Rangelands

Society for Range Management

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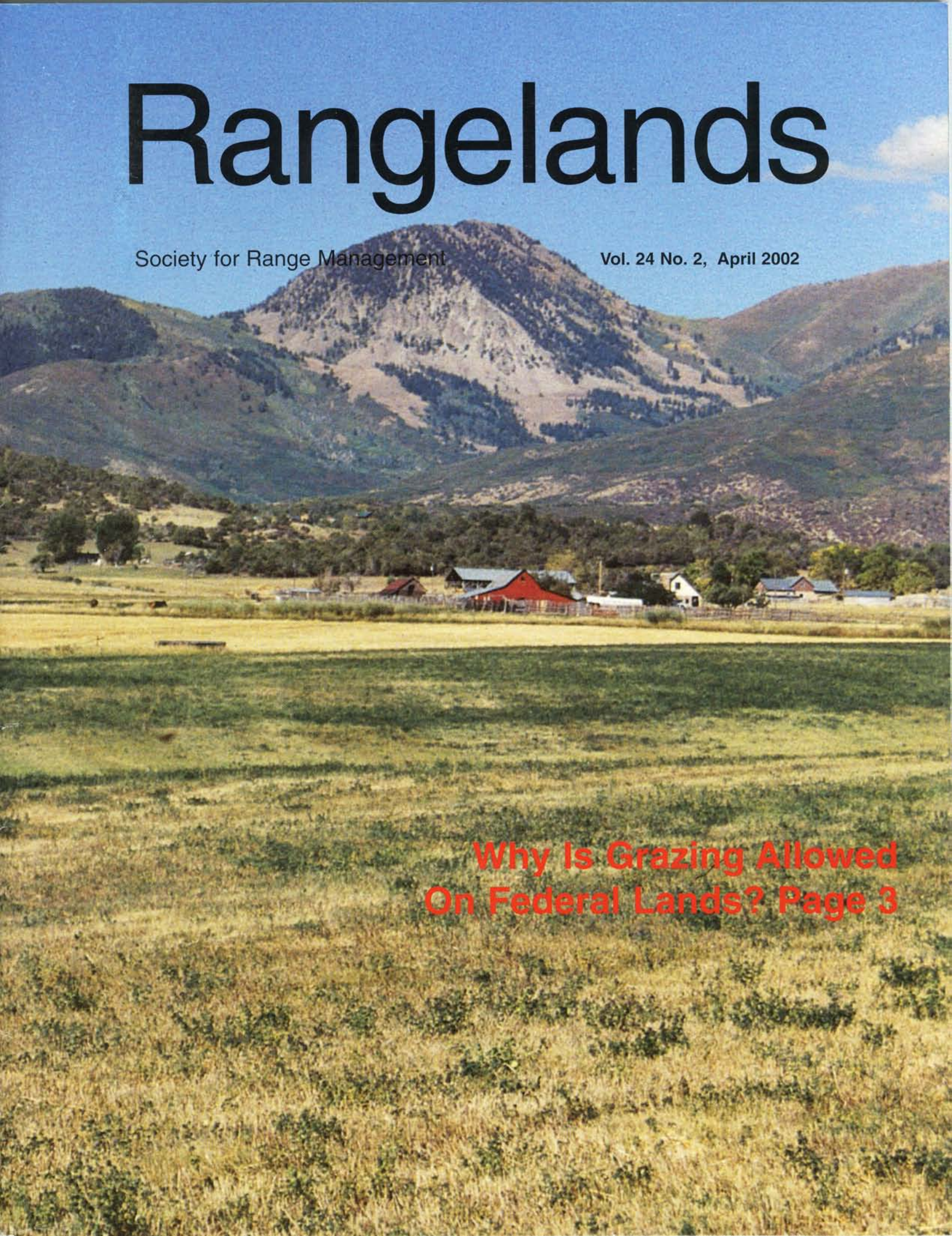

Why Is Grazing Allowed On Federal Lands? Page 3

The Society for Range Management

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

The objectives for which the corporation is established are:

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

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

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

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

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

—to promote professional development of its members.

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

Rangelands

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

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Rangelands

FEATURE ARTICLES

DEPARTMENTS

COVER

Cunningham Ranch on the front cover has livestock grazing on the national forest near Crawford, Colorado. Needlerock is featured on the back cover with the West Elk Mountains in the background. The article beginning on page 3 takes an in-depth look at why grazing on these lands is beneficial. Photo by David Bradford.

EVP's Comments

Information Overload

Today we are blessed and cursed with information. We have the ability to quickly do a search on the World Wide Web, via any number of search engines, on any topic, and instantly get thousands of data points on any subject. We may look at the first few, but we generally don't go into depth in the search results. If we don't find what we like, we refine the search and start over.

I would submit to you that this is two-dimensional information. It has no depth. It comes from questionable sources. We don't know the original intent of the data. We don't know the background. Is it bad information? No, but it does (or should) generate some additional validation issues.

Also, we still receive information in the traditional manner. On my desk at this moment is a stack of books, technical journals, issue papers, and brochures all delivering information. These are "data points" from other professional organizations, user groups, special interest groups, government agencies, etc. This information has some depth, both in detail and in validation. But the volume of this information contributes to the overload.

So, where am I going with this? I started thinking about the usefulness of *Rangelands* and the value of SRM to our members. *Rangelands* is providing data management services. We are searching out useful topics, we are synthesizing and validating, and converting this data to a format that will provide a nice, balanced, three-dimensional product. It is a teamwork approach between our authors, editors, and production staff and is another value of SRM.

Some might think that it is the amount of information that is valuable. Some might think it is the depth of the research that is important. While each has it's place, there is still a need for some balance, and it is our goal that *Rangelands* will provide that balance.

Livestock Grazing On The National Forests – Why continue to do it?

By David Bradford, Floyd Reed, Robbie Baird LeValley, Calvin Campbell and Steve Kossler

Grazing on the National Forests and Public Lands continues to be contentious. It is the subject of vigorous debate and even lawsuits. A number of groups, including the Sierra Club, have increased their opposition to public land grazing, calling for its outright abolishment. To date this has not happened. Why? Why do the Forest Service, the BLM and other public land agencies continue to allow grazing on the national forests and public lands?

To begin to answer that, we need to go back to why the National Forests were established and why grazing was allowed on these lands. The original forest reserves were established in 1891 by presidential order to protect the forests of the mountain ranges of the West from fire and reckless cutting. These original forest reserves were exactly that —reservations where human activity was prohibited. No timber cutting, no livestock grazing, in fact, no trespassing was allowed.

These reservations created considerable controversy, as many western settlers believed they were being locked-out of valuable lands. In 1897 the Congress specified the purposes for which the forest reserves were established and provided for their protection and administration. In 1905 the forest reserves were transferred from the Department of Interior to the Department of Agriculture. The reserves were renamed national forests and placed under the administration of the newly established Forest Service. The management of the national forests continued to be contentious.

In 1907 the *Forest Service issued a publication, The Use of the National Forests*. This book became known as *The Use Book*. It was intended to explain to the public what the national forests were, what they were for and how they were to be used. It was recognized that the national forests were for use of the people of the West as well as for the whole country. The development and use of the forests would provide growth and prosperity. The range resources of the national forests were recognized as important and should be used. The emphasis was on commonsense management that allowed benefits for the present and sustained the resources for the future .

We should note that the issue of livestock grazing on the national forests was controversial from the very beginning. John Muir, founder of the Sierra Club, opposed livestock grazing and Gifford Pinchot, first Chief of the Forest Service, supported it. This disagreement was the basis of a lifelong rift between the two men.

Has the purpose of the national forests changed? We

Demographics For The North Fork of the Gunnison River Valley

The North Fork of the Gunnison River Valley (North Fork Valley) lies in Western Colorado. Most of the valley is located in Delta County with the upper drainage being located in Gunnison County and a southern branch located in Montrose County. The economy of the valley is based on coal mining, fruit orchards and ranching. The valley is rural and sparsely populated. The county is composed of 740,480 acres and there is a total population of 27,800 people (a population density of one person for every 26 acres). However, like most of Colorado and much of the western United States, even this small western Colorado county experienced a significant increase in population and development in the 1990's—growing from 20,980 people in 1990 to 27,800 people in 2000 (a 33% increase over this 10 year period).

The climate and topography of Delta County and specifically the North Fork Valley is typical of western Colorado. The land can be described as dry valleys surrounded by higher and wetter mountains. Precipitation varies from 8 inches per year in the valley bottoms to over 40 inches per year in the highest mountains. The fields of corn and grains, orchards, and pastures that make the valley lands green in the summer are all based on using irrigation water from the adjacent mountains.

Most ranches in the North Fork Valley are small to moderate in size. Like several other areas in Western Colorado the North Fork Valley developed a large fruit growing industry in the late 1800's-early 1900's. The development of the fruit growing industry caused much of the valley land to be broken up into small parcels that were practicable for fruit growing at the time. Many areas that were once in fruit have been converted to irrigated pastures as the high cost of production and low returns on fruit have made fruit growing less viable. As a consequence much of the valley bottom land is broken up into 40 to 100 acre blocks of irrigated lands.

do not believe it has. The Forest Service continues to emphasize that livestock grazing is a legitimate use of national forest rangelands. That commitment is identified in the Forest Service manual. The objectives of the range management program for the National Forests and National Grasslands are:

1. To manage range vegetation to protect basic soil and water resources, provide for ecological diversity, improve or maintain environmental quality, and meet public needs for interrelated resources uses.
2. To integrate management of range vegetation with other resource programs to achieve multiple use objectives contained in Forest land and resource management plans.
3. To provide for livestock forage, wildlife food and habitat, outdoor recreation, and other resource values dependent on range vegetation.
4. **To contribute to the economic and social well being of people by providing opportunities for economic diversity and by promoting stability for communities that depend on range resources for their livelihood.**
5. To provide expertise on range ecology, botany, and management of grazing animals.

Can livestock grazing on public lands produce any benefits? If so, what are they?

We plan to discuss the various ways that the ranches in the North Fork of the Gunnison River Valley in western Colorado (the North Fork) that hold grazing permits on the adjacent Gunnison National Forest are interconnected. We hope to show how this relationship is producing ecological, economic and social benefits to the people of the communities of the West, as well as the rest of the United States.

Dyer allotment was grazed season-long by 1048 cow/calf pairs from May 15 to October 15, 1948. Note 2-foot deep, raw gully, bare ground and lack of vegetative cover. Shrubs are primarily snowberry. Precipitation for the year was "average." Photo by A. Cramer October 15, 1948. Photo courtesy of Denver Public Library.

Dyer allotment now managed under a deferred/rest rotation system—this area was rested in 2001. Precipitation for the year was 88% of average. Photo by David Bradford, October 12, 2000.

Ecological Benefits

Biological—Plants evolved with the ability to withstand a variety of environmental conditions. Nature is often not a well-tended garden. Most plants and animals are faced with conditions that are often not conducive to their individual survival. Fire, drought, floods, landslides, wind-storms, tornados, grazing, insects and disease are all environmental disturbances that affect plants. Plants developed physiological mechanisms that allow them to survive,

Cattle grazing in High Park on West Terror allotment. Photo by David Bradford.

and sometimes even thrive when impacted by these disturbances.

Grazing is actually one of the more benign environmental disturbances that plants encounter in nature. However grazing by herbivores can severely impact plants. Plants that are grazed too often can be reduced in vigor or even killed. Grazing by domestic livestock needs to be based on plant physiological needs in order for the plant to sustain itself.

Grazing strategies for domestic livestock have developed to the point that they not only will maintain plant health but also can actually be used as vegetation treatments. The grazing of goats on noxious weeds, such as leafy spurge, is a fairly common grazing treatment used in many areas. But grazing can also be used for other types of vegetation treatments.

For example, on the Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG NF) cattle have been used to treat areas where native plants, such as mulesear, have increased beyond the range of natural variability. This treatment involves grazing the area with a large number of cattle for a short period of time. As another example, sheep are commonly used to graze tall larkspur to reduce the potential of poisoning cattle that follow the sheep. Neither of these treatments will completely eliminate these native plants but will reduce their density to levels that are considered to be more normal.

