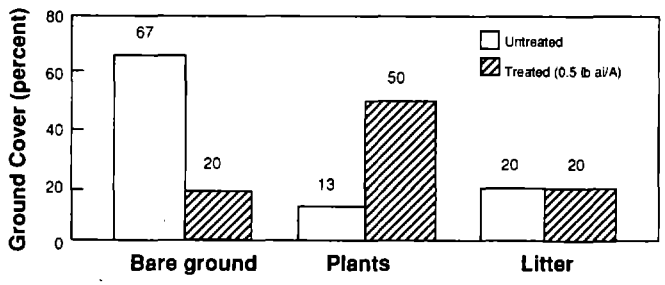

Figure 4—A comparison between bare ground, plants, and litter at Riddle, ID, 13 years following treatment with tebuthiuron. Note in the treated area, percent bare ground decreased from 67 to 20 percent, the plant density increased from 13 to 50 percent, and litter remained the same.

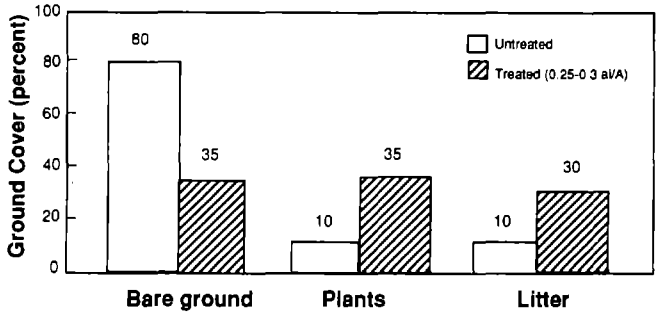

Figure 5—A comparison between bare ground, plants and litter at Mountain Home, ID, measured 14 years following treatment with tebuthiuron. Note when sagebrush overstory was decreased from 20 to 10-12 percent, the bare ground decreased from 80 to 35 percent, plant density increased from 10 to 35 percent, and the litter increased from 10 to 30 percent.

Summary

Technology now exists to thin dense stands of sagebrush by applying reduced rates of tebuthiuron (Spike 20P) herbicide. Thinning dense stands of sagebrush can improve biological diversity and restore damaged ecosystems to a more healthy condition. This benefits wildlife habitat, forage production, ground cover, and soil stability on a sustained basis.

References

Blaisdell, J.P. 1958. Seasonal development and yield of native plants on the upper Snake River Plains and their relation to certain climatic factors. U.S. Dept. Agr. Tech. Bull. 1190.

Christensen, Earl M. 1963. The foothill bunchgrass vegetation of central Utah. Ecology 44: 156-158.

Cottam, Walter P. 1947. Is Utah Sahara bound? Univ. Utah Bull. 37.

Hull, A.C., Jr.; Hull, Mary K. 1974. Presettlement vegetation of Cache Valley, Utah and Idaho. J. Range Manage. 27:27-29.

Johnson, K. H.; Whitson, T. D.; Olson, R. A. 1995. Long term changes occurring in plant communities when thinning big sagebrush (*Artemesia tridentata* Nutt.) with Tebuthiuron. Paper presented at 1995 meeting of the Weed Science Society of America Jan. 30-Feb. 2, 1995.

Winward, Al H. 1991. Special Report 880, Management in the sagebrush steppe. Agriculture Experiment Station, Oregon State University.

Passey, H.B.; Hugie, V.K. 1963. Some plant-soil relationships on an ungrazed range of southeastern Idaho. J. Range. Manage. 16: 113-118.

Wildlife/Livestock Interactions

A Holistic Approach to Managing Wildlife and Big Game Movements With Livestock: the Lost Creek Foundation

Rick E. Danvir
Steven L. Kearl

Abstract—The Lost Creek Foundation, a group of private and public land managers in northeastern Utah, has taken a holistic approach to managing watersheds, wildlife, and agriculture for economic and ecological stability. Members use a team approach in planning and managing movements and distribution of livestock and big game to minimize conflict and optimize production and land health. Using livestock to manage big game movements can be effective, but only when applied as part of a unit-wide management approach.

Available literature suggests large herbivores (wild and domestic) may have positive or negative effects on land health in terms of ecological diversity, stability, and productivity. Season-long livestock grazing and fire suppression appear to have decreased herbaceous vegetation and increased shrub dominance of western rangelands (National Resource Council 1994). Season-long utilization by both cattle and elk (*Cervus elaphus*) have reduced willow (*Salix* spp.) abundance and riparian condition (Kay 1990; National Resource Council 1994). Evidence suggests high densities of elk may reduce both aspen (*Populus tremuloides*) regeneration and forage and seed production of shrubs (Kay 1990; Shepperd and Fairweather 1994; Kay 1995). Resultant habitat changes may influence the welfare of other wildlife species.

Livestock management strategies incorporating deferment and rest-rotation (Stoddart and others 1955; Hormay and Evenko 1958) and time-control grazing (Savory 1988) seek to maintain vigor and survival of grazed plant species. Advocates of these methods suggest that unless preferred plant species are periodically rested from grazing, less preferred species will eventually dominate.

Multi-species grazing by ungulates on arid grasslands and savannahs appears to maximize forage harvest while maintaining ecosystem stability (Bell 1971; Hirst 1975; McNaughton 1985; Heitschmidt and Stuth 1991; Ritchie and Wolfe 1994). A broader spectrum of the forage resource may be utilized by multiple grazing species. Glimp (1990) and Walker (1994) summarized grazing studies using cattle and sheep alternately or in combination. Evidence suggests differences in dietary preference between cattle and sheep may facilitate grazing strategies that increase both animal production and plant community stability.

Managers recognize that livestock grazing intensity and season of use can affect wildlife habitat values, and when used appropriately may enhance wildlife habitat (Severson 1990). Seasonal grazing by cattle, sheep, horses, and goats has been used to maintain or restore desirable shrub species on mule deer (*Odocoileus hemionus*) winter ranges in Utah (Urness 1990). Early summer grazing by cattle may improve forage quality of elk winter range (Anderson and Scherzinger 1975).

Strategies that use livestock to alter big game distribution and movements can be categorized as either "positive" (using livestock to enhance habitat condition and attract wildlife) or "negative" (disturbance related) influences. Grazing strategies may be developed to increase seasonal forage desirability and attract big game to desired areas. Goals might include reducing seasonal depredation conflict, increasing animal vigor, or shifting wildlife concentrations to rest high use areas (Savory 1988; Clegg 1994). Disturbance of big game by livestock, although possibly stressful to animals in the short term, may enhance long term range condition (Clegg 1994).

"Good range condition," as used in this paper, refers to land having a high diversity and density of plant species and low rate of soil erosion. "Stability" refers to maintaining this condition, as well as associated fauna, over the long term.

This discussion focuses on the efforts of several private landowners and agency personnel to manage a large unit of land in northeastern Utah using a team approach. These individuals include personnel from the Utah Division of Wildlife Resources (UDWR) and private landowners; the team is collectively known as the Lost Creek Foundation (LCF).

The mission statement of the LCF is "To maintain productive, healthy watersheds, agricultural values and healthy, diverse wildlife populations now and for future generations." The authors recognize the efforts of E. Wilde, G. Hopkin, S. Petersen, and J. Kimball in the success of this process.

Historical Perspective

The LCF management unit includes 142,000 ha (350,000 acres) of wildlands. Archeological evidence (Shields 1968) and journals of early explorers (Russell 1955; Rawley 1985) indicate bison (*Bison bison*), elk, pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and mule deer

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were ungulate fauna common to these lands prior to European settlement. As these lands became settled, with resultant overhunting, livestock diseases, and overgrazing by domestic livestock, the bison, bighorn sheep, elk, and antelope disappeared. By 1900, even mule deer were uncommon (Julander 1962; Gruell 1986). Domestic grazing has been the predominant industry on LCF lands since the 1870's. High livestock densities (particularly sheep) and season-long grazing were the rule through the early 1900's. By 1920, approximately 100,000 ewes and 5,000 cattle summered on LCF lands; most of the sheep wintered in the Salt Lake valley (McMurrin 1989). The mid-1900's began a period of gradually declining livestock densities and implementation of basic range management concepts (Stoddart 1940). Current livestock summer stock averages 10,000 cattle and 17,000 sheep.

As a result of early livestock grazing practices in northern Utah, range composition generally shifted to higher shrub densities, reduced herbaceous forage, increased bare ground, and deteriorating watershed condition (Urness 1990). Resultant habitat changes, reduced sheep densities, and the institution of hunting restriction in the early 1900's allowed mule deer populations to increase to record levels by 1960 (Julander 1962). Subsequent immigration and reintroduction efforts have established populations of elk, pronghorn, and moose (*Alces alces*) on the LCF unit.

Table 1 compares estimates of animal use and AUM (animal unit months) removal by species from LCF unit lands circa 1920 and 1995 (Stoddart 1940; McMurrin 1989; USDA Forest Service 1980; UDWR, unpublished data). While forage harvest estimates are similar for both time periods, the number of grazing animals has decreased, the number of ungulate species has increased, and range condition has improved.

During the past 20 years, most LCF private landowners have incorporated big game fee hunting into ranch management strategies. As landowners became accustomed to the revenues from hunting programs, it became increasingly clear that critical big game winter ranges within the LCF management unit were being lost through wildfire burns, poor domestic livestock grazing practices, excessive big game populations, and residential development. Reductions in big game winter carrying capacity lowered big game hunting opportunity, and increased winter-spring big game depredation conflicts. These concerns prompted several landowners and UDWR managers to begin a process whereby landowners could better understand the influences their land and management practices have on the condition of big game populations unit-wide. Equally important, these discussions provided landowners and UDWR managers opportunities to explain their respective personal, economic, and land management goals and constraints. Through this process, all participants began to realize that the fates of individual ranches and big game populations were inextricably linked to management of the whole unit.

Table 1—Estimated ungulate numbers and forage AUM removal from LCF lands circa 1920 and 1995.

	1920-1925		1990-1995	
Species	Ungulate numbers	AUM's removed	Ungulate numbers	AUM's removed
Sheep[a]	100,000	120,000	17,000	20,400
Cattle	5,000	60,000	10,000	120,000
Deer	1,000	2,400	9,000	21,600
Elk	—	—	3,500	29,400
Moose	—	—	500	4,800
Pronghorn	—	—	600	1,080
Totals	106,000	182,400	40,600	197,280

[a]Summer grazing only, 6 months per year.

The process culminated in the formation of the LCF in 1992. Members formed a governing board, conceived a mission statement, and prioritized unit needs. Restoration of critical spring livestock/big game winter range was identified as the "weak link" and given top priority. Members voluntarily assessed a per acre fee to generate funds. Potential rehabilitation projects were developed and prioritized unit wide, based on greatest return per dollar spent. Members developed a "burn" fund to reseed future wildfires when appropriate. The LCF funded big game migration studies and sage grouse (*Centrocercus urophasianus*) research on the unit. Finally, members began promoting the benefits to wildlife and agriculture of managing for diverse plant communities.

Description of LCF Unit

Elevations on the unit range from 1,525 m (5,000 ft) to nearly 2,745 m (9,000 ft). Average annual precipitation is highly variable, averaging 63.5 cm (25 inches) in the northern and western portions and 30.5 cm (12 inches) in the southern and eastern portions of the unit. Approximately half of the precipitation comes as snow, November to March. Mean summer temperature averages 14 °C (58 °F), mean winter temperature averages –2 °C (28 °F). Winter temperatures of –29 °C (–20 °F) are not uncommon. Rapid forage growth generally occurs during a 6-week period May to July. Forage production can double from one year to the next depending on available moisture (M. Ritchie, unpublished data).

The eastern half of the unit is predominantly flat to rolling sagebrush (*Artemesia tridentata*) dominated vegetation. The western half of the unit is montane, dominated by mixed shrub and aspen communities, interspersed with smaller mixed conifer stands and riparian areas. Critical big game winter ranges are generally sagebrush, oakbrush (*Quercus gambelii*), or mixed shrub communities. Most big game wintering areas are located adjacent to agricultural and residential areas, along the perimeter of the LCF unit. Approximately 90 percent of the LCF is privately owned; 10 percent is owned and managed by the State of Utah or BLM.

Management of Spring Livestock/ Big Game Winter Range

The landscape management goal of spring livestock/big game winter range (hereafter referred to as "winter range") is to maintain or obtain a mixture of shrubs, grasses, and forbs. This mix of plant types offers a variety of winter big game forage (depending on snow conditions) as well as herbaceous spring forage for livestock and big game. Vegetation above snow provides winter thermal cover, and can

promote melting of surrounding snow (Austin and others 1983). Management of winter range includes early season livestock grazing (late April-May) and maintaining big game populations at levels that minimize overbrowsing of shrubs. Shrubs such as snowberry (*Symphoricarpos albus*), rabbitbrush (*Chrysothamnus* spp.), big sagebrush, winterfat (*Ceratoides lanata*), and bitterbrush (*Pursia tridentata*) will vigorously resprout following winter defoliation at moderate levels (<60 percent utilization of current year's growth). Conversely, growing season utilization of <30 percent can significantly reduce both foliage and seed production (Willard and McKell 1978; Stevens and others 1977; Giunta and others 1978; Kay 1995).

Livestock graze a mixture of old, mature and new, succulent herbaceous forage during the spring, prior to rapid growth of grasses. Operators strive to limit spring livestock grazing season length on winter range to minimize rebiting of growing herbaceous plants (Savory 1988). Most winter range is rested from livestock grazing every 2 to 3 years. This grazing strategy is designed to maintain plant diversity and vigor (Urness 1990; Ritchie and Wolfe 1994).

Equally important, livestock operators have learned to significantly reduce fall use of winter range through innovative management. Deseret Land and Livestock (DL&L) for example, has significantly increased calf weaning weights, average daily gain, and cattle fertility rates through a strategy of "stockpiling" traditional fall forage for spring use, increasing efficiency of irrigated pasture use, and shifting the cattle reproductive cycle to match the ranch's naturally produced forage (Simonds 1995). DL&L also feeds hay to 800 to 1,000 elk wintering on the eastern winter range, to reduce depredation conflicts and competition with wintering mule deer and pronghorn.

LCF experience suggests that managing for big game population levels in balance with winter resources, managing for adequate big game winter forage and planning for spring livestock/big game forage in desired areas can profoundly reduce winter-spring big game depredation problems. Minor changes in livestock grazing have allowed us to plan for and provide adequate big game forage in desired areas, thus reducing "unplanned" use of haystacks and irrigated pastures.

Management of Critical Big Game Winter Range

Winter range areas that are critically important to big game survival during severe winters (generally lower elevation, steep southerly aspects) are a primary focus of LCF efforts. Many of these critical areas lie adjacent to agricultural or residential areas. A significant portion of critical winter range has been lost due to wildfire burns, or is threatened through expanding residential development. Burned-over portions of critical winter range are dominated by stands of cheatgrass (*Bromus tectorum*), bulbous bluegrass (*Poa bulbosa*), and annual forbs, and generally lack perennial grasses, forbs, and shrubs. Cooperative efforts involving the LCF, UDWR, and volunteers have begun the long, slow task of re-establishing desired species. Various techniques including burning, chemical spraying, and intensive grazing are used to reduce dominance by annuals. Desired species are introduced by broadcasting, livestock herd effect (Savory 1988), handseeding, and handplanting browse seedlings, depending on topography and environment. The majority of money generated through the LCF is spent on rehabilitating critical winter range on private, State, and Federally owned land.

Management of Livestock/Big Game Summer Range

While winter range on the LCF unit is limited and of major concern, summer range is relatively abundant. If big game population levels are held within winter range carrying capacity, summer range is not limiting.

Summer range on the eastern part of the unit is predominantly sagebrush steppe. Eastern summer range is shared by pronghorn, mule deer, and cattle. Montane western summer range has a high interspersion of mountain shrub, aspen, coniferous, and riparian habitat. This summer range is shared by elk, mule deer, moose, cattle, and sheep. Much of the LCF summer range is shrub dominated and lacking in bunchgrasses or perennial forbs. In recent years, selected areas have been mechanically disked and reseeded to a more herbaceous-dominated mix of grasses, forbs, and shrubs. Recent wildfire and controlled burns, along with reseeding when appropriate, have increased plant diversity and herbaceous production. We have noted increasing elk use of these areas, reducing elk concentrations on traditional winter range and summer riparian areas.

Cattle are grazed using time-control grazing principles on the eastern sagebrush steppe range (Savory 1988). This method is designed to mimic the activity of migratory herding ungulates, such as bison. Cattle are run in a single large herd. During rapid grass growth, livestock are grazed <5 days per pasture to reduce rebiting of plants. Roughly 90 percent of the cattle occupy <10 percent of the range at any given time. Pastures are totally rested from livestock grazing every 2 to 3 years. This method has been employed by DL&L for over 10 years. Computer modeling, based on empirical data from exclosure research on DL&L, suggests ecological stability may be enhanced by grazing both cattle and big game rather than grazing cattle or big game alone (Ritchie and Wolfe 1994).

Cattle and sheep are grazed on the western montane summer range. Most cattle operators have implemented three or more pasture rest-rotation strategies. Approximately one third of pastures are grazed early summer (June-July), one third deferred until late summer (August-September), and the remainder rested from livestock use each year. Sheep on the LCF are usually herded, herders move sheep to fresh forage every 1 to 3 days to maximize weight gains and avoid rebiting.

Influences of Livestock on Summer Big Game Movements

Both cattle and sheep operators on the LCF have observed late summer movements by elk to areas grazed in early summer by livestock. Clegg (1994) studied summer distribution and foraging behavior of elk relative to cattle and sheep

use on DL&L from 1991 to 1993. Elk densities decreased rapidly following introduction of sheep, herders, and dogs, suggesting disturbance-induced movement. Elk densities also decreased following introduction of cattle, although to a lesser degree. The degree of elk displacement seemed dependent on cattle density, suggesting movement may have been influenced more by competition for nutritious forage than by disturbance. Elk densities in livestock-grazed areas generally increased within 2 to 4 weeks following livestock removal. Lyon (1979) noted similar elk behavior relative to logging activity in Montana.

During wetter summers, Clegg noted high September and October elk densities in areas grazed in early summer by livestock. Observations of foraging elk indicated elk were selectively grazing regrown herbaceous vegetation. Forage samples collected on rested and July-grazed mountain pastures on DL&L suggest early summer grazing may increase herbaceous forage quality in late summer (fig. 1). September TDN (total digestible nutrients) and protein levels were greater in early-grazed pastures than rested pastures. Increasing forage quality prior to the onset of breeding can positively affect both pregnancy rates and conception dates of ungulates (Robbins 1983). Anderson and Scherzinger (1975) used early season cattle grazing to increase forage quality of winter elk ranges.

In extremely dry years, nutritious late summer herbaceous regrowth is lacking. Elk and cattle alike use ungrazed areas and browse in lieu of herbaceous regrowth. McCorquodale (1993) observed a similar elk foraging strategy in winter. Elk selected higher quality, widely dispersed bunchgrasses when available, shifting to willows and riparian meadow grasses when unavailable.

Observed change in elk densities following disturbance by herded sheep suggests a method to periodically rest mountain riparian areas from elk grazing. Season-long elk grazing appears to be adversely impacting a mountain riparian area on the LCF that is not livestock grazed. Preliminary investigations indicate that disturbing elk from this area with herded yearling (dry) sheep mid June to mid July allowed meadow grasses to mature and increased fall willow abundance. Elk densities increased to pre-disturbance levels within 1 month following disturbance by sheep. Herded yearling sheep can be moved easily and grazed on upper slopes, minimizing use of riparian areas.

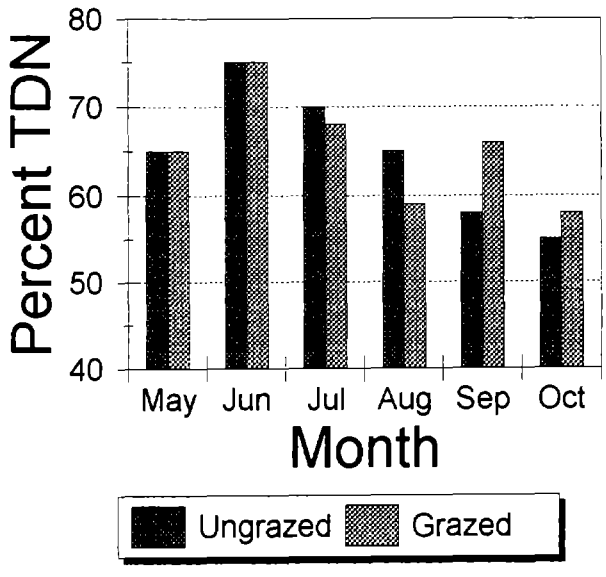

Figure 1—Monthly comparison of herbaceous forage TDN (total digestible nutrients) from livestock-rested mountain pastures and pastures grazed by cattle in July 1993, Deseret Land and Livestock.

Our observations of elk behavior suggest effective planning for late summer forage involves providing opportunities for elk to access either regrown or rested areas, depending on growing season conditions. Rest rotation and time-controlled grazing provide this flexibility. Additionally, rotating herds on summer range provides necessary rest to plants. Inducing herd-forming wild ungulates, such as elk, to periodically move during summer may likewise benefit plant and land health. It is important however, that stocking rates are not excessive and elk are provided areas to access when disturbed.

Summary and Conclusions

Attitudes toward land management on the LCF are changing. Landowners, traditionally livestock operators, are forming new opinions concerning what constitutes "good" range composition. Since landowners are managing for wildlife as well as livestock, they are concerned with maintaining a mix of winter browse, summer grasses, and nutritious forbs on the range. Since some landowners are developing fee fishing, bird watching, and other wildlife viewing programs, they are concerned with riparian quality and structural diversity on the range.

Profit provided a strong incentive to begin the LCF. Private enterprises must remain profitable, or they cannot exist. However, long-term ecologic stability and production capability are the foundations of long-term profit. Although LCF members could gain immediate and substantial profit by simply selling land, these individuals desire to remain a part of the land. The LCF represents a shared vision of production, landscape, and quality of life goals. Landowners in the LCF are learning that working together for proper management of the entire unit has been not only profitable, but also an educational and personally satisfying experience. We feel the concepts learned through our experiences are applicable to any unit of land being managed for the benefit of wildlife, livestock, land health, and people.

A few key principles have proven useful in management of the LCF to date:

1. Invest the time necessary to communicate and understand the goals, constraints, and opinions of all members. Seek common ground and define holistic team goals based on consensus and shared values.

2. Approach unit management holistically. Understand the roles of individuals and ranches in the overall functioning of the unit. Identify factors limiting success, and devise management options to increase production capability and land health.

3. Approach grazing management as an optimization strategy, whereby pastures are periodically rested or deferred to promote plant health, and periodically grazed to produce meat and income.

4. Multiple grazing species, if properly managed, can aid in maintaining ecologic and economic stability.

5. Communicate with other managers and researchers. Learn to review published literature (old and new) concerning arid lands management, ecology, and restoration. Nearly all of the methods described in this paper have been practiced or published elsewhere.

References

Anderson, E. W.; Scherzinger, R. J. 1975. Improving quality of winter forage for elk by cattle grazing. Journal of Range Management. 28(2): 120-125.

Austin, D. D.; Urness, P. J.; Fiero, L. C. 1983. Spring livestock grazing affects crested wheatgrass regrowth and winter use by mule deer. Journal of Range Management. 36(3): 589-593.

Bell, R. H. V. 1971. A grazing ecosystem in the Serengeti. Scientific American. 225: 86-93.

Clegg, K. 1994. Density and feeding habits of elk and deer in relation to livestock disturbance. Logan, UT: Utah State University. Thesis. 41 p.

Giunta, B. C.; Stevens, R.; Jorgensen, K. R.; Plummer, A. P. 1978. Antelope bitterbrush—an important wildland shrub. Publication 78-12. Salt Lake City, UT: Utah Division of Wildlife Resources. 47 p.

Glimp, H. A. 1990. Multi-species grazing and marketing. In: Research progress report. 1990. Dubois, ID: U.S. Sheep Experimental Station and University of Idaho. Agricultural Research Service. 196 p.

Gruell, G. E. 1986. Post-1900 mule deer irruptions in the Intermountain West: principal causes and influences. Gen. Tech. Rep. INT-206. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 37 p.

Heitschmidt, R. K.; Stuth, J. W. 1991. Grazing management: an ecological perspective. Portland, OR: Timber Press.

Hirst, S. M. 1975. Ungulate—habitat relationships in a south African woodland/savannah ecosystem. Wildlife Monographs. 44: 60 p.

Hormay, A. L.; Evanko, A. B. 1958. Rest-rotation grazing—a management system for bunchgrass ranges. Misc. Pap. 27. U.S. Department of Agriculture, Forest Service, California Forest and Range Experiment Station.

Julander, O. 1962. Range management in relation to mule deer habitat and herd productivity in Utah. Journal of Range Management. 15: 278-281.

Kay, C. E. 1990. Yellowstone's northern elk herd: a critical evaluation of the "natural regulation" paradigm. Logan, UT: Utah State University. Dissertation. 490 p.

Kay, C. E. 1995. Browsing by native ungulates: effects on shrub and seed production in the greater Yellowstone ecosystem. In: Roundy, B. A.; McArthur, E. D.; Haley J. S.; Mann, D. K., comps. 1995. Proceedings: Wildland shrub and arid land restoration symposium; 1993 October 19-21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 310-320.

Lyon, L. J. 1979. Influences of logging and weather on elk distribution in western Montana. Res. Pap. INT-236. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experimental Station. 11 p.

McCorquodale, S. M. 1993. Winter foraging behavior of elk in the shrub-steppe of Washington. J. Wildlife Management. 57(4): 881-890.

McMurrin, J. A. 1989. The Deseret Live Stock Company: the first fifty years, 1890-1940. Salt Lake City, UT: University of Utah. 113 p. Thesis.

McNaughton, S. J. 1985. Ecology of a grazing ecosystem: The Serengeti. Ecological Monographs. 55(3): 259-294.

National Resource Council. 1994. Rangeland health: New methods to classify, inventory, and monitor rangelands. Washington, DC. 180 p.

Rawley, Edward V. 1985. Early records of wildlife in Utah. Salt Lake City, UT: Utah Division of Wildlife Resources. Publ. 86-2. 102 p.

Ritchie, M. E.; Wolfe, M. L. 1994. Sustaining rangelands: application of ecological models to evaluate the risks of alternative grazing systems. In: Covington, W. W.; DeBano, L. F., tech. coords. Sustainable ecological systems: implementing an ecological approach to land management; 1993 July 12-15; Flagstaff, AZ. Gen. Tech. Rep. RM-247. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 363 p.

Robbins, Charles T. 1983. Wildlife feeding and nutrition. New York: Academic Press. 352 p.

Russell, Osborne. 1955. Journal of a trapper. Ed: Haines, A. L. Lincoln, NE: University of Nebraska Press. 191 p.

Savory, Alan. 1988. Holistic resource management. Washington, DC: Island Press. 564 p.

Severson, K. E. 1990. Summary: Livestock grazing as a wildlife habitat management tool. In: Severson, K. E., ed. Can livestock be used as a tool to enhance wildlife habitat? Gen. Tech. Rep. RM-194. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 123 p.

Shepperd, W. D.; Fairweather, M. L. 1994. Impact of large ungulates in restoration of aspen communities in a southwestern ponderosa pine ecosystem. In: Covington, W. W., comp. 1994. Sustainable ecological systems: implementing an ecological approach to land management; 1993 July 12-15; Flagstaff, AZ. Gen. Tech. Rep. RM-247. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 363 p.

Shields, W. F. 1968. The Woodruff bison kill. Salt Lake City, UT: University of Utah Anthropological Papers No. 99. Misc. Pap. 21. 10 p.

Simonds, G. E. 1995. Matching cattle nutrient requirements to a ranch's forage resource. In: Intermountain Cow Symposium. Twin Falls, ID: College of Southern Idaho. 87 p.

Stevens, R.; Giunta, B. C.; Jorgensen, K. R.; Plummer, A. P. 1977. Winterfat. Publ. 77-2. Salt Lake City, UT: Utah Division of Wildlife Resources. 41 p.

Stoddart, L. A. 1940. Range resources of Rich County, Utah. Bull. 291. Logan, UT: Utah Agricultural Experiment Station. 30 p.

Stoddart, L. A.; Smith, A. D.; Box, T. W. 1955. Range management. New York: McGraw-Hill. 532 p.

Urness, P. J. 1990. Livestock as manipulators of mule deer winter habitats in northern Utah. In: Severson, K. E., ed. Can livestock be used as a tool to enhance wildlife habitat? Gen. Tech. Rep. RM-194. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 123 p.

USDA Forest Service. 1980. History of wildlife management in the Intermountain region. Booklet 26-31. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 44 p.

Walker, J. W. 1994. Multi-species grazing: the ecological imperative. In: Sheep Research Progress Report No. 3. Dubois, ID: U.S. Experiment Station and University of Idaho Agricultural Research Service. 193 p.

Willard, E. E.; McKell, C. M. 1978. Response of shrubs to simulated browsing. Journal of Wildlife Management. 42(3): 514-519.

Strategies to Keep Wildlife Where You Want Them—Do They Work?

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Abstract—The Dry Beaver—Ladd Canyon Elk Enhancement project is a multi-year, multi-phase project designed to influence elk movement patterns from private land winter range to public land summer range. A combination of road closures, prescribed burning, fertilizing and salting was used to attract elk onto summer range. Thirty adult cow elk were radio-collared to determine if treatments were effective in attracting elk onto public land during summer. Preliminary results indicate elk movement patterns are being influenced by project treatments.

For nearly 100 years, elk (*Cervus elaphus*) have helped define a way of life in northeastern Oregon. From the early 1900's when elk were virtually extirpated except in isolated areas, to the present when herds are near all-time highs, these animals have influenced discussions and decisions on many levels. At local cafes and Federal office buildings, elk are a controversial topic.

Much of the controversy exists because of changes in land use, both on private and public land. The majority of traditional elk winter range has been converted to agricultural or urban uses. Public land summer range has been drastically altered in recent years by increased demands for logging, grazing, road building and recreation. Expanding elk populations also increased conflicts on private land winter range. These changes prompted wildlife managers, Federal land management agencies, and the private sector to employ a unique approach for resolving some of the resulting land use conflicts.

In 1991 a venture known as the Blue Mountains Elk Initiative (BMEI) was chartered by 21 organizations. The main goal was to improve elk management and elk habitat in the Blue Mountains of Oregon and Washington. It started as 11 trial projects with $50,000 funding and expanded in 4 years to requests for $1,000,000 to fund 50 projects. Additionally, in 1995, the BMEI received a commitment of another 5 years of support from charter members.

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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Most BMEI projects are done on public land to attract elk off private land where damage occurs. Early projects included fertilizing, prescribed burning, seeding, water developments, and aspen regeneration. While many early projects were "one time only" treatments, they did prove moderately successful. Prescribed burning or fertilizing of 500 to 700 acres was found to be effective on a local scale, influenced elk use for 3 to 5 years, and was cost effective.

Dry Beaver—Ladd Canyon Project: A Model

One of the early submissions to BMEI for funding was the Dry Beaver—Ladd Canyon Elk Enhancement project (DBLC). Unlike "one time only" projects, DBLC was a multi-year, multi-phase project done on a landscape scale. Furthermore, this particular area had a variety of background data that could be used to evaluate the effectiveness of project treatments.

The DBLC area lies in the center of the Starkey Wildlife Management Unit (750 mi^2). It is home to 3,500 to 4,000 of the estimated 8,000 elk in the unit. The Starkey Unit accounts for 10 percent of all Rocky Mountain bull elk (*C. e. nelsoni*) harvest and hunter recreation days in Oregon. DBLC includes a 65,000-acre winter range (several private landownerships) and a 55,000-acre summer range (primarily public land managed by the LaGrande Ranger District of the Wallowa-Whitman National Forest).

Over the past 25 years, migration patterns for elk in the DBLC project area have changed dramatically. An Oregon Department of Fish and Wildlife (ODFW) telemetry study done in 1988 to 1991 showed 12 of 18 radio-collared cows (67 percent, approximately 1,400 elk) never migrated from private land winter range to public land summer range (Van Dyke and Kemp 1990). Additional data indicated during severe winters 32 percent of radio-collared elk (approximately 450 elk), which were year-round residents on private land winter range, migrated west across the Blue Mountains into lower elevations of the Ukiah Wildlife Management Unit. These animals caused serious agricultural damage.

There were several reasons that may have brought about this change in migration patterns. The major influence was lack of motorized vehicle disturbance on access controlled private lands and the high level of vehicle use on the public lands. Lyon and Ward (1982) reported roads have a negative impact on elk, both from motorized vehicle disturbance and

as physical barriers. While almost all privately owned land in the DBLC has little or no public access, public lands have been through a period of extensive road building, and subsequently a dramatic increase in year-round forest activities. Prior to the DBLC project, open road densities on public land were greater than 3.5 miles/mi^2, while densities on private land were less than 0.5 mi/mi^2 (Thomas 1991). Logging, mushroom picking, ATV travel, woodcutting, and other recreational activities contributed to an exceptionally high activity level on public land during the critical spring and early summer calving period. Open road densities on public and private land were similar only during bull elk hunting seasons when two cooperative closures limited the open road density on public land to less than 1 mi/mi^2.

Lack of salt could be another possible factor influencing elk to change migration patterns (L. M. Kemp, personal communication). Elk use salt sites in the spring when forage is green. There had been no active grazing allotment on 60 percent of the public land for over 20 years prior to the DBLC project, therefore no domestic salt was available. Conversely, during this same time period all private land had been grazed, and salt was routinely put out for livestock. The decrease in the number of elk following spring green up on National Forest land summer range may have been influenced by the lack of salt on the higher elevation summer range.

Although no quantitative data on forage utilization or production were available for the DBLC area, forage on summer range was not thought to be a limiting factor (Thomas 1991). Livestock grazing on private land was more extensive. A possible forage deficit brought about by intensive livestock grazing and elk residing on private land year round may have stimulated elk to migrate over the Blue Mountains during hard winters.

Major insect epidemics between 1969 and the present may have influenced elk migration during hard winters. Douglas-fir tussock moth (*Orgyia pseudotsugata*), mountain pine beetle (*Dendroctonus ponderosae*), and western spruce budworm (*Choristoneura occidentalis*) epidemics led to the loss of important winter thermal cover on private land. High timber prices and a decrease in National Forest timber availability accelerated private land timber harvest and further reduced winter thermal cover availability.

Biologists from ODFW were limited in management options to control elk populations once elk became permanent residents on private land. Most private lands were fee hunted and had little public access during hunting seasons. Consequently, the lack of antlerless elk harvest allowed resident elk populations to increase rapidly. Meanwhile, elk inhabiting National Forest land were harvested more intensively. Hunting opportunities had to be increased in an attempt to reduce Starkey Unit elk population levels. The resulting under harvest of antlerless elk on private land and over harvest of antlerless elk on National Forest land heightened land use conflicts and presented a dilemma to ODFW biologists.

Strategies for Solution

In 1990 Tom Thomas (LaGrande Ranger District wildlife biologist) submitted a request to BMEI to fund the DBLC project, integrating a variety of methods to attract elk off private lands. The main objective was to redistribute 60 percent of elk spending the summer on private land winter range to public land summer range for at least 2 of the 4 summer months (June through September).

The most crucial project phase was implementation of an effective, year-round area closure prohibiting all motorized vehicle travel within DBLC except on designated open roads. Proposed open road density was less than 1 mi/mi^2. An environmental assessment (EA) was required to implement the closure. After several months of meetings, the LaGrande District Ranger signed a decision notice in July 1994 to implement the area closure. Three factors aided this decision. First, the LaGrande Ranger District was simultaneously implementing their Access and Travel Management Plan. Secondly, public comments received over a 3-year period were overwhelmingly in support of the project (more than 95 percent favorable). Lastly, outside funding sources committed dollars to DBLC under the assumption an area vehicle closure would be implemented. The BMEI, ODFW, Rocky Mountain Elk Foundation, and Seeking Common Ground all made early and substantial monetary contributions to support DBLC strategies.

Implementation of the area vehicle closure began in fall 1994 and was completed in spring 1995. Roads were closed by earthen berms, locked gates, or obliteration. Portal entry signs were installed at six main access points into the project area. Maps and brochures explaining DBLC were made available at portal signs as well as agency offices. "Road Closure Violation" report forms were also included in the brochure. Money was budgeted to change methods of closure if a barrier was found to be ineffective. The area vehicle closure was extensively monitored in the spring, summer and fall of 1995 to determine effectiveness.

Another phase of DBLC was large scale forage enhancement treatments. Even though forage was not likely to be a limiting factor, it was thought that any forage enhancement would only improve chances of attracting elk to public land. Prescribed burning, fertilizing, and seeding palatable species were proposed as forage treatments.

Traditional high elk use areas were treated first with prescribed fires starting in 1991. Adjacent areas were burned in later years. Total acres burned through fall 1995 were 2,335. A total of 1,200 acres were fertilized in 1994 and 1995 in areas of high and moderate elk use. No forage seedings had been done as of 1995.

Improving salt availability on public land was a project phase easily accomplished. Twenty-six historical salt sites were located and 300 lbs of mineral salt were stocked at each site during the fall and spring starting in 1993. Additional salt was provided as needed to assure availability at each site.

The last phase of the project was monitoring the effects of implemented treatments. Forage treatments were monitored through photopoints and vegetation measurements. The timing of spring green up was monitored from April to June weekly at each treatment site. In April 1995, 18 cages were randomly placed on two burns and one fertilized area, with six cages placed on nearby untreated sites. Vegetation was clipped starting in late July, dried, and weighed to evaluate forage productivity.

Overall project success was determined by monitoring elk migration from private land to public land during the summer. Thirty adult cow elk were captured on private land in late July 1993 and fitted with radio-collars. Each collar represented a ratio of one radio for approximately 115 elk, about the same as for the original Starkey telemetry project. Collaring was timed to occur after calving and the completion of the normal migration of elk to public land. Elk were usually monitored every 2 weeks in the spring, summer and fall. Telemetry flights were generally made only once a month during winter to determine if animals were migrating across the Blue Mountains and to check for mortality signals. Radio-collars recovered during hunting seasons were reapplied on other elk the following summer.

Project success was determined by documenting radio-collared elk moving onto public land during June, July, August or September. An average of 19 locations for each elk were documented for the three summers of 1993 to 1995. Elk were categorized as resident (two or less telemetry locations on public land), transient (more than two locations and less than 50 percent of all locations on public land), or migrant (more than 50 percent of all telemetry locations on public land). Only radio-collared elk alive for all three summers of the study were included in this preliminary analysis.

Preliminary Results

Since habitat improvements of DBLC were implemented over a 4-year period, some results are more definitive than others. Also, DBLC has one more year of implementation before final results can be assessed.