Grazing is also being used to treat deer and elk winter range. There are shrub-lands on the Forest that have become overly mature, or overly dense or stagnant. These areas are grazed by a large number of cattle for a short period of time. This treatment will open up the shrub canopy, creating a more open stand, and providing more palatable under-story vegetation. These treatments are also used where prescribed burning is not feasible or undesirable. Obviously, it is also a less severe treatment than spraying with herbicides.

Grazing is a natural process. It can be managed to maintain plant health and even used as a land treatment to provide a more desirable plant community.

Undeveloped open space— Ranches that hold grazing permits on national forests are composed of a combination of private and public lands. In general the private lands are located in the lower elevations on prime agricultural lands. Ranches that hold grazing permits on the GMUG NF **are required to own** a certain amount of private or base property. This requirement states that a permit holder must own sufficient base property to sustain their

Range ride with Leroux Creek grazing pool permittees to discuss range conditions, grazing plans and range improvements. West Elk mountains in background. Photo by David Bradford.

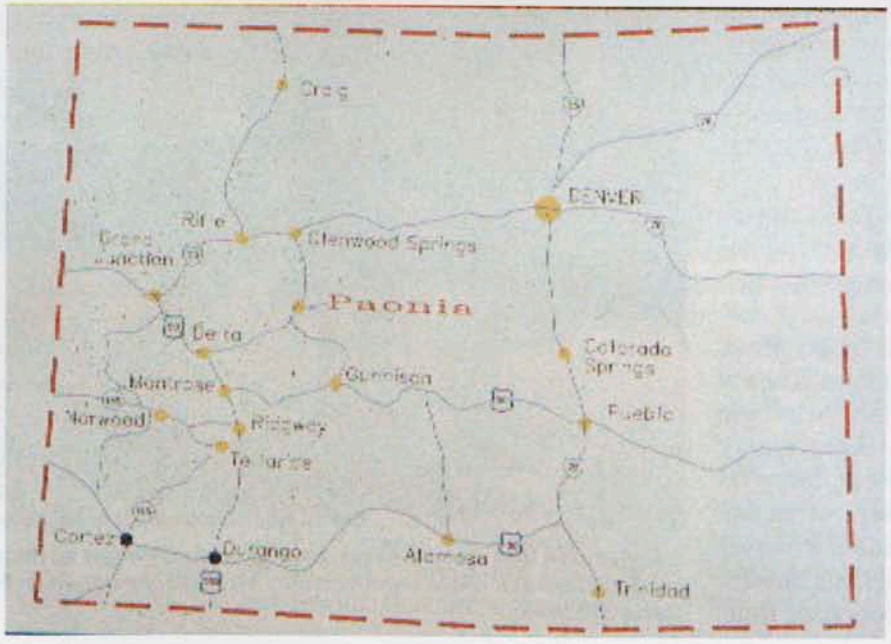
permitted numbers of livestock for a period of time equal to the time they graze the national forest or half the time they are off the national forest. This requirement goes back to the early days of grazing on the national forests. It was developed to assure that local, legitimate livestock operations would be given preference for grazing their livestock on the adjacent national forests.

Transient or speculative grazing operations were given a lower priority for issuance of grazing permits. As a consequence of the base property requirement all grazing permit holders on the GMUG NF own a certain amount of land used in their overall ranching operations.

In the North Fork Valley there are 47 ranches that hold national forest grazing permits. The amount of private land that each ranch owns ranges from 30 to 11,000 acres. There is a total of over 50,000 acres of private land or base property tied to these 47 ranches. In addition to this deeded land, these ranches lease an additional 36,000 acres of private land for grazing. The 50,000 acres of deeded land plus the 36,000 acres of leased land provides over 86,000 acres of ranch land in Delta County. These 86,000 acres are providing undeveloped open space in Delta County. Looking at it on a per ranch basis—each ranch holding a grazing permit on the Paonia Ranger District of the GMUG NF is providing an average of 1,830 acres of undeveloped open space.

How do these ranch lands fit with the overall land ownership pattern in Delta County? The 86,000 acres represents about **11% of the total area** of the county and **25% of the total private land** in the county, see Table 1 Delta County Land Ownership. Counting only the lands the ranches hold fee title to this is **7% of all land** in the county and **15% of the private** land in the entire county. This represents a significant number as the North Fork Valley represents approximately 40% of Delta County. In summary, approximately **50% of the private land** in the North Fork Valley is owned by ranches that hold grazing permits on the adjacent Gunnison National Forest. This represents a significant amount of land in the valley.

Similar studies show similar results. The ranches along the eastern side of the Uncompahgre Plateau in western Delta County comprise over 34,000 acres of private ranch land . This represents an additional **10% of all the private land** in Delta County. The other large agricultural area in Delta County is Surface Creek, near Cedaredge. This area also has a significant number of ranches with National Forest grazing permits.



It is important to note that the use of the National Forest for summer range allows North Fork ranchers to manage their home ranch primarily as irrigated hay meadows. Looking at the contribution of a National Forest Service grazing permit strictly on a calendar basis, public land ranches use their Forest Service grazing permit for 1/4 to 1/3 of their total forage base. However this is somewhat misleading. By maintaining their irrigated pastures ranchers are able to produce up to 45% of their total forage needs for the year. In effect by grazing their livestock on the National Forest ranchers are able to manage their land for maximum forage production during the peak growing season. As a consequence these parcels of land in the mountain valleys are maintained as large blocks of green, undeveloped open space.

Table 1 -- Delta County Land Ownership

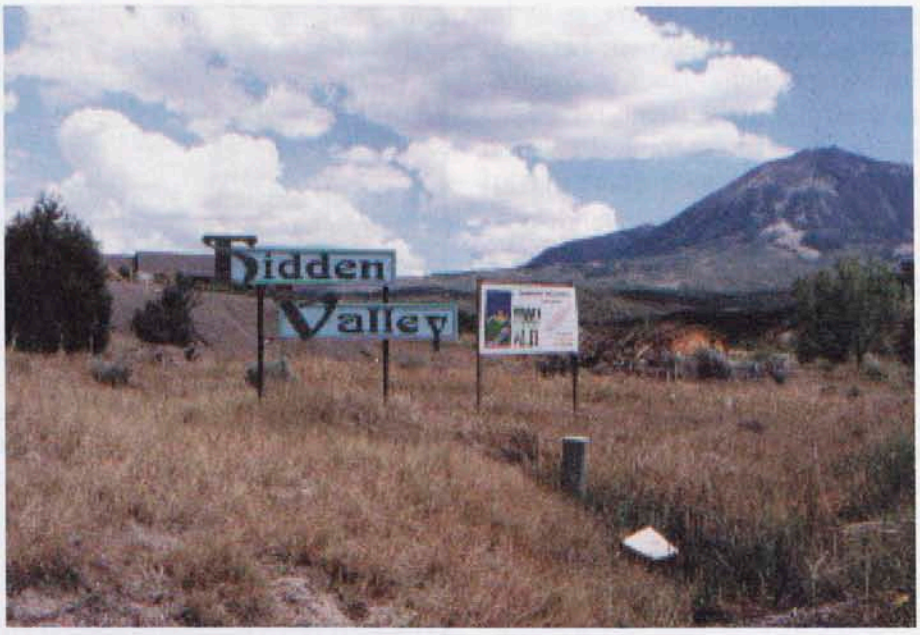
Ownership	Acreage	Percent
BLM	209,946	28%
National Forest	189,378	26%
Total Private	341,156	46%
Breakdown of Private Land:		
Agricultural	284,570	38%
Irrigated	74,000	10%
Non-irrigated	210,570	28%
Other	31,069	4.2%
Municipal	15,312	2%
Roads	10,205	1.4%
Total	**740,480**	**100%**

Scale—As noted in the discussion above the greatest amount of private

land in the county is agricultural land. The farms and ranches in Delta County provide the largest, least fragmented, undeveloped blocks of private land in the county. In addition some ranches are located directly adjacent to the public land where they hold grazing permits, while some are located at a distance from them. In either case, these areas provide the greatest opportunities for managing large blocks of undeveloped land for wildlife habitat and biological diversity in the lower valleys in the county.

When farms and ranches are sold-off or subdivided this often results in smaller land units. This results in fragmentation of habitat. These smaller land units cause a decrease in opportunities to manage for large-scale wildlife habitat and biological diversity in the lower elevations in the county. Development along the Front Range of the Colorado Rockies is causing the loss of habitat for the black-tailed prairie dog and the Prebbles meadow jumping mouse. The population of Delta County increased 33% from 1990 to the year 2000. This represents a significant increase in 10 years. It is likely that increased development on the Western Slope and the loss of additional ranches will result in the loss of habitat for wildlife species such as the Gunnison sage grouse and the Gunnison and white tailed prairie dogs. The continued operation of ranches in the western valleys provides the greatest opportunity to maintain large blocks of undeveloped valley land.

Habitat—An additional consideration is that private agricultural interests own much of the valley bottom-lands and associated riparian habitats. If these lands are sold or subdivided these limited valley bottom riparian habitats will be negatively affected or lost. The ranches and farms that hold these lands either need to be maintained or the lands need to be preserved though public acquisition. Development of these lands will result in the loss of these very limited habitats. There are many benefits to maintaining these habitats. Obviously maintaining the existing agricultural operations provides the most economical means of maintaining these large-scale blocks of land.



Hidden Valley Sub-division above Paonia, Colorado. Developed since 1995. Mt. Lamborn of West Elk Mountains in background. Photo by David Bradford.

Economic Benefits

Agriculture has been the traditional mainstay of the economy of Delta County. Along with mining, it is the economic activity that has most influenced the character of the towns and the landscape. Agriculture and mining created the infra-structure and the society of Delta County. While agricultural earnings have declined, it remains a significant part of the Delta County economy. Currently the economy of Delta County is based on agriculture, construction, manufacturing/timber, tourism and various service activities, such as retail sales, transportation, communications, utilities, real estate, finance, insurance, education and health services. Agriculture produces nearly 12% of all the earnings in the county and over 16% of all employment in the county .

In addition there are a number of additional economic factors relating to public land ranches. One factor is the effect of development on the county tax base. A number of studies have been completed to measure the impacts of different land uses on a county's tax base. A 1998 study of Custer County, Colorado by the San Isabel Foundation, Custer Heritage Committee, Sonoran Institute and the American Farmland Trust, showed that:

1. Agricultural land and open space provide more in tax revenue to the county than they demand in service costs—$0.54 in services for every $1.00 in tax revenue.
2. Commercial and industrial land put more in county coffers than they take out in services—$0.71 in services for every $1.00 in tax revenue.
3. Residential land, incur higher service costs than it provides in revenue—$1.16 in service costs for every $1.00 in tax revenue.

There are economic benefits to

maintaining agriculture in Delta County as well as economic costs of losing agricultural lands to development. We believe it can be argued that there is an economical value to maintaining agriculture as part of our county economic base.

Social Benefits

Agriculture has provided long-term benefits to the North Fork Valley (as well as many other areas). Agriculture has been a significant economic activity in the North Fork Valley since the valley was settled in 1881/82. It has proven to be sustainable. Many of the ranches in the North Fork Valley have existed for a long time, with some being recognized as "Century Ranches".

As noted previously, irrigation-based agriculture had created the "green" landscape that characterizes the North Fork Valley, as well as most of the other valleys in western Colorado and the West. It is, in fact, this rural, green, agricultural landscape that appeals to many and attracts them to settle in these western valleys. At the same time while agriculture provides a greener landscape, some forms of agriculture have a greater impact on the land than others. Fruit orchards and row-crops, while providing important and desirable products, alter the native vegetation of the land in a significant manner.

However, the mix of agricultural products/types has provided a diverse combination that often compliment one another. Livestock are often grazed on row crop aftermath, such as corn stalks, sugar beets and onions. Livestock ranching provides the lowest impact form of agriculture, with the land being maintained in generally continuous cover and often in its natural state. As with much of our human activities, there are trade-offs. Some negative effect is often caused in the production of a positive one.

North Fork Valley Ranch Operations...Through The Seasons

Forest Service grazing permits in the North Fork Valley are used in the summer to early fall. Average turn-on for cattle allotments is June 16, with turn-off dates averaging October 15. Sheep allotments are generally grazed July 1 to September 15.