The area vehicle closure implemented in Spring 1995 proved to be highly effective. There were 16 violations in May, 10 in June, and 18 in July. Violations dropped to less than two per month in August, September, and October, probably due in part to the tradition of a hunting season road closure in this particular area. A few roads were documented as needing more effective closure methods to increase compliance. These will be modified in spring 1996. Public response to the closure was generally favorable, and in several instances, people voluntarily reported road closure violations and helped agency efforts in citing violators.

Both fertilizing and burning were found to be effective in increasing forage productivity. Forage measurements indicated treated areas were more productive and plant growth occurred at an earlier date than on untreated sites.

Salt sites were found to have heavy use in spring and moderate use in fall. Several sites had more than 300 lbs consumed in a season. Lesser used sites had over 150 lbs consumed. All sites had at least some elk use in both spring and fall. A problem in assessing elk use at some sites occurred when trespass cattle were found in the area in the summers of 1994 and 1995.

Overall, preliminary telemetry data indicated DBLC strategies were effective in attracting elk onto public land (table 1). Only 37 percent of collared elk (9, N = 24) were found to be year-round residents on private land winter range as compared to 67 percent (12, N = 18) found in the earlier Starkey telemetry project. While there was virtually no difference between DBLC and the original study in the number of elk considered to be migrants (21 percent and 22 percent, respectively), the number of transient elk increased dramatically in DBLC. Telemetry data from DBLC indicated 42 percent of collared elk (10, N = 24) spent at least some of the summer on public land, compared to only 11 percent (2, N = 18) on the original study.

Table 1—Preliminary telemetry data indicated a change in radio-collared elk movements between the original Starkey study and DBLC.

	Private land residents	Private/public transients	Public land migrants
DBLC (n = 24)	9 (37 percent)	10 (42 percent)	5 (21 percent)
Starkey (n = 18)	12 (67 percent)	2 (11 percent)	4 (22 percent)

It is apparent that DBLC has not influenced elk enough to the extent that they spend the majority of the summer on public land. However, it is unrealistic to expect elk to alter their movement patterns after only one summer of complete project implementation. This elk population changed movement patterns from an annual summer migration to 67 percent of the population not migrating at all, but did so over 20 years. The DBLC project hopes to reverse this change and see traditional migration patterns reestablished in perhaps 5 years. The most promising aspect the data have shown thus far is the change in the number of elk considered to be transient. Only 11 percent of the original study elk were found on public land for short periods of time. The 67 percent considered to be resident elk had no opportunity to become habituated to public land summer range and the better forage it offered. During the DBLC project the number of resident elk has decreased and subsequently, the number of transient elk has increased to 42 percent. This change indicates the likely possibility of success.

Even though transient elk spend only a short period of time on public land each summer, they at least have an opportunity to be affected by the DBLC forage improvements, salting and road closures. It is hoped that over the next few years, the elk will begin to spend even more time on public land. As these elk reestablish a more traditional migratory pattern to public land summer range, they will be imprinting their calves to spend more time there as well. It is possible these transient elk will become migrant and perhaps influence resident elk to become transient or migrant. Eventually, the population may once again exhibit annual summer migration patterns. From the preliminary results, it is not unrealistic to expect the DBLC project to meet the objective of redistributing 60 percent of the resident elk so they spend at least half the summer on public land.

References

Lyon, L. Jack; Ward, A. Lorin. 1982. Elk and land management. In: Thomas, Jack W.; Toweill, Dale E. Elk of North America ecology and management. Harrisburg, PA: Stackpole Books. 698 p.

Thomas, Tom. 1991. Dry Beaver—Ladd Canyon elk enhancement. Blue Mountains Elk Initiative Cost Share Proposals. 37 p.

Van Dyke, Walt; Kemp, L. Mike. 1990. Starkey Elk telemetry. Progress Report #2. Oregon Department of Fish and Wildlife. 5 p.

Wells Resource Management Plan Elk Amendment

Ray Lister
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Abstract—During the past 10 years, elk populations within the Bureau of Land Management's Wells Resource Area, Elko District, Nevada have expanded and now exceed reasonable numbers at the time the resource area's land use plan was completed. Due to the potential impacts these expanding elk populations might have on attainment of existing multiple use objectives, the Bureau of Land Management solicited the help of a Task Force comprised of resource management agency personnel, landowners, and special interest groups within the tri-State area of Nevada-Idaho-Utah. Their assignment was to identify issues, develop alternatives, and provide baseline information. As a result, the land use plan was amended and a preferred alternative was developed using a conservative, yet flexible, approach to resolving the issue of expanding elk populations. The Approved Wells Resource Management Plan Elk Amendment allows for expansion of target elk populations from the 1985 reasonable number of 400 to a population level of 2,200.

In accordance with the Federal Land Management and Planning Act of 1976, the Wells Resource Area of the Bureau of Land Management (BLM) completed its resource management plan in July, 1985, establishing management objectives for 4.3 million acres of public land in northeastern Nevada (USDI, Bureau of Land Management 1985). This resource management plan did not allocate forage for authorized grazing uses, rather it identified vegetation and habitat goals and objectives, "initial levels" of livestock and wild horses, and "reasonable numbers" of wildlife from which monitoring would be used as the basis for recommending adjustments in grazing uses. Reasonable numbers of wildlife included 400 elk (330 winter, 10 summer, 60 yearlong) within two specific management areas; Pilot Mountain and the Jarbidge Mountains.

Utah first released elk on Pilot Mountain near the Nevada-Utah border in 1944 and augmented that release in 1979 (State of Nevada Board of Wildlife Commissioners 1988). The Pilot Mountain elk introduced by Utah pioneered adjacent contiguous range in Nevada. In 1985, the Wells Resource Management Plan estimated the existing Pilot Mountain elk herd to be 165 (60 yearlong, 105 winter) with a reasonable number of 290 (60 yearlong, 230 winter). Currently, the Pilot Mountain herd is estimated to be 350 to 400, of which approximately 200 to 250 are using public land habitat in the Wells Resource Area (Williams 1994).

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In 1985, the Jarbidge Mountains were identified as a future management area with a reasonable number of 110 elk (10 summer, 100 winter) for public lands in the Wells Resource Area. In January, 1990, an elk reestablishment effort was completed on adjacent Humboldt National Forest lands (Nevada Division of Wildlife and others 1990). To date, the Jarbidge elk herd has remained within identified management areas on Elko District BLM lands and Humboldt National Forest lands and currently totals approximately 130 to 150 elk, of which about 40 to 60 are using habitat on public lands in the Wells Resource Area.

In 1988, the Nevada State Board of Wildlife Commissioners issued a policy statement, which recognized that elk populations in the Wells Resource Area had grown steadily and that dispersing animals had attempted to voluntarily pioneer nearby mountain ranges. However, at that time, successful establishment of permanent populations by these dispersing elk had not been conclusively demonstrated. Therefore, the Pilot Mountain elk herd was identified as the only established elk population in the Wells Resource Area.

Elk populations in the Wells Resource Area continued to expand and pioneer adjacent unoccupied habitats from Pilot Mountain. Elk were also beginning to immigrate into the resource area from occupied habitats in northwestern Utah and southern Idaho. In 1990, the Nevada Division of Wildlife identified three new established herd areas adjacent to the Pilot Mountain herd. These herds were considered established because they maintained a breeding nucleus of animals for the past 4 to 8 years, were commonly sighted throughout the year, and did not appear to migrate to Pilot Mountain or to other areas seasonally. Currently, the elk population in the Wells Resource Area exceeds the reasonable numbers identified in 1985 and is estimated to be 390 to 575 (Williams 1994).

Increased Levels of Concern

As elk numbers in the resource area increased, so did the level of concern for potential impacts to existing resource uses and the attainment of existing multiple use objectives. In general, livestock permittees were of the opinion that the entire public land forage resource had already been adjudicated and there was no forage available for elk. The views of hunters and recreationists were mixed. Some felt that perhaps existing livestock numbers should be reduced to a level which would have less impact on big game habitat. Others, however, wished to see elk use in the Wells Resource Area maximized without compromising existing livestock and wild horse use levels. The Nevada Division of Wildlife took the position that the Wells Resource Area had the potential to support an elk population greater than current levels without

impacts to existing uses and were willing to commit to establishing population targets to guide future elk management.

Based on the level of concern, it was determined the best way to address the issue was through an environmental assessment level amendment of the Wells Resource Management Plan. The objectives for the amendment were to establish elk habitat management areas, identify habitat requirements and specific management objectives and practices, establish target elk population management levels, develop factors for attainment and future adjustments in elk population management levels, and identify constraints on other resources.

Several planning criteria were established to guide the development of the resource management plan amendment. These planning criteria made it clear that an amendment of the land use plan to address the issue of expanding elk populations was to be accomplished without impacting existing resource values and uses. In other words, the expansion of elk populations in the Wells Resource Area up to target levels would not affect existing domestic livestock permits and licensed animal unit months (AUMs), wild horse appropriate management levels (AMLs), or wildlife use levels identified in the existing Wells Resource Management Plan.

Formulating a Task Force

The Wells Resource Area contains 5.7 million acres, of which 4.3 million are public lands administered by the Bureau of Land Management. Elk are highly mobile and adaptable creatures that do not recognize administrative boundaries. Therefore, it became evident that elk management decisions in the Wells Resource Area could have impacts on adjacent private and public lands within the tri-State region of Nevada-Utah-Idaho. Conversely, elk management decisions on public lands in adjoining States could have impacts on private and public lands in the Wells Resource Area. Therefore, a regional approach was felt to be most appropriate in addressing the issue of pioneering elk.

In 1992, the Bureau of Land Management formulated a Task Force to help address the pioneering elk issue in the most efficient manner possible. The Task Force consisted of 17 representatives from four Bureau of Land Management District offices, two Forest Service Ranger District offices, three State wildlife agency offices, the Nevada State Board of Wildlife Commissioners, the Rocky Mountain Elk Foundation, the Elko County Advisory Board to Manage Wildlife, the Elko County Board of Commissioners, and three private landowners within the tri-State area. The hope was that a Task Force, representing diverse and often conflicting interests, would be able to openly communicate and assist the Bureau of Land Management to reach a common ground in addressing the pioneering elk issue and identify elk management objectives which would best meet the needs of all those concerned.

The Task Force assisted the Bureau of Land Management in: (1) formulating planning issues, (2) identifying the scope of analysis, (3) developing a public scoping document, (4) reviewing public comments, (5) identifying management alternatives to be considered, (6) providing baseline information, and (7) selecting a preferred alternative.

Identifying the Issue

Issues drive the resource management planning process and indicate specific concerns that the BLM and public may have regarding the management of specific resources in a planning area. An issue is defined as an opportunity, conflict, or problem pertaining to the management of public lands and associated resources. Identification of issues orients the planning process so that the effort of an interdisciplinary analysis and documentation are directed toward resolution of the issues.

Through use of the Task Force and public scoping, it was determined that the amendment to the resource management plan would only address the issue of elk habitat management. In addressing this issue, the amendment would respond to the following planning questions:

1. Where will elk be managed on public lands in the Wells Resource Area?
2. What habitat requirements and specific management objectives and practices are needed for elk?
3. What target elk population level will habitat be managed to support?
4. How will elk population management levels be achieved or maintained?
5. How will adjustments be made in elk population management levels?
6. What constraints, if any, will be placed on other resource uses?

Formulating Management Alternatives

After receiving initial comments from the public, the Task Force was asked to formulate a reasonable range of management alternatives to be analyzed. These alternatives ranged from no action to maximizing elk numbers at the expense of all other existing resource uses. A total of nine management alternatives were developed by the Task Force (USDI, Bureau of Land Management 1995). However, four were eliminated from further consideration because they did not adequately address the elk management issue nor comply with the planning criteria established for the amendment to the resource management plan.

The no action alternative was defined as those reasonable numbers described in the existing resource management plan. In other words, under the no action alternative, the resource management plan would not be amended and elk management objectives would not be developed for areas outside the Pilot and Jarbidge Mountain areas.

Under the existing land use plan (no action alternative), elk populations in the Wells Resource Area would be allowed to expand as a result of populations being established through "pioneering" outside existing management areas or through immigration into the resource area. Population expansion would be allowed to the extent that elk were not preventing attainment of existing multiple use objectives. The Task Force agreed that at 1992 population levels, elk were not preventing attainment of existing multiple use objectives. However, it was felt that common ground surrounding the elk management issue in the Wells Resource Area could best be achieved by establishing target population levels.

Based on information provided by Task Force members, a reasonable range of intermediate alternatives was developed based on elk densities per square mile experienced in similar habitats elsewhere in the Great Basin. Based on this input, it was determined that low potential elk habitats were capable of supporting 0.5 elk/square mile, moderate potential habitat 2.5 elk/square mile, and high potential habitat 4.0 elk/square mile (USDI, Bureau of Land Management 1993).

The Task Force first agreed to divide the Wells Resource Area into six management areas which closely coincided with existing Nevada Division of Wildlife big game management zones. Elk habitat within each of these six management areas was classified as having either low to moderate or moderate to high potential. Moderate to high potential habitat would have the capability of supporting 2.5 to 4.0 elk/square mile or an average of 3.25. Low to moderate potential habitat could support 0.5 to 2.5 elk/square mile or an average of 1.5. Applying these elk habitat classifications and densities to the public land acres in the Wells Resource Area resulted in a maximum supportable elk population of 12,868 at the expense of all other existing uses (USDI, Bureau of Land Management 1993).

The Task Force agreed that existing resource uses and values must be maintained. It was also agreed that elk management objectives for the Wells Resource Area needed to be established with definitive target population levels for which the Nevada Division of Wildlife would be committed to manage until monitoring could support adjustments. Therefore, a range of intermediate alternatives was developed by the Task Force with these goals in mind.

In addition to a no action alternative, the Task Force developed four intermediate alternatives to be analyzed (USDI, Bureau of Land Management 1994). A limited growth alternative was based on current growth and harvest estimates projecting a total resource area population that would be achieved by 1998. This alternative would have a target elk population of 1,000. Three other alternatives were based on low, moderate, and high elk densities of 1.5, 2.5, and 3.5 elk/square mile, respectively. To maintain a conservative approach, these elk densities were then only applied to the public land acres of moderate to high potential habitat within each of the six proposed management areas. Low to moderate potential habitats within each of the six proposed management areas were not included when developing proposed target populations.

Task Force members representing private land interests were concerned for the impacts of elk management on public lands to adjacent private land resources. Therefore, in a further effort to maintain a conservative approach and address the potential for conflict associated with elk use on adjacent private land resources, the Task Force agreed to a private land adjustment factor. This adjustment factor was determined by the percentage of public lands within each management area (for example, 90 to 100 percent public lands = 1.0 adjustment factor, 80 to 90 percent = 0.75, and less than 80 percent = 0.5) and was applied to the low, moderate, and high density target population levels determined for each management area. The result was a low density alternative of 2,200 elk, a moderate density alternative of 3,500 elk, and a high density alternative of 4,800 elk.

Available Forage Analysis

The existing resource management plan did not allocate forage to the competing grazing uses. Rather, it established initial stocking levels for livestock and wild horses and reasonable numbers for wildlife from which monitoring would form the basis for making necessary adjustments in grazing use. Similarly, the proposed amendment established a target elk population for the Wells Resource Area from which adjustments would be made based on monitoring. To assist in the impact assessment in the environmental assessment, an analysis of available elk forage was developed (USDI, Bureau of Land Management 1994). This available elk forage analysis was based primarily on analysis of livestock and wild horse use pattern mapping data and presented a range of elk numbers which could be supported by forage currently determined unavailable to livestock. Several assumptions were developed to qualify the available forage analysis as follows:

1. Calculating a range of elk numbers supported only by forage or habitat areas currently unavailable to livestock or wild horses assumes a complete dietary overlap which does not exist.
2. Only those areas determined unavailable to livestock within moderate to high potential elk habitats were included, negating the potential for low to moderate potential habitats to support elk.
3. Public acres within moderate to high potential habitats designated as unavailable to livestock could decrease, reducing those acres and AUMs unavailable to livestock, with the development of rangeland improvement projects, particularly water developments.
4. All acres labeled unavailable or unsuitable to livestock were considered suitable for elk. However, some habitat limitations could exist within moderate to high potential habitats.

To compensate for the limitations inherent to the assumptions described here, several conservative factors were used to determine (for analysis purposes) the range of elk numbers which could be supported within each proposed management area:

1. Only public land acres within moderate to high potential habitat areas were included in the analysis.
2. Not all forage or habitat areas unused by livestock were included. Only those public acres stratified as receiving zero use and only 10 percent of those acres stratified as receiving slight use by livestock were included.
3. The AUMs calculated as unavailable to livestock were based on 11.4 acres/AUM. This is the overall average based on the total public land acres within the resource area and current active livestock grazing preference. Forage production within those areas unavailable to livestock would most likely be greater than the average due to higher elevations, greater precipitation, and later seral stage conditions.
4. In order to express available AUMs in terms of elk numbers, a conversion factor was applied that expresses the forage requirements of elk relative to the requirements of an animal unit (one mature domestic cow of approximately 1,000 pounds, and her calf up to 6-months of age, five sheep, or one horse). The existing resource management plan uses

a conversion factor of 1.25 elk/AUM (USDI, Bureau of Land Management 1985). However, current literature supports conversion factors ranging as high 3.7 elk/AUM (Anderson 1978; Nelson 1982; Rintamaki 1992; Utah Division of Wildlife Resources 1987). Because of these variabilities, the Task Force agreed to present a range of elk numbers supportable by AUMs determined unavailable to livestock. This range of elk numbers was calculated based on a low-range conversion factor of 1.25 elk/AUM and a high-range of 3.1 elk/AUM.

Preferred Alternative

The elk available forage analysis determined public acres of moderate to high potential habitat within each proposed management area which were unavailable to livestock and wild horses based on use-pattern mapping data. Only those areas identified as receiving zero use and 10 percent of those areas receiving slight use by livestock were included. These acres were then converted to AUMs by using the resource area average of 11.4 acres/AUM calculated by the total public lands acres in the resource area divided by the total livestock grazing preference. The forage demand for wild horses was then subtracted from these AUMs determined unavailable to livestock, resulting in an estimate of AUMs available for elk. By applying a low-end conversion factor of 1.25 elk/AUM and a high-end conversion factor of 3.1 elk/AUM, a range of 1,125 to 2,789 elk was determined to be supportable by forage unavailable to livestock and wild horses.

The Task Force reached consensus and the low density alternative (2,200 elk) was selected as the preferred alternative. The Task Force felt that this alternative demonstrated the most conservative approach to establishing a target elk population for the Wells Resource Area consistent with existing resource values and uses. The impact analysis presented in the environmental assessment for the proposed amendment to the resource management plan supported the preferred alternative as being compatible with all existing uses within the resource area and consistent with maintaining a sustainable and biologically diverse ecosystem within the tri-State area.

References

Anderson, L. D. and Denton, J. W. 1978. Base Data Analysis Required for Forage Allocation. Preliminary Draft, Bureau of Land Management Technical Note.

Nelson, Jack and Leege, Thomas A. 1982. Manuscript on Nutritional Requirements and Food Habits for Elk of North America.

Nevada Division of Wildlife, and others. 1990. Jarbidge Elk Six-Party Agreement.

Rintamaki, R. C. 1992. U.S. Department of Agriculture, Soil Conservation Service. Nevada Technical Notes. Estimating Forage Requirements for Game Species. Adapted from Wyoming Technical Note Biology No. 37, July, 1988.

State of Nevada Board of Wildlife Commissioners. 1988. Commission Policy Number 26: Re-establishing, Introducing, Transplanting and Managing Pioneering Rocky Mountain Elk.

USDI, Bureau of Land Management. 1985. Wells Resource Management Plan Record of Decision. Elko District, Elko, NV.

USDI, Bureau of Land Management. 1993. Public scoping document issued for Wells Resource Management Plan Draft Elk Amendment. Elko District, Elko, NV.

USDI, Bureau of Land Management. 1994. Wells Resource Management Plan Draft Elk Amendment. Elko District, Elko, NV.

USDI, Bureau of Land Management. 1995. Wells Resource Management Plan Proposed Elk Amendment. Elko District, Elko, NV.

Utah Division of Wildlife Resources Utah Department of Natural Resources. 1987. Guidelines for Evaluating Annual Crop Losses Due to Depredating Big Game. Publication No. 87-5.

Williams, Joe. 1994. Nevada Division of Wildlife, Region II Big Game Biologist, personal communication.

Use of Sheep to Improve the Nutritional Quality of Elk Winter Range Forage in Northeastern Oregon

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Abstract—Clipping bluebunch wheatgrass (*Agropyron spicatum*) plants under three different phenological stage/intensity level combinations resulted in significant changes in crude protein, *in vitro* dry matter digestibility, and dry matter production in early winter forage samples compared to an unclipped control ($P < 0.05$). Late spring clipping treatments produced changes in basal area of individual bluebunch wheatgrass plants ($P < 0.05$). Statistical analysis of an experiment examining the effect of late spring domestic sheep (*Ovis aries*) grazing on winter forage quality and forage and habitat utilization by Rocky Mountain elk (*Cervus elaphus nelsoni*) is in progress.

In northeastern Oregon, as in other Western States, much of the traditional Rocky Mountain elk (*Cervus elaphus nelsoni*) winter range has been lost to urban expansion and agricultural development (Lyon and Ward 1982; Vavra 1992; Cronyn and Workman 1994; Sheehy and Vavra 1995). Currently, many elk in northeastern Oregon winter on what was traditionally transitional range (Skovlin and Vavra 1979; Sheehy and Vavra 1995), a substantial portion of which occurs on private lands used as spring and fall range for livestock grazing (Nelson 1982; Sheehy 1987; Sheehy and Vavra 1996). Use of these private rangelands by elk during the winter and early spring can result in losses of spring and summer livestock AUMs (Nelson 1982) and potentially generate conflict between private landowners and big game management agencies (Vavra 1980; Long 1989; Lacy and others 1993; Clark 1994). This potential for conflict emphasizes the need for better tools to manage winter elk distribution.

Area

Our objective was to examine the feasibility of using late spring livestock grazing as a tool to improve the nutritional quality of winter forage for elk and to manage winter elk distribution. The study was conducted from 1992 to 1995 on an elk winter range located on National Forest land adjacent to Starkey Experimental Forest and Range approximately 42 km southwest of La Grande, OR. The climate on the study area was continental with cold winters and warm summers. Precipitation came primarily as winter snow and spring rain.

The study consisted of two experiments. The first experiment was part of a series of studies (Bryant 1993; Westenskow-Wall and others 1994) conducted at this study area that evaluated the effects of late spring clipping treatments on the nutritional quality and vigor of bluebunch wheatgrass (*Agropyron spicatum*). These clipping experiments were conducted within 0.5 ha (1 acre) livestock exclosures that were constructed in 1986 at two sites on the study area, McCarty Spring and Winter Ridge. The McCarty Spring exclosure was located on a gently sloping (0-5 percent), westerly aspect at 1,274 m in elevation. The elevation at the Winter Ridge exclosure was 1,366 m with a gently sloping (0-5 percent), south-southwesterly aspect. The plant community classification for both sites was bunchgrass on shallow soil, gentle slopes, GB-49-11 (Hall 1973). The dominant perennial species were bluebunch wheatgrass, Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*) and western yarrow (*Achillea millefolium*). Soils at both sites were shallow, extremely stony to very cobbly, loams and silt-loams of the Anatone-Bocker complex (Dyksterhuis and High 1985; Bryant 1993).

The second experiment of the current study examined the effect of late spring domestic sheep (*Ovis aries*) grazing on: (1) the nutritional quality of bluebunch wheatgrass, Idaho fescue, and elk sedge (*Carex geyeri*); (2) winter elk utilization of bluebunch wheatgrass, Idaho fescue, and elk sedge; and (3) winter elk distribution as determined by telemetry. This experiment was conducted near the McCarty Spring livestock exclosure used in the clipping experiment.

Methods

Clipping Experiment

The area within each livestock exclosure was divided into 10 m by 10 m plots. Four late spring clipping treatments, as described below, were assigned to these plots under a completely randomized experimental design.

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Bluebunch wheatgrass plants within the treatment plots were either left unclipped as a control or were clipped to a 7.62 cm (3 inches) stubble height under three different phenological stage/clipping intensity combinations: (1) mid boot/whole plant clipped, (2) mid boot/half of the plant's basal area clipped and, (3) seedhead emergence/whole plant clipped. Forage samples from each treatment were collected in early November. Treatment effects on crude protein, *in vitro* dry matter digestibility, and dry matter production were examined. Also in early November, tagged bluebunch wheatgrass plants from each late spring clipping treatment were either clipped to a 2.5 cm (1 inch) stubble height to simulate early winter utilization by elk or left unclipped. The percent change in basal area of the tagged plants was evaluated at the hard seed phenological stage 1 year after the application of the late spring clipping treatments. Each of the four late spring clipping treatments was replicated four times at each study site. The experiment was repeated during two consecutive years (1993 and 1994) using new plots each year.

Grazing Experiment

Six nearly parallel, forested drainages were selected from those available in the study area. A 20 ha (49 acre), rectangular plot was established on each drainage, with the long axis of the plot oriented parallel to the drainage direction. Each plot had a similar aspect, elevation, and amount and distribution of three dominate vegetation types: (1) an open ridgetop grassland type, (2) a forest-grassland savanna type and, (3) a forested stringer drainage type. The most prominent perennial species in the ridgetop grassland type were bluebunch wheatgrass, Idaho fescue, and western yarrow. Ponderosa pine (*Pinus ponderosa*) dominated the overstory in the forest-grassland savanna type with Idaho fescue, elk sedge, and bluebunch wheatgrass in the understory. The overstory of the forested stringer type was made up of grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), and ponderosa pine with elk sedge, pine grass (*Calamagrostis rubescens*), and ninebark (*Physocarpus malvaceus*) forming the understory.

Three locational blocks of paired plots were formed from the six plots. Using a randomized block experimental design, each plot within a block was randomly assigned to either the late spring domestic sheep grazing treatment or left ungrazed as a control. Electric fencing was used to confine the sheep within the grazed plots and exclude the sheep from the control plots. In the grazed plots, sheep grazing was applied during the mid to late boot stage of bluebunch wheatgrass until approximately 50 percent utilization was obtained on at least one of the three dominant, graminoid forage species within the plots: (1) bluebunch wheatgrass, (2) Idaho fescue and, (3) elk sedge. The experiment was repeated during two consecutive years (1994 and 1995). However, treatment assignment of the two plots within each locational block was reversed during the second year to simulate the effect of a rest-rotation grazing system. Forage samples and elk utilization data were collected in early November and again in early March of each year to evaluate the nutritional quality and elk utilization responses to the livestock grazing treatments. Winter elk distribution was assessed using telemetry data obtained from 15 adult cow elk with a Loran-based telemetry system located at Starkey Experimental Forest and Range. Elk locations were obtained at 1 hour intervals, 24 hours per day, throughout the winters of 1994 and 1995. To evaluate the influence of habitat and environmental variables on winter elk utilization and distribution responses to the grazing treatments; topographic and canopy closure data were collected from the grazing plots during the summer of 1992 and, weather and snow characteristics data were collected during the winter 1993 (pretreatment winter) and during the winters of 1994 and 1995 (treatment winters).

Results

Clipping Experiment

The mid boot/whole plant and seedhead emergence treatments had similar effects on the nutritional quality of early winter forage samples of bluebunch wheatgrass. Percent crude protein and percent *in vitro* dry matter digestibility were highest ($P < 0.05$) in the mid boot/whole plant and seedhead emergence treatments (figs. 1 and 2). The mid boot/half plant treatment resulted in intermediate levels of percent crude protein and percent *in vitro* dry matter digestibility. Samples from the unclipped control had the lowest percent crude protein ($P < 0.05$) and lowest percent *in vitro* dry matter digestibility ($P < 0.05$). Dry matter production (kg/ha) was highest in the unclipped control ($P < 0.05$) while the two mid boot treatments yielded intermediate levels of dry matter and the seedhead emergence treatment resulted in the lowest ($P < 0.05$) level of dry matter production (fig. 3).

Highly significant differences in the percent change in basal area were found in tagged bluebunch wheatgrass plants receiving the late spring clipping treatments ($P = 0.0001$). The mid boot/half plant treatment and the unclipped control

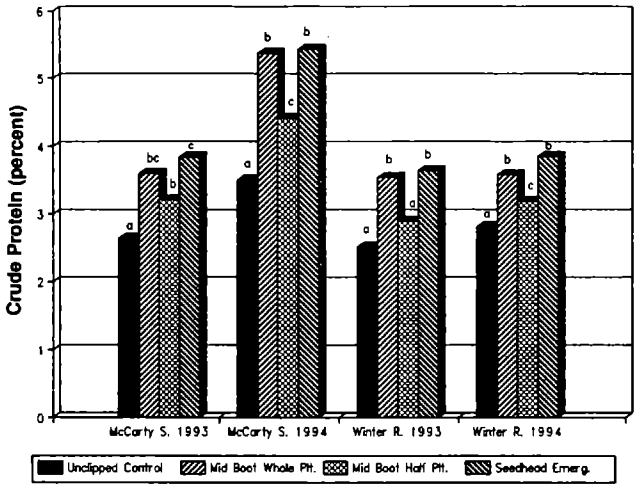

Figure 1—Percent crude protein in early winter forage samples of bluebunch wheatgrass from the late spring clipping treatments. Bars with different letter codes were significantly different ($P < 0.05$) within location/year combinations.

produced statistically similar ($P > 0.05$), positive changes in basal area while the mid boot/whole plant and the seedhead emergence treatments resulted in similar ($P > 0.05$), negative changes in basal area (fig. 4).

No significant differences ($P = 0.1257$) were detected between tagged plants receiving only the late spring clipping treatments and tagged plants receiving both the late spring and early winter clipping treatments (fig. 5).

Grazing Experiment

Statistical analyses of late spring livestock grazing effects on the nutritional quality of elk winter range forage, forage utilization by elk, and winter elk distribution were still in progress at the time of this writing.

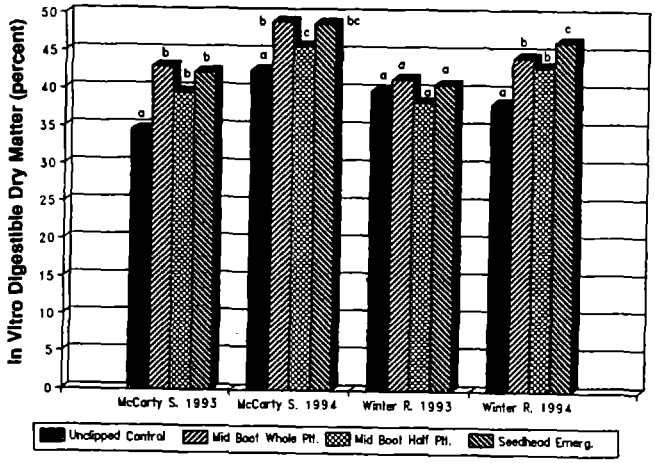

Figure 2—Percent *in vitro* dry matter digestibility of early winter forage samples of bluebunch wheatgrass from the late spring clipping treatments. Bars with different letter codes were significantly different ($P < 0.05$) within location/year combinations.

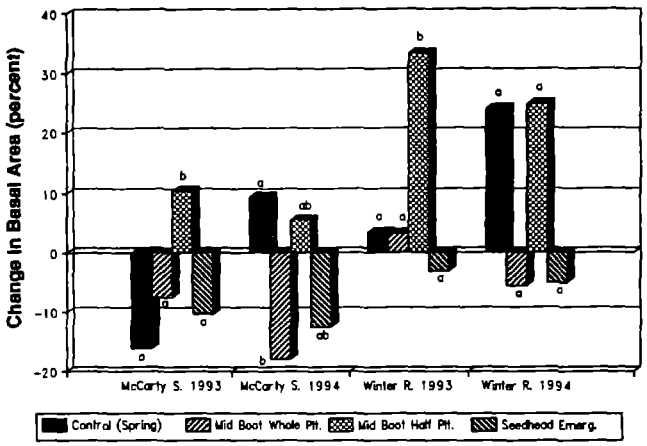

Figure 4—Percent change in the basal area of individual bluebunch wheatgrass plants 1 year after receiving only a late spring clipping treatment. Bars with different letter codes were significantly different ($P < 0.05$) within location/year combinations.

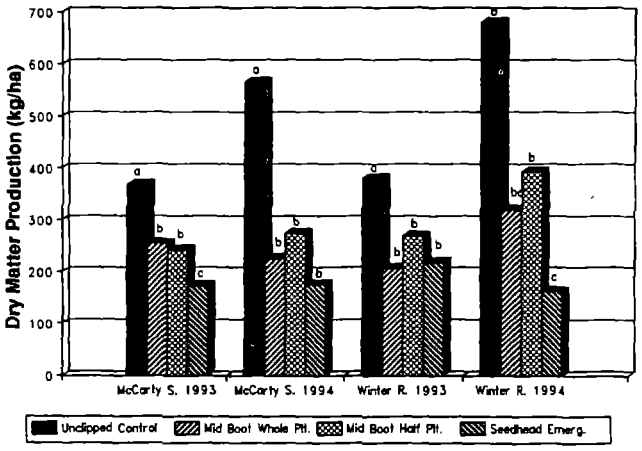

Figure 3—Dry matter production (kg/ha) in early winter forage samples of bluebunch wheatgrass from the late spring clipping treatments. Bars with different letter codes were significantly different ($P < 0.05$) within location/year combinations.

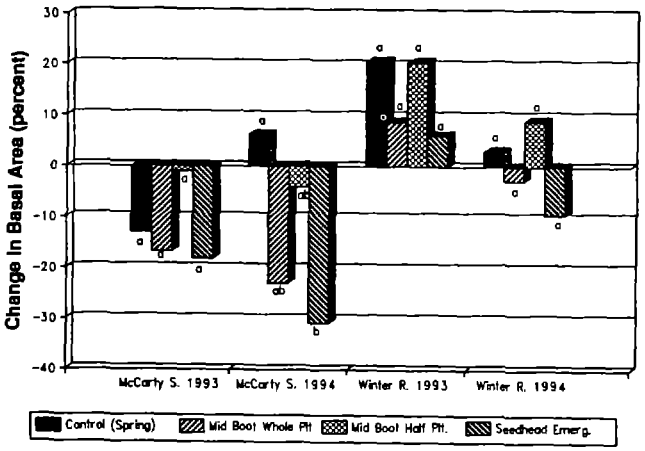

Figure 5—Percent change in the basal area of individual bluebunch wheatgrass plants 1 year after receiving a late spring clipping treatment and an early winter clipping treatment. Bars with different letter codes were significantly different ($P < 0.05$) within location/year combinations.

Discussion

Preliminary results of this study suggest the early winter nutritional quality of bluebunch wheatgrass may be improved by defoliation to a 7.62 cm (3 inch) stubble height during the mid boot or seedhead emergence phenological stages. The findings of Pitt (1986), Bryant (1993), and this study support the hypothesis presented by Anderson and Scherzinger (1975) that the potential exists for improving the nutritional quality of winter elk forage with late spring livestock grazing. However, attempts to tailor grazing management systems to enhance the forage quality on elk winter range should also emphasize the sustainability of the forage resource. Data from the present study indicate a potentially useful grazing management system may be one designed to achieve a light to moderate level of defoliation of bluebunch wheatgrass plants during the mid boot stage. If one half the basal area of individual bluebunch wheatgrass plants was grazed to a stubble height of 7.62 cm (3 inches) by livestock, the nutritional quality of the winter forage from these plants may be significantly enhanced compared to ungrazed plants and the vigor of the grazed plants could potentially be similar to ungrazed plants.

The effect of competing plant species on the nutritional quality and vigor of bluebunch wheatgrass was not directly evaluated in this study. Mueggler (1972) found the partial reduction of competition by neighboring plant species reduced the negative effect defoliation had on the vigor of bluebunch wheatgrass plants. The grazing experiment in the current study examined the nutritional quality of bluebunch wheatgrass, Idaho fescue, and elk sedge under practical conditions where the competitive relationship between neighboring plants was modified by livestock grazing. Analysis of the data from the grazing experiment may provide information on whether spring sheep grazing was as effective as clipping for improving the nutritional quality of elk winter range forage and, whether wintering elk responded to the sheep grazing treatments by increasing or decreasing forage utilization and occupancy on the grazed plots as compared to the ungrazed control plots.

Acknowledgments

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References

Anderson, E. W.; Scherzinger, R. J. 1975. Improving quality of winter range forage for elk by cattle grazing. Journal of Range Management. 28: 120-125.

Bryant, L. D. 1993. Quality of bluebunch wheatgrass (*Agropyron spicatum*) as a winter range forage for Rocky Mountain elk (*Cervus elaphus nelsoni*) in the Blue Mountains of Oregon. Ph. D. Dissertation. Corvallis, OR: Oregon State University. 147 p.

Clark, P. E. 1994. Livestock-big game interactions: A selected review with emphasis on literature from the Interior Pacific Northwest. Submitted to: Eastside Ecosystem Management Project. Walla Walla, WA. 109 p.

Cronyn, N.; Workman, J. P. 1994. Improved foothill rangelands—an economic analysis. Rangelands. 16: 110-113.

Dyksterhuis, E. L.; High, C. T. 1985. Soil survey of Union Country area, Oregon. Washington, D.C.: U.S. Department of Agriculture, Soil Conservation Service. 194 p.

Hall, F. C. 1973. Plant communities of the Blue Mountains in eastern Oregon and southeastern Washington. Area Guide R6 3-1. Portland, OR: U.S. Department of Agriculture, Forest Service, Region 6.

Lacey, J. R.; Jamtgaard, K.; Riggle, L.; Hayes, T. 1993. Impacts of big game on private land in southwestern Montana: landowner perceptions. Journal of Range Management. 46(1): 31-37.

Long, W. M. 1989. Habitat manipulations to prevent elk damage to private rangelands. General Technical Report RM-171. Fort Collins, CO: U.S. Department of Agriculture, Rocky Mountain Forest and Range Experiment Station: 101-103.

Lyon, L. J.; Ward, A. L. 1982. Elk and land management. In: Thomas, J. W.; Toweill D. E., eds. Elk of North America: ecology and management. Harrisburg, PA: Stackpole Books: 443-477.

Mueggler, W. F. 1972. Influence of competition on the response of bluebunch wheatgrass to clipping. Journal of Range Management. 25(2): 88-92.

Nelson, J. R. 1982. Relationships of elk and other large herbivores. In: Thomas, J. W.; Toweill, D. E., eds. Elk of North America: ecology and management. Harrisburg, PA: Stackpole Books: 415-441.

Pitt, M. D. 1986. Assessment of spring defoliation to improve fall forage quality of bluebunch wheatgrass (*Agropyron spicatum*). Journal of Range Management. 39(2): 175-181.