Calving generally occurs from late January to early March; lambing occurs from March to April. Both calving and lambing take place on the home ranch. As calves and lambs mature, the livestock are moved to early spring pasture that is either owned or leased. If the ranch holds a BLM grazing permit or lease, livestock are moved to BLM lands for spring grazing. Livestock are moved to the National Forest for summer grazing.

Livestock are moved off the Forest in the fall. Calves are weaned and shipped to feedlots or some are kept and finished on the home place before being shipped to market. Lambs are shipped to feedlots when they are weaned, right as they are moved off the Forest. Cattle are then generally moved to private pasture. The type of pasture varies—some are moved to owned pasture, some to leased pasture. Some pasture is irrigated grass or grass/alfalfa mix, some is crop residue—corn and onion are common in Delta County. Sheep are generally moved to BLM lands for the winter, generally moving down to the lower desert ranges, in the Delta and Grand Junction areas. Livestock are generally moved back to the home ranch for calving and lambing, as the cycle repeats.

As the debates over grazing on public lands intensify, there is increasingly rapid urban, suburban and exurban development occurring in Colorado and across much of the West. This phenomenon is also creating concerns and becoming the subject of vigorous debate. Is there a connection between rapid human development and livestock grazing on public lands? We believe there is. The loss of farm and ranchland in Colorado averages 250 acres per day (90,000 acres per year), and 11,300 acres per day nationally .

The concern over the loss of undeveloped lands has increased in Colorado to the point that concerned citizens initiated an amendment to the state constitution in the 2000 state elections limiting uncontrolled growth. The initiative failed, but on December 11, 2000, *The Denver Post* printed an editorial stating that growth remains an issue for Colorado and that if the state legislature fails to address the growth issue again in 2001 then concerned citizens are sure to push for another state constitutional amendment. Is there a relationship between urban growth and the maintenance of agricultural operations? We believe there is.

Programs To Preserve Open Space

In Colorado as well as other states, numerous programs to preserve agricultural and undeveloped lands have developed. At least 7 counties and one city in Colorado have created "Open Space" programs. These are county and city government programs that have been created in order to maintain agricultural lands, rangelands and other undeveloped lands. The intent of open-space programs is generally to preserve land for scenic, agriculture, wildlife habitat and buffer values. The programs are generally funded through a tax, often a sales tax but also through special mill levies on property taxes.

Boulder County and the City of Boulder have some of the largest Open Space Programs in the state of Colorado. The City of Boulder pro-

gram started in the 1960's and the Boulder County program, started in the 1970's. Both programs are funded through sales taxes. The City of Boulder has acquired 30,000 acres of land and spent nearly $100 million in acquisition of these lands. Boulder County has acquired 47,000 acres and nearly 13,000 acres with conservation easements, spending nearly $250 million in acquisition. Obviously, the people in Boulder County are concerned with the loss of agricultural and undeveloped lands.

Another method for preserving agricultural and undeveloped lands is a "Conservation Easement". A conservation easement is generally described as a right, an interest in real property or an interest in land . Easements are entirely voluntary and are either donated or sold by landowners at their discretion. These easements vary considerably from state to state and are used to protect a variety of resources on private property from scenic vistas, urban parks, gardens, greenways, wildlife corridors, open space, wetlands, groundwater recharge zones, farmland, cultural and historic lands, habitat and river corridors.

These easements work by restricting or obligating the activities that may occur in the property and thus limiting a landowner's use of the property. The intent is to protect or preserve a particular resource that is provided on the property. A government entity, a charitable corporation, a charitable association or a charitable trust may hold Conservation Easements. Most conservation easements in the last fifteen years have been acquired by charitable trusts - generally called land trusts.

Since the mid-1980's over 650 land trusts have been formed in the United States. In Colorado over 29 land trusts have been formed. These groups have acquired over 3 million acres. In Colorado there are nearly 80,000 acres of land on which there are conservation easements. These figures indicate that Americans believe our undeveloped lands need additional forms of protection. One major caveat in considering conservation easements as a means of preserving open space is that there is some concern as to the long-term ability of these lands to be maintained under the terms of the easement. There has not been a legal challenge to-date in maintaining a conservation easement and there is concern that a legal challenge could break an easement.

Once these lands are acquired they still require some form of management. Management can be custodial or more active. Whatever the level of management there is still a cost associated with management. Boulder County spends nearly $8.0 million for management operations per year. With 4.0 million visitors per year, there is good justification for these costs. Nonetheless, this level of management requires nearly $133 per acre to manage the Open Space lands of Boulder County. There is a price tag associated with the management of Open Space lands.

Is this a rationalization for continued use and abuse of public lands from livestock grazing? Absolutely not. We know that uncontrolled and under-managed grazing can cause resource damage. In general, the public lands have shown a marked improvement in resource conditions in the last 50 years. This is difficult to document on a large-scale basis. The large amount of land involved in such an assessment, combined with the tremendous variation in land types and habitats makes these types of assessments difficult and expensive to complete. As a result, this information is often lacking.

The Grand Mesa, Uncompahgre and Gunnison National Forests began a review of historic photographs and evaluations that were done on the three forests in the late 1940's–1950's. This review has shown tremendous damage had been done to parts of the Forests by improper livestock grazing. When

North Fork Valley with West Elk Mountains in background. Base ranches are located along the river bottom, with National Forests rangelands on the slopes of the mountains. Photo by David Bradford.

these sites were re-evaluated and re-photographed there was significant improvement that has occurred in these areas. These areas have continued to be grazed, with the improvement attributed to improved management. We need to continue to emphasize improved management on public lands where it is inadequate to maintain resource conditions. But we also need to recognize those areas where there is excellent management and use those as examples for others.

A major factor in the improvement of conditions to range lands in the North Fork Valley and Delta County is the educational program initiated by Colorado State University Cooperative Extension Service known as "The Range Management Schools for Ranchers." These schools provide improved range and livestock management to ranchers and produce dramatic on-the-ground improvements. The schools have been taught in western Colorado since 1995. These schools have been an overwhelming success.

They have created a collaborative approach to improved range management on the public lands. The schools have also produced numerous on the ground results. Several ranches in the North Fork Valley have been recognized for their outstanding management. The Campbell and Sons Ranch and the West Elk Livestock Association have been recognized for their management of National Forest rangelands. There is a direct link between the on-the-ground improvements and the Range Management Schools for Ranchers.

We believe these examples demonstrate that livestock grazing can occur on public lands and also accomplish the many resource objectives that the public lands are expected to provide. We believe these examples also strongly demonstrate the relationships between private land ranches in the western valleys in Colorado and the adjacent National Forests.

Our evaluation shows that private land ranches in western Colorado with public land grazing permits are providing significant benefits to the people of the West and the American public in general. These benefits are ecological, social and economic. These so-called public land ranches make up a significant portion of the private lands in many western counties. As a consequence they produce a significant portion of native plant and wildlife habitats in the limited, mostly privately owned valley bottoms. The conversion of these agricultural areas to human housing developments causes distinct losses of habitat in these valley bottoms.

In addition, these ranches provide a significant amount of the open space that characterizes rural western Colorado. Development on agricultural lands is creating increasing concerns for the public. The loss of open space and the conversion of the rural landscape to an urban, suburban and exurban environment is creating increasing concerns for western communities. Government sponsored "Open Space" programs and "Conservation Easements" can help mitigate the loss of these open spaces but they are expensive and still require some type of on-going land management. The rapid development of housing is also creating an economic impact that rural counties are struggling to deal with.

If we are to continue to discuss the removal of livestock grazing from public lands, we need to consider what will happen to the ranches that currently hold those grazing permits. Will management on those private lands change? Will they remain as active ranches? Will they be sold and subdivided for housing? There are existing examples. Numerous Colorado counties, such as Boulder, Larimer, El Paso, Douglas, Eagle, Summit and Routt, once had many ranches that held grazing permits on adjacent national forests. These permits were waived back to the government and livestock grazing no longer is occurring on these areas of the national forests. What has happened to the ranch lands that were attached to those grazing permits? What has happened to the national forest lands since grazing has been eliminated? We can study these examples to see the actual "benefits" of removing grazing from the national forests. To date, this has not been done. If this debate about grazing on national forests is to continue, these questions need to be addressed.

There is a significant relationship between private land ranches in the West and the public land grazing permits that those ranches hold. There are benefits that our communities derive from that relationship. We need to change how we view that relationship. We need to recognize that ranches with public land grazing permits provide significant ecological, social and economic benefits to the communities of the West. These ranches are an integral part of the western landscape. We need to focus on the entire ecosystem and decide what our desired future condition of that ecosystem will be.

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References

Adams County, Boulder County, Douglas County, El Paso County, Jefferson County, Larimer County, Pitkin County and the City of Boulder.

American Farmland Trust. 10-31-2000; website: http://farmland.org

Baird LeValley, R. , J. Murray, F. Reed, J. Hawks, and D. Bradford. 2000. The Range Management School for Ranchers: or How to Teach Range Management to a Bunch.of Cowboys." Rangelands. V. 22, No. 4, 10-13.

Bradford, D. 1998. "Holistic Resource in the West Elks-Why It Works." Rangelands V. 20, No. 1, p. 6-9.

Bradford, D. F., Reed, J. Campbell, C. Campbell, and C. Campbell 2000. Campbell and Sons Ranch: Colorado Section SRM 1999 Excellence in Rangeland Conservation Award." Rangelands V. 22, No. 4, 8-9.

Chapman, Mary, Nancy Fishering, and Maria Forster. 1997. "The Regional Economic Design Project: Final Report on the Base Economy of Delta and Montrose Counties.

Delta County Assessors Office. Personal Communication; November 11, 2000.

Ferriday, James 2001. "Uncompahgre Plateau Base Ranch Mapping Project." Draft Report—10/25/2001.

Forest Service Manual (FSM) 2202.

Gustanki, J.A., Squires R.H. editors 2000. Protecting the Land: Conservation Easements Past, Present and Future. Island Press, Washington D.C., Covelo, CA.

Sayre, Nathan F. 2001. The New Ranch Handbook: A Guide to Restoring Western Rangelands, p. 21-32. The Quivira Coalition, Santa Fe, N.M.

The Use of the National Forests. U.S. Department of Agriculture, Forest Service, 1907.

Vavra, Martin, William A. Laycock, and Rex D. Piper. 1994. Ecological Implications of Livestock Herbivory in the West, p. 202. Society for Range Management, Denver, CO.

Feed Less, Earn More

By Matthew J. Ricketts

Grazing longer and feeding less is key to improving ranch income. Here are profit improvement strategies to consider.

Feed and feeding is the number one cost of maintaining a cow herd. Producing, harvesting, baling, stacking, and then unstacking and feeding hay is not inexpensive. If the amount of hay fed could be reduced, the profitability of many ranches could be improved.

Feeding too much hay can often put you in a bind financially. Producing cattle that wean large calves often means selecting bulls and cows on the basis of what they can produce. This generally means a larger framed cow and/or higher milk production.

But eventually, both of these traits can translate into higher nutrient requirements. If these requirements outpace the ability of the rangeland or pasture to provide those nutrients at critical stages of production, the cow may come up dry or have related health problems. This translates into lower weaning percentages (the number one economic indicator for a cow/calf or ewe/lamb operator).

Are we spending big dollars for bulls that over the long term produce replacements that require more nutrients than our rangeland is able to provide year in and year out?

If profit equals production times price minus costs how do we optimize production at the least cost? (OPTIMIZE is the key word.) We need to conduct nutritional assessments of our least expensive and most abundant feed source—rangeland.

Knowing what nutrition is being provided to our range livestock by season is essential in order to improve ranch income and sustainability. Conducting nutritional assessments is key.

Nutrition Is Key

Managing feed resources to attain a consistently high reproductive rate at a low cost is essential in order to maintain profitability. Nutrition is the most important factor in fertility, good health, and high reproductive rates. Most problems with reproduction are associated with insufficient nutrition, particularly protein and energy (Spitzer 1986).