Sheehy, D. P. 1987. Grazing relationships of elk, deer, and cattle on seasonal rangelands in northeastern Oregon. Ph. D. Dissertation. Corvallis, OR: Oregon State University. 269 p.

Sheehy, D. P.; Vavra, M. 1995. Managing wildlife in incomplete habitats. Natural Resource News. La Grande, OR: Blue Mountain Natural Resources Institute. 5(2): 5-7.

Sheehy, D. P.; Vavra, M.; 1996. Ungulate foraging areas on season rangeland in northeastern Oregon. Journal of Range Management. 49(1): 16-23.

Skovlin, J.; Vavra, M. 1979. Winter diets of elk and deer in the Blue Mountains, Oregon. Res. Pap. PNW-260. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 21 p.

Vavra, M. 1980. Problem analysis—forage allocation for big game and livestock in northeastern Oregon. Unpubl. Rep. La Grande, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry and Range Science Laboratory. 37 p.

Vavra, M. 1992. Livestock and big game forage relationships. Rangelands. 14(2): 57-59.

Westenskow-Wall, K. J.; Krueger, W. C.; Bryant, L. D.; Thomas, D. R. 1994. Nutrient quality of bluebunch wheatgrass regrowth on elk winter range in relation to defoliation. Journal of Range Management. 47(3): 240-244.

Dietary Overlap and Preference of Elk and Domestic Sheep in Aspen-Dominated Habitats in North-Central Utah

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Abstract—Dietary overlap and preferences of elk (*Cervus elaphus*) and domestic sheep sharing a common 100.1-km^2 range dominated by aspen in north-central Utah are reported for May-October 1994. Mean dietary overlap was 36.4 ± 32.8 percent in summer, and 40.5 ± 37.1 percent in fall. Crude protein (CP) was the most consistent nutritional component influencing variation in elk preference for forage. Total nonstructural carbohydrates (TNC) were the most consistent nutritional fraction influencing sheep selection of forages. Natural mineral licks provided essential elements, including Mg for elk in the study area. Salt placed for sheep was lacking in Mg, and during summer, sheep exhibited a preference for Mg-rich forages. Changes in availability of important minerals such as Na and Mg are hypothesized to cause changes in dietary overlap because this may cause elk and sheep to select different forage species.

Much debate centers on whether elk (*Cervus elaphus*) compete temporally and/or spatially for forage plants used by livestock on rangelands in the western United States. It is important to know the botanical composition of sympatric elk and livestock diets, and the landscapes on which they feed, to determine if dual use of resources does exist, and at what levels. Plant nutritional factors contributing to grazing animal forage preferences include content of water, minerals, protein, and carbohydrates (Skiles 1984). Preference for similar forages based on these nutritional resources contributes to dietary overlap. When dietary overlap is high, increases in wild and/or domestic animal numbers can be expected to result in vegetational changes such as: decreases in plant diversity and vigor; decreases in preferred plants; and increases in poisonous taxa.

There is a broad literature concerning elk and cattle interactions on summer ranges in the Western States and Canadian Provinces; however, there is a paucity of literature on elk and domestic sheep interactions on summer ranges in the West. Nichols (1957a,b) and Pickford and Reid (1943) detailed forage use by elk and domestic sheep using common summer ranges in northwestern Colorado and northeastern Oregon, respectively. Their studies concerned use of small (less than 307.4 ha) mountain meadows that were not associated with aspen habitats. MacCracken and Hansen (1981) compared diets of domestic sheep grazing in spring on south-central Colorado winter ranges with diets of elk and mule deer (*Odocoileus hemionus*) that used the same ranges in winter. Olsen and Hansen (1977) reported seasonal food relations of elk and domestic sheep in the Red Desert of southwestern Wyoming.

A study conducted from May-October 1993 and 1994 on the 100.1-km^2 Willow Creek Demonstration Area on the Heber Ranger District, Uinta National Forest, addressed multidimensional impacts of range interactions between elk and domestic sheep in aspen-dominated ecosystems of north-central Utah. This paper reports findings from the 1994 data set in relation to how diet preference (electivity) for forage (elk in spring, summer, and fall; sheep in summer and fall) was related to nutritional fractions and thus influenced dietary overlap.

Methods

Data Collection

Herds of elk and bands of sheep were located randomly throughout eight sheep grazing allotments in the Willow Creek Demonstration Area. In each herd or band, one animal was randomly selected using a random digits table. The behavior of this animal was determined using focal-animal sampling (Altmann 1974) and recorded. When the focal elk or sheep was foraging on herbaceous or woody vegetation, a feeding site was designated.

Workers returned to measure micro and macrohabitat variables and vegetation at feeding sites within one week after initial observations of feeding elk and sheep. The location where the selected elk or sheep was foraging was designated as the center location, whereon a 100-m^2 vegetation sampling plot was established. Five 0.25-m^2 microplots were nested in each 100-m^2 plot and a list was made of all herbaceous species rooted in these nested plots. An ocular estimate was recorded of the percent biomass of each herbaceous species removed through herbivory in each 0.25-m^2

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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microplot. Residual herbage was clipped, weighed, and saved for future analyses. Utilization of woody species was determined by selecting the closest shrub or tree to the center of the feeding site and ocularly estimating the percent biomass ingested by elk or sheep. An equivalent amount of material from these selected woody plants was clipped, weighed, and saved for future analyses.

Plant samples were oven-dried and weighed. Samples of plants contributing to at least 90 percent of elk and sheep diets (based on oven-dry weights) were submitted to the Brigham Young University (BYU) Soil and Plant Analyses Laboratory for nutritional analyses. Plant nomenclature follows that of Welsh and others (1993).

Statistical Analyses

Dry weights of plants were used to compute relative dietary proportions of each food item in elk and sheep diets. Similarities between relative proportions of food items in elk and domestic sheep diets were calculated using Kulcynski's mathematical expression of similarity (Oosting 1956). Preferences for plants by elk and sheep at each feeding site were calculated using Ivlev's electivity indices (Ivlev 1961).

Multiple regressions were performed on nutritional fractions implicated with Ivlev's electivity index of forage preferences on a seasonal basis (for example, elk in spring, summer, and fall; sheep in summer and fall). Nutritional fraction variables included in regressions were crude protein (CP), acid detergent fiber (ADF), total nonstructural carbohydrates (TNC), calcium-to-phosphorous ratio (Ca:P), magnesium (Mg), salt (Na), and water (H_2O). Data were subject to best subsets of regression (Minitab 1993) to select those variables that contributed more to the overall regression model and less to total variation. To standardize this selection, models with the highest adjusted R^2 and lowest C_p statistic were chosen. A plot of the residuals versus the fits determined that these regressions met the assumptions of linear regression (Ott 1993).

Results and Discussion

Dietary Overlap

In summer 1994, elk and domestic sheep ate 36 plant species in common. Dietary overlap, based on similarities of relative proportions of dry biomass in diets, was 36.4 ± 32.8 percent ($r_s = 0.63$, $P = 0.000$) (table 1). In Fall 1994, elk and domestic sheep dually consumed 15 plant species and dietary overlap was 40.5 ± 37.1 percent ($r_s = 0.53$, P = 0.046) (table 1). Fewer species were dually used in fall than in summer. This agrees with the finding that elk and sheep used fewer plants in fall (n = 42) than in summer (n = 70) 1994 (Beck 1996). The highest correlation of elk and domestic sheep diets was for browse in summer 1994 ($r_s = 0.80$, $P = 0.166$). Olsen and Hansen (1977) reported an average similarity of elk and domestic sheep seasonal dietary overlap of 30 ± 15 percent ($r_s = 0.61$, $P = 0.002$) in the Red Desert of southwestern Wyoming. In their study, only horses and cattle had a higher Spearman's correlation coefficient ($r_s = 0.64$), which seems plausible since graminoids were the dominant fraction of cattle and horse diets in this forb-limited study area (Olsen and Hansen 1977). Using Kulcyznski's similarity index, MacCracken and Hansen (1981) found elk diets overlapped sheep diets 46 ± 11 percent on south-central Colorado big game winter range. Selection of plants containing nutrients needed by elk and sheep should affect dietary overlap. In addition, variation in the vegetative complement within and between each plant community should influence elk and sheep dietary similarities.

Table 1—Seasonal dietary overlap of elk and domestic sheep in the Willow Creek Demonstration Area, Uinta National Forest, north-central Utah, 1994. Based on relative percent of dry biomass in diets. Overlap represented through means of Kulcynski's index of similarity and Spearman's rank correlation coefficients (r_s).

		Percent similarity		Spearman's	
	n[a]	$\bar{x}$	SD	r_s	P[b]
1994 Summer					
Forbs	23	33.3	33.1	0.60	0.005
Graminoids	9	32.0	31.7	0.18	0.604
Browse	4	64.6	25.3	0.80	0.166
Total diet	36	36.4	32.8	0.63	0.000
1994 Fall					
Forbs	6	30.4	34.1	0.75	0.092
Graminoids	5	29.7	38.6	–0.10	0.842
Browse	4	69.3	31.3	–0.20	0.729
Total diet	15	40.5	37.1	0.53	0.046

[a]The number of species in each forage class used by both elk and sheep.
[b]Significant correlations ($P < 0.05$).

Dietary Preference

Mean preference for forage comprising at least 90 percent of elk and domestic sheep seasonal diets indicates several species were important to elk and sheep during periods when they shared the range (summer and fall) (table 2). Tall bluebell (*Mertensia arizonica*) was important to elk and sheep in summer and Michaux's wormwood (*Artemisia michauxiana*) was an important forage for both during fall. Mountain snowberry (*Symphoricarpos oreophilus*) and aspen (*Populus tremuloides*) were important browses in elk and sheep diets during summer and fall. Slender wheatgrass (*Elymus trachycaulus*) was the only species contributing to a portion of at least 90 percent of elk and sheep diets during both seasons (table 2). Diet preference, as measured by an electivity index, varied considerably by species. Degree of electivity indicates relative use of plants in relation to all herbaceous and woody biomass sampled. Concurrent with this assumption is the fact that rare species are not included in the list of plants contributing to at least 90 percent of elk and sheep diets and these may or may not be highly preferred by elk and/or sheep. Diets of elk included fewer species (spring = 11, summer = 11, and fall = 7) than sheep (summer = 21 and fall = 12) (table 2). An average electivity index should demonstrate degree of preference or avoidance for the suite of species considered. Spring 1994, was the only instance in which elk forages comprising at

Table 2—Mean Ivlev's electivity index of forage preference of species that comprised at least 90 percent of seasonal elk and domestic sheep diets in the Willow Creek Demonstration Area, Uinta National Forest, north-central Utah, 1994. This index calculated relative to all herbaceous and woody species. Preference values are from 0.00 to +1.00, and avoidance values are from 0.00 to −1.00.

Species	Common name	Elk Spring	Elk Summer	Elk Fall	Sheep Summer	Sheep Fall
Forbs						
Artemisia ludoviciana	Louisiana wormwood	[a]	−0.07			
Artemisia michauxiana	Michaux's wormwood			0.65		0.27
Clematis hirsutissima	Lions-beard	−0.37			0.61	
Erigeron speciosus	Oregon daisy		0.79			
Lupinus sericeus	Silky lupine				0.19	0.57
Mertensia arizonica	Tall bluebell	−0.21	0.25	0.79	0.40	
Potentilla anserina	Common silverweed	−0.28				
Smilacina stellata	Stellate smilacina		0.02			
Vicia americana	American vetch				−0.16	
Grasses						
Bromus carinatus	Mountain brome	−0.17	−0.17	0.28	−0.08	
Bromus inermis	Smooth brome	0.34			0.30	
Elymus spicatus	Bluebunch wheatgrass	0.23				
Elymus trachycaulus	Slender wheatgrass	−0.06	−0.58	0.24	−0.34	−0.01
Festuca pratensis	Meadow fescue				0.22	
Melica bulbosa	Oniongrass				−0.48	
Poa fendleriana	Muttongrass		0.64			0.26
Poa pratensis	Kentucky bluegrass	−0.59				
Stipa comata	Needle-and-thread grass				0.10	
Stipa lettermanii	Letterman's needlegrass	−0.78			−0.21	0.24
Stipa nelsonii	Nelson's needlegrass	−0.52	−0.49		−0.34	
Sedges						
Carex aquatilis	Water sedge				−0.03	
Carex douglasii	Douglas' sedge					−0.10
Carex egglestonii	Eggleston's sedge				0.30	
Carex hoodii	Hood's sedge	−0.43			−0.12	
Carex petasata	Liddon sedge				0.06	
Carex vallicola	Valley sedge					0.62
Browse						
Amelanchier alnifolia	Serviceberry				0.72	
Chrysothamnus viscidiflorus	Viscid rabbitbrush			−0.49	−0.12	0.48
Populus tremuloides	Aspen		0.53	0.42	0.26	−0.54
Ribes cereum	Wax currant				−0.31	−0.41
Salix wolfii	Wolf's willow		−0.01			
Sambucus racemosa	Red elderberry					0.59
Symphoricarpos oreophilus	Mountain snowberry		−0.02	−0.43	−0.12	−0.17
Total species		11	11	7	21	12
$\bar{x}$		−0.25	0.08	0.21	0.04	0.15
SE		0.11	0.13	0.19	0.07	0.11

[a]Blanks represent either unreported or unavailable data.

least 90 percent of elk diets had an average electivity that was negative ($\bar{x}$ = −0.25, SE = 0.11) (table 2). This may suggest a preference by elk at this time of year for relatively few species.

Regressions of Ivlev's electivity index on selected nutritional fractions found in forages well predicted which nutrients contributed to the selection of major constituents of elk and domestic sheep diets. Most regressions were significant ($P < 0.05$), and R^2 values ranged from 0.25 to 0.87 (table 3). These results indicate that these regressions are useful in predicting why elk and sheep selected the suite of plant species comprising a majority (≥90 percent) of their seasonal diets. Olsen and Hansen (1977) reported the optimum diet for all herbivores was characterized by an abundance of plant tissues containing high proportions of crude proteins (CP) and low proportions of nondigestible fiber (ADF). Concurrently, CP was a variable positively identified in all regressions on forage electivity except the regression of sheep electivity for forage in summer 1994.

The only time nondigestible carbohydrates (ADF) were important in a regression was for elk in summer (table 3). This may have been a factor related to the change in ADF content in plants. Nutrient concentrations in vegetation in aspen habitats changed drastically from spring and summer to fall. Generally, from spring to fall, percent CP and TNC (soluble carbohydrates) decreased, and percent ADF increased (Beck 1996).

Table 3—Multiple regression of Ivlev's electivity index of forage preference values on nutritional fractions[a] of those species comprising at least 90 percent of seasonal elk and domestic sheep diets in the Willow Creek Demonstration Area, Uinta National Forest, north-central Utah, 1994.

Predictor	Coefficient	SE	*P*	R^2	df	*F*	*P*[b]
Elk-Spring				0.62	10	6.46	0.021
Constant	–1.147	0.548	0.070				
Ca:P	–0.043	0.032	0.221				
Percent CP[c]	6.298	3.001	0.069				
Elk-Summer				0.87	10	6.51	0.030
Constant	–4.1710	0.896	0.006				
Ca:P	0.030	0.008	0.013				
Percent ADF[d]	3.643	0.799	0.006				
Percent CP	6.456	2.467	0.047				
Percent H_2O	2.612	0.778	0.020				
Percent TNC[e]	2.408	1.583	0.189				
Elk-Fall[f]				0.49	6	1.90	0.264
Constant	1.891	0.883	0.099				
Percent CP	–13.762	8.372	0.176				
Percent TNC	–4.713	3.825	0.285				
Sheep-Summer				0.25	20	3.04	0.073
Constant	–0.617	0.291	0.048				
Percent Mg	150.520	93.940	0.126				
Percent TNC	2.676	1.654	0.123				
Sheep-Fall				0.70	11	10.30	0.005
Constant	0.542	0.464	0.273				
Percent CP	8.344	3.409	0.037				
Percent TNC	–6.653	2.240	0.016				

[a] Nutritional fraction variables included: CP = crude protein; ADF = acid detergent fiber; TNC = total nonstructural carbohydrates; Ca:P = calcium-to-phosphorous ratio; Mg = magnesium; Na = sodium; and H_2O.

[b] Significant regressions ($P < 0.05$).

[c] CP is the percent of nitrogen in each sample x 6.25.

[d] ADF reflects amounts of carbohydrates not solubilized by acid detergent. These undigestible carbohydrates are cellulose, lignin, lignified nitrogen, cutin, silica, and some pectins.

[e] TNC are the percent of sugars in a sample.

[f] Sodium and Ca:P ratios were not calculated in the regression of fall elk preferences with nutritional fractions to complement the regression matrix. This was done, since these minerals are generally not considered to be important nutrients in fall for herbivores.

Salt (Na-dominated) placements for sheep were used by both elk and sheep and natural mineral licks were used by elk and not by sheep (Beck 1996). High accessibility to Na was apparent since Na was never identified as an important variable in regressions of elk or sheep electivity for forage. It is not clear why Ca:P content in forages was important in regressions of elk forage preference in spring and summer. Calcium was a very prominent component of forages and natural mineral licks (Beck 1996); however, P was more limited and may have been a nutrient present in forages selected by elk since they need this mineral for antler and bone growth.

Magnesium (Mg) was selected as a variable in sheep summer electivity for forage (table 3). This mineral is essential for grazing animals in spring since they often suffer from low blood serum Mg levels when growth conditions are optimal (Robbins 1993). Magnesium in granulated salt placed for sheep was the third highest fraction, but was never greater than 0.18 percent of the total mineral fraction. Magnesium also ranked third in natural mineral licks, but occurred in relatively more abundant levels than in artificial salt placements (Beck 1996). These results indicate that in spring, summer, and fall, elk obtained a sufficient supply of Mg from natural mineral licks. Domestic sheep depended upon forages in summer to acquire Mg.

Conclusions

Elk obtained their nutrient requirements from fewer plants than sheep. In every season, elk preferred forages that contained high levels of CP, and sheep selected plants containing high levels of TNC. To meet the demands placed on herbivores for Mg in spring and summer, elk used natural mineral licks while sheep selected forages rich in Mg. Overall, the mobility of elk allowed them to select forages and ingest mineral-laden soil and water that contained essential nutrients. Sodium and moisture were never important factors in forage selection by elk or sheep, since Na and water were readily available through human-placed salt licks and abundant watering points throughout the study area. Thus, if Mg were readily available to sheep in the area, or if Na salts were no longer placed for sheep, these relations would be expected to change, and dietary overlap should change as

well. It is thus proposed that elk in the Willow Creek Demonstration Area were in better nutritional condition than sheep. Since elk were wild and free-ranging, they expressed free-choice in their preference for plants while sheep subsisted on those plants presented to them in areas where they were herded. As a result, elk selected fewer plants than sheep. Under herded conditions, domestic sheep should receive a more robust set of mineral supplements.

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References

Altmann, J. 1974. Observational study of behavior: sampling methods. Behaviour. 49: 227-265.

Beck, J. L. 1996. Elk and Domestic Sheep Interactions in an Aspen-Dominated Ecosystem: Use of, and Impacts on Vegetation, Habitats, and Minerals, as well as Implications for Ecosystem Management. Provo, UT: Brigham Young University. 396 p. Thesis.

Ivlev, V. S. 1961. Experimental ecology of the feeding fishes. New Haven, CT: Yale University Press. 302 p.

MacCracken, J. G.; Hansen, R. M. 1981. Diets of domestic sheep and other large herbivores in south central Colorado. Journal of Range Management. 34: 242-243.

Minitab. 1993. Minitab reference manual: release 9 for windows. Lebanon, PA: Sowers Printing Company. 472 p.

Nichols, L., Jr. 1957b. Forage utilization by elk and domestic sheep in the White River National Forest. Fort Collins, CO: Colorado State University. 92 p. Thesis.

Nichols, L., Jr. 1957a. Study of forage utilization by elk and domestic sheep on the South Fork of the White River. Compl. Rep., Proj. W-38-R-10. Denver, CO: Colorado Fish and Game Department: 11-22.

Olsen, F. W.; Hansen, R. M. 1977. Food relationships of wild free-roaming horses to livestock and big game, Red Desert, Wyoming. Journal of Range Management. 30: 17-20.

Oosting, H. J. 1956. The study of plant communities. San Francisco, CA: W. H. Freeman and Company. 440 p.

Ott, R. L. 1993. An introduction to statistical methods and data analysis. 4th ed. Belmont, CA: Duxbury Press. 1051 p.

Pickford, G. D.; Reid, E. H. 1943. Competition of elk and domestic livestock for summer range forage. Journal of Range Management. 7: 328-332.

Robbins, C. T. 1993. Wildlife feeding and nutrition. 2d ed. San Diego, CA: Academic Press. 352 p.

Skiles, J. W. 1984. A review of animal preference. In: Developing strategies for rangeland management: A report prepared by the committee on developing strategies for rangeland management. National Research Council, National Academy of Sciences. Boulder, CO: Westview Press: 153-211.

Welsh, S. L.; Atwood, N. D.; Goodrich, S.; Higgins, L. C., eds. 1993. A Utah flora. 2d ed. Provo, UT: Print Services, Brigham Young University. 986 p.

The Human Dimension

Common Ground

Jack Metzger

Common Ground is the acceptance of a future for what we need and want, derived from what we have, and a plan of how we plan to achieve that future.

Common Ground, in relation to wildlife and livestock in the West, is political because it reflects public policy and public choices for allocations of money, resources, and time. It is social because it defines social relationships among people who are needed to accomplish mutual goals. It is biological because it is a definition of a particular faunal scenario. And it is economic because all of the land-based products of Common Ground cost money and effort.

So far we have spent our effort on the biological and social sides of the Common Ground debate surrounding wildlife and livestock. We have brought the "right" people to the table and we have made decisions about land use, land condition, and desired future condition. We have begun to adjust management; and from those changes we can show some positive results in some places in the West. We have come a long way, and we each can take some credit for our mutual progress. But let's admit it, this has been the easy part.

I believe the few solutions that we have so carefully crafted are in real jeopardy unless we are honest and admit that wildlife cost landowners and lessors something—either lost production or higher production costs, or both. Wildlife, particularly big game, is not a freebie; it is not an entitlement. It has been a great mistake to "regulate" for huge wildlife population increases through policy and procedure. When the White Mountain Apache Tribe in central Arizona can charge several thousand dollars for a bull elk, why should I raise one for you for nothing? It is not an entitlement. If I were a sportsman, I would ask: "What is being done to ensure that I will have big game hunting here next year, 10 years from now? What about hunting opportunity for my children or my grandchildren?" The completion of Common Ground debate is at the prerogative of the sportsman who is the wildlife consumer, and the landowner/lessor who is the producer/manager of habitat. The balance of the public are legitimate participants. The balance of the public are legitimate and needed participants. However, if the two principals, the sportsman and the landowner/lessee, cannot reach agreement on sound sustainable solutions to the economic realities of the big game production, there can be no Common Ground; and, big game as we know it in the West will slowly be replaced by other land uses which generate profits rather than expenses.

This is serious. Together we have dodged the financial questions; maybe to be polite to each other; maybe to not appear greedy; maybe to not shut off discussion; maybe to not incur the wrath of the "public"; maybe to not become obstacles or irrelevant to the process. Whatever the reason, we have failed to reach Common Ground.

I submit that the next phase of this debate is economics. If and when we can agree that all products, amenities and experiences that come from the land are costly to someone; and that is wise in everyone's best interest to pay for those outputs; then, and only then, can we achieve Common Ground.

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Free Market Wildlife Management: A Plus for Landowners, Hunters, and the Environment

Wayne Long

Abstract—Free market wildlife management is a concept whose time has come. Now more than ever, landowners have a higher stake in how effectively their property is managed. With traditional livestock practices coming under more scrutiny and being less profitable in recent years, and quality hunting and additional outdoor recreation opportunities seeing an upswing in popularity, the trend is for landowners to treat wildlife as an economic base. If wildlife has economic worth, it is argued, the wildlife as well as the private landowner will prosper. Three States currently offer programs with incentives to landowners to actively manage their land for wildlife. These programs show that positive results occur for the landowner, the hunting public, and the environment.

A Way to Improve Conditions and Income

Free market wildlife management is a program in which a landowner, his agent, or lessee purposely manages free ranging wildlife and their habitat on private land for economic gain. This concept has gained tremendous popularity with western landowners over the past 10 years. The most recent years show the biggest gains in the awareness of this course of action and, therefore, more acres being actively managed for wildlife. The word "management" is the key. Numerous landowners and hunting clubs for years have charged a hunting or access fee to hunters for hunting a variety of game on their lands, but with little thought to actually managing their land for wildlife. Three western States' fish and game departments have developed programs that provide incentives to landowners to better manage their wildlife species. In these programs, the landowners get longer seasons and/or more liberal bag limits but are required to do quantifiable habitat work. In two of these States, public access to the land is also required.

In some cases, due to poor market conditions within the livestock and farming industries, landowners have turned to wildlife to help keep their property economically viable.

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A Program That Benefits Landowners

Those landowners who today treat wildlife as a valuable resource and benefit by increasing their land-based revenues are "free market wildlife managers." This new breed of ranchers is not only finding it profitable and enjoyable to work with wildlife, but understands that overall good land use and management has other benefits, including increasing land values. A hunting program can bring in significant cash flow and profit.

In the West, a few State fish and game departments have realized the numerous benefits that occur when landowners are given the right incentives to manage wildlife resources. Three States have initiated such "Ranching for Wildlife" programs. The first was California; its program is called "Private Lands Wildlife Management Program" or "PLM" program. It was followed by Colorado's "Ranching for Wildlife," and Utah's "Posted Hunting Units for Big Game." All three programs require that landowners carry out habitat enhancement programs. By doing so owners get extended hunting seasons and a set number of big game or nonmigratory bird tags for use just on their property. These tags are very important since most western States have gone to a draw system where it is difficult to obtain hunting tags, particularly for nonresident hunters.

Each State has a few different program structures. In California, no public hunting access is required; however, in both Utah and Colorado, it is. For these two States, a majority of the tags available to the public are doe tags to better manage the herd numbers and composition. California has no minimum acreage requirement, while in Colorado you must have at least 12,000 contiguous acres, and in Utah, the minimum requirement is 10,000 acres. Properties as few as several hundred acres have participated in the California program. Colorado's Ranching for Wildlife program also has a limit of ranches that can participate in the program; this is set at 25 at the present time. Utah and California have approximately 55 ranches in their programs.

California has a licensing fee of $1,250 for acreages of less than 5,000 and a fee of $2,000 for properties over 5,000 acres. The license is good for 5 years. California also charges the landowner each year for the individual tags. Utah has a $5 licensing fee for participating landowners; Colorado has no licensing fees. Utah and Colorado do not have tag charges, other than what the individual hunters must pay for their individual tags, whether on one of these Ranching for Wildlife programs, or on other land.

The differences between particular programs are structurally significant, but all the programs have been successful. All three States presently have between 500,000 and

1,000,000 acres enrolled in their particular programs. In Colorado and Utah, where public hunting is part of the agenda, game officials are enthused. The flexibility the program allows them to better manipulate the big game herds while offering substantially more hunting opportunities to the public. All three of these State programs emphasize that habitat improvement is the surest way for the landowners to increase the wildlife populations that use their land. Just as "Location, location, location," are the three most important items to consider in real estate deals, "Habitat, habitat, habitat," are the three leading factors influencing long-term wildlife health.

While these western States have the most dramatic and landowner-friendly programs, other States are looking closely at these success stories and are beginning to appreciate that they need to be working more closely with private landowners. In New Mexico, the State essentially issues tags directly to the landowner to sell to individuals as they wish, depending upon the property's big game populations. Montana has a Block Program where more public hunting is offered on private lands, but in its present form, it doesn't offer significant incentives to the landowner to become directly involved in improving conditions for wildlife.

Another benefit to those managing wildlife resources and having abundant game to prove it, is if they want to sell the ranch, there is more interest and at a price higher than if it has been managed as a single use property.

A Program That Addresses Hunter Concerns

Hunters benefit in numerous ways. Those looking for quality hunts, and particularly nonresident big game hunts, can be assured of obtaining tags in at least four western States if they want to spend the money. Also, two States with Ranching for Wildlife programs demand some public access on the private lands; in some cases it is the first time in many years these lands have been available to the public.

Hunters should also be content to know that landowners who are involved in Free Market Wildlife Management are doing something for wildlife and keeping their land for such uses and not selling it to be chopped up and/or subdivided.

Hunters who prefer public land hunting and have no desire to pay landowners for access and services, should also consider that hunters that do choose private land programs are not competing with them for space on public lands. If private landowners cannot make a living on their land, which is becoming more difficult each year, and must sell the property without it being managed for wildlife or for development, there is, of course, less space for hunting. This is one reason why overcrowding is increasing in many of the better public hunting areas even though hunting license sales continue to decline. In short, Free Market Wildlife Management directly addresses the two biggest hunter concerns: poor hunting quality and too little hunting space.

It is ironic that isolated groups of hunters have been the only real antagonists against this type of management, since they have much to gain. Hunter contention in northeastern California had been that the State's Private Lands Wildlife Management Program was degrading the gene source of the mule deer in the region by allowing hunters to harvest the large, mature bucks during the breeding season. Not only did the State prove with hard data that this was not happening, but the program emphasizes quality hunting. Through controlled access, landowners were allowing the males to grow older, increasing the age structures of the herd, and actually allowing the better deer to breed more.

A Program That Fosters A Healthier Environment

The landowner that practices Free Market Wildlife Management definitely does a better overall job of managing his property's environment. Clean farming and overgrazing practices have no place when wildlife concerns are integrated into the whole ranch management plan. Increasing profits by improving conditions for game animals has a very positive spill-over effect on non-game species as well. Some landowners are even focusing on some non-game species and seeing sizable returns involved in watchable wildlife programs and other non-consumptive recreation programs.

If done effectively, Free Market Wildlife Management shows the public sector that environmental health is an important factor when land use practices are discussed.

In reviewing landowner projects for wildlife, we find them primarily concentrating on improving habitat conditions for the wildlife. Popular projects include developing water resources, enhancing riparian habitats, managing vegetation for both livestock and wildlife, and addressing limiting factors for the targeted species. For instance, if a spring is developed so that water is available at that site on a year-round basis, non-game species like songbirds, small mammals, amphibians, reptiles, and insects will certainly utilize it. There are no signs posted saying, "Only deer allowed here." Besides, animals don't read signs on a regular basis anyway.

And in most cases, census work on the animals is done periodically to gain better insight into the population dynamics of the wildlife. This kind of information can give the landowners and game biologists a look into population trends, cycles, and compositions.

All in all, when landowners are given the incentives and opportunities to manage wildlife better, everyone involved benefits. The landowner gets more profits and a healthier land. Hunters get more hunting opportunities, higher quality hunting, and less crowding. The general public benefits by improved environmental conditions on the land for both game and non-game animals. When habitat enhancement is accomplished and wildlife is part of a ranch's whole management scheme, the public will also likely see better grazing practices, and a higher regard for the wildlife.

Showcasing Sharing Common Ground on Western Rangelands: the Owl Mountain Partnership

Stephen H. Porter

Abstract—The Owl Mountain Partnership is a coalition of local government agencies and private sector stakeholders implementing an on-the-ground prototype for Ecosystem Management in rural Jackson County (North Park), CO. The Partnership, by identifying land health as its common ground, has brought diverse interested parties to the same table. Social, cultural, and economic factors, as well as ecological sustainability, are addressed in a pro-active, long-term approach to sustainable resource management. This group views its process as a viable alternative resource management tool and strongly believes that it should be duplicated elsewhere.

The Beginning

The North Park Habitat Partnership Program is one of many Colorado Division of Wildlife programs, authorized by the Colorado Wildlife Commission, whose purpose is to aid in alleviating rangeland forage and fence conflicts between big game animals and livestock on public and private lands. The program resolves these conflicts by developing partnerships between landowners, land managers, sportsmen, the public, and the Colorado Division of Wildlife.

The Habitat Partnership Program began in North Park, Jackson County, CO, in 1991 through the formation of a Committee of interested stakeholders representing various public land use agencies and the private sector. The group first began by writing a 5-year plan for North Park that addressed livestock/big game conflicts. Primary funding is provided by the Colorado Division of Wildlife and is based on 5 percent of the yearly total big game license revenues from Jackson County.

In September 1993, the North Park Habitat Partnership Program applied for and received a grant from Seeking Common Ground. Initially, the Partnership applied for additional monies to increase its ability to resolve livestock/big game conflicts. However, after receiving the grant, this group was approached by sponsors of the Seeking Common Ground group to broaden their responsibilities by putting together an ecosystem-based planning prototype for managing natural resources in North Park. After giving this idea considerable thought and discussion, the North Park Habitat Partnership Committee decided it would use the grant to develop a prototype for ecosystem management, but that a separate entity would have to be formed to take on this added responsibility. While no one really knew exactly what they were getting into, everyone agreed the challenge sounded extremely fascinating.

Thus, the formation of a Steering Committee and the Owl Mountain Partnership began. A great deal of time and effort was expended assimilating the vast amounts of data defining the concept of ecosystem management. It immediately became clear that although the concept was on the minds and tongues of agencies, universities, environmental groups, and had been incorporated into their agendas and workplans, there were very few examples on the ground anywhere in the United States. There were also a great many fears, especially from the private sector, that government was using the ecosystem management concept to take away property rights and impose more regulations. Working prototypes were needed to provide a realistic definition to a relatively undefined and controversial concept. The Steering Committee also immediately learned that controversy was going to be a constant factor involved in this process and that we would have to learn how to effectively cope with the turmoil, (mis)perceptions, and politics surrounding ecosystem management concepts.

By sponsoring a multitude of public meetings, newspaper articles, one-on-one discussions, and other similar efforts, the Steering Committee helped formulate a set of Fundamentals of Ecosystem Management, which are recognized as essential for successful community land stewardship:

Fundamental 1	Increased trust must be developed between local stakeholders and all levels of government.
Fundamental 2	Ecosystems allow harvest and use of appropriate natural resources on a sustainable basis.
Fundamental 3	Local people being affected must be involved and empowered to make decisions and implement actions that will contribute to sustaining the social, cultural, economic, and ecological systems on which they depend.

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Fundamental 4 Environmental education is a crucial element of management because it is a process of mutual learning about interactions and interdependencies of socio-cultural, economic, and ecological systems that support mankind.

Fundamental 5 Issues that drive an ecosystem management effort must, in large measure, originate from the community's grass roots, where a sense of place and community ties to a natural world are best expressed.

The Steering Committee also developed its own mission statement:

> Our mission is to serve the economic, cultural and social needs of the community, while developing adaptive long-term landscape management programs, policies and practices that ensure ecosystem sustainability.

Goals were also developed to govern the working group and to guide our planning processes:

Goal 1 Create partnerships that build trust and teamwork to achieve ecosystem health and resolve conflicts which will serve the economic, cultural and social needs of the community.

Goal 2 Develop and implement an adaptive ecosystem management plan across political, administrative and ownership boundaries based on identified issues and needs.

Goal 3 Document the implementation process of ecosystem management and communicate knowledge gained from the Partnership to partners and the public.

Developing a Planning Process

Although most everyone at higher government levels expected the group to begin with a working plan, the Steering Committee decided to first develop a planning process that would provide the framework to produce a final plan. Since there was no "cookbook" for ecosystem management and the Committee would indeed be playing a role in writing it, a plan would be a final product based on what was learned through each step of this evolving process. A 5-year planning process was developed in stages, with major emphasis on certain processes during each stage (boldface shows emphasis within each phase):

Phase 1 **DATABASE/INVENTORY**, planning, projects, monitoring/analysis/education

Phase 2 Database/inventory, **PLANNING**, projects, monitoring/analysis/education

Phase 3 Database/inventory, planning, **PROJECTS**, monitoring/analysis/education

Phase 4 Database/inventory, planning, projects, **MONITORING/ANALYSIS/EDUCATION**

As the group began developing a work plan, controversy increased, precipitating some local groups, citizens, local government, landowners, and even some agency personnel to begin looking at disbanding or stifling the Partnership. Strong local distrust of government, combined with local economic depression added fuel to the fire. Jackson County, like many rural western communities, is undergoing change at an accelerating pace, so tempers flare easily and attitudes can be negative. Local economic depression with the coal mines and the local wood mill shutting down, loss of the railroad, perceived threats of Range Reform, increasing environmental legislation, "new" people moving in, and a proposed ski area all resulted in creating an extremely fragmented community. The town of Walden was listed as one of 10 endangered communities in America according to the National Association of Counties.

The Steering Committee viewed ecosystem management as a way to address change and as a means of gaining more voice in government decisions on resource management. Government rules and regulations and "environmentalists" are viewed as the primary reasons for decline in the local economy. Many view the Partnership as an underhanded attempt of "big" government to gain more control over people (and their property) who have little voice left in government. The question became, "How can the Partnership survive in the face of this atmosphere of distrust and negativism?" The Steering Committee stood firm, realizing it was working on a process that could address fears and concerns of the community, changes taking place, and controversies they were facing—from a local level. We also realized that if government truly wants to empower local groups of citizens and give them a voice in local resource management it must participate in the development of such a process.

The Steering Committee moved forward by defining a project area encompassing two major drainages, the Michigan River and the Illinois River; bisected geographically by Owl Ridge and Owl Mountain. Thus the name—The Owl Mountain Partnership. This project area is a mosaic of lands managed by the Bureau of Land Management (Kremmling Resource Area), the U.S. Forest Service (Routt National Forest), the U.S. Fish and Wildlife Service (Arapaho National Wildlife Refuge), Colorado (Division of Wildlife and State Land Board), 35 ranchers, and over 300 smaller landowners having small acreages and seasonal homes.

Owl Mountain Partnership acreages are as follows:

		Percent of total
Private	87,791	37
U.S. Forest Service	62,165	25
Bureau of Land Managment	45,795	19
State Forest	19,840	8
Wildlife Refuge	23,267	9
State of Colorado	6,261	2
Total	245,119	100

The area is representative of Jackson County as well as many western rural communities and provides an excellent setting for developing a prototype for ecosystem management. The strength of the Owl Mountain Partnership is with our people, who portray the very essence of Western culture—independence, common sense, and realism—and who want to be actively involved. The Steering Committee represents a diversity of interests, motives, attitudes, and values. We are willing to take on the challenges of providing credible, educated input into resource management. Our common

ground is sustainable land health, which immediately gives us a united focal point as we develop our processes.

This Committee has a strong representation of landowners—both from the ranching and from the smaller, non-agricultural sectors. Government agency resource personnel who live and work in the community provide essential technical expertise and funding, allowing the Partnership to financially and administratively function. Government agency involvement, under direction of the Steering Committee, exists for support and guidance. Community involvement must increase over time until ultimately it becomes the driving force in the Partnership. The key is to develop a credible, grass-roots working group of interested stakeholders capable of making informed decisions and recommendations on resource issues and conflicts. One of our primary covenants is: Communities can manage the lands upon which they live and depend. They do it best because they live there and know the issues and conflicts.

However, a working group such as the Owl Mountain Partnership must educate itself on issues and learn to listen to the desires of all interested parties to make effective management decisions and recommendations. This is a tremendous responsibility requiring a great deal of time and effort on everyone's part. It is by working through this process that trust begins to develop—trust that binds the Steering Committee together, forming an informed and credible team of stakeholders capable of making solid and realistic decisions, and rebuilding trust, among government agencies, local citizens, and communities. This is a concept essential to our system of ecosystem management.

While the Steering Committee forms the foundation for the planning process, other stakeholders are always welcome to participate. Communication is the most difficult and most important ingredient in the process and is where the system most often breaks down.

Making Decisions

As issues and conflicts are identified, a considerable amount of background work is first addressed by appointed subcommittees such as economic, budget, education, projects. Their decisions and recommendations are then taken to the full Steering Committee for further review and approval. It is essential that every stakeholder presents his/her concerns. Our process is based on consensus: decisions need full agreement by the entire group. This mandates that all participants have a full understanding of all sides of an issue.

While this type of decisionmaking is often extremely slow and frustrating, it results in the most strongly supported decisions. There has been a lot of discussion surrounding consensus-based decisionmaking in terms of whether it is realistic, functional, or efficient; but it has been tested and it has worked extremely well with both the Habitat Partnership Program and the Owl Mountain Partnership. If this method of decisionmaking is strictly adhered to, no matter how horrid it may seem during the process, it will work if the group allows it to work!

The following two sections detail how this process has worked for us.

The Hebron Slough Management Plan

In the early spring of 1995, Bureau of Land Management (BLM) was in the process of producing a waterfowl management plan for a wetland area that had been cooperatively developed through partnerships involving the Colorado Division of Wildlife and Ducks Unlimited. What had not been addressed, and what was considered a major conflict by some, was the fact that a grazing permit was in place involving 178 springtime AUMs together with some fall use, dependent upon forage production during the growing season over the 2,050 acre unit. The BLM, very much aware of this conflict, asked the Partnership to use its decisionmaking process to address the issue, and to make recommendations to BLM on possible solutions. Owl Mountain Partnership accepted the challenge and began a series of meetings bringing all interested stakeholders to the planning table—agency biologists, agency and landowner Steering Committee members, other interested landowners, and, of course, the permittee, Jack Haworth.

The first meeting essentially laid out the ground rules involved with consensus-based planning. Everyone, including the permittee, agreed that the area had been overgrazed for a period of over 80 years. It was also agreed that the uplands surrounding the wetland areas represented relatively unproductive range sites—dry exposure and salt flats. Initially, the planning process looked relatively easy. All that was required was a grazing system that would improve livestock distribution and forage utilization over the entire unit. However, as meetings continued, communication began breaking down; biologists disagreed between maximizing and optimizing waterfowl production, livestock impacts on waterbird nesting, and duck nest initiation dates. There was considerable discussion about not grazing high-quality nesting areas and "sacrificing" uplands with heavy cattle use. Tempers flared, especially on the side of government, and it became evident early in the process that while we were all talking, no one was really listening. Halfway through the process any kind of a solution seemed impossible. Everyone was quite frustrated with a process that could only be described as horrid.

But then, almost unexplainably, reality began to set in. The group setup some new ground rules. Options that addressed health and integrity of the entire unit were the only ones that would be addressed. Also, the current grazing permit was secure and would remain secure as long as the health of the land, over time, could be sustained. A grazing system would be adopted that would be monitored yearly by all stakeholders and would have the flexibility for changes on the part of Bureau of Land Management and permittee, based on yearly monitoring. The group agreed that land health represented common ground, with the goal of optimizing (not maximizing) waterbird and livestock management. A plan was recommended and adopted by BLM that created seven pastures and involved implementation of a rest rotation system that took into consideration the needs of waterbirds and upland species, such as sage grouse. The permittee was fully cooperative, both during the planning process and during the grazing season. He moved his cattle

according to dates prescribed by the grazing system, monitored utilization, and reported his observations to the BLM.

Bureau of Land Management personnel and Owl Mountain Partnership employees moved electric fences to partition off some pastures. Water for the ponds was needed, as 8 years of drought had severely lowered some and dried up others. Luckily, 1995 was an extremely wet year, and local ranchers themselves saw to it that ponds were filled. Vegetation responded very well to both the grazing system and to the wet weather. Even though the ponds were not filled until after July 15, well after the nesting season, they were teeming with waterfowl and shorebirds by the end of August.

It became apparent to everyone that birds had successfully nested on private lands adjacent to the wetlands. Private landowners provide nesting and brood-rearing habitat for waterbirds through flood irrigation of their native hay meadows. When these meadows are dried up for haying, waterbirds seek out quality habitat areas like Hebron Sloughs in late summer and early fall. Therefore, it is extremely important to recognize that quality waterbird production takes place on a much larger unit than the Hebron Sloughs area alone, with the private sector playing a major role on a county-wide basis. Good land management practices on both public and private lands increase both wildlife populations and livestock productivity. Mr. Haworth not only raises waterbirds, but he also "nurses" over 300 head of elk on his early spring and upper summer private pastures annually. This, too, must be recognized as part of the equation.

By integrating uses on public and private lands that promote sustainability, benefits are realized biologically (healthy lands and wildlife), socially (western culture), and economically (livestock production and recreation). This is ecosystem management!

The Small Landowner Project

While not nearly as controversial as the Hebron Sloughs project, the Small Landowner project also accurately portrays what Owl Mountain Partnership is all about. Ed Erickson, a member of the Steering Committee who owns 21 acres with a seasonal residence on Owl Mountain itself, saw an opportunity to use our process to promote land stewardship. He contacted seven landowners adjacent to his property, some of which border Routt National Forest lands, and created a block of 690 total private acres. These properties all were being grazed, as there were no internal fences to separate the properties. Some landowners received compensation and some not. No property owners were against grazing, but some questioned the summer-long grazing system that was taking place.

Mr. Erickson put together a series of meetings with the landowners and with Owl Mountain personnel. It was decided by the group to work with Owl Mountain Partnership in developing a joint grazing management system that would benefit wildlife by managing the vegetative component of the eight properties. Partnership staff developed several alternative grazing systems with the landowners.

The landowners chose a system that allowed 263 AUMs of cattle grazing over a 30-day period. This shortened the grazing season, avoided hunting seasons, and provided the longest rest for the properties. This system called for moving cattle periodically to ensure proper distribution and use of the entire block of properties. The current lessee, Verl Brown, is both a rancher and outfitter, as well as an adjacent landowner. He contacted the group, stating he was interested in leasing these lands and would cooperate with their grazing system.

Mr. Brown, the newly-elected Chairman of the Owl Mountain Partnership Steering Committee, saw a golden opportunity to reduce livestock grazing pressure and thus provide additional forage for big game, especially elk on his property. Elk (wildlife) will benefit through improved management on all these properties. They will stay on the properties longer in the fall and be attracted again in the spring, helping to alleviate pressure on lower elevation, critical winter ranges. The group of small landowners benefits by receiving monies for the grazing lease. An added economic benefit is having their properties taxed as agricultural instead of recreational, because of the grazing management plan and the lessee making a living from agriculture. Projects, including water development and some fencing, will be implemented to benefit the grazing system and wildlife. A win/win situation for everyone involved.

Again, agriculture (economic, socio-cultural), range and wildlife habitats (biological), and public benefits (recreational wildlife viewing and hunting) are sustained on a long-term basis, by looking beyond the boundaries of the individual small landowner. This is also ecosystem management!

Current Status

The first 3 years were spent gathering data—including vegetation sampling, soils studies, and Neotropical bird surveys. Most of the Partnership's time, effort, and money went into an extensive range site inventory throughout the entire project area. We strongly feel that answering the question of rangeland health, especially through the vegetative component, is one of the most important factors facing us. This information will be used to drive our planning process and ultimately define projects needed on the ground.

Our projects to date have been integrated with those previously planned by landowners and agencies:

High Tensile Hay Stackyards
Ridge Line Fence Realignment
New Burke Ditch Irrigation Project
Colorado Breeding Bird Atlas Survey
Levis Land Co, Inc. Division Fence
Soil Micro Study
Spring Creek Well Pipeline
Sagebrush Chemical Treatment
Reseeding Projects
Owl Mountain Spring Development
Owl Ridge Spring Development
Mount Wolford Mitigation Plan
Common Well/Sagebrush Treatment
Deer Creek Willow Planting
Partnership Resource Management Plans

Future projects will be a result of our own planning process. The Partnership is now moving into the project emphasis phase; the next two field seasons will include project implementation, as well as a strong informational and educational component. This will give us a full 5 years, as planned. At the end of 5 years, in 1998, we plan to put together a document that fully describes and analyzes the process to determine whether or not it should be continued. A full assessment cannot be made until our project implementation phase is complete; both the private sector and the land use agencies need to see the final "products" of our process. Current agency budget shortfalls have jeopardized our funding, and could severely impact our ability to follow through on the project implementation phase. Much of what we are really doing in terms of integrating resource management is a matter of necessity, as both agencies and the private sector simply do not have monies available to implement management projects.

Summary

Our system is not perfect and probably never will be. Our goal, however, is to always strive for perfection. We have many critics, and politics constantly gets in our way. The most important thing, even more important than our projects, is that we have a lot of people thinking about, addressing, and resolving resource issues in a positive and proactive manner. This is a tremendous responsibility requiring a great deal of time and effort—it is difficult!

Government and citizens must learn how to work together, not only for economy and efficiency, but also because land health is essentially seamless and extremely interconnected. It does not know boundaries—dirt moves, streams flow, animals migrate, and the wind blows. Land will always be managed for many different things, but sustainable land management requires analyzing the whole while working with its parts—dealing with problems and not the symptoms.

There are some things we know and a lot we do not know about land health, so science cannot provide all of the answers. Common sense, experience, and local expertise are essential ingredients for success. This can only come from grass-root levels. We are creating a local body of interested stakeholders who are willing to take risks and are willing to try to show government that successful management can be done at the local level.

Like cooking on a wood stove, it will take some time to get it right! While we do have a technical definition of ecosystem management, we like this one the best—community-based, government-integrated land stewardship. This is our way of implementing America's Land Ethic.

Steering Committee Members

Verl Brown	Chairman, Rancher, Owner Whistling Elk Outfitters
Ed Erickson	Vice-Chairman, Landowner
Steve Porter	Project Manager, Colorado Division of Wildlife
Roy Roath	Project Leader, CSU Range Specialist
Dusty Smith	Treasurer, Landowner, Owner Jackson County Star
Jerry Jack	Bureau of Land Management
Claude Wood	Colorado Division of Wildlife
Paul Janzen	Colorado State Forest
Lori Weddle	CSU Cooperative Extension ad hoc
Al White	Natural Resources Conservation Service
Steve Kerpan	U.S. Forest Service
Gene Patten	U.S. Fish and Wildlife Service
Greg Sherman	Environmental Rep. Wstrn. Environment & Ecology
Jim Baller	Rancher, Baller Ranch
Bill Burr	Rancher, JB Ranch
Cary Lewis	Rancher, Lewis Ranch
Dan Meyring	Rancher, NPHPP Liason
Ty Willford	Rancher, Willford Ranches
Mike Prescott	Rancher, Buffalo Ranch
Bob Love	National Park Service, Rocky Mountain National Park

Using Hunters to Affect Elk Distribution on Private Lands: North Park Habitat Partnership Program

Kirk Snyder

Abstract—Different types of "Damage Hunts," called Distribution Management Hunts, were tried in Jackson County, CO, in an effort to change elk distribution. A committee of local citizens, authorized by a new program in Colorado called the Habitat Partnership Program, evaluates the circumstances of the damage, either to forage or stacked hay, and determines if a Distribution Management Hunt is appropriate. These hunts have been successful in redistributing elk to areas of less conflict. This committee was also instrumental in passage by the Colorado Wildlife Commission of a new type of Private Land Only license that also appears to create better elk distribution.

The basic program used to change elk distribution on private lands in Colorado is called the Habitat Partnership Program. The basic charge of this program is to address the conflicts experienced by private landowners when big game damage fences and forage. This program is a result of the frustration experienced by landowners in not having the proper tools to prevent damage and in not receiving proper compensation for damage to their fences and forage.

The Colorado Legislature and the Colorado Wildlife Commission, throughout history, have been concerned about damage that the agricultural community has experienced due to populations of big game. Also, throughout history, some within the agricultural community have felt these laws were inadequate in addressing big game damage, especially to fence and forage. As a result, in 1990, Colorado initiated a new program called Habitat Partnership Program or HPP. Two pilot programs were started in that year. One was in Middle Park, and the second in the North Fork of the Gunnison Valley in Southwest Colorado. This program begins by first identifying the area of conflict, which is usually an area that contains the year-round range of one or more identifiable big game herds. The next step involves selecting members of a committee. Typically, the committee consists of three landowners, one member of the recreational wildlife users public called the sportsman's representative, and one spokesman from each of the local land use agencies such as the U.S. Forest Service, the BLM, and the Division of Wildlife.

The committee receives a budget that is administered by the Statewide HPP Coordinator. The amount of this budget is determined by establishing the number of hunters who hunted in the area covered by the HPP Committee. This is done by using the Division of Wildlife's Harvest Survey data. The amount hunters spent on those licenses is then calculated. The Committee gets 5 percent of that amount. As an example, our budget is somewhere near $80,000 per year, and we are one of the smaller HPP areas in Colorado. The Committee then formulates and writes a 5-year plan called a Big Game Distribution Management Plan, which details how the Committee plans to spend that budget to try to solve conflicts between big game and fence or forage.

One of the beauties of this program is its built-in flexibility. Each Committee is not only allowed to come up with new solutions to local problems, they are encouraged to do so. This idea is founded on the principle that people from within the community have better knowledge on how to identify and solve these problems.

North Park Habitat Partnership Program

The North Park Habitat Partnership Program Committee was formed in 1991. The location of our efforts is in Jackson County, CO. The county itself is an "intermontane park" commonly referred to as North Park. This area is characterized by rolling sagebrush hills in the valley floor surrounded by high elevation mountain ranges, with flood-irrigated native grass hay meadows adjacent to the rivers that flow through the park. The fact that we live in a park provides us with some wildlife management benefits, because our big game herds are not affected by significant amounts of ingress and egress from the park.

Our Committee is comprised of the representatives mentioned before. However, we have added a representative from the Arapaho National Wildlife Refuge, as they are a major land manager within North Park and they winter large numbers of elk. Our Committee completed its distribution management plan in the spring of 1992. This plan was reviewed and accepted by the Colorado Wildlife Commission in June of that year. This document outlines the basic methods our Committee chose to address the local fence and forage conflicts with elk. (While we do have some very minor conflicts with pronghorn and deer in specific localities, they are insignificant when compared to the conflicts that result from our elk population.) The direction of this plan was to initially attempt short term projects to move elk away from areas of conflict. In subsequent years, we proposed to use tools that provide results for longer periods of time, such as grazing management systems and permanent elk-proof stackyards.

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One of the most successful tools our Committee has used has been holding public hunts on private ranches to move elk from an area where they are causing damage to an area of less conflict. Examples of a damage situation that would cause us to consider a hunt would be if elk are utilizing forage the rancher depends on for livestock operation or if elk are eating the hay in a haystack. We call these hunts Distribution Management Hunts. These hunts are held between the 15th of August and the 28th of February and are for antlerless elk only (cows or calves).

To facilitate landowner participation in this project, the Committee gives the landowner the ability to pick the hunters that will hunt on his or her land. Usually, the rancher chooses a handful of relatives or friends to participate in the hunt. However, in some cases, the rancher has requested additional hunters. Our Committee has then solicited applications from the public by a newspaper article. A random drawing from these applications takes place to establish a list.

How the System Works

A landowner with hay or forage damage approaches a Committee member and explains the damage situation to that member. The Committee members then discuss the circumstances involved and choose the tool that they feel may work best. In addition to Distribution Management Hunts, other solutions could be the use of pyrotechnics, or firecrackers, strung on a fuse rope to scare the elk away, or temporary elk-proof panels.

If the Committee feels that a Distribution Management Hunt is the best tool for the circumstances, the Committee authorizes licenses to be sold. These licenses cost the normal elk license price—$30 for residents, $250 for nonresidents. Typically, two to four hunters are chosen and given a time frame of 10 days or less to fill their license. The hunt area is limited to the specific locality of conflict. These licenses are sold by a local Division of Wildlife employee. The hunters that have been chosen either by the landowner or the public draw list are contacted to determine when they can begin the hunt. If they are not available to hunt soon, which many times means the next morning, they are not chosen to participate. The reason for the limited time frame to hunt, and the short notice to begin the hunt, is to encourage the hunters to apply adequate hunting pressure on the elk to derive the desired results—move them somewhere else.

Hunters are also prompted to try to harvest the "lead cow" (the matriarch of the group). Experience has taught us that she usually leads the group in repetitive behavior such as returning to the same haystack or hay meadow year after year. Removing her from the population appears to, in many instances, change that pattern. The hunters are given a harvest survey form that they must return to the Committee.

From 1991 to 1996, the North Park HPP Committee has authorized and issued licenses for 190 hunts, 119 of which have been due to forage damage and 71 due to damage to haystacks. The numbers of licenses in the forage damage category were zero for 2 years, jumped up significantly to 34 and 76 for the next 2 years, and then decreased to only nine for the 1995-1996 season. The reason for this jump is that, frankly, the Committee didn't think of using these hunts to address forage damage for the first 2 years. The success and usefulness of these hunts became apparent and caused the Committee to come up with another system called Private Land Only licenses. These will be discussed later, but they are the cause of the decline in licenses for 1995-1996.

The haystack damage licenses were also low in number at first due to the newness of the program; only 10 were sold in 1991-1992. They too caught on for the second and third years to 22 and 31, but also decreased in number in 1994-1995 and 1995-1996 to four each year. We feel the reason for the decline is that the Committee constructed elk-proof stackyards where damage had previously occurred.

Results of the Program

The harvest and percent success information show that even though some hunters expected these hunts to be a guaranteed elk for their freezer, they have found that this is not so. The percent success has been declining, from 60-80 percent during the first 3 years to 25-55 percent last year, probably as a result of the elk getting smarter and responding to the hunts more quickly. The success of the program lies in not necessarily killing large numbers of marauding elk, but in the resulting movement of the whole herd away from the area. Many times only 1 or 2 elk are harvested before the entire group leaves the area.

The number of ranches involved with this program over time shows similar trends in participation. Participants were few at first due to the novelty, but caught on over time. Seventeen ranches have held hunts. A decrease in participation in the last 1 or 2 years is due to the new type of private land hunts and the success of this and companion programs that will be discussed in a moment.

A Case Study

In 1994, the HPP Committee tried a different type of Distribution Management Hunt that, because of the circumstances, didn't fit the situations we had encountered before. Usually, a relatively small group of elk would cause damage to a single ranch.

Elk in North Park tend to vacate the high country where they spend the summer months and winter in the lower elevations of the valley floor. Over time, some of these elk have found that the security provided by the heavily willowed riparian areas in the valley floor are also nice places to live in the summer. Some of these elk have become resident animals along these riparian corridors, particularly on parts of the Arapaho National Wildlife Refuge and on five private ranches to the south of the refuge. The resident herd in this locale had grown to somewhere in the neighborhood of 200 elk by the summer of 1993. That number of elk living year round not only caused damage to forage the ranchers depended on for the cattle, but caused moderate to severe damage to the native hayfields in that area. The landowners felt that they could tolerate from between 75 to 100 elk. This situation had been compounded in mid August through the month of September because of the early movement of the "high country" National Forest elk down to their wintering ground south of the Refuge as the archery and muzzleloader season opened.

After lengthy discussions on how to address this developing problem, and realizing how complicated the circumstances had become, the Committee and the five landowners affected by this situation decided to hold a coordinated distribution management hunt by hiring someone to oversee the hunt. Applications for a hunt coordinator were solicited through the news media. An individual was selected based on his knowledge of the area and experience harvesting elk.

A meeting was held with the five landowners, the hunt coordinator, and the HPP Committee. It was decided that each ranch could choose five hunters of its own and a list of 20 other hunters would be selected on a random-draw situation. The five hunters from each ranch could hunt anytime they wanted from August 15 until August 31. From that point on, if they desired to hunt, they needed to hunt under the direction of the hunt coordinator. On September 1, the hunt coordinator began his hunt with five of the individuals picked from the draw. He would replace a successful hunter with the next person on the list. The coordinator was instructed to apply hunting pressure to the elk in a manner that would move them to the summer range via their traditional migration route.

This hunt was extremely successful. Through the harvest of 19 antlerless elk and the constant everyday pressure placed on the resident elk, the hunt was terminated on October 2, when only an estimated 10 to 15 elk were left within the hunt boundaries. Probably the most interesting result of this hunt is that when the archery hunters appeared to push the elk from the high country, as they had in the past, the intensive hunting pressure placed on the elk within the coordinated hunt area caused the almost immediate return of those elk to where they migrated from. On September 2, a herd of about 70 elk appeared overnight in the hunt area from the summer range of Owl Mountain. On that day the hunt coordinator used hunters to harvest two elk from this group of elk. Two more elk were taken the next day. The remaining group moved back to where they had come from. They did not return during the time of the hunt.

This hunt may have a longer-term result than we originally thought. The numbers of elk in the resident herd (those who stayed after last spring's movement to the high country) were well below the level of toleration expressed by the landowners. While this hunt worked very well to accomplish the goal, we feel that the situations where similar hunts will work are limited to circumstances where the whole group of landowners within the conflict area can work together to address the problem.

Private Land Only Licenses

Over the years, the Committee has been discussing the increase of elk on private lands at lower elevations and the movement of elk to these areas after the start of the archery and muzzleloader seasons on the National Forest that was just described. This was occurring elsewhere in the county, but to a less drastic degree than where we held the coordinated hunt.

In 1994 the HPP Committee, along with the local stockgrowers organization and the Owl Mountain Partnership, put our heads together and proposed to the Colorado Wildlife Commission what we felt might be a partial solution to this problem. We proposed to have a certain number of antlerless elk licenses that would be valid on private lands within the game manage unit where the landowner had a conflict. These are called Private Land Only or PLO licenses. These licenses had been used in other parts of Colorado to move elk away from private land in the months of November through January. The new twist we wanted to put on these licenses was to hold the hunts in the fall before the rifle seasons.

The way these hunts work is the hunter is required to obtain permission from the landowner prior to the purchase or application for the license. Our licenses would be valid from September 1 until November 10. These licenses would allow a hunter to harvest an elk on the PLO license and still hunt another elk in another season. The Wildlife Commission acted on this joint recommendation and established the first season for this type of hunt in 1995. The harvest from these licenses not only helped us get closer to our harvest objective on antlerless elk, but provided for better distribution of elk during the other hunting seasons as elk moved back onto the National Forest where the public hunters had an opportunity to harvest them. These licenses have also had a side benefit of taking the place of some of the forage damage Distribution Management Hunt licenses we sold in the past. Landowners can now allow PLO hunters onto their property without going through the process with the HPP committee to hold a hunt to move elk. Once again, we feel the success of these hunts was well worth the effort and believe that future years will show even more results.

Discussion

While the success of using the hunting public in unique types of hunts to affect elk distribution in itself was successful, one very important point to remember is that these efforts would not have been nearly as successful, we feel, without the other projects we have completed. During the writing of our Distribution Management Plan, the Committee located and identified areas that were traditionally occupied by large numbers of elk, primarily winter range, without causing a conflict. We named these "security areas". In order to make the security areas more attractive, we applied fertilizer to over 500 acres of this range to attract elk from conflict areas. We have placed thousands of pounds of salt on these areas to attract and hold elk. We have constructed 16 elk-proof hay stackyards to combat the "short stopping" of elk that prevents them from migrating to security areas when they find an unprotected stackyard. We have constructed or provided materials to build miles of "wildlife friendly" fences to facilitate elk movement and decrease damage. Recently we have become involved in grazing management systems that benefit both wildlife and livestock.

The North Park Habitat Partnership Program believes that our successes could not have been accomplished without community involvement and participation.

Arizona Elk Habitat Partnership Project

Vashti "Tice" Supplee

Abstract—The Arizona Game and Fish Commission, in 1992, initiated a steering committee charged with the task of creating a local process for resolution of conflict over elk and elk habitat with livestock interests. Identified stakeholders were invited to sit in as members of the committee, which successfully applied for a Seeking Common Ground grant and formed the Arizona Elk Habitat Partnership Program. The program has developed into a habitat partnership program no longer exclusively focused on elk, but on entire ecosystems. Over $500,000 of habitat projects have been approved and funded. The program is based on consensus, maintaining an open table for all interested participants and trust.

Arizona elk (*Cervus elaphus merriami*) populations were extirpated by the end of the 19th century; the last native elk was killed in 1898. Concerned conservationists returned elk (*Cervus elaphus nelsoni*) to Arizona in the early part of this century; 86 head of elk were captured near Gardner, MT, and were shipped by rail to Winslow, AZ, in 1913. Additional releases of Yellowstone elk were made through the 1920's and again in the 1960's. From these modest efforts, the public and private lands of Arizona now support approximately 50,000 elk (including calves) prior to the hunting seasons. Additional populations of elk reside on the White Mountain Apache, San Carlos Apache, Navajo, and Hualapai Indian Reservations. Post-hunt population estimates for these herds conservatively total 15,000 adult animals. Arizona elk populations have flourished in the past two decades, expanding ranges into habitats that, until recently, had been unoccupied by elk. With the success has come rising concern about the numbers of elk and the impacts they are having on traditional livestock operations and grazing lands.

In response to these concerns, the Arizona legislature convened a Big Game Ranching Study Committee in 1989 charged to resolve issues associated with big game management and livestock management. One year later, the USDA Forest Service conducted the Livestock/Big Game Interaction Activity Review, which included field visits to selected Arizona forests. Participants in both endeavors arrived at a similar consensus: the soil, water, and vegetation resources need to be maintained, grassroots public process was essential, and sustainable ranching was an integral part of successful big game management.

Concurrently, ranchers with grazing allotments on the Coconino National Forest near Flagstaff requested the Arizona State Land Commissioner, the Arizona Game and Fish Department (AGFD), and the Coconino Forest Supervisor to support formation of a local committee oriented toward coordinated forage resource allocation for livestock and wildlife. The resulting group is called the Forage Resource Study Group and has served as the template for creating a similar effort throughout Arizona elk habitat. The kick-off for the local elk habitat partnerships began in 1992 when the Arizona Game and Fish Commission authorized the establishment of the Arizona Elk Habitat Partnership Steering Committee (AEHPSC) and appointed Commissioner Larry Taylor as chairman. The Steering Committee was charged to develop and implement an elk habitat partnership program based on the premise of grassroots local participation. Invited representation on the Steering Committee included the Arizona State Land Department, U.S. Forest Service, Bureau of Land Management, Soil Conservation Service (now the Natural Resources Conservation Service), Arizona Association of Natural Resource Conservation Districts, Arizona Cattlegrowers Association, Rocky Mountain Elk Foundation, and the Arizona Wildlife Federation. Committee members agreed to a goal statement "To develop a Habitat Partnership Program and guidelines for management actions in Arizona to minimize conflicts between elk and other habitat users." The objectives adopted by the AEHPSC were:

1. Develop a program encompassing all lands directly and indirectly influenced by elk management; encouraging an atmosphere of partnership between wildlife managers, habitat managers, private landowners, and the public.
2. Develop Habitat Partnerships within definable geographic areas.
3. Develop mechanisms for pooling financial resources to be used for funding Arizona Elk Habitat Partnership Program projects.
4. Develop a process within the Arizona Elk Habitat Partnership Program to provide for habitat enhancements.
5. Monitor and evaluate habitat enhancements, as needed, to determine the level of success as it relates to project objectives.
6. Develop mechanisms to select projects that could be funded through the Arizona Elk Habitat Partnership Program.
7. Identify critical areas of concern potentially affecting the success of the Arizona Elk Habitat Partnership Program.

The Colorado Habitat Partnership Program, developed in 1991 as a cooperative agreement between the Colorado Division of Wildlife, Bureau of Land Management, and U.S. Forest Service, was used as a model for developing an Arizona version focused on elk habitat. The concept of management plans for identified land areas was modeled

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after the already existing Arizona Coordinated Resources Management Agreement between the participating land and wildlife resource agencies. The Steering Committee agreed that management of elk populations, like management of a livestock herd, was one tool for achieving desired habitat objectives and that elk population and hunt management should not be the focus of the partnership. The Arizona partnership is based on shared goals and objectives for habitat resources. Management of livestock herds, elk populations, public access and land use, and habitat enhancement projects are treated as tools toward achieving agreed on habitat goals and objectives.

The Arizona program went public in January 1993 after receiving a Seeking Common Ground grant that provided funding for establishing the Arizona Elk Habitat Partnership Program. Public meetings were held throughout Arizona, with a focus on communities within elk habitat. The meetings were professionally facilitated and participants were encouraged to share their personal visions of what they would like to see happen locally in terms of the land, natural resources, and community. Over 350 people attended facilitated meetings held in eight communities within elk habitat, and in the cities of Phoenix, Tucson, and Yuma, where most Arizona elk hunters reside. Participants in all meetings reached consensus that a sustainable habitat that also sustained rural lifestyles and wildlife recreational opportunities was the desired condition. Three "groups" emerged around elk management issues; landowners, hunters/conservationists, and agencies. The facilitator summarized the key issues for these three groups as follows.

Landowner Issues

Landowners, large and small alike, have deeply felt opinions on issues regarding elk. Elk are seen as a threat to the economic vitality of a rancher's livelihood by competing with cattle for forage or causing a drop in permitted cattle numbers on lease lands. Small property owners have experienced significant losses in orchards and gardens due to elk. Landowners say they want a simple and easy way to resolve elk depredation. They also believe in monitoring grazing land condition for management purposes, but encounter different positions from agencies over how monitoring should be done and what the data mean. Although they admire and appreciate the elk, they are concerned that agencies are not accountable about how many are on the land.

Hunter/Conservationist Issues

Hunters and conservationists see the ranchers and landowners as allies in achieving the kind of recreational interests they enjoy. The alliance stems from landowner stewardship for the land and the wildlife populations that flourish as a consequence of that stewardship. Hunters are split regarding elk populations; some believe there are too many and more hunting tags should be issued to harvest them; others believe there are too few elk. Another group believes elk herd quality is more important than total numbers and herd balance needs to be based on what the forage resource will support.

Agency Issues

Regardless of agency, the critical issues of internal communications and interagency communications standout clearly. Perhaps the most critical communication issue among the agencies involves forage resource monitoring. The issue of what is available in forage resources and which animals are using it is central to the friction among agencies and is driven by different methodologies. The other key issue is—what is the elk population? Landowners, hunters, and others want to know how many animals are on the land; they do not feel that agencies have good data on population levels. Agency staff are frustrated when challenged to demonstrate the real population to someone who has just seen a large number of animals. The final issue for agencies is resolution of depredation complaints, which agency staff find to be a tough job. Apparently no one comes out of the experience feeling very good about it.

Habitat Partnership Committee

At the close of each meeting, the facilitator recruited individuals interested in being part of the core group for a Local Elk Habitat Partnership Committee (LEHPC). These individuals committed to a meeting date and location.

The new committees were tasked with defining the geographic boundaries of their areas, arriving at a consensus goal statement and, if possible, consensus objectives to achieve the goal. The local committees were encouraged to operate in a moderated, informed consent environment. Agendas would be prepared in advance and discussion would be addressed through the moderator. Initial committee meeting results varied in achieving progress toward consensus on core issues. A lack of trust among participants still prevails in certain committees; others seem to be slowly building a local level of trust. Committees were encouraged to create local identity, including renaming their local committee to better reflect an ecosystem or habitat goal, rather than being specific to elk or even big game. The Arizona Game and Fish Commission followed the lead taken by some of the local committees and dropped elk from the name of the State committee, which is now known as the Arizona Habitat Partnership Committee (AHPC).

The membership and role of the Arizona Habitat Partnership Committee (AHPC) was also redirected based on input from local committee membership. Agency representatives are now designated as technical support to the voting members of the AHPC. Voting membership is composed of a representative selected by each local committee and the chairman of the AHPC, who is a member of the Arizona Game and Fish Commission and appointed by that body. The AHPC meets twice a year. Winter meeting topics focus on elk population and hunt management and rangelands monitoring. Summer meeting topics include AHPC review, approval and identification of possible funding sources for habitat projects submitted by the local committees. Representatives from possible funding partners are invited to the summer meeting to provide input and technical advice concerning eligibility of projects for their respective funding sources.

The already existing Forage Resource Study Group (FRSG) has been used as a model for the other committees to consider. Members of this group also experienced the conflict and emotions associated with initial distrust for one another. Members of the FRSG see time spent working together as the only way to create trusting partnerships. The FRSG became an affiliate to the Arizona Habitat Partnership Committee and shared its membership list for the purpose of exchanging minutes and information with the eight Local Habitat Partnership Committees (LHPC). Arizona Game and Fish Department functions as an administrator for the committees, mailing minutes of all committee meetings to the full participant mailing list, and providing clerical and facilitator support for the local committee meetings.

Where Are We Today?

The idea of using the Arizona Coordinated Resources Management Agreement between the participating agencies has largely been unsuccessful. Interagency conflict over various issues, including monitoring methods and analysis of data, persists and executive administrators for the agencies have failed to meet for some time. Agencies also do not uniformly embrace the idea of writing Coordinated Resource Management Plans at the ranch unit level. Representatives of the NRCS believe that much of the problem stems from (1) lack of ownership in the name by all agencies, and (2) ecosystem management initiatives and associated planning processes recently embraced by the Federal land management agencies. The core issue of imprecise interagency communication and agreement on approaches for planning, management, and monitoring continues to frustrate local landowners and grazing lessees. Clearly, all partner agencies have the challenge still before them to develop true interdisciplinary communication and agreement on methodologies.

Individual local habitat partnership committees have overcome State-level failure to agree or communicate by forging local agreement on planning, monitoring, and management. The existence of these grassroots committees provides a pathway toward achieving local success stories. The future holds opportunity to use the experience of individual committees to assist one another and share successes and failures; this perhaps will result in agreement on how to measure, monitor, and achieve agreed on landscape goals at higher levels.

The Arizona Game and Fish Department initially entered the partnerships clearly separating elk population and hunt management from habitat management. An initial effort to create an Arizona elk operational plan was not successful because the Department separated elk population and habitat management. Local partnership committee members did not feel they really had a say in elk population management decisions. Also, AGFD personnel were initially very silent at local committee meetings and generally did not attempt to present their scientific information; doing so had often resulted in verbal attacks. When the Department more strongly facilitated the process, using staff from the information/education division, field biologists from all agencies were more able to present information. Arizona Game and Fish Department members on some committees have included local committee members in elk population survey efforts, giving them hands-on experience in how the population data are collected. Areas with low elk densities also used committee members to create elk observation spot maps to assist AGFD biologists in determining elk distribution in these areas. Cooperative monitoring of forage and riparian resources was also very successful as a result of local committee efforts. When participants were on the ground, differences in techniques could be discussed and a local agreement about which techniques worked best could be achieved.

Recognizing the need for broader local input to the development of the annual Arizona elk hunting recommendations, the Arizona Game and Fish Commission directed AGFD to use the local committees to solicit input about elk population concerns and to achieve "informed consent" for the local elk hunt recommendations. Disagreement from committee members regarding the hunt recommendations and elk population objectives for the local area were documented and included with the hunt recommendation package given to the Arizona Game and Fish Commission for its consideration and adoption.

The Arizona Game and Fish Commission 1996 to 2000 Statewide elk strategic plan now directs AGFD to develop local elk operational plans through the local partnership committees. These local plans will include elk population and habitat goals and objectives and suggested actions in the form of hunts, and management and habitat projects, to achieve those objectives. The local elk plans will be updated annually and submitted as supporting documentation with the elk hunt recommendations to the Commission. Projects identified in these plans will also receive higher priority for funding than projects not in the plans.

Resolution of depredation complaints on private lands continues to be difficult and contentious. Where possible, complainants are encouraged to participate in a newly created private lands stewardship program, which is presented at this symposium in the poster session. The stewardship program encourages cooperative resolution of problems and also affords opportunities for the Arizona Game and Fish Department and Commission to assist financially. Successful stewardship projects have included providing fertilizer, seed, salt blocks, and elk jumps for use on private and associated grazing lease lands. Complaints that are still very difficult to resolve are those involving agricultural crops, orchards, and gardens. Elk-proof fencing is usually the best solution. Most landowners with these problems have been unwilling to enter into a stewardship agreement that benefits elk, and are therefore unable to obtain AGFD funding for elk-proof fencing. The Department is exploring possible options, including installation of temporary fencing that would belong to the Department and enhancing native forage pastures, in hopes of reducing elk use on adjacent irrigated and cultivated lands.

Beginning in 1994, the LHPC's were asked to submit habitat enhancement project proposals for consideration by the SHPC and appropriate funding partners. After 2 years of soliciting project proposals, a total of 31 projects have been funded with Arizona Game and Fish Department Big Game License-Tag Funds for elk, whitetailed deer (*Odocoileus virginianus cousei*), pronghorn antelope (*Antilocapra*

americana), and mule deer (*Odocoileus hemionus*) for a total of nearly $325,000; $195,000 in matching funds have come from the partnership partners, primarily the U.S. Forest Service. One of these funded projects, Burton Wildlife Openings, received additional matching funds through a Seeking Common Ground grant awarded in 1995. The third year of project solicitation through the LHPC's is currently in progress.

After 3 years on the ground locally, what has been accomplished? Most importantly, a mechanism for local level communication about big game population and habitat issues has been put in place in the elk habitats of Arizona. The formation of the Arizona Habitat Partnership Committee and nine local affiliates (including the Forage Resource Study Group) has accomplished the original Steering Committee objectives of (1) creating local partnerships, (2) creating mechanisms for proposing and funding habitat enhancements, and (3) creating an environment to assist in pooling available financial resources for projects.

The original objective of the Steering Committee to develop mechanisms to monitor and evaluate habitat enhancements is still pending. There is also no formal interactive communication process for identifying critical areas of concern that would affect the success of the Arizona Habitat Partnership Program. The issue of trust is most certainly the area of greatest concern for long-term success. I agree with the members of the Forage Resource Study Group; trust is achieved only through time, working side by side and gaining mutual respect for the experience each participant brings to the table. I also believe that individual candor and honesty are essential toward achieving trust. When dealing with an issue as volatile as big game and livestock management, a certain amount of emotional heat will be a necessary part of any process. Training participants on how to be players in emotionally charged environments is also key to long-term success. More and more individuals are trained in techniques to assist local partnerships in learning how to cooperatively discuss and achieve local objectives, even with a difference of opinion. Understanding and supporting the human dimension is ultimately the key to successful land and wildlife stewardship.