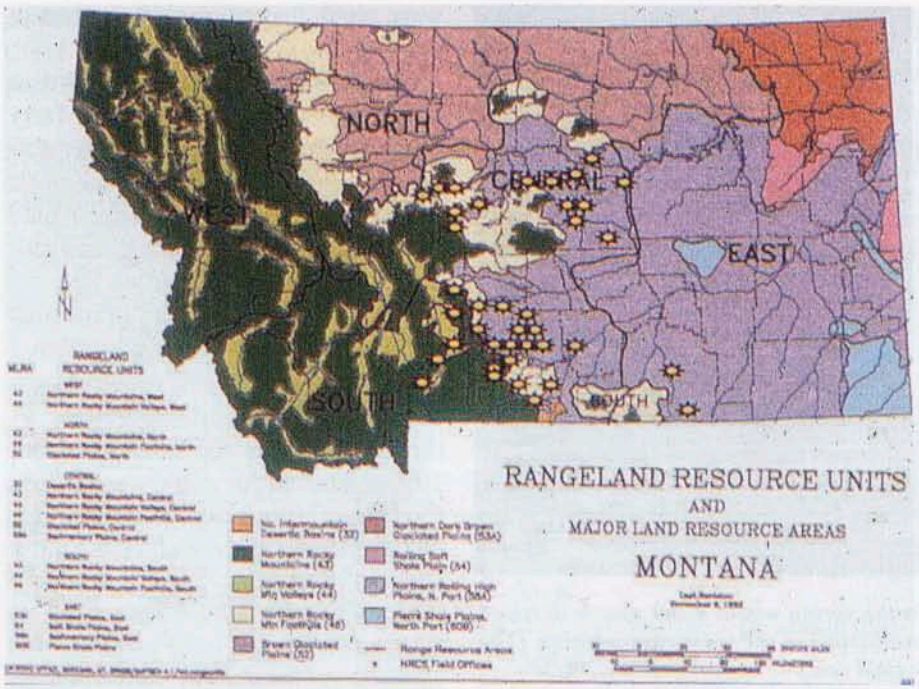
In the spring of 1995 we began assessing the nutritional value of the least expensive and most abundant feed source available to Western ranchers – rangeland.

We sought to examine if feed costs could be cut and sufficient nutrition provided by shifting calving dates and conducting nutritional assessments.

This project centered on fecal profiling to predict livestock energy and protein intake (Stuth et al. 1989, Coleman et al. 1989, Lyons and Stuth 1991, Lyons et al. 1992, 1993, Coates 1998). Thirty ranchers in the sedimentary plains and the foothills regions of Montana collected samples.

Livestock performance was then evaluated based on the forage quality, environmental conditions, breed type, age, sex, physiological stage, body condition, and performance goals using the Nutritional Balance Analyzer computer program (NUTBAL) (Ranching Systems Group 1993). With this information a rancher could make more informed feeding or supplementation decisions or adjust his or hers grazing program to improve the overall economic and resource conditions on their ranch.

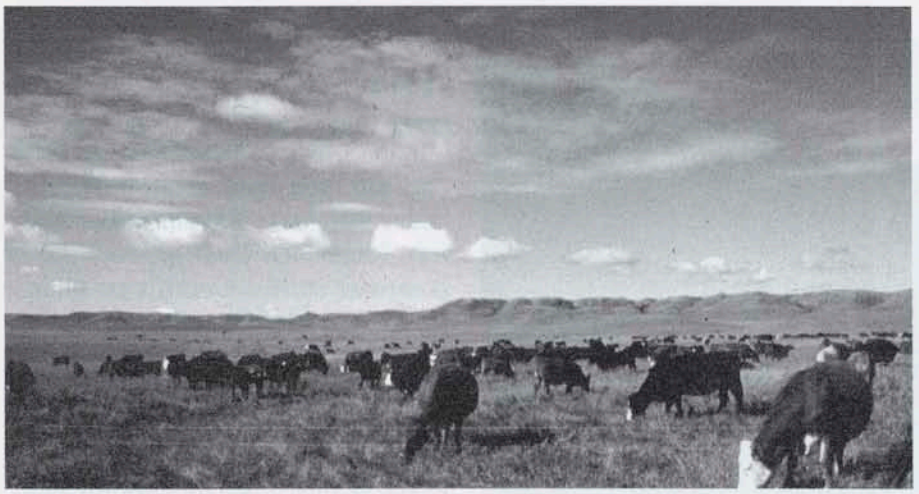
The sedimentary plains are characterized by rolling grassland intermixed with occasional rocky bluffs and ponderosa pine. Precipitation in



Location of ranches participating in rangeland quality assessments. The yellow represents the foothills region and the purple is the sedimentary plains region.

this region is between 12" to 14" on average. The characteristic plants include bluebunch wheatgrass, western and thickspike wheatgrass, needleandthread grass, blue grama, prairie junegrass, green needlegrass, fringed sagewort, dotted gayfeather, and scattered Wyoming big sage.

The Northern Rocky Mountain Foothills are characterized by steeply to gently sloping grassland leading up to the mountains. Precipitation in this region is between 15" to 20" on average. The characteristic plants include bluebunch wheatgrass, Idaho fescue, cussicks bluegrass, thickspike wheatgrass, green needlegrass, prairie junegrass, sandberg bluegrass, lupine, and daisy species, and scattered pockets of mountain big sage.



Quality along with quantity affect the productivity and profitability of livestock operations. Cattle pictured here are grazing in the sedimentary plains region near Billings, Montana.

Both regions receive 70% of their total precipitation in the growing season, with 35% falling during the months of May and June. Temperatures vary between –35 degrees F in the winter to 95 degrees F in the summer for both regions.

We plotted the fecal sample results for protein and TDN (Total Digestible Nutrients), and compared them to livestock requirements.

Consider Matching Calving Dates To Forage

Overall TDN, or energy, was not deficient. However, protein was deficient at various times of the year.

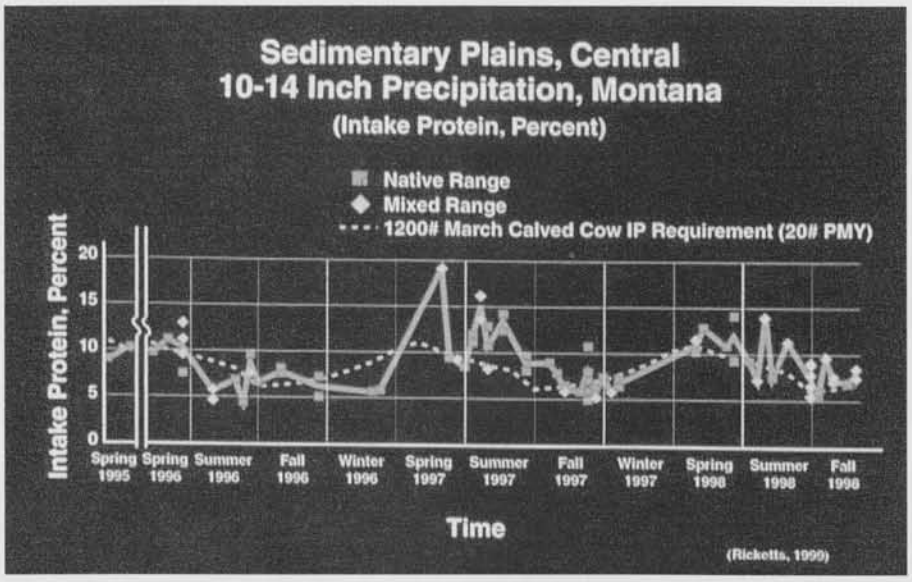
In the Sedimentary Plains, IP (Intake Protein) could be less than optimum at any time of the year with winter being the most likely time to experience deficits, followed by summer, fall, and then spring.

Many ranchers in the plains are calving in March. If calving dates were shifted two to four weeks to mid-March or April, feeding costs could be cut significantly, and profitability improved by matching the nutrients available in the forage with the cow's nutrient requirements.

Energy was not a problem as long as sufficient standing forage was available and protein and energy were properly balanced in the diet.

The digestible organic matter / crude protein ratio is the ratio of digestible organic matter (or energy) to protein in the animal's diet. Animal performance is generally affected negatively when the ratio falls below four or rises above eight. In the plains we found it to rise above eight quite often. This was associated with dry periods and protein deficiencies. It almost never fell below four (a washy forage condition with high rumen degradable protein) which may account for Montana's so called 'hard grass'.

The typical cow body condition score (BCS) for the plains was between 4 to 6. On the 1 to 9 scale,



Shifting calving two to four weeks later in the spring would better match livestock nutrient requirements with forage nutrient availability in the sedimentary plains. (The graph reflects a March calved 20# peak milk yield cow).

with 1 being extremely thin and 9 sloppy fat, a 5 or 6 at calving time is recommended to maintain a productive herd (healthy calves and timely breed back) (Richards et al. 1986).

In the foothills, intake protein could also be less than optimum at any time of the year with winter being the most likely time, followed by early spring, fall and summer.

Many ranchers are calving in February in the foothills. If calving dates were shifted eight weeks to April, feeding costs could be cut significantly in this region.

Again, energy was not a problem as long as sufficient standing forage was available and protein and energy were properly balanced in the diet. Tall statured forages are necessary when snow cover is deep to prevent energy shortages.

The digestible organic matter/crude protein ratio never fell below four and rose only on occasion above eight. Protein deficiencies were much less of a problem than in the plains.

The typical cow body condition score was between 5 to 8. Many ranchers are maintaining some expensive body condition on their cows, and could cut their feed bills with nutritional assessments and still maintain herd productivity.

In Nebraska a reduction in the cost of keeping a cow by synchronizing feed resources and cow requirements has been achieved (Proceeding of the Range Beef Cow Symposium 1997). This reduction in costs was more than enough to offset the reduced income from lighter weaning weights.

The hayland once being used to raise winter feed could be shifted to summer pastureland. Expensive machinery, as it wears out, may not have to be replaced, saving money.

Utilize The Forages Available

Knowing the quality of the different forages by season growing on your ranch can help to match grazing and calving dates so as to optimize the use of the available forage protein (Ricketts 1994) and still maintain high reproductive rates and weaning percentages.

When range condition declines, animal performance is impacted.

Range producing closer to its potential provides a greater total amount of energy and protein than range that is far below its potential.

In the Montana foothills rough fescue can dominate (high TDN and about 5% crude protein in the winter). Bluebunch wheatgrass can also dominate in the foothills or plains (high TDN and between 3 to 4 % crude protein in the winter). Both of these species are tall statured and can provide excellent winter forage.

Shrubs are important nutritionally in the plains. Palatable shrubs help maintain protein at proper levels in the animal's diet when grasses and forbs are deficient in protein. This

Foothills region in the spring near Livingston, Montana.

enables plains rangelands (that have these shrubs) to maintain animal performance at similar levels compared to the foothills rangelands.

Dotted gayfeather and forbs similar to it are like little protein blocks scattered across the range. They provide needed nutrients to assist animals in digesting the associated high-energy grasses that may be deficient in protein.

Greasewood is a palatable shrub that contains about 12% crude protein (cp) in the winter. Nuttlals saltbush is around 13% cp, and winterfat is around 13% cp in the winter. Both are very palatable.

Forbs are also important. Purple prairie clover and dotted gayfeather are palatable warm season forbs containing around 25% cp when green. They are like little protein blocks scattered on the landscape.

Sampling for intake protein and energy intake can help with strategically supplementing protein. Fecal sampling (Stuth et al. 1989) is a cost and time effective means for assessing protein intake of range livestock.

By not over or under supplementing protein, optimum herd productivity can be maintained, while cutting wintering costs and optimizing summering costs, and while maintaining adequate forage intake.

Five Strategies To Consider

In summary, to graze longer and feed less, five management areas should be considered:

1) Cattle should be bred for moderate frame and moderate milk production, and conditioned to rustle (work the hills, not the feed bunk). The cows have to fit the environment, the resources, and the management practices on the ranch.
2) Shift calving later to about mid-March or April.
3) Conduct nutritional assessments on a regular basis.
4) Balance forage availability with livestock requirements.
5) Overall, good range management that promotes a productive, vigorous, and diverse plant community can improve the long-term profitability and sustainability of livestock operations.

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References

Coates, D.B. 1998. Predicting diet digestibility and crude protein content from the feces of grazing cattle. Meat Research Corp./CSIRO, Final Report: Project CS. 253. CSIRO Tropical Agriculture, Queensland, Australia.