Montana's Livestock/Big Game Coordinating Committee

Bruce Fox

Abstract—Following the Seeking Common Ground Symposium held in September 1991, key Federal, State, and livestock industry representatives in Montana met to discuss cooperative approaches to livestock/big game issues. This group has been active since October 1991. The Committee has gone through a number of steps in order to gain a common understanding of problems and facilitate cooperative solutions including: (1) sharing perspectives, (2) identifying common ground, (3) identifying a desired future, and (4) taking actions that move toward a desired future.

Conflicts between wildlife and livestock have intensified in much of the Western United States in the last decade. Intensifying concerns resulted in an activity review by the USDA Forest Service during May 1990 in the Southwestern and Intermountain Regions. The review addressed important issues that extended beyond these two Regions. Due to the potential applicability of findings, other Regions and Research Stations were asked to participate in similar reviews and develop action plans to respond to issues identified.

A symposium entitled "Livestock/Big Game, Seeking Common Ground on Western Rangelands," was held as a followup to the activity review. This symposium, attended by over 750 people, encouraged a climate of cooperation in resolving livestock/big game issues.

Following this symposium, key Federal, State, and livestock producer representatives in the State of Montana met to discuss cooperative approaches to livestock/big game issues. This group, referred to as the "Montana Livestock/Big Game Coordinating Committee" continues to be active. Represented on the committee are the Montana Stockgrowers Association, Montana Woolgrowers Association, Montana Public Lands Council, Montana Association of State Grazing Districts, Montana Fish, Wildlife, and Parks Department, USDI Bureau of Land Management, and the USDA Forest Service.

The Committee has gone through a number of steps in order to gain a common understanding of problems and facilitate cooperative solutions including: (1) sharing perspectives, (2) identifying common ground, (3) identifying a desired future, and (4) taking action to move toward our desired future.

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Sharing Perspectives

To share a common understanding of individual and mutual concerns, the Committee agreed to devote the time necessary to listen, understand, and empathize with the concerns of each of the representatives. These concerns were summarized and presented in writing and reviewed by the group to ensure they were accurately described. These perceptions, concerns, and questions are listed below by representative area.

Livestock Industry Perceptions

Livestock numbers suffer for the sake of increased big game populations. There is a need to find a balance between wildlife populations and livestock numbers.

Agencies pass the buck on responsibility. Forest Service controls the habitat and State controls the population numbers; there is no agreement on how much livestock and wildlife use the habitat can support. Because the Forest Service doesn't control wildlife population numbers, it automatically defaults to adjusting livestock numbers if the vegetation resource is being overused.

Contribution of private lands in supporting big game populations and the effects of big game populations on the management of private lands are not recognized. For example, private land is being rested to improve condition but the area is utilized by elk; this removes any benefit to the area.

Permits are being phased out when in estate status.

Need to adjust elk numbers, which are at an all-time high.

Concern that landowners will resort to other extremes such as sub-division, if livestock numbers suffer in favor of big game numbers. The end result will be a negative impact on big game and recreation opportunity.

Question the knowledge level of some groups that express interest in range management decisions.

Question the scientific soundness of positions taken by some environmental groups. Feel their influence is significant but on an emotional level versus a scientific basis.

Assure that there are good data to support adjustments in the amount of grazing use by livestock.

Concern that major changes in land ownership are occurring, resulting in a change of land use. For example: the purchase of large ranches by wealthy individuals who have no interest in agricultural uses of the land.

Actions on grazing permits and wildlife populations need to consider the viability of the landowner and the needs of the resource.

Question how closely the Forest Service and State cooperate when allotment management plans are being developed and livestock use may need adjustment.

Determine balance between livestock and big game populations on a case-by-case basis.

Publicize improvement in range conditions as compared with the 1930's.

Range conservationists and wildlife biologists from State and Federal agencies don't spend enough time on the allotments to become familiar and knowledgeable with what is taking place.

Bureau of Land Management Perceptions

Decisionmakers within the agencies need to resolve management of big game numbers and the management of the range resources.

More problems are occurring in western Montana than in eastern Montana with big game and riparian issues.

Noted the East Pioneer Experimental Stewardship Program success and recommended doing a better job of publicizing such successes.

Montana Fish, Wildlife, and Parks Department Perceptions

Committed to finding common ground with all interests in resolution of conflicts.

Agency has been reluctant in the past to identify population objectives but has made a significant step with current draft elk management plan.

We all need to accept mutual responsibilities for environmental concerns and resolving issues.

The National Livestock/Big Game Interaction Report is not a good tool for finding common ground.

The biggest area of conflict is elk wintering on private land, not conflict on summer ranges with domestic livestock.

Identify these impacts to private land and resolve them.

Pursue cooperative management programs with private landowners. Compensate at fair market value through leases or easements of land and to cost share development costs.

USDA Forest Service Perceptions

Need increased emphasis to bring grazing permits and allotment management into compliance with Forest Plans.

Must meet National Environmental Policy Act requirements.

Highest priority will be placed on allotments with the most serious resource problems.

Riparian concerns are much greater than livestock/big game conflicts.

Riparian concerns are much broader than just wildlife, they include water storage, water quality, and watershed stability.

Implement management that will bring about an upward trend, recognizing that in some cases reaching the desired condition may take considerable time.

Avoid falling into an "either/or" mentality in regard to livestock versus elk. By looking at broader management opportunities, objectives for elk and livestock may not be mutually exclusive.

Be clear on economic effects versus impacts of wildlife. Don't blame adverse market situations on wildlife impact.

Guard against popularity vote or opinion driving the management of natural resources.

Finding Common Ground

Following a thorough review and discussion of the perspectives that were shared with the group, the Committee identified those areas in which common ground was shared. These included:

- We must all be responsible to the land first.
- Pursue and improve communication among all cooperators and through all levels of organizations.
- Agencies need to better publicize success stories to provide a more balanced perspective.
- Focus on the issues.
- Commit to fair play.
- Explore possibilities of cooperative efforts to produce marketing materials.
- Focus on the value of the land, land uses, and life styles in marketing cooperative success stories.
- Focus on cooperative projects to build cooperation and understanding between interest groups, agencies, and users.
- Show wildlife and livestock living together and the health of the resource.
- Capitalize on Montana as "the last, best place" and "telling our story of success."
- Make a long-term commitment.
- Increase use of easements as opposed to fee title for FW&P acquisitions.

Identifying a Desired Future

Following a listing and thorough discussion of shared common ground, the Committee attempted to identify what a desirable future should look like and described potential actions that could lead toward this desired future.

The following desired future conditions were identified:

- "Let's walk together." Private landowners and public land managers work cooperatively for common and complimentary resource objectives, economic balance, and viable agriculture.
- Private landowners and public agencies recognize responsibility for land stewardship and mutual effects.
- Effective educational efforts inform and involve new landowners. Cooperative management of their lands with adjacent owner may achieve big game population objectives.
- Agree on wildlife population objectives. It was noted that the current proposed elk management plan was a major step in that direction.

- Agree on the overall carrying capacity of habitat/rangeland as well as the balance of use between livestock and big game to achieve proper management of the resources.
- Agencies and cooperators are willing to try new ideas and seek assistance in resolving individual problems.
- Use processes such as CRM to facilitate solutions.
- Adequate monitoring of rangelands occurs with responsibility shared between agencies and permittees. Agency specialists have a clear knowledge and understanding of on-the-ground conditions and work closely with permittees to achieve optimum results.
- Solutions are built on a common land stewardship ethic.
- We are united and pro-active in communicating our successes.

Taking Action

Following a description of a common desired future, the Committee brainstormed potential actions that could move us toward the desired future. Key action items were selected for implementation. The majority of the Committee's efforts to date have been directed in the area of conflict resolution and an informational and educational video depicting the common ground that livestock and wildlife interests share.

In the area of conflict resolution, members of the Committee have worked collectively with their respective counterparts in several situations where conflicts were beginning to develop. Committee members attempt to transfer the philosophy of shared common ground and suggest approaches to resolve issues before the conflicts escalate.

The Committee is nearing completion of a professionally done, 30-minute video on the common ground that wildlife and livestock interests share. The video will depict the often conflicting values present in the West today through the values communicated in the artwork of two great past western artists. Famous modern day artist, Larry Zabel, attempts to capture today's reality and the common ground that livestock and wildlife interests share in his painting "On Common Ground."

Conclusions

The future of the Montana Livestock/Big Game Coordinating Committee is undetermined at this time. Current actions identified for implementation will likely take some time to accomplish. The Committee has been a positive effort in bringing people together to develop cooperative resolution to these difficult issues.

Noncontroversial Techniques to Manage Rangeland Resources

James E. Knight

Abstract—Various strategies for managing livestock and wildlife in the Intermountain West have been developed. Many of these strategies do not involve forced reduction in number of grazing animals to reduce negative impacts. Some of the practices involve people management; some involve resource management. Use of multi-interest advisory groups, strategies to lure livestock and wildlife from riparian areas, and the use of livestock to enhance wildlife forage are examples of techniques being used across the West. Conservation easements to ensure maintenance of wildlife habitat and hunting access programs to ensure public hunting on private lands are additional methods being used to enhance resource management.

Wildlife managers in the United States are learning that cooperation between ranchers and the public is a necessary component of effective wildlife management and livestock grazing (Knight 1996). Increasing public involvement in a variety of environmental issues has created increasing restrictions and policies for grazing management, especially on public lands. Resource managers have conducted research concerning wildlife and livestock relationships, but often this research focuses on the negative impacts one has on the other (Cory and Martin 1985; Kothman 1984; Bernardo and others 1994; Lacey and others 1988). This often leads to management decisions that restrict the use of an area or impose an either-or strategy. This research is effective in identifying situations that are detrimental to agriculture or to wildlife, but it also leads to confrontational situations. The purpose of this paper is to describe current techniques that effectively manage grazing without restricting livestock use. Some of the techniques involve people management, and some involve resource management.

Proper development of advisory groups and management techniques can make the job of the resource manager much easier. Emphasizing positive aspects of livestock grazing and wildlife habitat will reduce much of the controversy.

Advisory Groups

The use of advisory groups has increased with the public demand to be involved in decisionmaking. These groups can sometimes pose barriers if they become a focal point for those concerned only with their specific agendas.

Advisory groups, when properly composed, provide an opportunity for managers to identify concerns, strategies, and issues that might enhance decisionmaking (Roberts 1992). In south-central New Mexico, a multi-interest advisory team developed a grazing management plan as part of the Negrito Ecosystem Project (Wondolleck and Yaffee 1994). The team was composed of ranchers, environmentalists, sportspersons, county commissioners, and loggers. Representatives of the Gila National Forest and the New Mexico Department of Game and Fish have worked with the group to develop the management plan.

One of the unique aspects was the selection of members for this team. To satisfy National Environmental Policy Act (NEPA) requirements, it was necessary that all interested organizations be allowed to provide input. Invited representatives, however, were selected based on recognition as representatives of particular interest groups and their reputations in seeking solutions rather than promoting controversies. The process allowed participation and attendance by those not specifically selected as a part of the team. This strategy worked exceptionally well because the invited members of the team worked in a positive manner and this attitude influenced others to also provide positive, constructive input.

Using this process, the team has been successful in developing consensus support for management strategies. Needs associated with ranching, endangered species management, timber harvest, riparian management, and community economics have been accommodated. The Negrito Ecosystem Project team illustrates that multi-interest advisory groups can be successfully used if the individuals making up the groups are oriented toward solutions rather than toward perpetuating controversy.

Riparian Management

Controversies over wildlife and livestock grazing often revolve around livestock damage in riparian areas (Smith and others 1992). Strategies that involve fencing of riparian areas often lead to controversy because this practice excludes an important grazing component of the ranch (Bryant 1982). Several strategies can be considered to manage riparian areas while not eliminating their use by livestock.

Fencing a riparian area so that it can be managed as a separate pasture may provide the necessary care (Thomas 1991). If a rancher is able to graze the riparian area for 1 or 2 weeks per year, impacts to the vegetation and water quality could be acceptable, and this minimal use might provide benefits to the rancher. For example, the riparian pasture might be used as a place to hold cattle just prior to shipping to increase body condition and reduce roundup costs. Proper grazing of the pasture may enhance the value of the area for wildlife (Sedgwick and Knopf 1991). If the riparian area is an important wintering range or an important fawning or

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calving area, livestock grazing can be scheduled at a time that will not pose a conflict (Chaney and others 1990).

Several new management strategies that involve non-exclusion techniques are being tested in riparian areas . A project in Montana is investigating the effectiveness of cross riparian drift fences in encouraging livestock to use upland areas (Carter 1995, personal communication). Cross riparian drift fences are placed perpendicular to the stream and ascend to mid-slope on both sides. The idea behind these fences is to prevent livestock from using the bottoms as travel corridors (Mueggler 1965). Livestock will encounter the fence, then walk along the fence to go around; in doing so they will end up half way up the slope. In many cases, livestock will continue traveling toward the ridge rather than dropping back down into the bottom. This technique is especially effective when the upland area provides sufficient forage (Granskopp and Vavra 1987).

Other methods of attracting livestock to the upland areas involve the use of off-site water and fertilized plots in the uplands (Miner and others 1992). These strategies make the uplands more attractive and make it unnecessary for livestock to use the riparian areas for water or more lush vegetation. When livestock use riparian areas for water, quite often they will loaf in the area and damage may occur. By providing water on a ridge, livestock will often stay in the upland areas. The use of fertilized plots in the uplands will create small areas of highly palatable vegetation (Smith and Lang 1958).

Excessive damage to fences can occur in areas where elk (*Cervus elaphus*) migrate or are in high numbers. Certain fence designs can reduce maintenance required because of damage by elk (Jepson and others 1983). In the past, fence damage areas were protected by using poles across the top of the fence. In many situations, these poles caused elk to use adjacent fence crossings that did not have poles. A recent study has tested different fence designs and also monitored those most preferred by elk (Knight and others 1996). Results indicate that lowering the top wire on a standard 4-wire fence is the most effective way to reduce maintenance and provide a crossing that elk do not avoid.

Grazing for Wildlife Enhancement

In western Montana, several landowners are cooperating with the U.S. Forest Service and the Montana Department of Fish, Wildlife, and Parks to use livestock grazing to enhance elk winter range on State Wildlife Management Areas (WMA's) (Frisina 1992). It has been found that the WMA's can be grazed to a level that maximizes the palatability of grasses and forbs. Historically, private lands adjacent to the WMA's received the most use by elk during the winter and early spring. This posed a livestock management problem because these areas were needed for livestock grazing in early spring. It was determined that the elk used the grazed private land more than the ungrazed WMA's. Livestock removed the older and more decadent grasses and allowed easy accessibility to the more nutritious and palatable young shoots. Ongoing studies are investigating the effect of grazing on forb production. Elk may be attracted to the grazed areas because removal of the dense overstory allows sunlight to stimulate forb production (Singer 1975).

Conservation Easements

Public and private wildlife management organizations have long recognized the need to preserve wildlife habitat. In the past, wildlife habitat has been preserved through purchases of critical areas to prevent them from being developed. More recently, conservation easements have become an acceptable way of ensuring maintenance of wildlife habitat by attaching land use restrictions to deeds (Knight 1995). Conservation easements can be developed that allow grazing and other agricultural practices and still provide for wildlife habitat. Many of the interests of the landowner are compatible with the interests of the wildlife habitat manager.

The amount of payment is normally dependent on the value of the land as wildlife habitat and, to a certain extent, the potential for that land to be developed in the near future. The starting point for payment for a conservation easement is usually the difference between the value of the land as agricultural land and the value of the land to developers.

A conservation easement is attached to the deed and restricts how the land will be used in the future. Most conservation easements are designed to keep the land from being subdivided. Many conservation easements not only allow, but encourage, current agricultural practices. For some landowners, the attractiveness of a conservation easement is the guarantee that the land will stay in the use that it is in today and will stay in one piece.

Some landowners are concerned that a conservation easement will devalue their land. The value of the land as agricultural land is not decreased if restrictions are not placed on agricultural practices. The value of the land as developed land is decreased.

Hunting Access

Increasingly, hunting access on private land is a point of concern and controversy. Hunting is usually the most logical way for landowners to keep wildlife populations at proper levels. While access to wildlife populations is necessary for the general hunting public, landowners have been increasingly discouraged by demands for access and, in some situations, poor behavior of hunters. This has resulted in the closure of many private lands traditionally open to hunting. Several programs are being implemented to address access for private land hunters (Teer 1981; Knight 1984). States such as California, Colorado, Montana, and New Mexico have implemented programs that provide incentives for landowners to allow public access.

In Montana, a program known as Block Management provides incentives to landowners who allow public hunting on their land (Mt. Dept. Fish, Wildlife & Parks 1996). This program provides funding to offset expenses incurred by landowners who allow public hunting. Legislative action in 1995 established a fee of up to $8,000 per landowner to offset potential impacts. Funding for this program comes from license fees.

Conclusions

Across the West there is an increasing interest in minimizing controversy in wildlife and livestock grazing management issues. Interest groups that are striving to identify win-win situations rather than prolonging controversies are more likely to be invited to problem solving sessions. Conservation groups, land management agencies and state wildlife agencies recognize the contribution of agriculture and are trying to develop ways to enhance cooperation. Habitat management practices that consider needs of agriculture are more likely to be implemented by landowners. Finally, conservation easements and hunter access programs are examples of win-win strategies that address the needs of landowners while accomplishing objectives important to wildlife management.

References

Bernardo, D. J.; G. W. Boudreau and T. C. Bidwell. 1994. Economic tradeoffs between livestock grazing and wildlife habitat: a ranch level analysis. Wildl. Soc. Bull. 22: 393-402.

Bryant, L. D. 1982. Response of livestock to riparian zone exclusion. J. Range Manage. 35: 780-785.

Chaney, E.; W. Elmore and W. S. Platts. 1990. Livestock grazing on western riparian areas. Eagle, ID. EPA. N.W. Resource Information Center.

Cory, D. C. and W. E. Martin. 1985. Valuing wildlife for efficient multiple use: elk versus cattle. West. J. Agric. Econ. 10:282-293.

Frisina, M. R. 1992. Elk habitat use within a rest rotation grazing system. Rangelands. 14(2): 93-96.

Granskopp, D. and M. Vavra. 1987. Slope use by cattle, feral horses, deer and bighorn sheep. Northwest Sci. 60: 74-81.

Jepson, R.; R. G. Taylor and D. W. McKinzie. 1983. Rangeland fencing systems: state-of-the-art review. San Dimas, CA: U.S. For. Serv. Equip. Dev. Center. 23 p.

Knight, J. E. 1984. Landowner opportunities. In: Increasing wildlife on farms and ranches. In: F.R. Henderson, ed. Great Plains Ag. Council, Coop. Ext. Serv. Kan. St. Univ. Manhattan: 10-320.

Knight, J. E. 1995. How can wildlife be an asset to a ranch? In: Beef Questions and Answers, Mont. St. U., Anim. and Range Sci. Dept. 1(11): 70-94.

Knight, J. E. 1996. Minimizing controversy in wildlife and livestock grazing management. In: McCabe, Richard E., ed. Transactions of the 61st North American Wildlife and Natural Resources Conference; 1996 Mar. 22-27; Tulsa, OK. Washington, DC: Wildlife Management Institute,

Knight, J. E.; E. J. Swensson and H. Sherwood. 1996. Fence crossing maintenance and selection by elk. In: Private Rangelands: Stewardship and Responsibility. Abstracts for Soc. Range Manage. Annual Meeting. Wichita, KS.

Kothman, M. M. 1984. Concepts and principles underlying grazing systems. In: National Research Council, National Academy of Science. Developing strategies for rangeland management. Boulder, CO. Westview Press: 903-916

Lacey, J. R.; K. Jamtgaard; L. Riggle and T. Hayes. 1988. Impacts of big game on private land in southwestern Montana: landowner perceptions. J.Range Manage. 46: 31-37.

Miner, J. R.; J. C. Buckhouse and J. A. Moore. 1992. Will a water trough reduce the amount of time hay-fed livestock spend in the stream (and therefore improve water quality)? Rangelands. 14(1): 35-38.

Montana Department of Fish, Wildlife and Parks. 1996. Report and recommendations of the House Bill 195 Incentives Advisory Committee, Helena, MT. 22 p.

Mueggler, W. F. 1965. Cattle distribution on steep slopes. J. Range Manage. 18: 255-257.

Roberts, T. C. 1992. Political and social aspects of riparian area management. Gen. Tech. Rep. INT-289. Ogden, UT: U.S .Department of Agriculture, Forest Service, Intermountain Research Station: 120-122.

Sedgwick, J. A. and F. L. Knopf. 1991. Prescribed grazing as a secondary impact in a western riparian floodplain. J. Range Manage. 44: 369-373.

Singer, F. J. 1975. Nutrition and food habits. In: J. W. Thomas and D. E. Toweill, eds. Elk of North America: Ecology and Management. Harrisburg, PA. Stackpole Books. 354 pp.

Smith, D. R. and R. L. Lang. 1958. The effect of nitrogenous fertilizers on cattle distribution on mountain range. J. Range Manage. 11: 248-249.

Smith, M. A.; J. D. Rodgers; J. L. Dodd and O. D. Skinner. 1992. Declining forage availability effects on utilization and community selection by cattle. J. Range Manage. 45: 391-395.

Teer, J. G. 1981. Wildlife management on private lands. Sinton, TX. Welder Wildlife Foundation. 10 p.

Thomas, H. S. 1991. The importance of rancher input in solving riparian problems. Rangelands. 13(2): 83-84.

Wondolleck, J. M. and S. L. Yaffee. 1994. Building bridges across agency boundaries. In: In Search of Excellence in the U.S. Forest Service. Ann Arbor, MI. Sch. of Nat. Res. and Envir. The University of Michigan,

Ely Elk Viewing Interpretive Area: Elk and Cattle at Home on the Range

Mark J. Barber

Abstract—The Ely Elk Viewing Area in east-central Nevada is planned, developed, and operated as a partnership. The Bureau of Land Management, Ely District, and ten Federal, State, local, and private organizations participate in planning, implementing, and operation of the viewing area. The viewing area interpretive theme is "Multiple Use Management—Elk and Cattle at Home on the Range." Interpretive signing, a brochure, and associated display help educate the public and local community about the benefits of healthy rangelands for both elk and livestock.

Establishment of the Viewing Area

In 1991, the Bureau of Land Management (BLM) Ely District, in response to the National Watchable Wildlife Initiative, established the Ely Elk Viewing Area task force. Members came from the BLM, Humbolt National Forest, Nevada Division of Wildlife, Nevada Department of Transportation (NDOT), Great Basin National Park, White Pine Chamber of Commerce, White Pine Economic Diversification Council, Ely District Advisory Council, Nevada State Parks, Valley View RV Park, and White Pine County Advisory Board to Manage Wildlife. The task force drafted management objectives and development priorities, including promotion and interpretation needs for the area. These became the Ely Elk Viewing Area Plan (Barber 1992) and the Environmental Assessment, both approved in July 1992. The principal interpretive theme of the plan is "Multiple Use Management, Elk and Cattle at Home on the Range."

In 1992, BLM and NDOT crews jointly constructed an initial pull-off facility. This consisted of a graveled parking area and 1.2-mile elk viewing lane with cattle guards. The Nevada Division of Forestry, Ely Conservation Camp prison crews built lodgepole fencing around the parking and interpretive area. This allows visitors to view Rocky Mountain elk and other wildlife safely off U.S. Highway 50. The area was designed to accommodate the many retired persons, or sunbirds, who drive large RV units by the viewing area each spring and fall.

As the elk herd has grown in recent years, safety concerns have also grown. This included safety of visitors stopping along the highway to view elk and safety for the elk who would lay down on the warm highway at night. The elk viewing parking area and viewing lane provide for safe viewing off the busy highway. NDOT placed large elk silhouette signs with blinking lights along the area to warn motorists.

In 1993, the Rocky Mountain Elk Foundation (RMEF) provided BLM with a $1,000 grant to fund a consultant to prepare an Ely Elk Viewing Area Interpretive Plan (Anderson 1994). This resulted in the first interpretive sign. This sign helps the visitors know when and where to see elk and how elk and livestock can live together on healthy rangelands. A second sign gives credit to the partners. An underground traffic counter and visitor register were also installed to help document visitor use.

National Publicity

The viewing area is receiving wide notoriety. In September 1993, a dedication ceremony featured BLM Director Jim Baca. Channel 4 television from Salt Lake City, UT, covered the event by remote satellite hookup. The elk viewing area has been featured in a presentation by the author at the Second National Watchable Wildlife Conference (NWWC) in Corpus Christi, TX, in 1993.

The BLM developed a free-standing display featuring the viewing area. This display was taken to the third NWWC in 1994 at Burlington, VT. It was also featured at a poster session at the 4th NWWC at Estes Park, CO, in 1995. BLM featured the display at a booth at the RMEF Elk Camp in 1994 at Portland, OR, as well as at the local RMEF banquet in Ely, NV.

Falcon Press published the Nevada Wildlife Viewing Guide (Clark 1993) as part of their series on watchable wildlife sites. The guide features the elk viewing area and 54 other locations across Nevada.

Further Developments

In 1994 and 1995, BLM received a total of $84,000 in grants through the Intermodal Surface Efficiency Transportation Act (ISTEA) Federal Highway Administration for the elk viewing area facilities. As a result, conservation camp crews constructed four picnic tables with sun shades and BBQ pits. Also a contractor installed two modern self-contained pit toilets. BLM installed an entrance sign.

Garbage collection at the interpretive site is provided by the Nevada Department of Transportation. The Rocky Mountain Elk Foundation provided BLM a grant for $3,000 to help fund six signs to implement the interpretive plan. BLM produced an Ely Elk Viewing Area brochure (BLM 1994) that helps visitors and potential visitors learn more about elk. The brochure also helps educate the public on the

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objectives of safe viewing and the benefits of elk and cattle on healthy rangelands.

As a result of these developments, visitors from 19 States and five foreign countries registered at the area during October and November 1995. During the same period, traffic counter readings showed 20 vehicles per day stopping at the interpretive site. This was despite unusual weather conditions that resulted in few elk coming down within viewing distance. The site is designed so visitors can have an enjoyable visit even if they don't see elk.

In 1996, BLM plans to complete an earthen viewing mound with a steel slip-resistant ramp to improve wildlife viewing opportunities. The mound will feature a kiosk with six interpretive signs. An additional 1 mile viewing lane also will be built. All facilities are designed to be in compliance with the Americans with Disabilities Act requirements.

One of the new viewing area interpretive signs is entitled "A Days Wages for Elk." It features a 1932 photo of elk at an Ely livestock yard. The sign tells the story of how local miners donated a day's wages to bring elk from Yellowstone National Park by train to White Pine County. The herd has since grown to more than 2,000 animals, the largest herd in Nevada.

The other five interpretive signs are entitled: "Incredible, Adaptable Wapiti!," "What is an Elk?," "The Grass is Greener," "Elk? I Didn't See Any", and "What Else is there to See or Do?"

The Ely Elk Viewing Area is an example of how Federal, State, and county agencies can work together to tell the story of how elk and cattle can live together on healthy rangelands as well as provide a quality visit for the tourist and local resident.

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References

Anderson, Bruce. 1994. The Ely Elk Viewing Area An Interpretive Plan-Phase I, North Ogden, Utah: Andersen and Associates. 14 p.

Barber, M. J. 1992. Ely Elk Viewing Area Plan, Ely, Nevada, Bureau of Land Management. 21 p.

Bureau of Land Management. 1994. Ely Elk Viewing Area BLM/EL/GL/022+4350. 8 p.

Clark, Jeanne L. 1993. Nevada Wildlife Viewing Guide, Helena, Montana, Falcon Press. 87 p.

Process of Building Partnerships for Elk and Livestock in Nevada

William H. Geer

The Rocky Mountain Elk Foundation purchased a 4,725 acre cattle ranch in the Bruneau River drainage in northeastern Nevada in 1991. The acquisition provided a nucleus of land and forage to support the establishment of an elk herd in historic habitat. Severe local opposition to the reintroduction of elk came from landowners and livestock permittees using Federal lands. This led to the formation of a special advisory committee charged with developing working partnerships that would continue traditional public and private land uses at locally accepted levels in the face of an elk transplant.

The Bruneau River Elk Management Advisory Committee was established with members of key vested interests and industries, as well as State and Federal land managers and private conservationists. The committee set operating policies and facilitated processes that enabled it to reach consensus on recommendations to State and Federal land and wildlife managers. Recommendations were developed to achieve a menu of desired future conditions that would recognize and sustain several legitimate uses, including livestock and elk grazing, on public lands. The partnerships that were built fostered mutual interests in the needs and desires of others and led to a removal of significant opposition to the proposed elk herd reintroduction.

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Finding Common Ground

Origins and Successes of the Seeking Common Ground Project

L. L. Williamson

Abstract—This discussion of the origins of the Seeking Common Ground program and the reasons for its success emphasizes the value of public rangelands to wildlife and wildlife industries. Points are illustrated using the Ralston Hills, CO, case study and the Forest Service long-term Strategic Plan.

First, I want to thank the Nevada Cattlemen's Association, and especially Ms. Betsy Macfarlan and her staff for all their hard work on the logistics of this symposium. Too often, we forget to recognize those who do the heavy lifting for these meetings. Also, Herb Manig of the American Farm Bureau Federation deserves special recognition for his leadership within the steering committee.

If I accomplish one thing this morning, I hope to get all of you as enthused about the program "Seeking Common Ground" as I am. I have worked for nearly 30 years on various legislation, programs, and even schemes, to improve public rangeland management to optimum levels, and "Seeking Common Ground" is the first widespread effort that appears to have credentials acceptable to everyone and be capable of getting the job done.

This already successful effort resulted from the first Livestock/Big Game Symposium held here several years ago. It happened when the Forest Service's range and wildlife divisions and the Bureau of Land Management's range and wildlife offices whipped a group of us into line with determination that the initial symposium would not be just another meeting. "Seeking Common Ground" resulted from a series of get-togethers following the first symposium. The Forest Service, BLM, Rocky Mountain Elk Foundation, and National Fish and Wildlife Foundation were quick to provide financing for the many projects now under way within Seeking Common Ground. These agencies and organizations deserve special credit.

If as much is accomplished from this symposium as from the first one, our time will have been spent very well.

On the surface, Seeking Common Ground does not appear all that different from numerous past attempts to expedite rangeland conservation. For at least a couple of decades, to my knowledge, there have been several coordinated resource management programs sputtering along. Some locally successful. Many others not so successful. So what is the difference this time?

There are big differences, in my opinion. And to explain, allow me to give a little historical perspective.

Beginning in 1970, I was part of numerous negotiations between the livestock industry and government on improving public rangeland management. We would sit around tables and talk, but invariably, participants would wind up posturing, defensive, and negative. We had some good people on both sides. I recall fondly fine men from the ranching community, such as Herb Metzger, Gerald Tews, and Rubin Pankey. It must be 20 years since I have seen any of these men, but I have not forgotten that they were people that I trusted and could work with because I respected their needs and they respected mine.

On the conservation side, were people such as Bill Towell of the American Forestry Association, Maitland Sharpe of the Izaak Walton League, and Spencer Smith of the Citizens Committee on Natural Resources. They all were committed to better resource management and recognized that livestock grazing on public rangelands was not only appropriate, but complimentary as well.

Unfortunately, these people never achieved much success. This was caused, in my opinion, by extremists in both camps. Among conservationists and ranchers were enough detractors to spoil real progress with their uncompromising and combative nature. But we kept trying.

I was walking down the street in Washington, DC, one day with Ray Housley, who was then the DC representative for the Society for Range Management. We were discussing how fringe elements had slowed needed range management that would help both livestock and fish and wildlife interests. I asked if we might convene a select group from both sides, minus the fringe elements. My thought was to discuss only those issues on which there likely could be agreement and forget about such things as grazing fees. Ray thought a moment and said that such an outfit sounded like a "Lonesome Dove" operation to him. But we tried it anyway, and the process was called "Lonesome Dove." After several sessions, there was meager progress, such as agreeing to support more realistic budgets for range management in the Forest Service and BLM. But the effort eventually petered out.

About that time, the Forest Service initiated what usually is known as an "internal review" of livestock/big game conflicts on western range. Increasing elk populations was a big concern. However, the Service did the review a bit abnormally. Instead of involving just Service people, outsiders were invited to participate. Along with Service personnel were Jack Metzger and Jim Connelly representing the public land livestock industry, Don McQuivey of the Nevada Wildlife Agency, and myself representing big game interests. We visited forests and talked to many dozens of people in Nevada, Utah, Arizona, New Mexico, and Colorado. We met ranchers with real problems and a few that seemed intent only on causing strife. We talked with considerate and helpful wildlife and environmental groups and some environmental groups for which "green" is an inadequate description.

Some good suggestions came from that review, the best of which was to conduct the first Livestock/Big Game Symposium. But most importantly for me, the review revealed that

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Metzger, Connelly, McQuivey, and I could come to substantial agreement out on the ground and away from the stuffiness and temptations of a meeting room.

Also helpful to the alliance was our need to join forces and fight the Forest Service's tendency to feed us a big breakfast with lots of coffee and then throw us on a little airplane with no restroom for a 3-hour flight. It's obvious to me that Forest Service pilots are selected first on the basis of a bladder size and second on flying ability.

Seeking Common Ground involves three aspects, at least one of which all the failed programs have lacked. First, improved range management is initiated at the local level with local interests involved. Second, all land interests are a part of the effort, including the private landowner, Federal land management agencies, other Federal agencies such as the Extension Service and Natural Resources Conservation Service, State fish and wildlife agencies, representatives of public land recreational users, and county governments, if possible. Third, the first order of business and the most vital is to create an atmosphere of trust among the participants. Without trust, the project will fail.

A Wyoming rancher, participating in a Seeking Common Ground project, said last year that the greatest benefit he gets is the fact that all interest groups are strong supporters of what he is doing. He said that support is even more important than the money those groups are providing to improve his allotments and private range.

Get the various interests out of meeting rooms and on the ground at the local level, develop trust, determine what the ranchers and others need from the land, develop a plan, everyone throw a few bucks in the pot, and then go do it. I think that this is the way that range management will be done in the future, rather than by decrees from on high. Ranchers need our support and we need theirs. Together we can overcome the detractors.

Also this morning, I would like to clarify how valuable public rangelands really are to wildlife interests. Obviously, to livestock permittees, these properties are vital to maintaining economic operations, which translates into support for lifestyles, families, communities, and agro industries. Rarely, however, do the economics of wildlife get attention. The general public often mistakes my concern for public rangelands as merely a professional calling. Concern for wildlife, they think, is concern for esthetics, concern for maintaining populations of wild animals merely for people to enjoy.

Well, it is that. But it is far more. The relatively small industry that pays my salary, the sporting arms and ammunition manufacturers, employs more than 20,000 people with a payroll exceeding $600 million. Nearly 90 percent of my industry's business is dependent on huntable populations of wildlife. Inversely, wildlife depends on a strong national economy, because money is a key ingredient to wildlife conservation.

For an idea of the vastness of the public land fish and wildlife business in this country, look at the Forest Service's 1995 Long-Term Strategic Plan. That document contains economic estimates that by the year 2000, the National Forest System will contribute $130.7 billion annually to the Gross Domestic Product. Fish, wildlife, and recreation will account for 84.7 percent of that, with timber, minerals, livestock grazing and other uses providing the remainder.

A 1994 analysis revealed that wildlife on National Forests provides far more jobs to local communities than does timber (95,600 compared with 76,164). However, timber did offer higher paying jobs and produced $2.66 billion of employee income, compared with $2.47 billion for wildlife. Yet, in terms of annual economic contributions to communities, wildlife outpaced timber by more than two to one—$2.96 billion to $1.28 billion.

A smaller economic example is offered in research by Robert K. Davis, senior associate at the Institute of Behavioral Science, University of Colorado, Boulder. In a 1993 report titled "A Study of Western Colorado Big Game Hunters and the Issue of Access to Public Lands," Davis made a case for limiting public access to some public lands to maintain quality hunting experiences and income for adjacent ranchers who charge for access. The place he studied is called Ralston Hills, a piece of northwest Colorado rangeland identified by BLM as "lacking public access." The area includes eight grazing allotments totaling 45,000 acres of private (60 percent) and public (40 percent) land. For a hunter to reach the public land, he must scale a canyon wall and then be confronted with unmarked boundaries.

Ranchers in the area logically take advantage of their land's position and charge hunter access fees. In 1990, according to Davis, 330 hunters paid about $100,000 in fees and took a total of 109 elk and 162 deer from Ralston Hills. Davis interviewed the hunters and found that those paying fees had much better hunting experiences than those who climbed the wall to hunt for free on public land.

From this, Davis concluded that access would (1) allow more hunters in, but lower the quality of hunting; (2) make entry easier but blocks of private land would have to be dealt with and conflicts between landowners and hunters could increase; (3) displace hunters now using the area and they probably could not find equal hunting quality elsewhere. Thus, the gain of new hunters would be offset by the loss of the original group; and (4) result in a loss of $100,000 in annual fees, which capitalize to a community value of $1 million or more. Therefore, the hunters who would be displaced are worth more to the local economy than those who would replace them.

The system that Davis suggested to handle this situation is exactly what Seeking Common Ground is. He said, "Ralston Hills offers an opportunity for the public land and wildlife agencies to create a special management area in which the operators cooperate in range improvements, habitat management, and optimal harvesting programs in exchange for technical assistance and for the recognition that they are engaged in a legitimate, socially beneficial resource management activity."

This approach probably would be opposed by a majority of recreationists. But the fact remains that sustainable productivity of public lands increasingly will depend on *controlled* use. Recreationists in excessive numbers are just as destructive as livestock in excessive numbers. As with the demand for livestock grazing, the demand for recreation can exceed the land's ability, and already has in some places.

The 45,000 acres known as Ralston Hills illustrate to me the value of wildlife and the potential of Seeking Common Ground as much as anything I know.

I hope that you will join me in trying to make this symposium as fruitful as the first one. Better range management will benefit all users.

Beaverhead County's Memorandum of Understanding: Collaborative Approach to Planning

Spencer S. Hegstad

Abstract—Beaverhead County, MT's, Memorandum of Understanding has provided a strong basis for a return to community-based planning in our area. Citizens of the area have better access to and involvement in the decisionmaking process. A broad-based citizens group (The Beaverhead Community Forum) seeks resolutions to controversial resource management issues. To seek citizen input and involvement, numerous public forums have been offered on subjects ranging from livestock grazing to conservation easements. The coordination, communication, and trust that come as a result of working together have allowed the involved State, county, and Federal agencies to better use resources and funds. Resulting resource management plans now in the formative stages will have continuity and a common thread.

Beaverhead County is located in southwestern Montana. It is the largest county in Montana, covering 5,551 square miles or 3,549,870 acres. Of this land mass, approximately 69 percent is in public ownership. This is broken down as follows:

	Acres
U.S. Forest Service	1,370,444
Bureau of Land Management	662,396
U.S. Fish and Wildlife Service	44,157
National Park Service	665
State ownership	354,900
Total acres in public ownership	2,432,562

With over two-thirds of our county's land mass in public ownership, land management decisions made by the State and Federal agencies have significant effects on the economic and environmental climate of Beaverhead County.

Beaverhead County had taken a stance of being opposed to almost everything the State and Federal agencies did. The opportunity appeared to always be there to participate, but the county never took advantage of that opportunity. It seemed that we would react to decisions the agencies were making and then complain about those decisions. There was no trust with State and Federal agencies and County government. We had very little communication. We were never involved in the decisionmaking process "up front." Again, let me emphasize, it appeared that we had the opportunity to participate. We chose not to.

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In June of 1993, the Beaverhead County Commissioners began a spirited debate about our involvement with the State and Federal agencies. Should we be involved? To what extent? Would we be willing to devote the time necessary? How would we get involved?

There were a number of questions that needed answers. We decided that we must get involved. To get this started, we set up meetings with the Forest Service and Bureau of Land Management. We would meet with the Forest Service one month; the next month we would meet with the Bureau of Land Management. The agencies would go over some of the programs that were in progress, answering any questions we would have. We also attended two range tours to look at rangeland conditions.

During the next several months, we looked at several alternatives to become involved in the planning process. We studied both the Catron County approach and the Nye County approach. Neither of these approaches seemed realistic to us. We did not have the resources to attempt to become the land managers of Beaverhead County.

Early in 1994, we met with all the agencies that operate in Beaverhead County and started to work on building some kind of relationship that would help identify a way that all groups could work together. In June of 1994, we accepted a memorandum of understanding (MOU) concerning a coordinated ecosystem approach to the planning in Beaverhead County. The signers of this MOU included the following: Beaverhead County, Beaverhead National Forest, the Montana Department of State Lands, the Montana Department of Fish, Wildlife and Parks, Bureau of Land Management, the U.S. Fish and Wildlife Service, and the National Park Service. During the last year, we have added two agencies to the MOU. They are the Beaverhead Conservation District and the Bureau of Reclamation. The Memorandum of Understanding is as follows:

Memorandum of Understanding

I. Purpose

The goals and objectives of the Beaverhead County Comprehensive Plan recognizes the need to address the long-term land use patterns within the county to preserve the "Quality of Life" for the area's current and future generations and the need to strike a balance among the many and often competing needs and interests. With 69 percent of the county's land area in State or Federal ownership, the actions of the state and federal land management agencies can and do have a significant effect on the economic and environmental climate of Beaverhead County. Represented Federal

Agencies are directed by law to develop and implement land and resource management plans. The agencies have a responsibility and obligation under these laws to coordinate the preparation of these plans with local governments and agencies. Conversely, state and local government agencies have an obligation to join with the federal agencies to ensure that the needs of the citizens of Beaverhead County are recognized and addressed in the resulting plans. Therefore, it is recognized that it is in the best interest of all parties to join together in a coordinated effort to develop and implement plans.

II. Assessment Area

The area covered by this MOU consists of all lands within Beaverhead County of the State of Montana. Land management decisions that result for activities undertaken as a result of the MOU will apply only to the lands within the respective authorities of each party to this agreement.

III. Administration

Nothing in this memorandum shall obligate the parties to this agreement to expend funds or to enter into any contract or other obligations.

Specific work projects or activities that involve the transfer of funds, services, or property among the cooperators of this MOU will require the execution of separate agreements or contracts, contingent upon the availability of funds as appropriated by Congress, State Legislature or Beaverhead County.

Each subsequent agreement or arrangement involving the transfer of funds, services or property between the parties to this MOU must comply with all applicable statutes and regulations, including those applying to procurement activities.

This MOU in no way restricts the cooperators from participating in similar activities or arrangements with other public or private agencies, organizations, or individuals.

No part of this agreement modifies existing authorities under which the parties currently operate.

This MOU shall become effective on the date of the last signature by participants. It may be renegotiated or cancelled at any time at the initiative of one or more of the participants, following at least a 60-day notice period to the other cooperators.

Supplements or amendments to this MOU may be proposed by any party and shall become effective upon approval by all parties. Following any change in the MOU membership, all parties must reapprove the MOU.

The parties agree to review and assess the effectiveness of this MOU annually.

Unless otherwise terminated under the terms of this section, this MOU will remain in full force and effect until September 30, 1999.

In the execution of this MOU, there shall be no discrimination by any of the parties against any person because of race, creed, color, religion, national origin, handicap or gender.

In consideration of the Federal Advisory Committee Act (FACA), it is understood that the Interagency Steering Group meets exemption (i)(41 CFR ch. 101-6.1004) from the FACA. Group members participate "for the purpose of obtaining the advice of individual attendees and not for the purpose of utilizing the group to obtain consensus, advice or recommendations."

IV. Authorities

Federal Land Policy and Management Act of 1976 (42 U.S.C. 1701 et. seq. as amended)

National Forest Management Act of 1976 (16 U.S.C. 1600(note)

Intergovernmental Cooperation Act of 1968 (42 U.S.C. 4201)

National Wildlife Refuge System Administration Act of 1966 (16U.S.C. 668dd-688jj)

V. Statement of Joint Objectives

- The Parties desire to provide a framework to fully consider the social, economic, and cultural impacts of public land and resource management decisions as part of the overall planning and decision making processes.
- It is the intent of this MOU to facilitate better communication and understanding of how each entity's individual actions benefit the area's resources and people.
- All Parties desire to develop processes and procedures to ensure that all concerned are able to efficiently and effectively meet their responsibilities as public entities.
- All Parties to this MOU will be mutually respectful of each others goals and objectives through the incorporation of the values, expectations, and needs for people within the context of ecosystem management.
- All Parties desire to develop a dynamic collaborative approach that builds or improves trusting relationships.
- Define role of each party to the MOU.
- Identify customers served by each party to the MOU.

VI. Organization, Roles and Responsibilities

The parties to which this MOU apply are the Bureau of Land Management, Forest Service, Fish and Wildlife Service, National Park Service, Montana Department of State Lands, Montana Department of Fish, Wildlife and Parks and Beaverhead County (referred to hereafter as "the parties"). They recognize that their authorities are distinctly different. Each is guided by the specific laws and regulations which pertain to their respective level of government and administrative responsibilities. However, they recognize the need to better coordinate with each other and share a broader vision of how their coordinated actions can contribute to implementing an ecosystem approach to resource management in the Assessment Area. "The parties" need to jointly share their knowledge of conditions and emerging issues and trends to best achieve common goals of enhancing the economic, social and natural resource conditions.

Representatives of "the parties" will comprise an interagency steering group formed pursuant to this MOU.

—The Interagency Steering Group will consist of the Butte District Manager of the Bureau of Land Management, the Forest Supervisor of the Beaverhead National Forest, the Refuge Manager of the Fish and Wildlife Service, the Area Manager of the Central Land Office of the Montana Department of State Lands, the Regional Supervisor (Region 3) of the Montana Department of Fish, Wildlife and Parks, Unit Manager Big Hole National Battlefield, and the Chairman of the County Commissioners of Beaverhead County.

Responsibilities

Bureau of Land Management—The BLM is responsible for administering 662,396 surface acres of public land and

2,317,545 acres of subsurface mineral estate in Beaverhead County.

National Park Service—The NPS is responsible for the management of the National Park System which includes 79 million acres in all 50 states. In Beaverhead County, NPS administers the Big Hole National Battlefield, covering just over 655 acres.

Forest Service—The FS is a land management agency responsible for the management of the national forests including 1,370,444 acres of the Beaverhead National Forest in Beaverhead County.

Fish and Wildlife Service—The Fish and Wildlife Service is a federal land management and regulatory agency responsible for implementing the Endangered Species Act and coordinating with other federal and state agencies in the national effort to prevent the extinction of species. The Service is also responsible for implementing the Migratory Bird Treaty Act, and others, as well as providing assistance to private, local and state government conservation efforts through various means to provide for ecosystem values. The Fish and Wildlife Service is responsible for the publication of the plant and animal candidate lists and has a national candidate conservation program.

The Service is charged with management of the National Wildlife Refuge System. The system includes the 44,157 acre Red Rock Lakes National Wildlife Refuge (NWR) located in Beaverhead County, within the Centennial Valley.

Montana Department of State Lands—The DSL is responsible for managing the State's Trust Land resources (5.2 million surface acres and 6.2 million mineral acres) to produce revenues for the trust beneficiaries while considering environmental factors and protecting the future income generating capacity of the land. The DSL is also responsible for regulating the development and requiring the reclamation of all mining activity in Montana.

Montana Department of Fish, Wildlife and Parks—The Montana Department of Fish, Wildlife and Parks is responsible for the management of fishery, wildlife, recreational, cultural, and historic resources of the State of Montana. They also have responsibility for managing Wildlife Management Areas, Fishing Access Sites, and State Parks, including a number of sites in Beaverhead County.

Beaverhead County—The County Commissioners serve as the governing body for the county and are charged with providing the services and leadership necessary to maintain the health and safety of the county residents. In a larger sense, the Commissioners are challenged to manage the changes and demands of a growing society.

Interagency Steering Group—Explores opportunities to further expand and strengthen coordinated planning efforts and cooperative implementation where there is mutual benefit to sharing resources, expertise and information.

—Coordinates the establishment of guiding principles for collaborative planning and developing an ecosystem approach to management of the Assessment Area.

—Coordinates appropriate procedures to ensure adherence to all legal requirements in analyzing changes and establishing new management direction.

—Promotes consistency in development and implementation of collaborative planning and ecosystem management.

—Clearing house for information/technology transfer related to collaborative planning and ecosystem management.

—Works closely with all interested public to gain general understanding of ecosystem management and collaborative planning efforts, including consideration of public needs and demands as a part of public participation.

Mutual Agreement

"The Parties" agree to:

—Share, when appropriate, available resources, personnel, funds and technical assistance. Technical assistance can include, but will not be limited to resource management and planning, administration, computers, conflict resolution and meeting facilitation, and community development.

—Recognize the multiple-use philosophy and principles of the BLM and Forest Service, and that a range of goods and services is provided to all people who choose to use and enjoy our public lands.

—Develop and exchange information related to land management decisions, socio-cultural values, economic considerations and natural resource conditions.

—Consider the community values, opinions, and perceptions of the residents of Beaverhead County as a part of overall public participation.

—Share, when appropriate, training, workshops, technical sessions.

Supplement to the Memorandum of Understanding

After many meetings and countless hours, it was recognized that it was in the best interest of all parties to join together in a coordinated effort to develop and implement plans. It was also understood that the "Parties" needed to jointly share their knowledge of conditions and emerging issues and trends to best achieve common goals of enhancing the economic, social, and natural resource condition. To ensure that this MOU was not just "lip service" filled with warm and fuzzy words that made folks feel good, an Interagency Steering Group (ISG) was formed. The group consists of representatives from all the agencies that are parties to the MOU. The primary role of the ISG is to explore opportunities to further coordinate planning activities. As the ISG begins to function, there is a desire to more specifically identify roles, functions, and organizational structure to accomplish the task of coordinated planning in Beaverhead County. The organizational structure is as follows:

Supplement to MOU—Operating Procedures

Interagency Steering Group—This group provides oversight of the process, establishes planning area priorities, and maintains consistency and direction in addition to the specific responsibilities identified under the responsibilities section of this MOU.

ISG Staff—Bureau of Land Management, Forest Service, and County Planners provide the staff work for the ISG as requested by the ISG.

Area Resource Managers—This task force is responsible for the control and direction and the necessary day-to-day coordination of the planning project. They coordinate the activities of the Interagency Resource Team and ensure the planning activities meet the needs of the agencies involved. Members of this task force are assigned area by area by the ISG. (See Intercounty Participation below)

Resource Team—This team is responsible for conducting the coordinated area assessment. The team is assigned by the area resource manager. While the assessment is not a decisionmaking process, it provides all agencies involved with information and data that the individual agency can use in making decisions for lands within their authority and in compliance with their procedures.

Agency Interdisciplinary Teams—These IDT's are responsible for conducting the analysis and project planning for those lands within their authority, in accordance with agency decisionmaking procedures. Teams maintain a coordinated and cooperative contact with the other agency teams. Teams are assigned by their respective agencies.

Ad Hoc Specialist Group—This group includes a pool of specialists from all involved agencies that are available to the Resource Team to provide data and information.

Intercounty Participation

The assessment area as defined under item III of this agreement may be expanded beyond Beaverhead County to include lands within adjacent counties through mutual agreement of the parties to this agreement and the County Commissioners of the adjacent counties. If the adjacent counties agree to participate in the coordinated planning process outlined, including this supplement, representatives of the adjacent Federal, State and Local agencies will be members of the Area Resource Manager's Task Force for those areas that overlap county jurisdictions.

In consideration of the Federal Advisory Committee Act (FACA), it is understood that the Resource Managers Task Force and Resource Team meet the exemption specified under Section 204(b)(2) of the Unfunded Mandates Reform Act of 1995.

Beaverhead Community Forum

With the MOU in place, the first question that needed to be addressed was: "How do we involve the public in the planning process?" What is the most effective way to draw information from the public?

Beaverhead County Commissioners are believers in "Community Based Planning." We feel very strongly that the local residents' voices be heard. In public land management decisions, it is extremely important to understand the needs of the local government and the public it represents.

The first project the Steering Group sponsored was a community forum on "Collaborative Planning" and how to involve the public. Matt McKinney with the Montana Consensus Council was the moderator. On January 24, 1995, over 70 citizens and leaders from Beaverhead County met at Western Montana College to explore the social, economic, and environmental trends in the county and how they might be cooperatively addressed. The participants represented multiple points of view: business and economic development; human services including schools, churches and housing; agriculture; mining; recreation; conservation; the media; private property; and local, State and Federal government. At this community forum a number of issues, concerns, and trends were identified. There was an excellent exchange of ideas. I think that the most important thing that came out of this meeting was the decision to convene a "working group" to further discuss the next steps and design the next meeting. From this first meeting, the Beaverhead Community Forum was formed. Participants offered several ideas as next steps:

- Identify and solicit the input of individuals and groups that did not participate in this meeting.
- Prioritize the issues, concerns, and interests that were identified at the meeting.
- Develop a better understanding of the social, economic, and environmental trends in the county.
- Identify the constraints or sideboards to this type of collaborative planning.
- Identify who is doing what in the county with respect to planning, economic development, and so on.
- Further discuss how to integrate public land planning and growth management within the county.
- Discuss the pros and cons of focusing on a particular project (for example, the Pioneer Mountain Landscape Analysis) or taking a broader view.
- Learn more about facilitation and collaborative problem solving.
- Learn more about what is being done in other communities and counties.

The Beaverhead Community Forum has been meeting on a monthly basis for over a year and has provided invaluable information and input to the Interagency Steering Group. If the ISG succeeds, it will be due in large part to the Beaverhead Community Forum.

Cooperative Efforts

Landscape Analyses

The first landscape analysis that the ISG studied was the "Pioneer Mountains." This area encompassed 1 million acres and involved lands within five different jurisdictions. The main reason this area was selected was that the Forest Service had already started a planning process in this landscape.

At the present time the ISG has just begun to study its second large landscape—the Gravelly Mountains. This is a large landscape in both Beaverhead and Madison Counties.

We have had five public meetings at which the public has identified the issues that are important to them. After these issues have been compiled, the area managers will start their analysis and put a special effort into addressing the issues that have been raised at the public meetings. The process will take about 18 months to complete. I believe that through this process the local citizens will have a major impact in deciding how this landscape will be managed. Again let me emphasize community-based planning. I believe that it will work.

Weeds

Weeds are a major concern to the Beaverhead County Commissioners. We have a weed program and would like to think that we are ahead of the curve in our effort to control weeds. With over 1,500 miles of county roads to care for, along with a large number of highway miles that we spray for the State, it is a very large undertaking. I put this on our agenda at one of the ISG meetings and found that all of the participants have some kind of weed programs. They also share our concern about weeds and their potential take-over in our county. Because of this discussion, we decided to sponsor a community forum on weed management issues. In December of 1995, we had that forum and found that the public has a concern and would like to see the agencies work together, sharing equipment and personnel, waging a war on noxious weeds. That is exactly what we are going to do. We have appointed a 14-member weed task force that is chaired by the Beaverhead County Extension Agent. There is a representative from each of the public agencies as well as members from the County Weed Board, and citizens at large. I am confident that we will have an impact on the weeds in Beaverhead County. The task force has been directed to create and help implement a weed management program for our county. Several innovative approaches are being explored. One is the possibility of sponsoring an "Adopt a Roadway" project. A group or family could adopt a section of roadway and be responsible for hand pulling weeds. Patagonia has offered to sponsor a river project, having sportsmen hand pull weeds on rivers in our county. They are going to organize a weed day, or weed week, to emphasize the importance of controlling weeds.

Conservation Easements Forum

With cattle prices as low as they are at the present time, ranchers are struggling to keep their heads above water. Agriculture is the number one industry in Beaverhead County. Is there something that would be of benefit to this industry; especially during these hard times? The ISG discussed this issue at one of our meetings and decided to sponsor a community forum on conservation easements. In January 1996, we held this forum. Presenters from the Rocky Mountain Elk Foundation, Nature Conservancy, the Montana Land Reliance, and the Montana Fish, Wildlife and Parks Department explained the pros and cons of conservation easements. The ISG did not take a position either for or against conservation easements, but all agreed that it has some very positive aspects. The program was well received by the public and gave people an option they may not have been aware of.

The Future

As the ISG continues to move forward, we fully realize that there are potential pitfalls and problems. There is a lot of historical baggage—citizens do not trust government. We will continue to have "turf" battles, the "that's the way we've always done it" attitude. There will be some folks who do not want to see us succeed. They have a vested interest staking out positions. There will be some staff people who are not committed to the process. They may feel there is no problem with the current way of handling land management decisions—the county should not be sticking its nose someplace it does not belong.

Make no mistake—this process is a lot of work. It takes a major commitment on all the players' parts. This is harder than the old way of doing business. It takes time to come around and build the trust required. It seems at times that we are "building the boat as we float down the stream."

The effort is well worth the work required. It is worth the criticisms, the setbacks, and the time. The old way simply was not working for Beaverhead County, its citizens, or the agencies involved. Any effort to make it better is worth any problems or roadblocks that come up. We must make this work if we are truly concerned about land management decisions in our county.

Ecosystem Management: the Owl Mountain Partnership

Roy Roath

Abstract—The Owl Mountain Partnership, a Seeking Common Ground project in North Park, CO, is introduced. Discussion focuses on: the wildlife/livestock conflict that was the impetus for the project, how commitment to cooperation was obtained, and why various parties chose not to cooperate. Local leadership, involvement, and commitment have been essential, as is shown in the project's motto: "People Support What They Help Create." Working partnership principles are outlined. Successes and results the project has been able to bring to the rural North Park area are also discussed.

The Owl Mountain Partnership is another one of the Seeking Common Ground projects found throughout the West. I believe the other projects have explained many of the things that are common to the Seeking Common Ground projects. I am going to tell a little about where the Owl Mountain Partnership came from, why we came from there, how we got to where we are, and what we did. Most importantly, I will tell you what we think the take-home messages might be from the Owl Mountain Partnership in Colorado. We are the Owl Mountain Partnership, with emphases on a partnership built at the local level.

Our origin came basically from two places. We were initiated from the Habitat Partnership Program in Colorado, which is funded by the Colorado Division of Wildlife to resolve wildlife/livestock conflicts throughout areas of Colorado. This program, seeing that there was a significant opportunity to broaden the base and approach to resolving wildlife/livestock conflicts, applied for the Seeking Common Ground seed money that was offered by the consortium of Federal agencies in efforts to resolve wildlife/livestock conflicts. A local group including the Habitat Partnership Program (HPP), North Park Committee, and other collaborators wrote the application to the Seeking Common Ground group. Then 3 to 4 months later the HPP committee was notified that the seed money was granted. At that point it was apparent that the project was going to take more time and supervision than the all-volunteer HPP committee could provide. So they asked for assistance from Colorado State University, which assisted with the program by providing technical support and organization in solving wildlife and livestock conflicts in North Park. **(Message: Every project needs technical support, guidance, and a vision.)**

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We did have a conflict with wildlife, livestock, people, and land. The essence of the Owl Mountain Project is, we believe, that without a galvanizing issue, collaborative management cannot continue to exist. There has to be an area, a mutual forum of concern, that drives the issue and drives the commitment of the people involved in the project. In the Owl Mountain Project area, we have a large number of elk that winter (in some years) on the Arapahoe National Wildlife Refuge, at the base of the valley, and on adjacent ranches. There are too many. Not only that, several elk spent the full year on the hay meadows in the bottom of the valleys. The elk reduced hay production on those meadows by as much as 50 percent. That was a problem. So there were issues to deal with.

We also have a variety of other issues that were important, but perhaps secondary. Undoubtedly, we have riparian issues, as does everyone in the West. We have moose affecting some of the species of willows in the riparian area. Elk use many of the lowland riparian areas year round. We also have grazing in riparian areas by cattle. So we did have a riparian issue; we do have a riparian issue, and we will continue to have a riparian issue that we are addressing in a broader context. Sage grouse populations across the West are declining. The Owl Mountain Partnership area is no exception. We have set our sights on increasing the sage grouse population. The North Park area had historically been a large deer production area and was renowned for its deer hunting. There is now a small deer herd. The Owl Mountain Partnership has a goal to increase the number and quality of deer in the area. There is a major waterfowl refuge for production of geese and ducks. Perhaps as important as any other of the single issues is that Walden, the County Seat for the county of 1,700 people, one of the least populated counties in Colorado, was declared a community at risk. That has been a major issue for us in dealing with the Owl Mountain Project.

So what did it take? We defined the land area by saying: the land area that we are going to deal with is that area occupied by a large number of elk that affect the agricultural and public land resources. So, the boundaries of our project area were defined by the boundaries of the distribution of an elk herd. You will note that it does cross more than one watershed. We have defined our ecosystem on an issue basis.

As with all collaborative processes, there must be a galvanizing issue. Our galvanizing issue was resources used by elk and livestock. We also decided that, if we were going to work together, we had to know the needs of individuals and the community and have a common understanding of what these needs were. Very early in our process, we sat down together and decided that individually and collectively we could get more done by working together than by working separately. In a meeting, the landowners made a uniform commitment that each and every person who was going to participate in the project was committed to cooperation. Not

every producer in the project area is a cooperator. Frankly, some of them are afraid to work with the project because the Federal government is involved. They will not cooperate because they dread having the government do something that they will not be able to recover from.

Each of the cooperating producers made a commitment to cooperate, provide resources, and participate in mutual solutions. One of the essences of the Owl Mountain Project is rapport. I have heard this from several other projects. People will not work with people they do not trust. Partnerships are based on trust. It does not matter whether you have a contractual relationship or a Memorandum of Understanding, the relationships that work are based on trust and rapport.

Once we had decided to work together, we had to decide what our working environment was going to be. A preamble for our working relationships defines our working environment:

1. We will be fair, not equal. We will be fair to every participant in the project.
2. We will recognize and protect landowners rights.
3. We will not make decisions unilaterally that favor one party over the other.
4. All decisions about the Owl Mountain Project will be made in a public forum.
5. Decisions will include an accounting for interests of the local community.

We wrestled for three meetings over what "local" meant, and we decided that local meant Jackson County. Fort Collins is over the mountain and has a vested interest in what happens in the Owl Mountain Project area, but local means Jackson County because that is where the people live who are driving the project, and whose needs we are committed to meeting.

The operating environment depends a great deal on outside influences. We had been blessed and damned in a myriad of ways. The week after our organizing meeting for the steering committee, one of the county commissioners for Jackson County went to Washington, DC, to testify in a hearing on payment in lieu of taxes for Federal lands. It was reported that one of the key people from the Department of the Interior testified against increased payment in lieu of taxes. That county commissioner came home angry and defensive. That affected our operating environment. Additionally, there was a proposal for a ski area in the project area. The Governor decided that, in the best interests of the people of Colorado, a ski area being run by an outside interest was not a good use of State lands of Colorado. He declared a moratorium on the development of ski areas on State-owned land. That was about 2 months following the payment in lieu of tax incident. The county commissioners were beside themselves and convinced that anyone who worked with the government, sat down with the government, or wrote a letter to the government was not only a suspect, but an enemy. That created a little controversy in the steering committee, to say the least.

People in rural areas have very long memories. The Arapahoe National Wildlife Refuge was established in the 1960's, on land that the Federal government purchased, basically for the production of ducks. It is locally called the "duck farm," sometimes with much disdain. The carryover feelings about the "duck farm" have had an influence on our project. In the Owl Mountain Partnership, grazing on the "duck farm" is really an important issue. Our project provides assistance in research to gather information that will allow people to make good decisions as to whether grazing is appropriate on the refuge.

Our motto is "People Support What They Help Create," and our test for success in this project is: "Did we live within the guidelines of this motto?" Communication, communication, communication. If you cannot communicate, you cannot collaborate. We have experienced both sides of that issue! We have reaped the successes of effective communication, and we have reaped the perils of ineffective communication. I suspect many of the other collaborative efforts in the West have found the same. We believe in proactive management, but the thing that makes collaborative projects work is action. People want to belong to things that are happening and they lose interest in things that are not.

For a moment I would like to focus on what is necessary for success in the collaborative process. What it takes, in my opinion, is it has to be local, it is needs driven, and it takes action. The question then is "How do you hold it together once you get it together?" Five elements I have identified include:

1. Common vision is essential; that ties directly with the needs-driven part of my statement. Without a vision keeper, sometimes projects can go astray. It is critical that someone or some group is a central focus of the group, the vision keeper. The vision may change. It is important to come back and check with the group. Is our vision the same as it was? If there is no vision that provides guidance and direction for the project, the project goes astray, loses interest, or frays.
2. There has to be legs for the project, that means the people that make the things happen. Our project has legs in the name of Steve Porter, who has lived in the community for 20 plus years as a Division of Wildlife employee. He makes things happen!
3. Every project has an activist, one or more; we do too. Activists can be beneficial or detrimental depending on how you use them. We have one activist that has been both. At first our activist was an enemy; now our activist is one of our biggest supporters. It took concerted effort to bring that person in as a friend of the project, but it was worthwhile.
4. We use the sage. It is our tie to the land. Every community has one or more sages. These are people who have been there, lived through it, lived with the land, and have an enormous history with the land. We want to use their wisdom.
5. We also have naysayers in the project. Every project has naysayers and we feel it is our responsibility to placate them. That sounds a little crass, but I think it is true. We placate them in several ways: peer pressure, proaction and conversion. Conversion is the best, but it is not always possible. Many of our naysayers have either gotten in or gotten out. We would rather have them in, but some have chosen to stay out. We will continue to deal with them. We will continue to offer them the opportunity to be in, but we are also going to go on, with or without them.

So, what are the products of this ongoing action in the Owl Mountain Project area? We have cooperated in an Internet link for the local school district; it is used in grades three

through high school. We are using the Internet as our link to the outside world; two-way communication allows the outside world in and uplinks Owl Mountain to the outside world. We think that is a very positive thing. A water carnival was cosponsored by the Owl Mountain Project for grades 1, 2, 3, and 4. We took them to the land. Even though it is a very rural community, it was amazing how much those children learned in a 2-day water carnival. Partnership with the schools is a key product of the Owl Mountain Project.

We have built stackyards around haystacks to protect critical forage resources for the ranchers in the project area. We also put in water developments, including a new well. We paid for the pipeline; the rancher paid for the well and the pump. We shared the cost. We have worked on the "duck farm." We did a grazing project; we provided water, and new management for part of the "duck farm" that favored the refuge, the rancher, and a permittee. Everyone came out winners. We have done a complete assessment of the habitat in the Owl Mountain Project area, some 400,000 acres. We are assessing the capability of the project area to sustain cattle, sheep, horses, elk, moose, antelope, sage grouse, and neotropical birds. At least we have made some broad-based assessment of what we think it might be. We are now working on an integrated set of ranch plans that will interlock with a master plan for the Owl Mountain Project areas. We also have convinced a multimillionaire ranch owner not to subdivide his property; he has decided he wants a conservation easement because it is the right thing to do for the land. We may be able to maintain a block of land of several thousand acres in sustained management.

What tests determine whether the Owl Mountain Project works? The tests are:

1. Did we meet everyone's needs? We promised at the outset that we were needs based, that we were needs-driven, and to the best of our ability we would meet the need of every single cooperator in the project.
2. Will the project continue?
3. Will the solutions affect it? Did they happen? Were they joint? Did they solve what they were intended to solve?
4. Perhaps as important as any other single factor, are there better ties, and better relationships?
5. Is there more trust?
6. Is there greater strength in the community as the result of the Owl Mountain Project?

We believe that communities can manage their lands. Residents do it best, because they live there. The Owl Mountain Partnership is about the land, the people, and the communities, trusting each other enough to cooperate in land management for the good of everyone.

Upper Muddy Creek Coordinated Resource Management

Larry Hicks
Andy Warren
Cheryl Hicks

Abstract—The Muddy Creek project is a Wyoming success story with national significance. People with a vested interest in the watershed came together and agreed on common goals and how to achieve them. These were proactive people who believed that local problems were best solved by local solutions. The result was ecosystem management on a watershed basis. The lesson learned from the Coordinated Resource Management group is that successful natural resource management requires an investment in people.

The Muddy Creek drainage is located in south-central Wyoming in the upper Colorado River Watershed. Annual precipitation ranges from 7 inches in the lower project area to 18 inches at the headwaters. Saltbush, greasewood, sagebrush-grass, and juniper plant communities dominate the lower elevations while aspen, mountain shrub, tall sagebrush, and riparian plant communities dominate higher elevations. Ephemeral and intermittent drainages to the west contrast with perennial drainages to the east. Antelope, elk, mule deer, sage grouse, waterfowl, hawks and eagles, coyotes, badgers, and many other small birds, mammals, and fish abound. Muddy Creek is a major contributor of salinity and sediment into the Upper Colorado River system. Livestock grazing is an important element of the local economy. Oil and gas development occur within the watershed; coal reserves may be developed in the future. Recreational use is also expanding as people look to open areas like Wyoming. Recreation use in the project area consists of hunting, fishing, and other outdoor activities.

The Muddy Creek Coordinated Resource Management (CRM) Project is one of the original national Seeking Common Ground demonstration projects, encompassing nearly 300,000 acres of mixed Federal, State, and private lands in Carbon County, WY. The Muddy Creek CRM Project emphasizes cooperation rather than confrontation. The process involves people getting to know the land, building relationships through communication, earning trust so they can identify their common ground, and working together to achieve success. Using the philosophy of ecosystem management on a watershed basis, the CRM process was initiated by the local conservation district to get all affected interests in the watershed working on consensus management of the natural resources. To date there are over 25 members representing private landowners, Federal, State, and local agencies, environmental and conservation organizations, industry, and the public working on the project.

Cooperators

AL Land and Cattle Company	PH Livestock Company
Bruce Thayer	Salisbury Livestock Company
Bureau of Land Management (USDI-BLM)	Snyder Oil Corporation
Carbon County Commissioners	Stratton Sheep Company
Carbon County Cooperative Extension Service	Three Forks Ranch
Desert Cattle Company	University of Wyoming
Ducks Unlimited Incorporated	Weber Ranch
Environmental Protection Agency	Wyoming Department of Environmental Quality
Espy Livestock Company	Wyoming Game and Fish Department (WGFD)
Jack Creek Land and Cattle Company	Wyoming Outdoor Council
Little Snake River Conservation District (LSRCD)	Wyoming Riparian Association
National Fish and Wildlife Foundation	Wyoming Water Development Commission (WWDC)
Natural Resources Conservation Service (USDA-NRCS)	

Mission Statement

To protect, enhance, and conserve the Muddy Creek Watershed for healthy, sustainable use of natural resources for wildlife, livestock, energy, and recreation.

Goals of the Upper Muddy Creek/Red Rim CRM

- Increase cooperation, coordination, and trust among landowners, permittees, agencies, and interest groups.
- Improve critical ranges for antelope, elk, and deer in the area.
- Demonstrate that properly managed livestock grazing can be compatible with consumptive and non-consumptive uses of the area's multiple resources.
- Improve water quality and reduce erosion and sedimentation. Restore the riparian habitats to their desired future condition; this will consist of visible changes in

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the plant community, stream channels, and hydrologic regimes. It includes improvement of existing woody plant communities and their restoration to previously occupied sites. Reestablish Colorado River cutthroat to headwater streams.

- Manage upland habitats to improve their bio-diversity and productivity for selected wildlife species and domestic livestock.

Methods

Development of water sources was an important element, in addition to livestock management, in achieving resource objectives. Several innovative types of water developments have been used. Tires are obtained from coal mining operations, and have a much longer life than metal troughs. Tire troughs are gravity fed with water from springs or streams a short distance away. Some tire/spring developments are left on year-round for use by wildlife. Similarly, roads are used to collect water into pits, which are used by livestock walking the road rather than going to the creek. Upland pits and reservoirs have been built to stop active headcuts or gullies and create new water sources. Where sufficient water occurs, ponds are built to support fisheries.

High tensile solar electric fencing is used to shorten duration of livestock use and reduce impacts to big game. These fences are unbarbed and partially lay down under the weight of animals enabling them to pass through or over. The high tensile strength results in the fence bounding back up after a herd of elk crosses it, instead of breaking. Livestock quickly learn to leave it alone, so long-term maintenance costs are lower than those of conventional fences.

In some allotments, herding is utilized to move cattle out of riparian areas and onto uplands. This is primarily done in yearling cattle operations.

In the Muddy Creek drainage, there are approximately 120,000 acres of sagebrush. Most of this sagebrush is the same age class due to fire suppression. Aspen habitat used to occupy twice the acreage it does today. Prescribed burning is being utilized to diversify plant communities, regenerate aspen, and improve the overall health of the watershed.

Vegetative plantings are another tool used to ensure woody species diversity and promote healing of riparian habitat. Planting trials have been established in conjunction with the Natural Resources Conservation Service, Plant Materials Centers in Meeker, CO, and Bridger, MT, to evaluate which species are best adapted. Silver buffaloberry has responded well in planting trials along Muddy Creek. Other species planted include various willows, waterbirch, aspen, cottonwood, rose, currant, twinberry, dogwood, hawthorn, and chokecherry.

The Muddy Creek CRM promotes innovation of new ideas for solutions to old problems. Various types of instream structures have been experimented with to provide gradient control and speed up riparian recovery on destabilized stretches of streams. Squared timbers or single logs are used on smaller streams. Interlocking materials, polyvinyl or steel, are driven in with a backhoe to minimize bank disturbance where soils and bank stability are of high concern. Polyvinyl and steel structures are also being used to stabilize headcuts and raise water tables in downcut channels to regain channel/floodplain function. Another important purpose of the instream structures is to improve fish habitat.

At the lower end of the project area is an 1,100-acre mosaic of wetlands and irrigated meadows. It was created by spreader dikes built by homesteaders in the early to mid 1900's. This area acts as a natural water filter to remove sediment and store water. Stream gauging in 1987 documented 10,000 acre feet of water stored in these meadows for vegetative growth and late season release. Since the 1960's the dikes have breached and active headcutting and gully erosion were draining this meadowland. The CRM process helped bring the people, engineering, and funding together to rebuild these spreader dikes.

Erosion from roads was identified as a major cause of sedimentation into Muddy Creek. Over 3,000 miles of roads exist within the watershed; less than 200 miles of those roads are actually planned and designed roads by the county or the Bureau of Land Management. Increase in use of four-wheel-drive vehicles over the last 20 to 30 years has proliferated an increase in roads. The average road density is 3.5 miles of road per square mile of land. This sheer number of roads not only contributes erosion into Muddy Creek, it impacts wildlife and their habitat. Deer and elk vulnerability to hunting are very high.

Roads directly reduce site productivity and negatively affect water quality, fisheries, and riparian habitat. While technical solutions such as improving road design, culverts, wing ditches, and water bars are being implemented throughout the area, this is only part of the answer.

Figures 1 and 2 illustrate the diverse funding sources and expenditures for the project.

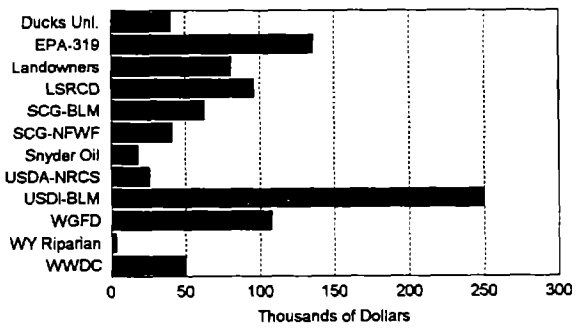

Figure 1—Muddy Creek funding, 1993 to 1995.

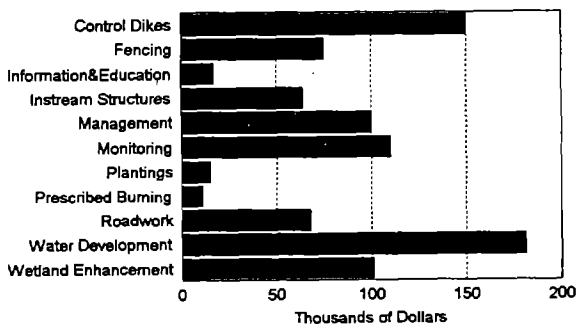

Figure 2—Muddy Creek expenditures, 1993 to 1995.

Results

The combination of upland water development, creation of smaller pastures, and prescribed burning provides opportunities for more intensive livestock management. This has resulted in better distribution and shortened duration of use. For example, where 50 cows might have spent their summer at the junction of Littlefield and Muddy Creeks, now over 600 cows use this area for only 2 weeks leaving most of the summer for plant growth and expansion. Plant cover on the streambanks has dramatically increased from only 5 percent in 1989 to over 90 percent in 1995. The stocking rate on this area has been relatively constant and at full grazing preference for the last 30 years. Improvement in streambank cover is an important early step to holding soil in place, improving water quality, and providing more forage and habitat for livestock and wildlife. Short duration use in summer allotments, usually 2 to 4 weeks instead of 4 months, has allowed the riparian habitat to heal.

Management changes on Muddy Creek have allowed plants more time to grow and stabilize streambanks. As this process continues, vegetation is encroaching into and narrowing stream channels, resulting in 30 to 50 percent reduced stream width along Muddy Creek in 6 years. This is important for several reasons. Reduced stream surface area and greater depth result in lower water temperatures for fish and aquatic insects. A narrower channel has less friction resulting in a faster current, helping to flush out sediment from the bottom and deposit it on building banks, thus improving water quality and channel bottom habitat. In many places, gravel substrate has been observed where none previously existed. A narrower channel will fill faster during high flow events, resulting in more over-bank flooding; this increases bank water recharge and storage for late season release, and reduces destructive energy by spreading water over a broad area.