Coleman, S.W., J.W. Stuth, and J.W. Holloway. 1989. Monitoring the nutrition of grazing cattle with near-infrared analysis of feces. p. 881-882. In: XVI Internat. Grassl. Congr., Nice, France.

Lyons, R.K. and J.W. Stuth. 1991. Procedures for processing cattle fecal samples for NIRS analysis. Anim. Feed Sci. Technol. 35:21-36.

Lyons, R.K. and J.W. Stuth. 1992. Fecal NIRS equations predict diet quality of free ranging cattle. J. Range Manage. 45:614-618.

Lyons, R.K., J.W. Stuth, J.E. Huston and J.P. Angerer. 1993. Predictions of the nutrient composition of the diets of supplemented versus unsupplemented grazing beef cows based on near-infrared reflectance spectroscopy of feces. J. Anim. Sci. 71:530-538.

Proceeding of the Range Beef Cow Symposium, 1997. Contact: Don Adams, University of Nebraska, North Platte 69101.

Ranching Systems Group. 1993. Nutritional Balance Analyzer User's Guide. Dept. of Rangeland Ecology and Management. Texas A&M University. College Station, TX 77843-2126. USA. 148 pp.

Richards, M.W., J.C. Spitzer, and M.B. Warner. 1986. Effect of varying level of postpartum nutrition and body condition at calving on reproductive performance in beef cattle. J. Anim. Sci. 62:300-306.

Ricketts, M.J. 1994. Cutting ranching costs: optimizing forage protein value. Rangelands. 16:260-264.

Spitzer, J.C. 1986. Influences of nutrition on reproduction in beef cattle. In: D.A. Morrow (Ed.) Current Therapy in Theriogenology (2nd Ed.). W.B. Saunders Co., Philadelphia.

Stuth, J.W., E.D. Kapes and R.K. Lyons. 1989. Use of near infrared spectroscopy to assess nutritional status of cattle diets on rangeland. pp. 889-890. In: Proc. XVI Internl. Grassl. Cong., Nice, France.

The Statistical Power Of Rangeland Monitoring Data

A range consultant shares his thoughts on when numbers are really justified – and when they aren't.

By Peter Sundt

Demands for monitoring of all types of natural resources have steadily increased in recent years. Monitoring of rangeland condition and grazing utilization are now required by court order on federal grazing leases, and agencies are scrambling to comply.

"Monitoring" has joined "ecosystem" as a catchword of progressive resource management without which no proposal is complete. But in the clamor for more quantitative information little attention has been paid to the methods of monitoring, and even less to the statistical power of those methods to detect change.

This study evaluates power in a set of monitoring data in which the point-line method was used to estimate foliar and basal cover of rangeland vegetation. Statistically valid quantitative monitoring is more difficult than people seem to realize. I conclude that some of the rangeland monitoring being called for could likely be accomplished by qualitative evaluations by experienced professionals, and numbers should be reserved for properly-designed projects in which statistical power is adequate.

Methods For The Study

The data set consists of cover estimates for 48 study plots comprising an ongoing research project of the US Forest Service Rocky Mountain Research Station, in which Chihuahuan desert scrub vegetation was subjected to roller-chopping and grass-seeding in hopes of converting scrub to grass.

At each of four separate locations in the vicinity of Douglas, Arizona, twelve 500 ft x 500 ft plots were arranged contiguously in a large grid. At each site, eight of the twelve study plots were treated by pulling a large water-filled drum with sharp edges over the vegetation. Half of the treated plots were broadcast-seeded with species of native perennial grasses. Four plots were left as untreated controls.

Before and after treatment the cover of rock, bare soil, litter, the foliar cover of all plant species and the basal cover of perennial grasses were estimated by the point-line method, primarily to evaluate the success of the treatments in replacing shrubs with grass. Ten temporary transects per plot were systematically located and at 100 points along the transects a sharp steel pin was used to identify the plant or soil category occurring at the point, for a total of 100 points per transect, 1000 points per plot. Transect data was kept separate to estimate within-plot variance. The data set analyzed for this study consists of estimates from one pre-treatment and two post-treatment years.

Statistical Power And Minimum Detectable Change

Statistical power is a way to measure how effective monitoring methods are in detecting change. Power can be defined as the probability that a real change from one sampling time to the next is detected and not mistaken for sampling error or random variation.

Related to power is minimum detectable change (MDC): the smaller the minimum detectable change the more powerful the methods. Given the number of samples and the variance of the data (i.e. the variation of cover values among the 10 transects in a plot), one specifies the acceptable probabilities of false-change and missed-change errors (alpha and beta) and can calculate the minimum change that can be detected (see formula in sidebar).

For this analysis I specified alpha=beta=0.20; in other words I want 80% confidence that an observed difference in mean cover value from one year to another is not due to random events (such as variation in point placement). I also want to be at least 80% sure that a real change will be detected. The more confidence one requires the more difficult it is to detect change or to distinguish real change from random effects. All else equal, the more con-

Formula for MDC
From Zar (1984):

$$MDC = [\sqrt{(2s^2/n)}]\ (t_{\alpha,v} + t_{\beta,v})$$

where MDC=minimum detectable change, s^2 = pooled sample variance, n = sample size, t_α = t value for alpha (two-tailed), t_β = t value for beta (one-tailed), v = degrees of freedom (= n-1).

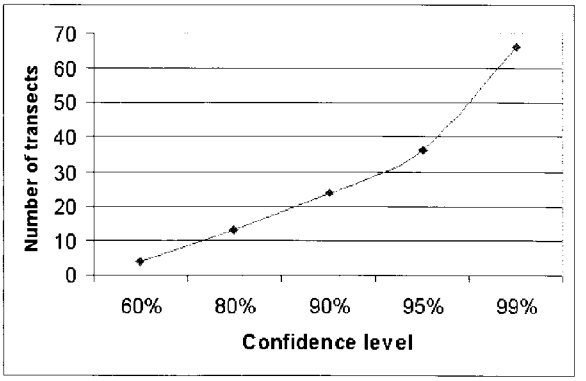

Fig. 1. *Sample sizes (number of transects) needed to detect a 20% change in the bare ground cover at plot GW1, at various levels of confidence. For 60% confidence alpha=beta=0.4, for 80% confidence alpha=beta=0.2, etc. Calculated from the formulae in Elzinga (1998), p. 346.*

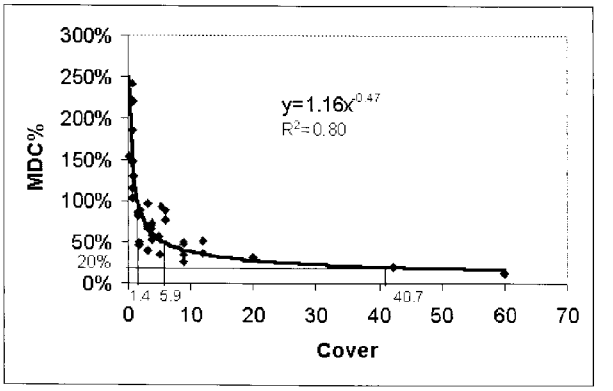

Fig. 2. *Minimum detectable change (expressed as a percentage of initial cover) vs. initial cover for plot GW6. The best-fit curve is illustrated and cover values at MDC%=100%, 50% and 20% calculated from the equation of the curve are indicated. R^2 is a measure of the accuracy with which the curve fits the data points (values range from 0 to 1.0).*

fidence one demands, the more samples are needed (Figure 1). I have settled on 80% confidence as a reasonable level for most rangeland monitoring. For most biological research the required level of confidence is 95%.

Evaluating Power

Minimum detectable change is a function of alpha (the acceptable probability of false change error), beta (the acceptable probability of missed change error), sample size, and pooled sample variance. Consider the data in Table 1 from one of the 48 study plots. A change between years 1 and 2 from the initial cover of 60 to at least 60+7=67 or to less than 60-7=53 could have been detected – any smaller change would have to be attributed to random variation.

In percentage terms, the methods were sufficiently powerful to detect changes of 12% or more of the initial cover value between years 1 and 2. In later years the methods were less powerful largely because of the increased pooled variance—a minimum change of 13% was necessary between years 1 and 3, and of 19% between years 2 and 3.

Table 1. Data for bare ground cover in plot GW6 for 3 sample times (1996, 1999, 2000). The upper half of the table compares the mean cover values and variances among the 3 years. The lower half indicates the pooled sample variance, the minimum detectable change (MDC) and minimum detectable change as a percent of the mean initial cover value (MDC%) for each between-year comparison.

YEAR	1	2	3
MEAN COVER	60	42	67
VARIANCE	43	51	73

YEARS COMPARED	1 to 2	1 to 3	2 to 3
POOLED VAR.	47	58	62
MDC	7	8	8
MDC as % of cover	12%	13%	19%

These calculations were made for all the species and soil categories in all 48 plots for all possible between-year comparisons, about 1575 comparisons in all. To distill the enormous amount of data into a readily evaluated form, graphs were produced of MDC% versus cover for each plot (MDC% is the minimum detectable change expressed as a percent of the initial cover). One such graph appears as Figure 2. The power of the method is greatest for species with high initial cover. Most species in this plot have cover values less than 10% and any change in their cover must be 20-250% to be detected.

The data in Figure 2 can be fitted with a curve, the equation of which is a negative exponential function. While some species' points lie above or below this curve, the equation is a useful generalization of the method's power integrated across all species. For the average species in Figure 2 with initial cover less than 1.4% a change must be 100% or more to be detected; for species with initial cover between 1.4% and 5.9%, the change must generally be 50%-100%; and for those species with initial cover greater than 40.7%

Table 2. Cover values for MDC%=100%, 50% and 20% calculated from equations of best-fit curves for all the data pooled at each of the 4 study sites, and for all data pooled in the entire dataset. In each column the range of cover values calculated from the curves from each of the 12 plots at each site is in parentheses. In the right hand column the results are from the graph made by pooling all the data in the dataset (Figure 3).

MDC%	Site WG	Site GW	Site ER	Site SB	All data pooled
100%	2 (1-2)	2 (1-2)	2 (1-4)	2 (1-3)	2
50%	8 (4-15)	7 (4-14)	7 (5-9)	13 (6-32)	8
20%	49 (20->100)	48 (23->100)	58 (33->100)	132 (41->100)	61

a change of only 20% could be detected. Such graphs and their equations were created for each plot in the dataset, and provide a useful way to compare the power of the methods among plots (Table 2).

For Most Species Power Is Low

In Figure 3 all of the data in the study has been combined into a single graph, and the curve provides an overall assessment of the power of the monitoring methods integrated across all species in all plots at all sites in the study.

Generalizing from the equation of the curve one can say that for the average species with less than 2% initial cover a change must be 100% or more of the initial cover to be detected with 80% confidence of making neither a missed change nor a false change error. For the average species with cover between 8-61%, a 50% change can be detected, while for those species with initial cover ≥ 61% a change need be only 20% of the initial value to be detected.