Improved woody plant vigor has resulted in increased cover and vertical structure. These changes in riparian communities increase the diversity of animal species that depend on them. Other benefits include improved bank stability and stream shading, which helps lower water temperatures for fish and macroinvertebrates. Beaver historically were numerous along Muddy Creek and, as woody shrubs species regain their abundance, may also return.

Approximately 10,000 acres of the watershed have been prescribed burned since 1985; plans call for another 10,000 acres in the next few years. Prescribed burning has been extremely beneficial for livestock, wildlife, and vegetation communities. Removal of uniform stands of sagebrush stimulates forbs that are important for wildlife species like sage grouse, and desirable grasses such as green needlegrass and onion grass. Early successional species such as horsebrush and evergreen ceanothus benefit greatly from burning. Sagebrush seedlings are able to sprout and a more diverse age class of sagebrush result. Most of the riparian aspen communities that are important for beaver are gone. Existing upland aspen stands are mature and decadent. Fire removes the sagebrush competition so that aspen regenerate and expand in both riparian and upland sites. After burning, resprouting occurs quickly and within a few years larger, healthier communities emerge. Burning uplands also attracts livestock away from riparian areas due to increased quality and quantity of forage.

Forty miles of main transportation roads and 22 miles of secondary access roads were improved to protect the natural resources and reduce annual maintenance costs. Five miles of roads were reclaimed and 8 miles were signed for voluntary closure. Sedimentation into Muddy Creek from roads has been reduced.

Road management has been a difficult issue for the CRM group. Public perception has been negative, especially when any type of road closure was discussed. Public meetings were held to try and gain acceptance. Further public participation in travel management is being sought by the CRM group.

Open water and brood-rearing habitat have been developed for waterfowl and other wildlife in the meadowlands above and below the George Dew spreader dike. In addition to providing gradient control and enhancing historic irrigation, over 100 new acres of diverse wetland habitats were created. These new dikes were cost-shared by a variety of agencies and organizations, including Ducks Unlimited, Snyder Oil Company, Natural Resources Conservation Service, Bureau of Land Management, and the Little Snake River Conservation District.

This important habitat has been managed for both livestock and wildlife. Forage production averages about 4 tons per acre, enough to save the rancher $100,000 annually in hay costs during the October to February period of use. Livestock grazing is balanced to maintain healthy willow communities for beaver and mule deer habitat and grassy areas for spring waterfowl use. During high creek flow in the spring, thousands of migrating ducks and geese layover in the flooded meadows to feed on new plant growth where there is good visual security. Sufficient cover still remains in many areas for waterfowl that decide to nest and raise their young.

The CRM group is working to reintroduce the Colorado River cutthroat trout, which is a candidate for Threatened and Endangered Species. These trout have historically been in Muddy Creek as evidenced by Jim Bridger's journal "...the stream furnishes some small fish, among which were speckled trout." Currently it occupies just 1 percent of its historical range. Only a fraction of the watershed is capable of supporting trout at this time, essentially the headwaters of Muddy Creek. Trout reintroduction is scheduled for 1998. Recovery will represent a 32 percent increase in the number of stream miles inhabited by the Colorado River cutthroat trout in the Little Snake River Enclave. Through local, voluntary actions like this, it is hoped to avoid additional Federal mandates.

Trout are the "miner's canary" of the watershed, a biological indicator for success. Healthy riparian systems provide fish habitat in the form of cooler water temperatures, good water quality, overhanging vegetation, and undercut streambanks. Currently, numerous water column parameters are monitored including salts, turbidity, temperature, dissolved oxygen, and flow. This monitoring is expensive and time consuming. However, if a healthy trout population is reestablished in Muddy Creek, then water quality standards would be met.

Conclusions

The Muddy Creek CRM is showing managers and politicians that although technical expertise is available to solve problems, success is usually dependent on people and their ability to work together. Toward this end, education is the principal tool needing further development. A major element of the Muddy Creek CRM Project is information and education. All meetings are advertised and open to the public. Science curriculum in local schools is being changed to more "hands on" experiences within the local area. An educational workshop for teachers and other interested people was hosted through the Wyoming Riparian Association on Muddy Creek. Educational signs are planned for the field that explains prescribed burning, riparian management, and projects. These efforts need further support at upper levels and expanded scope beyond just Muddy Creek.

Although money is important, the Muddy Creek CRM Project is a success because of the cooperation and commitment by the local people. Numerous conservation and land management tools have been implemented to restore, enhance, and maintain the abundant natural resources in the area while maintaining the economic stability and cultural heritage of the people on the land. The ecosystem management philosophy has dictated that, before any action was taken or activity implemented, all impacts and users of the area were addressed. Schools, workshops, tours, and articles in local media have been used to educate all users of the Muddy Creek Watershed.

All the natural resources in the watershed have shown improvement since the initiation of the project. However, the greatest success of this project is the people story. Numerous people with diverse backgrounds and interests have come together to develop trust, respect, and commitment to an overall vision and conservation ethic on land management.

Monroe Mountain Livestock/Big Game Demonstration Project: "Seeking Common Ground"

Wallace Shiverdecker
Kreig Rasmussen
Larry Greenwood

Abstract—The Monroe Mountain Livestock/Big Game Demonstration Project is a Seeking Common Ground Initiative in south-central Utah. The Forest Service, Bureau of Land Management, Utah State Lands, Utah State Parks, and private landowners are cooperating across ownership boundaries, in an ecosystem approach, to improve water quality, watershed condition, aspen habitat, and food to cover ratios. Aspen regeneration and forage production stimulation have been identified as critical in the area, and are the focus of current projects. Elk and deer management changes have brought mitigation income to private landowners and resulted in trophy class elk.

Located in south-central Utah sits a biologically unique ecosystem called Monroe Mountain. It is the focus of a major cooperative management effort to identify and resolve conflicts between livestock and big game and is a major pilot effort in using ecosystem management to manage natural resources in an integrated manner.

This project is cooperative; it operates under the premise that ownership or land boundaries is inconsequential when analyzing management problems or sharing resources to solve problems.

Ownership of the 320,000 acre area is 65 percent Fishlake National Forest, 26 percent Richfield District of the Bureau of Land Management, and 7 percent Utah Division of State Lands and Forestry State School Trust Lands. The remainder belongs to the Utah Division of Wildlife Resources, Utah State Parks, and private landowners. Management efforts, however, are being integrated across boundaries; they use an ecosystem approach to meet differing management objectives.

A number of National organizations are sponsoring this and other demonstration projects to promote resolution of livestock/big game conflicts through cooperative management efforts.

Key cooperators include two Federal agencies, the USDA Forest Service and the USDI Bureau of Land Management (BLM); the livestock industry represented by the Public Lands Council and the American Farm Bureau Federation; and wildlife conservation and sporting groups represented by the Rocky Mountain Elk Foundation, the International Association of Fish and Wildlife Agencies, the Wildlife Management Institute, and the National Fish and Wildlife Foundation.

Area

The demonstration area is a biologically unique mountain range of the Wasatch Plateau. The boundaries encompass a unique ecological management unit that lends itself to demonstration of ecosystem management principles.

The unit includes a complete spectrum of summer and winter range for both livestock and big game. Approximately 3,500 cattle and 5,000 sheep will be involved in the project. In addition, the area includes an estimated 800 to 1,000 elk and several thousand deer.

Monroe Mountain is being managed for a trophy class elk herd which is rapidly becoming one of the premier herd units in the Western United States. Over the past 3 years, 116 elk have been trapped; all were earmarked, and 79 were outfitted with radio transmitter collars. Study of this elk herd has vastly increased our knowledge concerning critical use areas, competition with livestock, population dynamics, and migration patterns. It has also nearly eliminated the conflict with livestock interests. Since everyone has access to the same scientific information, many myths and perceptions about elk numbers and movements have been dispelled. In addition, the data have allowed selective harvest of cows causing specific problems on private land.

There are numerous opportunities to improve habitat for many species, including beaver, upland game birds, and fish. Efforts may also be expanded to help the threatened Southwest willow flycatcher and Utah prairie dog, the goshawk, eagles, and a wide range of other wildlife. At higher elevations, most of the free-flowing water is controlled by private water users living in surrounding valleys. The Utah Division of Wildlife Resources, however, owns water rights in several reservoirs and is managing Manning Meadow Reservoir for the Bonneville cutthroat trout, a sensitive species.

Riparian habitat is common within the project area. There is a growing population of beaver. Livestock interests and water users are increasingly concerned about beaver activity; other people appreciate the role beaver play in the ecosystem.

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Access to the project area is excellent. Interstate 70 runs along the northwestern boundary. Paved State Highway 24, 62, 89, and adjacent streams constitute the remainder of the boundary. Improved dirt roads branch off the paved road, providing seasonal access to the higher elevations. Most of the roads and trails at mid and higher elevations are closed in the winter. Even with good access, several large portions of the area remain roadless, providing rugged terrain for excellent deer and elk escape habitat.

Cooperative Projects

Over the last 3 years (1993 through 1995), the Bureau of Land Management (BLM) has completed several projects within the Otter Creek Watershed Area located in Grass Valley, Piute County. The most significant project has been the South Narrows Big Sagebrush Treatment, which involved discing and drill seeding 600 acres during the fall of 1993 and 720 acres during the fall of 1995. A total of 1,320 acres were treated. Funding for the project came from five sources: BLM, Monroe Mountain Demonstration Area, Rocky Mountain Elk Foundation (RMEF), Kasey King (livestock permittee), and the Environmental Protection Agency (EPA). The project is unique because this is the first time that the EPA has provided funding (319 Monies) to be used on BLM land in Utah. The 1993 treatment has proven to be a great success in terms of improving vegetative cover on the uplands above Otter Creek. This improvement in upland vegetative cover should, in turn, reduce the amount of nonpoint pollution that reaches Otter Creek and, therefore, help improve water quality and overall watershed condition. Other projects that have been completed include the planting of 140 cottonwood poles and 2,800 willow cuttings along Otter Creek. Eroding banks have been stabilized by using juniper riprap. Most of these projects have been completed by volunteers provided by high schools, Boy Scouts, and local wildlife groups.

The Forest Service has conducted two controlled burns and seeded 2,600 acres, Dixie-harrowed and seeded 650 acres, sprayed 40 acres of silver sage, cut 40 acres of encroaching young conifer trees in aspen habitat, built lodgepole fence crossings for elk, installed A.T.V. cattle guards, installed A.T.V. bridges, and started several new test plots for habitat research. All of these projects have been funded all or in part by the Seeking Common Ground group, Rocky Mountain Elk Foundation, National Fish and Wildlife Foundation, and the Forest Service. Volunteer groups include: Sevier Wildlife Federation, Boy Scouts, permittees, sportsmen, private landowners, and others.

Efforts to improve food to cover ratios have included use of prescribed fire and cutting to regenerate aspen, chaining and other mechanical treatments in pinion/juniper, Dixie-harrow work in sagebrush and several timber sales. The results have been very good for livestock and big game.

Prescribed burns have increased forage, expanded ecotones between brush and new grasses and forbs, and opened up dense stands of conifers and aspen.

Chaining projects, especially those above Koosharem, are excellent examples of how vegetation can be manipulated to blend existing environments, maximize ecotones and esthetics, and increase forage for deer, elk, and livestock. There has been a market for spruce in the area, and markets are now increasing for subalpine fir and aspen. Because of the low value for most of these products, fire has often been the most practical tool for vegetative manipulation in the area.

Aspen management projects and research conducted in the area demonstrate that aspen regeneration is possible and critically necessary. In addition, forage production and stimulation of aspen regeneration can be done in unison. Many high-elevation brush fields can be treated to improve both the size and quality of mountain meadows.

A new study is underway to better understand mountain lions within the Monroe Mountain ecosystem. This project is in cooperation with the Utah Division of Wildlife Resources, Utah State University, and APHIS-ADC (animal damage control). The intent is to place radio collars on all mature lions on the mountain and monitor their behavior over 3 years. Combining these data with the radio telemetry data for elk and deer will provide greater insight into predator/prey relationships and help improve management of the mountain lion as a game animal. They will also aid in development of a model that will allow managers to predict lion populations. This information will be combined with existing data to develop an integrated database on interrelationships and interactions.

An accomplishment report is produced annually and shared with stakeholders and partners in the project.

Organization

Elk and deer herd management for the unit is done through a cooperative process. Since the 1991 Livestock/Big Game Symposium in Nevada, there have been many efforts to get livestock owners and sportsmen to work together to resolve conflicts. In addition, owners of larger tracts of private land have formed a private landowners' association that now qualifies for several trophy elk permits on the mountain each year. The association auctions off these permits each year to raise funds to offset impacts of big game on their private properties. In 1995, several of these permits resulted in harvest of trophy class elk that may end up in the record books.

This program is directed by a steering committee of the principal land managers and those with special interests in the area, including private landowners. The steering committee coordinates efforts to identify and develop solutions to problems according to the guidelines from the National Seeking Common Ground Working Group. The Steering Committee is not a decisionmaking body or consensus group.

Informal advisory groups have been formed as needed, made up of representatives from all interested parties. They include research stations; wildlife, livestock, and sportsmen's groups; environmentalists; and local government. The advisory groups' roles are to provide recommendations to the steering committee regarding management of the area. They also provide recommendations for public participation in the management process.

Partners and volunteers are solicited and encouraged to join the project effort as endorsees of a Stewardship Management Program for the area.

An ecologist has been hired to work with existing personnel and partners to expand our understanding of the area.

Baseline data are being developed to cover the first 5 years of the project. Partners, including Forest Service Research and volunteers, are used to assist in data collection and database development.

All information and data collected are stored in a database compatible to electronic GIS data files used by the various land management agencies involved.

Conclusions

The Monroe Mountain Livestock/Big Game Demonstration Project is a unique opportunity for many people to cooperate through partnerships in resolving management on private and public land. The process, procedures, and decisions developed here are being shared across the country so that others with similar problems can be guided in charting a positive course to better management.

Government agencies cannot do this alone. Partners are sought and encouraged to join the Monroe Mountain Demonstration Project. Partners benefit by sharing their resources, expertise, and new technology in breaking new frontiers in cooperation and practical natural resource management. They will know that what they have done has gone a long way toward improved human relationships and quality natural resource management.

If you have an interest in the future of these resources, consider what you have to offer this project. What interests do you have that could be achieved by participation? How might your contributions help resolve conflicts and get the best possible management to the ground?

Contact a member to the Steering Committee or one of the agencies involved and express your interest and support. There is no limit to the number of partners that can be involved. There is no limit to our collective ability to work together. Join the Monroe Mountain Livestock/Big Game Demonstration Project today in seeking "Common Ground!"

Blue Mountains Elk Initiative: Management Success Through Cooperation and Cost Saving

Bill Mullarkey

Abstract—The Blue Mountains Elk Initiative was developed to address elk populations, habitat needs, and the divergence of the two management strategies. Twenty-eight official cooperators have signed a charter agreement to identify, discuss, and develop joint projects related to elk habitat, predation, herd sizes, and inter-area movement. Research and education programs are also funded. Mutually agreed-on management goals have been identified. During the first 5 years, about 150 projects have been begun on 1 mm acres of land, focusing on habitat management, fencing, and salt distribution. The number of cooperators and confidence in the Initiative are both increasing.

An Elk Initiative

In the late 1980's, wildlife biologists for the Oregon Department of Fish and Wildlife (ODFW) expressed concern that habitat quality for elk was declining on USDA Forest Service administered lands in the Blue Mountains of northeast Oregon as a result of increased open road densities and timber harvest; two factors considered in habitat effectiveness. The ODFW biologists set management objectives (MO's) for elk by management unit and believed that habitat quality was declining and would not sustain established elk numbers.

The Forest Service took the ODFW concerns seriously. Under the direction of John Lowe, Deputy Director, Region 6 (now Regional Forester), Jim Lawrence, Forest Supervisor, Umatilla National Forest, and Greg Clevenger, Umatilla Forest Wildlife Biologist, it discussed developing an initiative, a Forest Service term for taking action (not requiring any vote of the public). The initiative would address habitat quality issues on Federal land.

The Umatilla National Forest encompasses land in southeast Washington and northeast Oregon. Bruce Smith, Regional Director for the Washington Department of Wildlife (now Washington Department of Fish and Wildlife), and Jim Lauman, Regional Supervisor, Oregon Department of Fish and Wildlife Northeast Region, were invited to discuss resolution of the issues. Bruce Smith's vision was greater than habitat and issues on just Federal land; he asked for the inclusion of all lands.

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The Forest Service appointed Mike Wisdom, Wildlife Scientist for the Forest Service, to develop "the Initiative" from La Grande, OR, where he was located at the Pacific Northwest Forestry and Range Sciences Laboratory. The first goal was to "stop fingerpointing," identify the problems, seek resolution, and improve accountability.

The 1991-1995 charter was developed by working with cooperators and local groups throughout the Blue Mountains. On March 11, 1991, the charter was signed by 22 cooperators representing Federal and State agencies, Tribal nations, organizations, and private landowners and groups. This solidified support for the Initiative.

The Initiative was rechartered on September 6, 1995, for a second 5-year period—1996-2000, following a format similar to the first charter, but with 28 cooperators: 6 Federal, 3 Tribal, 5 State, 2 university, and 12 private.

How is the Initiative Funded?

Each cooperator (participant) contributes funds and other resources (staffing, labor, equipment, land, facilities, information, and advice) to the extent possible. Cost-share projects fuel the program.

How Does the Initiative Operate?

The Initiative has no legal standing or rigorous structure that binds any participant to a specific philosophy, mode of operation, or level of involvement. Its purpose is to provide a mechanism through which participants can identify and discuss elk management issues of mutual concern and develop joint solutions through field projects and other activities. Participants choose to be involved in whatever issues or activities are of interest to them. As the Initiative evolves, so do the issues, actions, and make up of partnerships.

Who Coordinates the Partnerships and Activities?

An Operations Committee, consisting of biologists and other resource specialists from Federal, Tribal, State, and private entities, shares resources and implements the Initiative. Its role is to facilitate the charter through communication, coordination, and consensus. As such, this committee has no legal standing or rigorous structure dictating the manner in which it operates. Rather, these specialists match the resources available from their respective organizations or governments (funds, labor, staffing, equipment, facilities, land) in active partnerships to achieve mutual goals. The Operations Committee also coordinates the activities of

smaller Work Groups that deal with each of the specific issues listed in the charter.

Work Groups are established in several geographical areas of the Blue Mountains that experience elk damage. These groups operate at the local level with local involvement. Each participant has equal status in bringing issues to the table and proposing projects. This has built camaraderie and accountability among participants.

The Initiative also has a formal Coordinator/Chairman stationed at the Pacific Northwest Forest and Range Sciences Laboratory in La Grande, OR. The Coordinator acts as a mediator, seeks consensus, and expedites work of the Operations Committee for efficient implementation of the Committee's responsibilities. The Coordinator communicates with the Cooperators, Operations Committee, Work Groups, and public.

How is Accountability Achieved for the Initiative Activities?

The Operations Committee hosts an annual meeting for all cooperators where leaders review past accomplishments and identify future goals and actions. Annual reports are prepared for review. The Operations Committee also hosts conferences, workshops, symposia, and other meetings as needed, to deal with specific elk issues.

Charter Agreement

The cooperators that sign the charter support the Blue Mountains Elk Initiative and its goals to improve the management of elk among all landowners, agencies, Tribal nations, and organizations in the Blue Mountains of northeast Oregon and southeast Washington. The charter illustrates their commitment to deal with elk and elk habitat issues through partnerships that rely on natural resource professionals from Federal, State, private, and Tribal entities; on lands managed by the same entities. Concerned citizens and groups are also involved in the decisionmaking. This charter is an active action plan designed to improve management of elk populations and habitat.

The primary goal of the Initiative is to manage habitat more effectively through field projects and to move forward in an open, active, and creative style that emphasizes cooperation, coordination, and collaboration. In addition to habitat management projects, the cooperators also fund research and education programs.

Guiding the work are the goals of State wildlife agencies; National Forest Plans; Bureau of Land Management Resource Management Plans; the needs and goals of private landowners; the needs, goals, and management plans of Tribal governments and the trust responsibility of Federal and State agencies to Tribal Nations; desires of sportsmen, conservation, and other user groups; and the latest research and management information.

It is understood by participants that the involvement of Tribal nations in this Initiative will not allow for review, discussion, or assessment of Treaty-reserved rights. Rather, it is understood that Tribal involvement in the Initiative will result in the effectuation of Treaty-reserved rights.

The Setting

The Blue Mountains are an integral part of a lifestyle and economy driven by natural resources. The Blue Mountains support some of the highest elk populations in the world. More than 55,000 elk inhabit the forests and rangelands of northeast Oregon and southeast Washington. The health of these herds is intimately tied to forest, ranch, and farm management; and recreational and subsistence hunting in the region.

In this setting, the prominence of elk is obvious. Some 72,000 elk hunters make their annual pilgrimage to the Blues each fall; many travel hundreds of miles for the experience. Elk hunter expenses bring in an income of nearly $15 million annually to the communities in the Blue Mountains region.

Use of public land is year round. Winter sports include skiing, snowmobiling, snowboarding, and wildlife viewing; spring—hiking, camping, fishing, wood gathering, and mushrooming (an average of 4,300 commercial and free-use mushrooming permits on the Malheur and 3,800 permits on the Wallowa-Whitman National Forests during the past 3 years); summer and fall—hiking, camping, fishing, hunting, and wood gathering. To support all these activities, public lands have been opened with often large road systems. But, while roads provide easy access for the user, it also provides easy access to wildlife, including elk, that is often detrimental. National Forests have focused efforts on reducing access to elk and improving elk habitat by closing roads.

Forest Plans have open-road density (ORD) standards for winter and summer range to reduce harassment of wildlife; some Bureau of Land Management Resource Areas are addressing this issue in their Environmental Assessments for the same reasons. Standards vary among forests, but are generally between 1.0 and 3.5 miles per square mile (m/m^2) for winter and summer elk range. The Malheur Forest reduced the ORD on summer range from 3.9 to 3.0 m/m^2 in 1995; and on winter range from 3.8 to 3.4 m/m^2 in the same period. The Ochoco Forest reduced the ORD to below 3 m/m^2 on all districts except the National Grasslands where the gentle terrain allows users to cut a new trail wherever they wish. The La Grande Ranger District in the Wallowa-Whitman National Forest has reduced ORD to about 1.5 m/m^2.

Boise Cascade Corporation is also reducing ORD on their 300,000 ± acres in the Blue Mountains to reduce fire danger, erosion, and elk harassment.

Problem Analysis

How well State wildlife agencies meet population goals for elk is affected largely by land and hunter management. For example, public access on both public and private lands affects hunter success, harvest goals, elk distribution, and habitat use. Hunter/land manager relationships are integral to the process of meeting management goals.

In the Blue Mountains, most land managers receive little or no monetary compensation for producing elk—be it for hunters or for meeting State wildlife agency goals. Elk at times cause damage on private lands to reforestation, agricultural crops, or to forage resources that are managed for

livestock. If elk production goals are to be met over the long-term, influences of elk on other production systems must be accounted for and addressed.

Elk distribution is also changing. Herd use of traditional winter range on private lands is increasing during other seasons, due to several factors including increased roading, hunting pressure, public access, loss of cover on adjacent publicly managed summer ranges, as well as superior forage resources on privately managed lands. National Forest Plans identify reductions in cover on some areas of both summer and winter range. The Initiative seeks projects to alleviate these impacts, if desired by the private land manager.

The Initiative also recognizes that without quality habitat on privately owned/managed lands, Federal and State agencies would not be able to sustain the present number of elk in the Blue Mountains. The economic benefits contributed by private landowners is immeasurable and the citizens of Oregon and Washington who enjoy hunting and viewing elk need to recognize this contribution.

Different land managers control different parts of elk range as well. Summer range may be adequate in forage quantity and quality, but winter range may be limited on private lands without influencing the integrity of pre-existing management programs.

In the Blue Mountains, this array of differing management interests is perplexing to all parties involved in elk management. The intensity of resource demands on varying land ownerships and the high mobility of elk across so many jurisdictional boundaries demand close and open coordination among all interests if management goals are to be mutually agreeable and attainable.

Major Goals

- Establish a "stockpile" of elk management cost-share projects for meeting Elk Initiative goals and for quick implementation of funds as they become available.
- Develop new and more effective methods of funding and find new and varied sources to finance elk management activities.
- Enable State wildlife agencies to meet population and herd composition goals for elk across varying ownerships and State management units in the Blue Mountains without negatively impacting primary land management goals.
- Protect and effectuate treaty-reserved rights of the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Indian Reservation, and the Nez Perce Tribe.
- Implement projects needed to meet elk management goals prescribed in Forest Plans of the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests; and Resource Management Plan of the Bureau of Land Management Prineville, and Vale Districts.
- Link State population and herd composition goals for elk with habitat goals on National Forests and Bureau of Land Management lands to unify State/Federal management strategies on public lands and improve coordination of effects on adjacent private lands.
- Work closely with private landowners on winter and spring ranges to alleviate elk depredation to crops, livestock forage, and tree seedlings.
- Maintain hunting opportunities and enhance the quality of elk hunting on public lands in the Blue Mountains; alleviate hunter trespass and damage to private lands bordering publicly managed lands.
- Develop and test innovative techniques for managing elk populations, habitats, and hunters; use such tools as the "Sled Springs Management Demonstration Area" and other demonstration areas in the Blue Mountains.
- Standardize the use of elk habitat models among State, Tribal, and Federal elk managers; train biologists and managers in their use; publish additional elk management guidelines for use by interested private landowners.
- Improve elk management by better integration of research information, using tools such as the Starkey Research Program, the Oregon State University Agriculture Research Center projects, and other Blue Mountains studies.
- Expand existing efforts and develop new ways to inform, involve, and educate forest users about elk management and research in the Blue Mountains.
- Enhance public opportunities for elk viewing, photography, and other nonconsumptive uses of elk in the Blue Mountains.
- Gather and summarize information about the economic value of elk as a recreational resource to communities and landowners of the Blue Mountains, including the relationships of elk production and management to economic health of related management programs.

A list of issues, concerns, and strategies is developed from this list of major goals that provides specific direction and measures of accomplishment to Initiative cooperators.

Accomplishments

During the first 5 years of the Initiative charter, about 150 projects were completed or ongoing on nearly 1 million acres of land. The on-the-ground management-type projects included prescribed burns and fertilization to enhance the quality of forage; seed collection and seedling establishment to enhance native grasses and browse species; noxious plant control to combat rampant invasion; water development to help redistribute elk populations; fence construction and repair to protect water sources, aspen clones, and manage cattle distribution; and establishment and maintenance of salt sites for elk use.

We have two national demonstration projects in the Blue Mountains—Dry Beaver/Ladd Canyon and the Grande Ronde Habitat Management Project—partially funded by the National Fish and Wildlife Foundation-Seeking Common Ground ($8,350 and $26,650, respectively).

These projects, as are many of our projects, are designed to alleviate depredation by elk on private lands and re-educate the elk to forage and live on public lands. These projects incorporate as many types of enticements mentioned above as are feasible to make the habitat more appealing.

Actions that show positive results in elk management on our projects are provided to others to consider in other projects. Well designed and implemented monitoring programs and progress reports are essential.

Nearly $3 million have been provided by official cooperators and other funding entities for projects in the Blue Mountains. We have found that much more can be accomplished with cost-share projects by increasing ownership, credibility, and accountability.

Conclusions

What began as a concern between two agencies has developed into a positive working relationship among 28 official cooperators and many private landowners addressing elk management, research, and educational needs as an integrated program on a landscape scale. We still have some projects designed to improve habitat quality on a local level, but are looking more for long-term changes and the big picture.

The fact that the number of cooperators has increased for the second 5-year period indicates that confidence is increasing in the Blue Mountains Elk Initiative and "Sharing Common Ground."

Devil's Kitchen Management Team: Real Life and Sharing Common Ground

Chase T. Hibbard

Abstract—Resource management in the Big Belt Mountains, between Helena and Butte, MT, is the focus of a group called the Devil's Kitchen Management Team. Its cooperators include the USDA Forest Service, Bureau of Land Management, Montana Division of Fish, Wildlife and Parks, Montana Division of Lands, sportsmen's groups, outfitters, and private landowners. After 7 years, levels of trust, respect, and commitment are still very high. Consensus and goal setting are described using the example of cooperative management to modify elk herd size and structure.

To paint an accurate picture of where we are today and what we have accomplished, I must give you a little Montana history, or at least my version of it, particularly as it applies to elk and hunter problems.

When I grew up in Montana, in a time that is feeling more and more like ancient history, I knew very few ranchers who did not allow hunting and fishing on their lands. There was a bond between ranchers and townspeople. Ranchers felt it was part of their duty as members of the community to allow access and did not mind doing it. The community, while respecting that right, came to feel that it was part of their birthright to hunt and fish, and the pattern of public use of private land became part of the social fabric of the region. This is particularly relevant in a State like Montana which is about two-thirds private and one-third public.

This "sportsman" heritage in our State is so strongly held that many people rationalize staying in Montana, at what they feel to be greatly diminished salaries, solely because of our free sporting tradition.

Like most everything else, times change. In my recollection, things were going along smoothly between landowners and sportsmen until the early 1980's when three things happened. First, commodity markets and land values took a nose-dive; second, the rest of the United States had become aware of the quality of our fish and game resource; and third, the population outside Montana had become affluent and mobile to an extent unprecedented in the past.

Ranchers learned that they could replace lost income quickly and painlessly by catering to these rich out-of-staters who would pay large sums to hunt and fish. More and more ranchers got on the bandwagon and as they did, less and less private land was available for the public to recreate on free of charge. The social fabric began to unravel as the regular Montana sportsman found his options for a quality hunting experience more limited.

Landowner-sportsman relations began to deteriorate rapidly. The Montana Wildlife Federation and other sportsmen's groups got more politically active. Conferences were held; steering committees were formed; thousands of dollars were given to political candidates. Legislation was passed making streams on private property the public domain. License fees were raised to create a fund to purchase additional public game habitat. Lawsuits were filed to open all State school trust lands to the public, even isolated tracts landlocked within private property. Landowners became more and more the "bad guy" in the eyes of the public, and as you can imagine, landowner-sportsman relations continued to deteriorate rapidly.

The politics of conflict had developed. Problem solving became confrontational and more and more oriented toward single issues. As you know, it is difficult to reduce resource matters to single issues. As we use up our energies fighting these battles, we may wake up one day finding an *unsympathetic* public putting forth simplistic solutions like we saw in "No Moo in '92" or "Cattle Free by '93."

It is against this backdrop that I am here to speak to you today. Our group is called the Devil's Kitchen Management Team, taking it's name from a Bureau of Land Management (BLM) primitive area on the north boundary. We also liked the name because its unique labyrinth of rock spires and fins make a journey through the area difficult, yet interesting. Our group has taken on difficult issues, not unlike navigating through the Devil's Kitchen itself. A concoction is heated by differences and boiled to a blend of shared vision, mutual goals, and action. Devil's brew!!!

The location is the Big Belt Mountains between Helena and Great Falls, approximately 80 miles east of the Continental Divide, as the crow flies. Our elevations range from a low of around 3,500 ft on the Missouri River to a high approaching 9,000 ft in the Gates of the Mountains Wilderness. This area stretches 31 miles from west to east and 21 miles from north to south and encompasses roughly 260,000 acres, 100,000 of which are public and 160,000 private. Its south boundary is the Gates of the Mountains Wilderness Area, a very dry area that has very little public use by other wilderness standards around the State. To the north of the Gates of the Mountains Wilderness is the Beartooth Wildlife Management Area, which is managed by the Montana Department of Fish, Wildlife and Parks. It was purchased in 1971 as an elk winter range. There are BLM and State school trust lands scattered throughout the Devil's Kitchen. There are four main ranches, varying in size from 20,000 to 70,000 acres. Most of them are traditional cow/calf or yearling cattle operations. There are 8,000 cattle and 3,000 sheep in the area plus 15 to 20 families and 15 to 20 single men and women are dependent on the production of the ranches for their livelihood. We raise feeder calves and have two bands of sheep. All of these ranches have a tradition in the sheep business, but there is no large scale production today.

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Chase T. Hibbard is a livestock producer in Montana.

The west boundary of the area touches 24 miles of the Missouri River. Extending eastward are numerous reservoirs and small to medium size streams, well stocked with brook, rainbow, and native cutthroat trout. Just east of the eastern boundary is the Smith River, one of Montana's most popular and scenic rivers for floating and fly fishing. Most of the area is in the 18 to 22 inch annual precipitation rainfall zone and has some of the best rangeland in Montana.

The Beartooth Wildlife Management Area was purchased in 1971. At that time roughly 300 elk wintered on the property. Since then, the number of wintering elk on the wildlife management area has grown to over 1,500 plus 500 to 1,000 that winter on neighboring private lands, making the elk numbers in the area about 2,500 to 3,000 head.

We formed the Devil's Kitchen Management Team to establish a group comprised of all the publics affected by resource decisions. We wanted to establish a public/private forum to explore and solve problems before they entered the increasingly polarized public arena of legislative, judicial, and bureaucratic problem solving. We wanted to involve all the stakeholders to "dream a larger vision of mutually shared management," a vision that through cooperation we could address the conflicts created by the growing elk herds, landowner-sportsman relations, public access, bull elk management, big horn-domestic sheep conflict, and others.

A basic tenet of this idea was that it had become increasingly difficult for one manager in the area, be it a rancher or the Fish, Wildlife, and Parks to make a decision that would not affect others. For instance, a growing winter elk population on one ranch might be the result of other surrounding ranches outfitting and not harvesting cows. So, what one ranch does or does not do (in this case *not* harvesting cows) creates a significant problem for another (too many resident elk causing financial loss). Another example would be—Montana Fish and Wildlife, by responding to their hunting constituency, makes the decision to expand the elk herd in the area and does not acknowledge the increased problems that it causes on surrounding lands. Private landowners find themselves double-damned; not only do they have increased elk numbers to deal with, but now they are forced to allow more public hunting to control expanding elk numbers on their properties.

You can see that what one party does or does not do affects others. By establishing a forum, by creating *trust* among all those with interests in the area, we hoped to deal with the problems in a constructive fashion and find solutions acceptable to all involved.

What I am suggesting *is not* a model for centralized and collective management of the combined properties. Management responsibilities need to remain with each respective fee owner. What *I am saying* is that common over-riding goals and trust lead to decisions that can better the whole, decisions that will lead to better solutions than are available currently.

With this in mind, the Devil's Kitchen Management Team was formed exactly 7 years ago this month. It is comprised of representatives from the Helena National Forest, the regional supervisor and wildlife managers of the Montana Department of Fish, Wildlife and Parks, sportsmen's groups and hunters on the Beartooth, the BLM, State lands, and ranchers from within the area. The team is moderated by a land conservation group called the Montana Land Reliance.

The initial meetings were spent in an attempt to build trust and understanding and establish common goals. We spent hours trying to define landscape description; production goals for livestock AUM's, revenues, hunter days, and fish; plus exploring what sort of quality of life expectations we all had for the area. After 7 years, we are still meeting four to five times per year and our sessions are attended by practically all of the participants. The level of enthusiasm and degree of commitment are considerable.

One year into the process, some hunters on the Beartooth accidentally started two fires, nearly at the same time. It was a dry fall and high winds from the southwest soon fanned the two small fires into a major catastrophe. Before it was over, 90 percent of the grass and cover had been burned on the wildlife management area, approximately 30,000 acres.

The Fish, Wildlife and Parks Department was faced with a huge decision. What should they do about the more than 1,500 elk who winter on the wildlife management area? Because of the communication channels and trust established in the group, we met and solved the problem in 2½ hours. The private landowners agreed to winter the elk, with contingency plans in place just in case the problem became overwhelming. We wintered the elk with little inconvenience.

I want to stress that the Devil's Kitchen group was not formed to deal with just elk, but the problems of the expanding elk herd have been so pressing that we have spent the majority of our time on that issue. Through the hours of exploring production goals, defining landscape descriptions, and quality of life expectations, four common goals evolved. All participants, from public land managers, to wildlife managers, to ranchers, outfitters, hunters, and other recreationists, view the Devil's Kitchen a little differently. We all have different ideas, needs, and expectations. There was one thread that everyone wholeheartedly agreed on, however. Everyone wanted to see some bull elk die of old age. Hence:

Goal Number One:
Manage for a more diverse age structure in the bull elk population.

Elk numbers had increased drastically on public and private land. What was needed was a way to stop the growth and/or reduce numbers. Hence:

Goal Number Two:
Control the female population.

The ranches had a long tradition of allowing public hunting and sportsmen were more than willing to help solve the population problem. Hence:

Goal Number Three:
Allow public access to private lands, including access to big bulls.

Managing hunter numbers is always a headache. Private lands in 1994 allowed nearly 6,000 hunter days. Hence:

Goal Number Four:
Take the monkey off the landowners back.

The Devil's Kitchen is made up of two hunting districts. One is nearly all private lands, the other is exclusively the Beartooth Wildlife Management Area. By extending the

boundaries to include both districts, nearly complete control of the resident herd is possible. The group put together a proposal meeting all four goals to present to the Montana Fish and Game Commission. It meant making radical changes in the season types in both hunting districts.

The Commission rejected our proposal. There were a number of reasons but one of the more notable was that they just did not believe that our group was for real, and that it was possible to achieve consensus on a matter of such radical nature.

Undaunted, we continued to meet. Adjustments were made, to respond to concerns raised by the Commission, but we remained true to our four goals and crafted a new proposal. By then, the Commission knew we were for real and we began to command the serious respect of regional wildlife managers. Our second attempt, 2 years after the first, sailed through the public hearings, and the Commission, and we now have a new, revolutionary season, meeting all four goals. I do not know of another season quite like it anywhere. The Commission chairman, attending our most recent Devil's Kitchen meeting, commented that he wished there were several other groups just like this one around the State. We take the work out of the process for them, by doing all the hard work and negotiating the compromise at the local level. The kinks are worked out and there is agreement before it ever hits the street.

In a nutshell, the season in District 445, the private lands district, is as follows:

- —Early antlerless permit season (10 days)
- —Early week **open**—antlerless season (week before general season)
- —Two weeks **open**—either sex (first 2 weeks of general season) with a voluntary quota on private lands agreeing to be bound
- —Three weeks **open**—antlerless and 40 either sex permits (last 3 weeks of the general season)

The season on District 455, the Beartooth WMA is compatible:

- —One hundred forty antlerless permits per week for 5 weeks
- —Eighty either sex permits for 5 weeks

These seasons address all our goals in the following ways:

Goal number one—**bigger bulls**:
- —Bulls by permit
- —Voluntary quota on private lands during 2-week either sex

Goal number two—**control cows**:
- —Ten-day early permit season
- —Cows open all season

Goal number three—**public access**:
- —Private lands allow public cow hunting
- —Private lands allow holders of either sex permits access to hunt bigger bulls

Goal number four—**monkey off landowners back**:
- —Block management in place
- —Full-time fish, wildlife and parks employee resides in area to answer phone, give permission, and manage hunters.

Have we been successful? In 1994, less than one half the bulls were harvested than the average of the previous 2 years, 128 percent more cows were taken than the average of the previous 2 years, and there were 12 percent more hunter days in both districts than the average of the previous 10 years. The 1995 preliminary results indicate that these trends are continuing and even accentuating. Even fewer bulls were harvested, overall elk population appears down, fewer cows harvested, and we are seeing more and bigger bulls.

This new season has been a win-win for everyone. We all have the bigger bulls we wanted. The landowners have achieved control of the expansion of the elk herd, and have the opportunity to address economic needs through limited outfitting during the either sex season. In addition, block management has gone a long way toward taking the monkey off the landowners' back, in terms of managing hunters. Sportsmen win because they have access to private lands, including access to the bigger bulls. There are now bigger bulls on public land as well. Outfitters, although their time frame for outfitting has been compressed, have bigger bulls and continue to have the opportunity, during the either sex portion of the season, to hunt them.

The harvest figures also indicate that we have been successful. I must tell you however, that not everyone agrees with what we are doing. Sportsmen are uncomfortable with the either sex part of the season and the voluntary quota; they see a leak in the system through those private landholdings not subject to the voluntary quota. Others have philosophical concerns with the opportunity created to profit from the large bulls during the either sex part of the season.

Through its 7 years of existence, the group has always had disagreements. So far we have been able to get around each and every problem. If we cannot meet our mutual goals, we scrap the whole thing. We have built a tremendous amount of trust and mutual respect within the group. I am confident that the current problems will be solved by the same group dynamic and goal setting process that has been successful to date.

One of the successes for me has been the personal growth I have experienced. I have learned that (as hard as it is for me to accept) I am not always right. Other members of the group who were very skeptical of the process and cautious about sitting down at the table with agency representatives, have become its strongest supporters, firmly believing in the process.

The Devil's Kitchen Team has taken on a life of its own. It creates its own rules and is on the cutting edge of group process. If the group does not evolve naturally into an issue, we do not get involved. The politics of conflict and confrontation do not apply. We formed the group to solve the problems at the lowest level, the level affected the most by resource issues - the people making a living from the land, recreating and appreciating the land and its bounty. The hard part is establishing the goals. All else falls into place.

Loco Creek Watershed Project

Larry Hicks
Andy Warren

Abstract—The Morgan-Boyer grazing allotment, in south-central Wyoming, has one of the highest stocking rates per acre in the BLM-Great Divide Resource Area. In 1991 ranchers, and representatives of land and wildlife management agencies sat down to develop a plan for the allotment as a result of concerns about the condition of riparian areas along Loco Creek. Management tools were implemented including drift fencing, upland water development, prescribed burning, vegetative plantings, and the use of instream structures. Livestock numbers and season of use remain the same. Results in 1995 indicate substantially better function of the watershed and riparian areas. Stream channel morphology and hydrology improved. Riparian vegetative communities expanded in both cover and vertical height. Trout have been successfully introduced into Loco Creek.

There are 12,000 acres in the Loco Creek watershed, which lies in south-central Wyoming within the upper Colorado River basin. Elevation ranges from 6,800 to 7,800 ft and precipitation averages 15 inches. The topography is dominated by the Loco Creek canyon, with gently sloping plateaus surrounding the canyon. Vegetation is a mixture of sagebrush, mountain shrub, aspen, and riparian plant communities.

The Morgan-Boyer grazing allotment contains most of Loco Creek, and is comprised of 70 percent public and 30 percent private and State lands. Initially, there was an unfenced border allowing uncontrolled drift in and out of the allotment, no interior fencing, and no upland water developments; this led to concentrated livestock use along creek bottoms. In 1991, the stream was wide and shallow with little vegetation on stream banks. Stream bed substrate consisted mostly of fine sediment. Riparian areas on Loco Creek had very low capacity to trap sediment and store water in the banks for late season release to augment stream flow. Loco Creek flows during spring runoff have reached 30 to 50 cubic ft per second (cfs) compared to low summer flows of 1 to 2 cfs.

The allotment is used by five ranchers for cattle and sheep grazing from May through October. These ranchers sat down in 1991 to 1992 with members of the Little Snake River Conservation District, Bureau of Land Management, Natural Resources Conservation Service, and the Wyoming Game and Fish Department and together agreed on a management plan to improve the natural resources in this area. Full use of grazing preference is being continued, amounting to an average of 4 acres per AUM (animal unit month). This is one of the highest stocking rates within the Great Divide Resource Area. Total AUM use and season-of-use have stayed the same; only management has changed.

Methods

Twelve upland water developments (reservoirs, pits, and springs) were the most important element in reducing dependence of livestock on Loco Creek. Upland water availability resulted in better distribution of animals within pastures, and use of previously unavailable forage.

Fencing was also used to control the length of time cattle spend along the creek. Three miles of drift fences were installed to divide the allotment into four management pastures. Fences are high tensile, solar electric, and located primarily in canyon bottoms to minimize cost and maintenance. High tensile fences were used to reduce impacts on elk and mule deer movements and migrations.

An 800-acre prescribed burn was completed during the spring and fall of 1994. The burn was a joint venture among the Rocky Mountain Elk Foundation, Bureau of Land Management, Little Snake River Conservation District, and ranchers. The purpose for burning was to improve forage on south- and west-facing slopes for elk winter range, stimulate aspen regeneration, and reduce sagebrush cover while improving herbaceous forage to better distribute livestock use away from Loco Creek.

To increase riparian shrub recovery and diversity, approximately 4,000 dogwood, chokecherry, waterbirch, twinberry, buffaloberry, cottonwood, and willows have been planted over the last 3 years.

In-stream structures were utilized to increase the rate of riparian recovery by elevating stream bank water tables and trapping sediment. Structures consisted of single logs or woven wire and steel posts.

Students from the Little Snake River Valley school have adopted Loco Creek as an outdoor classroom. They are learning about the ecology and management of the watershed, and help with plantings and monitoring change. An Environmental Protection Agency environmental education grant was used to purchase monitoring equipment so students could monitor both chemical and biological water quality on Loco Creek as management changed.

Figures 1 and 2 illustrate the diverse funding sources and expenditures for the project.

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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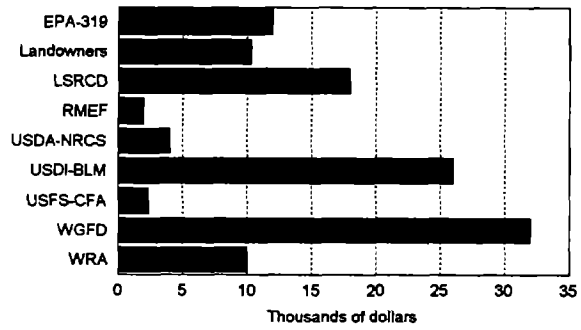

Figure 1—Loco Creek funding, 1991 to 1995.

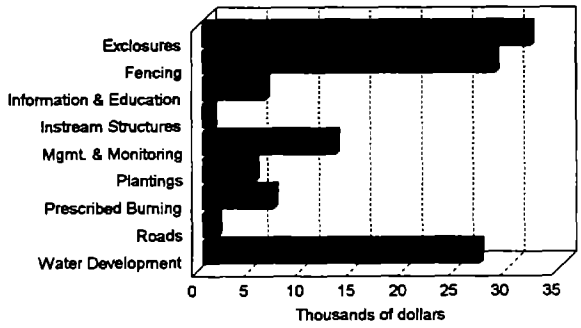

Figure 2—Loco Creek expenditures, 1991 to 1995.

Results

The riparian area, after 4 years of management change, has improved herbaceous and woody cover. Permanent stream cross sections have shown reduced width/depth ratios. The channel also exhibits substantial cleaning; the substrate consists of gravel and cobble instead of the fine sediment that previously existed.

The important riparian species, Nebraska sedge, is still highly used, but the shortened duration of use has allowed for improved plant vigor. Sediment trapping has resulted in bank building, deepening of the channel, and improved pool to riffle ratios in Loco Creek. This has resulted in more stable banks and increased water storage.

Willows are an important element of the riparian plant community, primarily whiplash willow and also sandbar, Bebb's, Geyer, and Booth's willows. Grazing use concentrated along Loco Creek kept willow height to less than 6 inches. Management changes since 1992 have allowed willow and cottonwood to regenerate and grow to heights exceeding 6 ft. Willows are important for wildlife habitat, stream shading, and bank stability.

Beavers were once very common along Loco Creek, supported by aspen stands and willows for food and dambuilding. Only isolated colonies occur today in the upper headwaters, but as woody plants respond and expand, the beaver may return.

Prescribed burning has stimulated aspen regeneration and improved herbaceous forage for livestock and wildlife. Change in vegetative communities has also resulted in decreased bare ground and healing of gullies. The spring burning allowed sagebrush to burn while protecting snowed-in serviceberry and chokecherry stands important to mule deer and grouse. Increasing the quality and quantity of herbaceous vegetation on elk winter range will improve distribution by elk and reduce their need to use private lands. Prescribed burning will also benefit mule deer that use the area during the spring, summer, and fall. Additional benefits include increased base flows, and improved water quality and fish habitat in Loco Creek. The riparian and fish habitat improved sufficiently in 4 years to allow the introduction of brook trout in 1995. Eight miles of stream fisheries now exist where none previously did.

Conclusions

Project monitoring has shown substantial improvement to riparian function and the watershed as a whole. Summer base flows in Loco Creek have increased during the project even in extremely dry years. Water quality has shown continual improvement. Total dissolved solids, turbidity, and water temperature, are all lower today. Macroinvertebrate data also indicate improvements in the biological quality of Loco Creek. Shallow stream bank water wells have been used to document increased bank water retention as riparian areas improved. Although it has been many years since trout were documented in Loco Creek, it only took 4 years of good management to restore the habitat enough to allow reintroduction.

Cobb Cattle Company is one of the ranching families who use and depend upon the Loco Creek watershed. The current management plan works on the ground because ranchers like Cobb, Morgan, Boyer, and McKee were involved from the beginning in making the plan. Healthy watersheds and streams are as important to the livestock producer as they are to other land users. Livestock numbers and season of use in the allotment have not changed. Livestock are more concentrated in pastures where they can be observed and doctored more frequently. Benefits to the ranchers include maintaining historic stocking rates, season of use, and improved conception rates. The success of the Loco Creek Watershed Project will build the foundation for further success stories in the Little Snake River Valley, and improve the public perception of livestock on western rangelands.

Section 319 Clean Water Act Funds: Opportunities for Cooperative Nonpoint Pollution Projects

Roger Dean

Abstract—Opportunities for collaboration are outlined for utilizing Section 319 of the Clean Water Act to achieve mutual goals. Nonpoint Source Program funds are available for implementation of cooperative management practices on both private and Federal lands and for planning, information, education, and training purposes. Information materials produced over the last 6 years by the Nonpoint Source Program are listed.

The control of nonpoint sources of pollution has evolved from the Clean Water Act (CWA) since its initial passage in 1972. The first step in the process, starting in 1974, was the preparation of Section 208 Water Quality Management Plans. The total Congressional appropriation for Section 208 was about $400 million, ending in 1981. These 208 Plans focused on assessment of point and nonpoint pollution sources and evaluated management agency roles and responsibilities in the control of those sources. The 1987 CWA amendments added the Section 319 Nonpoint Source (NPS) Control Program. Two documents were required from the States, a NPS Assessment Report and a NPS Program Management Plan. The content of both documents was specified in a December 1987 Program Guidance document. The State NPS Assessment Reports are required to:

1. Identify the navigable waters within the State which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or goals and requirements.
2. Identify the categories and subcategories of nonpoint sources which add significant pollution to each portion of the navigable waters.
3. Describe the process for identifying best management practices (BMPs) and measures to control each category and subcategory of nonpoint sources.
4. Describe the State and local programs for controlling pollution from nonpoint sources for each portion of the navigable waters.

State NPS Program Management Plans were to include:

1. Best management practices and measures that will be used to reduce pollutant loadings resulting from each category, subcategory or particular nonpoint source designated in the State's NPS Assessment Report.
2. Programs (including, as appropriate, nonregulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects to achieve implementation of the best management practices.
3. A schedule of annual milestones for BMP implementation.
4. State attorneys general certification of authority.
5. Sources of Federal and other assistance funding.
6. A list of Federal programs and projects which the State will review for consistency with the NPS program.

Funding

In fiscal year 1990, Congress started appropriating funds for States to implement their NPS programs. To date, $370 million in grants to States have been awarded, with an additional $100 million anticipated in fiscal year 1996. The funds can be used for demonstrating implementation of Best Management Practices on a watershed by watershed approach, for nonregulatory or regulatory programs for enforcement, and for technical assistance, financial assistance, education, training, technology transfer, and demonstration projects. States are encouraged to use the funds for a balanced NPS program of State staffing, watershed projects, information and education projects, training, technology transfer, enforcement, ground water assessment, and other elements needed for an effective State program. To date, each year's funds have been distributed to the Environmental Protection Agency (EPA) Regions by formula and then allocated to the respective State NPS agencies on a competitive basis. There are no State entitlements and a 40 percent cash or in-kind match at the State or local level is required.

Program guidance changes proposed for FY 1997 would eliminate the competitive nature of the funding process. They will also reduce and streamline the EPA oversight for States that have adopted all nine key program elements and have a proven track record of effective implementation. The EPA role will then be focused on technical assistance to the States and to watershed projects.

Many States also provide low cost loans for implementation of their NPS programs. These loans are made available through the State Revolving Loan Fund (SRF) established by the Clean Water Act. The SRF program was established in each State to provide loans (in lieu of grants) to cities to construct wastewater treatment plants. Based on individual State NPS program needs, a State can expand its SRF Program to include loans to operators for control of NPS sources such as underground storage tanks, closure of sanitary landfills, implementation of agricultural practices, or

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other NPS sources identified as priorities in its NPS Program Management Plan.

Water Quality Criteria

The 319 Program is primarily a voluntary program. However, enforcement of the State water quality standards established by each State under the Clean Water Act is a regulatory tool that can be used by that State (under State law) to encourage or require implementation of BMPs needed to attain or maintain State water quality standards. Most States used the Natural Resources Conservation Service (NRCS) Standards as the basis for establishing BMPs for their NPS program. States have set water quality standards to protect the designated uses of their waters (for example, cold water fishery and drinking water) of each water body. A water quality standard is a State law or regulation adopted under CWA Section 303(c) that consists of the beneficial designated uses of a water body and the water quality criteria (chemical, physical, and biological) necessary to protect the uses of that water body. The water quality criteria are not always numerical values and usually include narrative criteria such as "free of toxics in toxic amounts." Water quality standards also must contain an antidegradation policy which ensures that designated uses, once achieved, must be properly maintained. The Environmental Protection Agency sets minimum requirements for State policies to conserve, maintain, and protect existing uses and water quality. Each State has a list of water bodies currently not meeting water quality standards, called the Water Quality Limited Segment List, required by Section 303(d) of the CWA. The number of segments on a State's list can be extensive. One western State has listed nearly 1,000 segments.

Each State actually has four separate lists which list stream segments and other water bodies (lakes, aquifers, estuaries, wetlands) that do not meet their designated uses. These four lists were prepared under various sections of the Clean Water Act: Section 303(d); 304(l) with three variations; 305(b); and 319(a) (1). Each CWA Section list was prepared with slightly different intended use and criteria. Inclusion criteria for each CWA Section list also vary from State to State. Lists also overlap. Therefore, all four lists should be consulted when determining the status of a stream segment or water body.

Many of the segments appearing in these lists are listed due to nonpoint source problems, and some States have identified the specific sources of the NPS impacts (grazing, irrigation return flows, streambank stability, logging, riparian impacts). Water quality limited segments thus become prime candidates for future NPS projects if local sponsors can be established that are willing to prepare watershed project proposals and then hire staff to do the planning and oversee implementation, if the proposal is successful. These water quality limited segments are also a prime focus for additional monitoring by local, State, or Federal agencies. They also should be of prime concern for doing an adequate environmental assessment when issuing Federal lands grazing permits if there are Federal grazing lands in the watershed.

The nonpoint source impacts that result in a segment being listed are not always caused by man and may be the result of wildlife impacts. Therefore, NPS projects and Federal land managers are encouraged to evaluate all impacts and use good management techniques (such a forage allocations for both livestock and wildlife) when selecting implementation alternatives. Since the NPS program requires a whole watershed approach, Coordinated Resource Management (CRM) planning approaches have proven effective. Environmental Protection Agency Region 8 and several State NPS programs have funded Coordinated Resource Management training workshops. Riparian Management Workshops have been organized by State and local interests. The EPA Administrator supports the balanced approach to ecosystem management, taking into consideration ecological, economic and social issues, and community-based approaches to achieving sustainability for all three elements.

Since CWA Section 319 Funds can be utilized for installation of BMPs on Federal lands, implementation of management systems regardless of landownership is possible, facilitating an ecosystem or whole watershed approach to planning and implementation.

Consistency of Federal lands and activities with a State's NPS Management Plans is required by Section 319 of the Clean Water Act. Section 319 Funds can be used on Federal lands, but other Federal funds cannot be used to meet the 40 percent match requirement unless specifically approved by Congress; this has not yet happened. Permit holders, user groups, or individuals can provide the cash or in-kind services match for installation of BMPs on Federal lands. The BLM Washington Office has indicated that Taylor Grazing Act Section 3 and Section 15 Funds that are returned to the State/county could be used towards the 40 percent State and local match requirement if allowed by State law. These returned funds in effect lose their identity as Federal funds.

Other Water Quality Programs

The EPA NPS program is also linked to United States Department of Agriculture (USDA) water quality programs such as Hydrologic Unit Projects, Water Quality Demonstration Projects, ACP Special Projects, and Water Quality Improvement Program projects to provide water quality targeting and water quality technical assistance for implementation of their programs.

The challenge in the West for NPS implementation projects on multiple ownership watersheds has been to develop projects which treat all NPS problems in the watershed concurrently, regardless of boundaries or agency responsibilities, utilizing an ecosystem or watershed approach. This requires close interagency coordination on technical as well as budget and funding issues. The Coordinated Resource Management planning approach promoted by the Society for Range Management and by the National Association of Conservation Districts can be very effective in achieving this coordination. It also provides for input from user and interest groups.

An example of the benefits to be gained from the CRM approach is the Badger Creek Project in Colorado. The United States Forest Service (USFS), Bureau of Land Management (BLM), State Lands Board, and private parties each have about a 25 percent share of the land within the project boundaries. The 319 Funds of $169,000 through the

Colorado Department of Health have resulted in a total project funding of $650,000 through leveraging of U.S. Department of Agriculture (USDA), BLM, USFS, State, and private funds. It also provided for effective watershed/ecosystem planning at the local level as a result of the local initiative in preparing the proposal to obtain the 319 Funds. The proposal went through the competitive screening process first at the State level and then at the EPA Regional level. Greg Parsons, Colorado Department of Public Health and Environment is the contact, (303) 692-3585. This same opportunity exists on any stream segment that is listed as a high water quality priority in a State NPS Program Management Plan.

Another example of interagency and local cooperation is the Otter Creek NPS Project in Utah. CWA Section 319 Funds have been supplemented by USDA Hydrologic Assessment (HUA) funds, USDA Water Quality Improvement Program (WQIP) funds, Utah Agriculture Resource Development Loan program funds, and BLM funds for the Monroe Mountain Demonstration Project for resolving livestock/big game conflicts. George Hopkin, Utah Department of Agriculture, (801) 538-7177, can be contacted for further information.

A third example of interagency and local cooperation is the Owl Mountain Project in Colorado, which is also a Seeking Common Ground Demonstration Project. This project was awarded $75,000 of FY 1995 Section 319 Funds through the competitive process, and was also approved by EPA for up to $160,200 of FY 1996 funds. Since the Colorado Department of Health had more projects approved by EPA than they will be able to fund, the final funding level will depend on how 319 Funds are distributed to the approved projects. Greg Parsons, Colorado Department of Public Health and Environment is the contact, (303) 692-3585.

The Environmental Protection Agency has developed a Grants Reporting and Tracking System (GRTS) to track tasks, outputs and milestones for projects throughout the nation that were funded by the 319 Program. The national data base is now about 75 percent complete through data uploading by the States. Key word searches for project summaries, NPS source types, Best Management Practices or any other topic are possible for anyone interested, either by contacting their State NPS Coordinator or (hopefully by fall 1996) by accessing the data base through Internet. This can be especially useful in locating materials such as videos, manuals, or brochures produced anywhere in the national NPS program. Individual local project coordinator contacts are given which can be useful for discussions such as Best Management Practices success, cost sharing rates, or project/cooperator successes and lessons learned.

Conclusions

The Environmental Protection Agency supports and encourages those agencies, organizations, and individuals interested in issues related to healthy rangelands, multiple use, and coordinated resource management planning to get involved in the State NPS Programs. State NPS Task Force involvement can support the symposium goals through implementation of Section 319 of the Clean Water Act. Each State will be updating its NPS Program Management Plan to qualify for FY 1997 program funding. This will be a prime opportunity to integrate the symposium goals into each State's program. Nonpoint Source Task Force involvement also provides an opportunity for input and priority setting at the State level and promotion of watershed implementation projects in watersheds of concern to the attendees. Task Force participants can also promote future workshops, information, education, and training programs. Each State should be called regarding its due dates for project proposals for FY 1997 funds.

Symposium attendees are also encouraged to be involved at the local level. Serve on the steering committees for existing watershed projects and organize local support groups to generate proposals for additional NPS implementation projects to be funded by the State through the soon-to-be revised guidance for Section 319 of the Clean Water Act.

Appendix A: Other Tools

There are other tools and aids to implementing NPS programs in the Western United States that have been or are being developed through EPA initiative and with the support of key personnel in other agencies. A few are listed here. Additional tools are continuously being developed at the Regional, State, and local levels. Tools being developed by the States and local groups within the 319 NPS Program can be searched for by requesting a key word search of the Grants Reporting and Tracking System (GRTS) from a State NPS Coordinator or through Internet in the future. For additional information please contact one of the Western U.S. EPA Regional NPS Coordinators; the coordinator can provide the name and telephone number for the State NPS Coordinators in his/her Region.

"Livestock Grazing on Western Riparian Areas" by Chaney, Elmore, and Platts. The document is aimed at the broad and growing audience of people interested in improved management of livestock grazing on Western riparian areas and adjacent uplands. It provides insights into the problems and opportunities encountered and discusses case studies that show that there are "win-win" solutions available on certain streams where riparian areas and fisheries can be restored while also getting better weight gain on livestock. Nearly 50,000 copies were purchased jointly and distributed by EPA, SCS, FS, BLM, ES, BIA, NACD, and many user and environmental groups. The basic concepts from this document were integrated into "Managing Change..." discussed below. The document is out of print and Roger Dean, EPA, (303) 312-6947 is the contact for the few remaining copies.

"Managing Change/Livestock Grazing in Western Riparian Areas" by Chaney, Elmore, and Platts. This document is a sequel to the preceding document. Fifty thousand copies of this document have been distributed primarily through Federal and State agencies, user groups, and environmental groups. It is written for the men and women who own and/or move the livestock. The goal is a heightened awareness and a new perspective of the changes needed in rangeland grazing practices to protect and enhance the quality and quantity of water and improve riparian/wetland conditions on rangeland watersheds. It discusses various grazing practices and their water quality implications, typical things that can be done, and where to go to get help. Roger Dean, EPA, (303) 312-6947 or Don Prichard, BLM, (303) 236-3508 are the contacts for copies.

"Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams", October 1993, by Steve Bauer and Tim Burton. Steve Bauer is formerly of the Idaho Department of Environmental Quality. Tim Burton is from the Boise National Forest. The document focuses on monitoring in the water column, aquatic habitat, and the associated riparian zone in rangelands. The document is available from Teena Reichgott, EPA Region 10, (206) 553-1601.

"Monitoring Primer for Rangeland Watersheds", September 1994, by Tom Bedell and John Buckhouse. Tom Bedell is formerly of Oregon State University Rangeland Resources Department and John Buckhouse is from Oregon State University Rangeland Resources Department. The document focuses on upland monitoring and the associated riparian zone. The document is available from Roger Dean, EPA Region 8, (303) 312-6947.

Note: The riparian portions of these two monitoring documents have some overlap due to the different perspectives used. These two monitoring documents have extracted, from the extensive National monitoring technology base, the water quality related protocols/parameters for the monitoring of instream, riparian, and upland areas on Western grazing lands. The documents list the instream, riparian and upland attributes which could be monitored; the various monitoring protocol methods available for each attribute; and indicate (in general terms) the advantages and disadvantages of each method, including those related to the technical factors involved, relative cost, level of difficulty, collection time, and expertise needed. Planning of such monitoring programs requires consideration of: (1) what do we want to know, (2) why do we want to know it (relationships), (3) when do we want to know it (timing aspects), (4) how will it relate to the project, and (5) where do we monitor it? The drafts of both documents were field validated in eastern Oregon in late October 1993. The documents are being used by EPA and Western States to prepare the monitoring plans for the grazing lands portion of Section 319 watershed projects.

Monitoring Workbook for Ranchers—A 2½ day pilot workshop to train ranchers in the economics of healthy rangelands and the fundamental procedures to monitor their own uplands, riparian areas, and streams was held in Western Colorado near Meeker. There were about 40 rancher and Federal land management agency attendees. Classroom instruction was followed by application of the monitoring and assessment methods in the field. The group was broken up into teams. Each team performed the measurements at four sampling sites. Measurements at each site were followed by discussions with the site instructor as to the accuracy and repeatability of the measurements. Basic monitoring methods taught were: Uplands Cover, Upland Key Species, and Soil Stability; Riparian Health, Riparian Key Species and Stream Geomorphology; and Aquatic and Macroinvertebrate Health. The feedback from this workshop has been integrated into a draft outline for a monitoring workbook. The workbook will be used as a training aid at future workshops and can be used by ranchers for additional self training and field use. The workbook will also provide support material tailored to ecosystem type. Workplan and funding negotiations are under way with Dr. Allen Rassmussen of Utah State University and Dr. Clayton Marlow of Montana State University to be lead authors on the workbook. The EPA has requested participation and peer review by BLM, U.S. Forest Service, Natural Resources Conservation Service, Cooperative Extension Service, and the National Cattlemen's Association in the hopes that the workbook will be useful for implementation of their own healthy rangelands initiatives. Additional workshops in Colorado and Montana are being planned to further refine the contents of the draft workbook. If these efforts are successful, EPA has set aside funds to adapt the workbook for use in Southwestern ecosystems and Pacific-Northwest ecosystems.

An EPA grant has been competitively awarded to **Oregon State University** to support local, State and EPA NPS staff in setting up or evaluating water quality monitoring projects. Further information on how to obtain this support is available through the EPA Regional NPS Coordinators listed below.

The EPA Research Lab in Athens, GA, advertised a request for proposals for new technology development for control of livestock and/or pollution prevention on grazing lands and the development and validation of monitoring protocols. The University of California-Davis proposal entitled **"Protection of Sensitive Watershed Areas by Improved Animal Production Systems"** was selected. The proposal is a joint effort with Oregon State University and University of Nevada-Reno and involves three different pilot watersheds. Further information and project status are available through Mel George, UC Davis, (916) 752-1720, John Buckhouse, OSU, (503) 737-1629, or Sherm Swanson, UN Reno, (702) 784-4057.

The Environmental Protection Agency Region 8 has given a grant to the Society for Range Management (SRM) to search for existing videos and compile a range/riparian video loan library. At latest count over 100 videos have been screened by the SRM. The **SRM Range/Riparian Loan Library** has been announced in the SRM "Trail Boss" newsletter several times as updates occur. The videos are available for loan for $6.00 each to cover shipping and handling. Bud Rumburg, SRM, (303) 355-7070 is the contact.

The Environmental Protection Agency Region 8 is attempting to continue through Regional funding the **Rangelands Environmental Monitoring and Assessment Program** that was initiated by the EPA Lab in Las Vegas. The program is evaluating the technology and cost effectiveness of assessing rangeland ecological condition using an approach that combines sample-based measurements with remote sensing technology to periodically determine rangeland status and trend on a landscape and National scale.

Roger Dean, EPA Region 8, Denver, (303) 312-6947, is the EPA Grazing Management Specialist. As such he is the EPA representative to the BLM Healthy Rangelands Team, the Rangeland Health Assessment Team, the National Association of Conservation District's Grazing Lands and Public Lands Committee, the American Sheep Industry's Cooperative Sheep Grazing Project, and the National Cattlemen's Association's Environmental Issues Group. He was also Workgroup Chairman for the grazing section of the Coastal Zone Management Act management measure guidance document. He is available for coordination support to all agencies and user groups.

Appendix B: Western United States EPA Regional NPS Coordinators

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Region 7 (IA, KS, MO, NE)	Julie Elfving EPA Region 7 726 Minnesota Avenue Kansas City, KS 66101 (913) 551-7475
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Summary

Evaluation Results From the Sharing Common Ground Symposium, February 26-28, 1996, Sparks, NV

Keith E. Evans

Following is a brief summary of the results of an evaluation form completed by participants at the Sharing Common Ground Symposium. The general comments were, for the most part, very favorable. Several participants commented on the excellent facilities and sound system. A representative commented, "Thank you for a stimulating conference and assembling an outstanding group of presenters." There were also comments on the success of the demonstration projects and questions on how these could be continued and expanded. A full copy of all the comments can be obtained from Keith Evans, Intermountain Research Station, 324 25th Street, Ogden, UT 84401. The following questions were asked:

1. On a scale of 1 to 5, with 5 being the best, how well did the symposium meet your prior expectations?

Total responses = 93
Average value = 4.08

2. On a scale of 1 to 5, with 5 being the most useful, how useful do you feel this symposium will be to your future activities?

Total responses = 93
Average value = 4.03

3. As a result of the symposium, are you more likely to do anything differently at the local level? If so, what?

Following are a few of the comments that seem to summarize the feelings of those participants who answered "yes" to this question, then offered an explanation.

- I plan to contact various individuals and agencies in my area in an effort to work with them on some local issues.
- I plan on implementing some changes in how we are presently managing our riparian areas.
- I plan to attempt to get our Game and Fish Department to come to the table and be active and involved—to support activities or give reasons for not supporting.
- I plan on expressing my position more often and not expect others to explain my position.
- I gained many ideas for ranch management on my private lands. I also found out that if I need "outside" support, I have good management resources to draw upon.
- I plan on finding those who want to solve conflicts, not prolong them. We need to bypass those folks on both sides of the issue that refuse to negotiate.
- I plan to work harder to get State and Federal agencies to become committed to CRM and collaborative decision making. It's time to quit hiding behind FACA.
- I plan to challenge the agencies to go beyond arbitrary rulings and work toward common resolutions.
- I use the CRM process in my work—I picked up several great ideas to help me do a better job and be more successful.
- I developed a desire to take a couple of landowners to visit one of the demonstration projects. I have always believed they should be more involved in the decision-making process on big game management.
- I plan to work towards increasing trust levels with others; continue to resolve conflicts without litigation; and apply some of the practices discussed like using livestock to move elk, timed grazing, and plantation grazing.
- I've basically been following the concepts presented, however, this has given me a much needed boost. I understand that patience is the key.
- I plan to continue to drag conservation biologists and ecologists to the table—encouraging scientists to leave the ivory towers and get muddied on the ground.
- What I've heard confirms the collaborative approach I have pursued. Several specific techniques and ideas will be very helpful.
- I plan to pursue the local economy factor Jack Metzger spoke about.
- I plan to put greater effort in State programs to do community based planning for land management and to push for more monitoring efforts to improve programs.

4. What would you have liked to see less of during the symposium?

Following are a few of the comments that seem to summarize the feelings of those participants who offered comments.

- While National figures like BLM and FS Directors may add a few people to the symposium, I would rather see more practical application for on the ground issues.
- Less sitting and listening only.
- Less "glittering generalities," "pep talk," and "let's get together and work it out," and more on how to get it done.
- Less discussion of elk influence—like elk is the only issue. Less elk talk and more on other wildlife. Focus seemed to be only on elk. Note: Many participants wanted less on elk and more on other issues.

In: Evans, Keith E., comp. 1996. Sharing common ground on western rangelands: proceedings of a livestock/big game symposium; 1996 February 26-28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Keith E. Evans is Assistant Station Director of Research at Intermountatin Research Station, Ogden, UT 84401.

- Less people that are dull and don't stimulate action and more people like Wayne Elmore.
- Less on individual demonstration projects, which were better presented as posters, and more on major concepts such as adaptive management, restoration ecology, resource economics, and monitoring.

5. What would you have liked to see more of during the symposium?

Following are a few of the comments that seem to summarize the feelings of those participants who offered comments.

- More on how small livestock operators can diversify or change management to improve land and still make money. Not all "common ground" has to be on big areas with big groups.
- More ranchers and team members talking on panels.
- More interaction with those who have been successful on solving local issues.
- More poster papers, displays, and vendors. The long breaks were great and much information was shared during these periods.
- More on riparian management techniques.
- More ranchers and sportsmen—agencies should promote the symposium with these groups and subsidize their attendance.
- More hands-on workshops and field trips.
- More participation by ranchers and community members who are not employed by public agencies—maybe stage meetings near a project to improve community participation.
- More on conservation for the good of everything—not just livestock and elk.
- More emphasis on systems management and long-term planning, and collaboration with focus on riparian management initiatives.
- More solutions if a win-win decision is not possible. For example, if the solution of a particular watershed health problem will not allow for a continuously viable economic operation, then what should be done? Who should pay for restoration?
- More commitment by all stakeholders. We were often preaching to the choir. Where was Nevada's Wildlife Agency Director?
- More diversity in participants—county commissioners, county planning groups, sportsmen, recreationists, and politicians.
- More focus on university curriculum changes. I'm currently a graduate student just starting my career in natural resource planning—I need more training in these new processes—like collaborative management, conflict resolution, etc.
- More technical talks on adaptive management and habitat restoration, and how monitoring can aid and evaluate the processes.
- More of the agency bigwigs empowering the on-the-ground workers to work with and make decisions with these collaborative groups.
- More information and solutions for sheep/deer conflicts and where mustangs (wild horses) are involved in conflicts.

6. What would you like to see done as a followup to the symposium?

Following are a few of the comments that seem to summarize the feelings of those participants who offered comments.

- Establish a "sharing common ground" network where folks can have a contact point to seek solutions and assistance from those who have already "been there, done that."
- Have a newsletter where cattlemen and agencies can get the word out to smaller operators. The message needs to emphasize how all resources benefit with good land management practices and with information on economic ramifications.
- Have regional workshops, symposiums, and field trips to involve local people and inform them of options and possibilities. Have agencies seek out sportsmen, ranchers, and recreationists to interact on projects.
- Publish symposium proceedings **as soon as possible**.
- Disperse project information, successes, and failures—educate the public and target areas with possibilities.
- Develop a list of speakers and videos to use at other conferences and projects to help get the word out.
- Provide a clearinghouse or forum for sharing information (videos, brochures, posters, etc.) about project success stories.
- Make sure the proceedings get wide distribution, especially to those on-the-ground actually doing the work and making the contacts.
- Promote more interaction on systems management and not so much on single species management—more holistic approaches.
- Possibly a questionnaire to participants in a couple of years to monitor where they have taken concepts learned at this symposium.
- Videotape some key points from the symposium and furnish to local planning groups.
- Increase efforts to broaden the "community" of common ground participants—academia, environmentalists, and non-hunting recreationists seemed to be underrepresented.
- Help break down the control and positioning rampant among the agencies. The vision at the top needs to reach and reward the individuals on-the-ground. Tackle Jack Metzger's challenge about incorporating the economic and local way of life factor into the equations. A sustainable rural economy supports wildlife habitats.
- Promote discussion on the economics of healthy land management and specific ways to pay the costs of watershed improvement projects after the planning process is completed.

7. Would you or your organization be willing to be a part of a national, regional, or local partnership to foster Sharing Common Ground?

Yes = 62
No = 0
Maybe = 3
Already are = 7

Symposium budget

	1991 Actual	1996 Draft	1996 Actual
Income			
Sponsors	$ 8,000	$30,000	$35,078
Registration	53,185	44,450	31,055
Total income	61,185	74,450	66,133
Expenses			
Hotel rooms	$ 1,378	$ 3,000	$ 1,098
Audio visual	1,623	2,000	1,590
Meal functions	14,043	6,500	7,794
Planning meetings		800	1,949
Printing	9,890	12,000	2,698
Portfolios	3,120	2,000	1,638
Postage	2,828	5,000	256
Office supplies	479	600	192
Misc. expenses	546	600	476
Speaker expenses	4,551	7,500	7,805
Proceedings		15,000	15,000
Poster session		3,400	1,475
Dagget book		6,000	6,060
Logistics 15 percent	12,557	12,244	10,847
Total expenses	51,015	76,644	58,878

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This proceedings includes 37 papers and posters presented at the "Sharing Common Ground" symposium. The information represents the progress made in livestock/big game management since the 1991 symposium with the theme of "Seeking Common Ground." The broad range of topics includes the rangeland resource, the science of livestock/big game interactions, the human dimension, and the success stories from the seeking common ground partnership demonstration projects.

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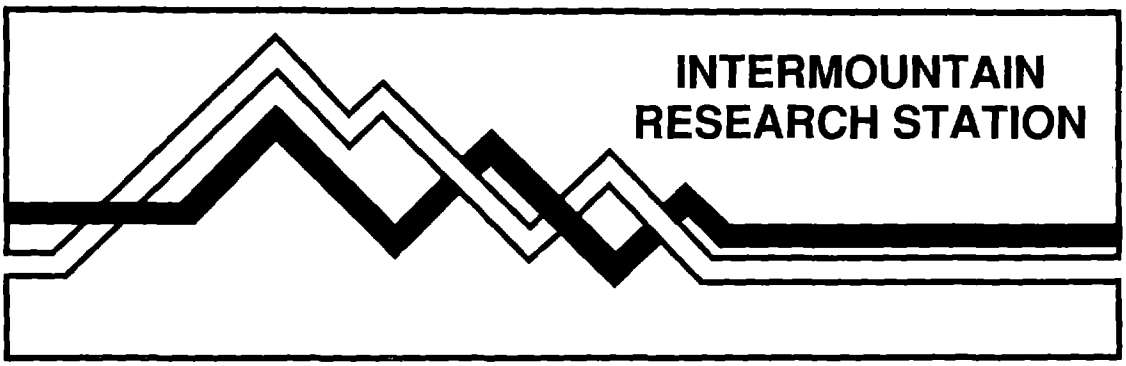

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