Figure 4 shows the distribution of all year-to-year comparisons in the dataset, with corresponding ranges of minimum detectable change. For almost one third of the species in the data set the change must have been

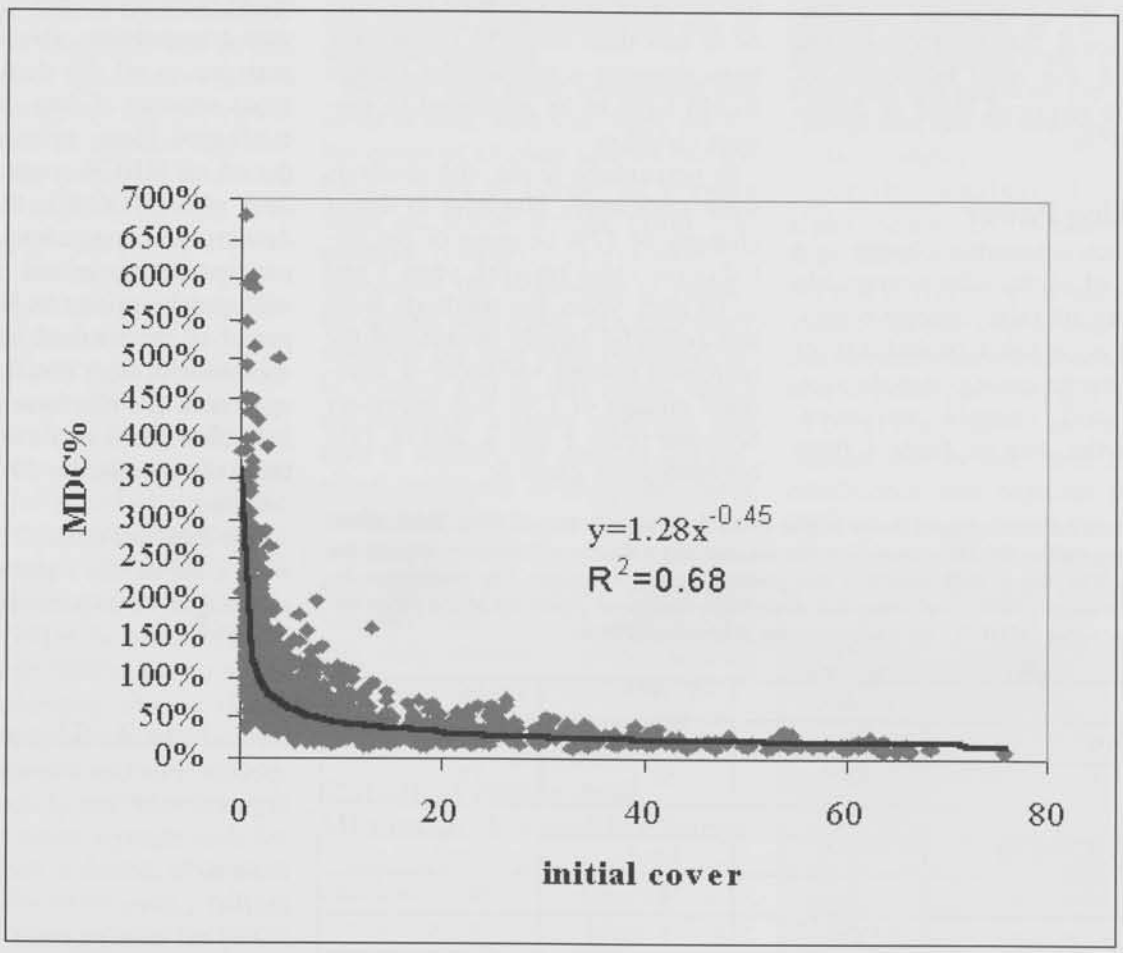

Fig. 3. ***Minimum detectable change as a percent of initial cover (MDC%) graphed as a function of initial cover for all 1575 between-year comparisons in the dataset. The equation of the best-fit curve and its R^2 value are indicated. R^2 is a measure of the accuracy with which the curve fits the data points (values range from 0 to 1.0).***

100% to 700% of the initial cover value to be detected--rather low power of the methods to detect change for many species.

Fortunately, most conclusions in this project and in rangeland monitoring generally are based on changes in common species and in bare ground cover, for which the methods have reasonable power. For bare ground, which in this data set is generally 50–75% cover, the methods are quite sensitive. The top 2 or 3 species in a plot generally exceed 2% cover, so that a 50-100% change in their initial cover values can be detected. These methods are rarely able to detect a change in basal cover of perennial grass species, however, simply because basal cover values are generally <1% and rarely exceed 2% in this study.

How To Boost Statistical Power

Much rangeland monitoring has been conducted with sample sizes considerably smaller than the 1,000 points per plot used in this study. Cover data will often be taken in conjunction with frequency data, using a single point indicator on the frequency frame (or a mark on a boot), and typically resulting in cover estimates based on 100 or 200 points.

In many rangeland situations these sample sizes are far too small for adequate statistical power, even for common species. Furthermore, many monitoring projects do not incorporate replication (i.e. by keeping data separate by transect) and so no evaluation of sample variance and confidence can be made.

Statistical power can be increased by

a) increasing sample sizes,
b) reducing within-plot and between-year variances, and
c) lumping species into groups to attain larger cover values.

More samples are almost always desirable, but the cost in time and effort is directly related to sample size. Reducing variance can often increase power with less effort than raising the sample size. Variance can be minimized by carefully selecting homogeneous vegetation for study plots, by permanently marking sample points or transects, and in some cases by using a rectangular rather than a square sampling frame. Lumping uncommon species into functional groups (i.e. annual forbs, perennial grasses) can boost power because, as this study shows, power increases with cover values. It is

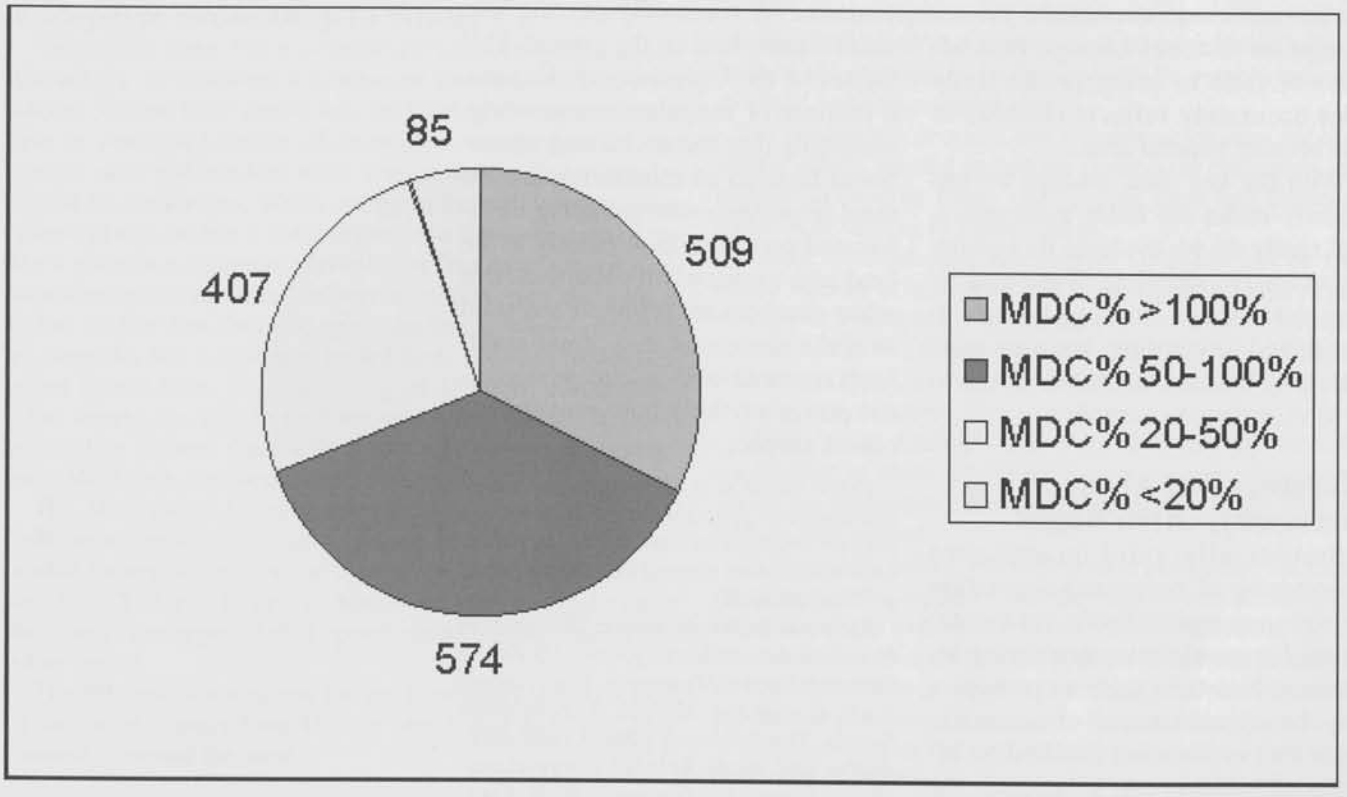

Fig. 4. *The distribution of between-year comparisons in the dataset (1575 comparisons total) in categories of the ranges of minimum detectable change expressed as a percentage of the initial cover values (MDC%). For example, in 509 of the 1575 comparisons the minimum detectable change must have exceeded 100% of the initial cover value to be detected with 80% confidence.*

easier to detect change in the group "annual forbs" than in any individual species of annual forb, and oftentimes it is a change in the functional group, rather than the individual species, that is of most interest. In my data set, lumping the basal covers of all perennial grasses into a group would make changes in this important vegetation component much easier to detect.

There is an unavoidable tradeoff between statistical power, which comes from large sample sizes and minimized variance, and adequate representation of the heterogeneity of real rangeland vegetation. With a small plot, permanently-marked transects and large numbers of unbiased samples one can attain considerable power to detect change within the study plot. But small plots encompass less of the real variation that exists, so there must be several such plots located to represent the variation, or one must make the assumption that any change that occurs or fails to occur in the study plot accurately reflects changes in the broader general area.

With the key area concept we implicitly make the latter assumption, but rarely do we evaluate its validity by extensive sampling. Time and effort are always limiting factors in rangeland monitoring, and one must carefully balance the values of intensive vs. extensive sampling.

Numbers Not Always Necessary, Often Bogus

Statistically valid quantitative monitoring of rangeland vegetation is both rare and difficult, yet the demand for quantitative monitoring increases. Numbers seem to provide a psychological veneer of scientific rigor that is often not justified by inadequate methods. In some cases the objectives of monitoring can be accomplished without hard numbers, based on professional opinion guided by semi-quantitative methods.

For example, an experienced observer can learn to estimate cover in broad categories (e.g. 10–25%, 25–50%) by calibration with small, intensively sampled plots or single transects, and such estimates may often provide sufficient precision for the objectives of the project. Qualitative assessments of species composition, erosion, and ground cover supplemented by photos are adequate for many projects and are always preferable to bogus numbers (reported with exaggerated significant digits and no estimates of uncertainty) resulting from inadequate methods.

There is a place for rigorous quantitative methods, such as when early detection of change is important and cannot be accomplished by visual inspection, or when, for legal reasons, an objective, quantitative record is demanded. Furthermore, sampling of vegetation has collateral benefits—one's attention is wonderfully concentrated by repeatedly peering into small frames laid on the ground. Phil Ogden of the University of Arizona, a pioneer of rangeland monitoring, maintains that the social and educational benefits of monitoring are the most important—the gathering of interested people to look closely at the land and to discuss its changes. But when numbers are reported and used to make decisions they must result from methods with adequate statistical power or the whole process becomes suspect.

Peter Sundt is a SRM certified range management professional who has been actively engaged as a consultant in rangeland monitoring since 1990. He is based in Pima, Arizona.

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References

Bonham, CD. 1989. Measurements for terrestrial vegetation. John Wiley & Sons. New York.

Elzinga, CL, DW Salzer and JW Willoughby. 1998. Measuring and monitoring plant populations. BLM Technical Reference 1730-1. This excellent reference book can be obtained free from BLM National Business Center, BC-650B, P.O. Box 25047, Denver, Colo., 80225-0047.

Zar, JH. 1984. Biostatistical analysis. Prentice-Hall. Englewood Cliffs, New Jersey.

Resource Roundup

Switchgrass For Biomass

Within a couple of years, Iowa farmers may be commercially growing switchgrass to fuel a power plant. Iowa-based Alliant Energy is testing small amounts of the grass as an alternative to coal at its generating station in Chillicothe, IA. Eventually, 5% of the fuel burned at the generating station may be switchgrass, totalling 200,000 tons burned annually.

The switchgrass mixture is said to produce less greenhouse emissions and is a readily renewable source of energy. The biomass project, a cooperative effort of government agencies and private sources, is managed by the Chariton Valley Resource Conservation & Development, Inc. of Centerville, IA. More than 80 producers are involved with raising and harvesting switchgrass for the experimental phase of the project.

Growing Numbers, Shrinking Space

The Western Futures project, a study by the University of Colorado's Center of the American West, predicts that 48 million people will be added to the West by 2050, resulting in 26 million acres of open space being converted to residential and commercial development. Of the eleven western states, Wyoming is expected to have the third highest growth rate.

Endophyte Toxins Drop In Winter

Tests that have been conducted for two years at the University of Missouri's Southwest Research Center near Mount Vernon have shown that the level of the toxin ergovaline in stockpiled fescue declines as winter progresses, but forage yield and nutrient value remain stable. Endophyte-infected fescue forages, which are typically high in ergovaline, almost always induce a toxic response in livestock. One of the toxic symptoms is a reduction in blood flow to an animal's extremities, which can result in freezing of feet, ears, and tails.

The finding that the toxic levels decline as winter progresses, suggests that hay should be fed first, and then feed stockpiled forage later, say University of Missouri researchers. "The longer you wait to feed stockpiled fescue grass, the less ergovaline content there will be for the cows to deal with," says MU forage agronomist Rob Kallenbach.

The MU studies found that ergovaline content above 150 ppb caused problems in cattle. Forage tests taken in 2000 revealed the ergovaline content dropped from a high of 450 ppb on Dec. 15 to only 75 ppb by March 14. In the second year of the study, the ergovaline dropped proportionally during the same period.

The MU tests showed that the crude protein content, actually increased slightly from Dec. to March and ADF and NDF content remained the same.

Longer Lasting Grass

A new orchardgrass variety is expected to double the longevity of orchardgrass pastures in the mid-south. Named Persist, it's also expected to extend the grazing season by at least 30 days. The new variety was developed by plant scientists at the University of Tennessee Ag Experiment Station.

The researchers say the new Persist variety should extend orchardgrass pastures from two to three years of productive grazing to five or six years. In one Tennessee field study, a greater than 90% stand of Persist still exists after five years of grazing.

The variety may be a suitable replacement for fungus-infected tall fescue. Currently, tall fescue is preferred over orchardgrass because it's better at withstanding grazing pressure and stresses such as drought.

Alfalfa Updates

Alfalfa Stands Up To Traffic—An alfalfa variety bred to withstand heavy traffic is now available. University of Wisconsin researchers have been studying the differences among alfalfa varieties in response to wheel traffic. They've found AmeriStand 403T to be the highest-yielding variety under wheel traffic during the two year study.

The variety, from America's Alfalfa, has extra large crowns and roots, which helps minimize disease introduction, improves winter hardiness and promotes longer stand life.

Alternative Alfalfa Establishment Tips—The University of Wyoming Department of Plant Sciences has released Alfalfa Establishment Alternatives, a 10-page bulletin that describes alternatives to traditional alfalfa establishment on cropland and non-cropland sites.

The publication provides tips to improve chances for a successful alfalfa seeding including: cover field evaluation, most successful seeding times and seeding rates and alternative methods of seeding in various areas.

Alfalfa Establishment Alternatives (B-1080) can be found on the Internet at http://uwyo.edu/ag/ces/plantsci.htm. A printed copy is available for a nominal fee. For more information, contact the UW College of Agriculture Resource Center at P.O. Box 3313, Laramie, WY 82071; phone: (307) 766-2115; e-mail: bixbyd@uwyo.edu.

Alfalfa's Silk Lining—University of Wyoming researchers are looking at using alfalfa for the production of spider silk. To do so, researchers are incorporating the spider silk gene into an alfalfa plant.

As the alfalfa grows, silk is produced in its cells, but there is no change in the appearance of the plant. When the alfalfa matures, the silk is extracted from the plant. The rest of the plant can be fed to livestock. The genetic alteration is inherited from generation to generation. No changes in planting or other production practices are necessary the researchers say.

Although still in the experimental stage, the scientists are confident of creating a value-added crop. Spider silk uses include biomedical products and bulletproof vests.

"Resource Roundup" is compiled by Kindra Gordon. Contributions welcome at kindras@gordonresources.com or 605/722-7699

Wetlands In Northern Plains Prairies: Benefitting Wildlife & Livestock

Prairie wetlands are often viewed as nuisances by the farming community, but provide valuable habitat for wildlife and livestock alike.

By Donald R. Kirby, Kelly D. Krabbenhoft, Kevin K. Sedivec and Edward S. DeKeyser

Wetlands, or prairie potholes as they are commonly called, are distinctive features of the Northern Great Plains. This is an area approximately 900 miles long and 500 miles wide. From east to west it stretches between the foothills of the Rocky Mountains and the 100th meridian, and from south to north between the North Platte River and the Boreal Forest of Canada.

Much of the topography of the Northern Great Plains north and east of the Missouri River is dotted with shallow basins following glacial advances and retreats. It is this region of glacial deposits interspersed with shallow basins that has been named the Prairie Pothole Region. The Pothole Region of the plains encompasses nearly 300,000 square miles from central Alberta to southern South Dakota and central Iowa.

Most of the shallow basins of this region hold surface water for only short periods of time allowing many to be intensively cultivated. In a report to Congress, Dahl (1990) estimated in the 1980's that 50% (2.5 million acres) and 65% (1.8 million acres), respectively, of the natural wetlands in North and South Dakota remained.

Wetlands in the Pothole Region are generally classified using the system developed specifically for this glaciated region by Stewart and Kantrud (1971). Most wetlands using this system fall into temporary, seasonal, semi-permanent and permanent wetlands based on water permanence with an increasing number of corresponding vegetative zones termed wet meadow, shallow marsh and deep marsh.

Wetlands perform a range of societal services by providing for direct and indirect human use, wildlife, and environmental maintenance. We will examine two major ecological functions wetlands perform in northern prairie complexes: (1) Wildlife Habitat and (2) Forage. On page, 25 we will discuss societal contributions of prairie wetlands.

Wildlife Habitat

A wide array of wildlife utilize wetlands depending upon seasonal and annual water level fluctuations, as well as disturbances such as grazing and fire. From severe floods to devastating droughts, extremes are commonplace within the Prairie Pothole region. Due to these cyclic climatic patterns, a single wetland may have a drastically different wildlife composition from year to year.

A reduction in natural ecological processes such as grazing, fire and water-level fluctuations contribute to decreased habitat diversity. Without disturbance dense stands of plants such as cattails become dominant in numerous wetlands. Unless unusually severe, livestock grazing of wetlands results in increased plant species diversity, more complex plant distribution patterns and more defined zonal boundaries. Decreased use of prairie wetlands by aquatic birds is often attributed to a decrease in habitat diversity. Duck production on four specialized grazing systems in south-central North Dakota was 1.5 to 2 times the level believed necessary to sustain a population. Average forage utilization by livestock ranged from 54 to 62 % on the grazing treatments during the five-year study.

Wetlands are best known for the waterfowl population they support. The Prairie Pothole Region comprises only about 10% of North America's wetland breeding area, but produces nearly 50% of the waterfowl in any given year. During years of above average precipitation, this percentage may be even higher. Estimates for total breeding duck populations in North America can be found in Figure 1.

The last two decades of the 20th century exhibited drastic waterfowl population changes. As the 1980's came to a close, a severe drought occurred in the Northern Plains. Decreased wetland habitat and increased predation were significant factors limiting waterfowl production. Since 1993, above average precipitation has increased waterfowl populations, though not for all species, to modern day high levels.

Other factors that have assisted the waterfowl recovery include the: 1) North American Waterfowl Management Plan; 2) U.S. Department of Agriculture's Conservation Reserve Program; and 3) U. S. Prairie Pothole Joint Venture.

Waterfowl use of wetland habitats can be placed in four broad categories.

- Courtship
- Brood raising
- Fall migration
- Drought

Each category can be associated with one or more wetland classes. For example, temporary and seasonal wetland abundance is critical during female mallard pre-nesting and egg production. These wetlands are first to become ice-free and provide display areas for attracting mates plus these are protein rich in insect populations needed for egg production. Brood raising occurs in those wetland habitats that contain the best combination of cover and food availability. Semi-permanent wetlands are used most often during this period as cover and water amounts provide safe conditions for raising newly hatched young. During wet years, seasonal wetlands also have provided waterfowl with attractive brood raising habitat.

During fall migration, water availability is usually restricted to permanent wetlands as the semi-permanent wetlands have dried up. Many waterfowl species feed in surrounding grain fields and use open water to rest. Open-water habitat becomes restricted during periods of drought. As temporary and seasonal wetland habitats dry up, semi-permanent wetlands sustain the waterfowl population. If drought continues for multiple years, dry wetland basins within cropland are often cultivated and seeded leading to declines in waterfowl populations.

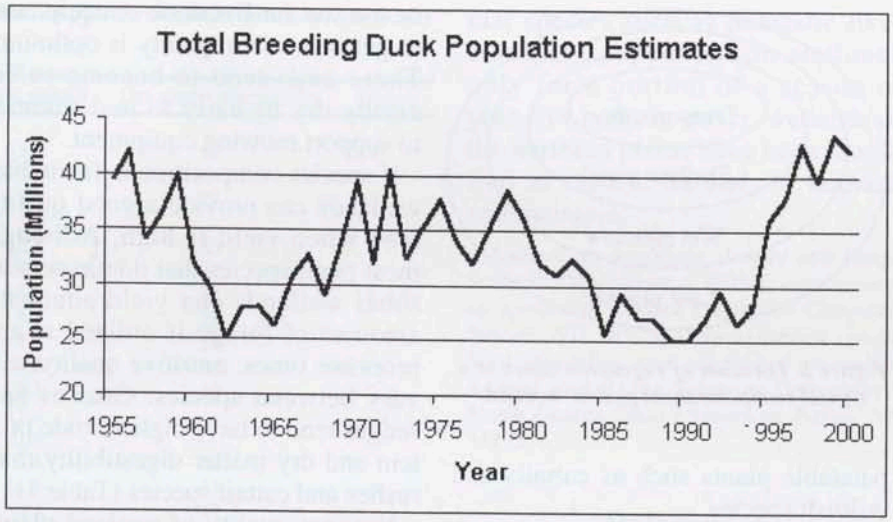

Figure 1. *Estimated total breeding duck population (Mallard, Gadwall, American Wigeon, Green-winged teal, Blue-winged teal, Northern shoveler, Northern pintail, Redhead, Canvasback and Scaup) for North America from 1955-2000 (modified from Wilkins et al. 2000).*

Forage Provided Too

While wetlands provide critical habitat for waterfowl and other wildlife species they can also provide valuable forage for livestock, either in a haying or grazing program. Forage production of vegetation in wetlands usually exceeds production on upland sites. However, wetland forage generally has lower crude protein and digestible dry matter content making it less valuable as livestock feed.

If harvested or grazed early-season (before heading), the dominant grasses and sedges of temporary wetlands can make nutritious forage. However, early season yields will be less than at mid-season (July and August) use. Wetland vegetation production steadily increases through mid July, peaking through August, and declining in September. Forage quantity and quality will vary with species composition, which is directly related to wetland type and zonation.

Grass and grasslike plants usually provide the highest quality forage, including nutrient content and palatability. Dry matter production of wetland vegetation will vary between wetland class and zone, with the greatest production associated with semi-permanent wetlands having little or no open water.

While wet meadow zones produce one-half to one-third the production of shallow marsh and deep marsh zones, respectively, they are the most frequently used forage area. Favorable forages such as grasses and sedges dominate wet meadow zones; whereas, less palatable plants such as rushes become prevalent in shallow marsh zones. Deep marsh zones become dominated by lower

Figure 2. *Millions of migrating waterfowl annually use prairie wetlands.*

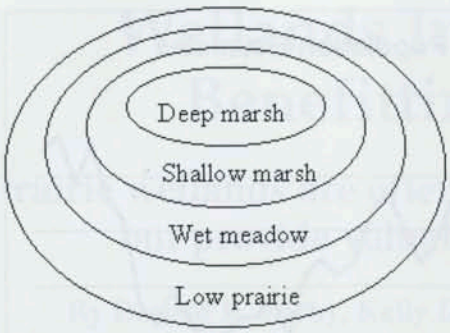

Figure 3. ***Location of vegetation zones in a typical semipermanent prairie wetland.***

palatable plants such as cattails and bulrush species.

In the Dakota's, dry matter production levels vary from 1 to 2 tons per acre on wet meadow zones, 1.5 to 3.5 tons per acre on shallow marsh zones, and 2.5 to 6.5 tons per acre on deep marsh zones. Peak yields of slough sedge have been reported to range from 2.0 to 4.7 tons per acre in North Dakota to nearly 10 tons per acre in Iowa.

Manipulation of water levels and vegetative structure can alter forage production and species composition of wetlands. Reductions of litter through prescribed burning, mowing or intense midsummer grazing programs have also increased yields of wetland stands. Disturbance programs not only produce substantial yields, but have altered pure stands of species such as rushes or cattails to diverse plant communities that improve quantity or quality of forage produced. Production of whitetop was increased to 5.2 tons per acre using fall burning and 4.5 tons per acre by mowing compared to 3.2 tons per acre from undisturbed stands.

Although livestock producers have consistently utilized aquatic plants as forage, little attention has been attributed to nutritive content. Crude protein and digestible dry matter tend to be lower from wetland forage than upland prairie. Seasonal wetlands provide the best quality forage compared to other wetland types. However, like most wetland areas, seasonal wetland soils tend to be too wet for livestock or equipment to get into when quality is optimum. These soils tend to become sufficiently dry by early to mid summer to support mowing equipment.

If species composition is favorable, wetlands can provide a good quality feed when yield is high. Although most plant species that dominate seasonal wetlands can yield adequate amounts of forage if utilized at appropriate times, nutritive quality will vary between species. Grasses and sedges tend to have higher crude protein and dry matter digestibility than rushes and cattail species (Table 1).

Nutrient quality of wetland plants declines with maturity, similar to upland prairie plants. Most wetland grasses have slightly lower protein and digestibility, higher fiber and similar phosphorus and calcium content when compared to upland prairie grasses. However, nutrient loss has been found to be greater in upland species than wetland species as the growing season progressed and wetland hays have been reported superior to upland hay in maintaining quality during dry years.

Palatability is a major concern when determining the overall use and importance of wetland vegetation. Wetland plant species will vary dramatically in palatability. Palatability will also differ for some plant species due to timing of harvest. Knowing the level of a plants palatability, which plants are palatable early (prior to heading) but not palatable once mature, and those that are unpalatable or low in palatability will help to fully utilize wetland plants in a livestock feeding program. Although a feed or forage may have high palatability, nutritional quality must be adequate to maintain livestock performance or body condition.

Many wet meadow and wetland plants are as nutritious as upland vegetation; however, digestibility drops off dramatically as plants mature, even when crude protein remains high. Many wetland plants, when fed as hay or grazed, tend to have a laxative effect in livestock. Knowing the quantity and quality of wetland forages is essential for best use in a feeding program.

In all, wetlands provide habitat for a variety of animals including wildlife and domestic livestock. Some wildlife species, such as waterfowl, are completely dependent on wetlands for food, protection, resting areas and water. Other ani-

Figure 4. ***Wetlands are an integral part of prairie landscapes providing forage and water for the livestock industry.***

Table 1. Nutrient content of emergent plants found in prairie wetlands (based on 100% dry matter).

Species	Date	Crude protein	Dry matter digestibility	Source
Grass-like Plants				
Broad-leaved cattail	10 June	15.1	52	6
(*Typha latifolia*)	15 July	3.8	-----	
	15 August	2.8	27	
	16 September	3.5	-----	
Hardstem bulrush	6 June	12.5	53	4
(*Scirpus acutus*)	15 August	8.8	37	
Baltic rush	26 June	15.6	42	2,4,9
(*Juncus balticus*)	23 July	8.7	28	
	4 August	9.2	28	
	12 August	7.2	23	
Spikerush	24 May	22.1	60	2,4
(*Eleocharis palustris*)	21 June	11.2	-----	
	13 July	11.4	-----	
	4 August	7.4	38	
Needle spikerush	6 June	11.8	63	4
(*E. acicularis*)	21 July	8.4	47	
	4 August	8.0	43	
Slough sedge	10 June	13.5	56	4
(*Carex atherodes*)	11 July	9.4	40	
	4 August	7.4	37	
	21 August	7.5	31	
Wooly sedge	6 June	11.4	55	4
(*C. lanuginosa*)	8 July	9.1	39	
	15 August	7.7	30	
Praegracilis sedge	15 June	10.5	50	4,8
(*C. praegracilis*)	28 July	7.8	41	
	4 November	3.6	-----	
Grass Plants				
Common reed	6 June	16.3	52	
(*Phragmites australis*)	25 July	9.9	42	
	15 August	9.1	43	4
Northern reedgrass	2 June	18.8	59	
(*Calamagrostis inexpensa*)	10 August	7.1	45	1,2
Reed canarygrass	6 June	16.2	56	
(*Phalaris arundinacea*)	4 August	5.2	43	4,5,6
	16 September	4.1	-----	
Tall mannagrass	6 June	14.6	67	
(*Glyceria grandis*)	25 July	10.9	35	
	15 August	6.4	33	4
Hollowstem, whitetop	6 June	18.4	54	
(*Scolochloa festucacea*)	7 July	9.9	39	1,4,10
	15 September	5.3	27	
American sloughgrass	21 June	11.2	47	
(*Beckmannia syzigachne*)	27 July	9.3	-----	
	4 August	8.8	41	2,4,9
	7 September	7.5	-----	
Prairie cordgrass	6 June	14.9	53	
(*Spartina pectinata*)	4 August	8.7	40	4
	23 August	7.4	-----	
	26 September	6.4	-----	
Foxtail barley	24 June	24.0	-----	
(*Hordeum jubatum*)	26 July	10.4	-----	2
Inland saltgrass	4 June	15.1	-----	
(*Distichlis spirata*)	16 July	10.2	-----	
	18 August	7.5	-----	2
Broad-leaf Plants				
Long-rooted smartweed	3 June	14.8	65	
(*Polygonum coccineum*)	22 July	7.1	36	4
	21 August	13.2	28	
Giant bur-reed	6 June	16.5	41	
(*Sparganium eurycarpum*)	4 August	11.5	34	4,11
	1 September	7.6	-----	
Water Plantain	1 July	34.3	-----	
(*Alisma plantago-aquatica*)	1 September	14.8	-----	3,7

Sources: 1) Christensen et al. 1947, 2) Clark and Tisdale 1945, 3) Gortner 1934, 4) Green 1987, 5) Hawley et al. 1981, 6) Klopatek 1975, 7) Korelykova 1970, 8) Mclean and Tisdale 1960, 9) Knight et al. 1906, 10) Smith 1973, 11) Linn et al. 1975.

mal species such as domestic livestock are dependent on wetlands only for a portion of a season or year. For both, however, wetlands of the northern plains have been identified as critical habitats to manage and maintain.

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References

Barker, W.T., K.K. Sedivec, T.A. Messmer, K.F. Higgins, and D.R. Hertel. 1990. Effects of specialized grazing systems on waterfowl production in southcentral North Dakota. In: Trans. 55th N. A. Wildl. and Nat. Res. Conf. p. 462–474.

Dahl, T.E. 1990. Wetland losses in the United States: 1780s to 1980s. U.S. Dept. of the Interior, Wash., DC.

Fulton, G.W., J.L. Richardson, and W.T. Barker. 1986. Wetland soils and vegetation. North Dakota Agri. Exp. Sta. Res. Rep. 106.

Hubbard, D.H. 1988. Using your wetland for forage. Rep. FS-853. U.S. Fish and Wildlife Res. Unit, South Dakota State Univ., U.S. Dept. of Agri., Brookings, SD.

Kantrud, H.A., G.L. Krapu, and G.A. Swanson. 1989. Prairie basin wetlands of the Dakotas: A community profile. U.S. Fish and Wildlife Serv. Biol. Rep. 85. 111 pp.

Smith, A.L. 1973. Production and nutrient status of whitetop. J. Range Manage. 26:117-120.

Stewart, R.E. and H.A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. U.S. Fish and Wildlife Serv. Resource Publ. 92. 57 pp.

Van der Valk, A.G. and C.B. Davis. 1978. Primary production of prairie glacial marshes. in R.E. Good, D.F. Whigham and R.L. Simpson (eds.). Freshwater wetlands: Ecological processes and management potential. Academic Press, NY.

Wilkins, K.A., M.C. Otto, and G.W. Smith. 2000. Trends in duck breeding populations, 1955-2000. Admin. Rpt., U.S. Fish and Wildlife Serv., Laurel, MD. 19 pp.

Wetlands In Northern Plains Prairies: Offer Societal Values Too

Unlike wildlife habitat and livestock forage, societal services provided by prairie wetlands are not easily observed, measured or valued.

By Donald R. Kirby, Kelly D. Krabbenhoft, Kevin K. Sedivec and Edward S. DeKeyser

Wetlands provide services to society in addition to the obvious services such as wildlife habitat and livestock forage. Most northern prairie wetlands remaining today lie in watersheds dominated by agriculture. This may have been the primary reason for Adamus and Stockwell (1983) to list wetland sediment trapping and nutrient removal as the greatest positive impact on water quality and a primary reason that wetlands have been legally protected by states and the nation. At the ecosystem level, wetlands have value to the public of which maintenance of water quality, groundwater recharge, and flood attenuation will be discussed here.

Maintenance Of Water Quality

Wetlands play a critical role in the maintenance of water quality by removing materials entering a wetland via water movement such as suspended solids, nutrients, metals, pathogens, and biological oxygen demand. There are two major methods in which wetlands improve water quality:

1) they adsorb nutrients or tie up metals and incorporate them into the soil
2) the vegetation incorporates nutrients and metals into their tissues and release the materials into the soil as dead organic matter

Sediment, organic matter, and other suspended solids arrive in a wetland via runoff in the form of particulate litterfall, or in water flowing from other water sources. Suspended sediments can be detrimental to wetlands by inhibiting light penetration, decreasing dissolved oxygen, and toxic substances, as well as nutrients, entering into wetlands. Wetlands assist in settling suspended solids by reducing water movement and catching suspended solids by stands of emergent vegetation.

Nitrogen and phosphorus are two nutrients that, in excess, are considered pollutants in wetland ecosystems. Wetlands incorporate nitrogen through uptake by plants, microorganisms, or sedimentation. Nitrogen is also removed and discharged into the atmosphere via release of N_2 gas. Phosphorus is mainly immobilized by plant uptake and decomposition into wetland sediments.

Metals are mainly tied up in wetlands by adsorption to sediments or to clay and organic compounds found in the soil, but may also precipitate as oxides, phosphates, or other salts. Plants may also incorporate metals into tissue and eventually release dead litter into the soil or rerelease the metals back into the water. Pesticides generally are adsorbed or incorporated in the same fashion as metals.

Pathogens, such as bacteria and viruses, usually are concerns in wetlands receiving sewage wastewater. Wetlands can remove pathogens, such as bacteria, by confining them until they die naturally. For example, protozoa may feed on bacteria, and excretions from some plant species can also kill bacteria. Wetlands also have the capacity to trap a virus by incorporating it into the soil.

Wetlands tend to remove the biological oxygen demand needed for the microbial decomposition of organic matter and oxidation of inorganic material. If the biological oxygen demand is high in a wetland, the amount of dissolved oxygen in the water could become low and decomposition by microorganisms located in the wetland is lowered or ceases. Overall, the filtering ability of wetlands aids the improvement of groundwater, river and other water resource quality in the Northern Great Plains.

Groundwater Recharge

The hydrologic functioning of prairie pothole wetlands have not been studied extensively. Most Prairie Pothole Region wetlands are small sized, isolated and located within topographic depressions in glacial till. Water permanence, chemistry and biological characteristics of prairie wetlands are highly

variable in time and space indicating that their hydrologic functions are probably complex as well.

However, their hydrologic functions have been of interest and at the center of conflict between agricultural producers and environmentalists. Some hydrologists tend to agree that some wetlands do recharge the groundwater system, but many do not.

In the Prairie Pothole Region, wetlands typically form large complexes of recharge and discharge patterns connected by shallow groundwater flow systems as shown in Figure 1 (Richardson and Vepraskas 2001). Ephemeral, temporary and seasonal class wetlands (short term flooded) are typically higher on the landscape and are classified by hydrologists as recharge wetlands. They typically act to collect surface runoff of water and, having a water level higher than the water table, recharge shallow aquifers. Recharge wetlands normally have soils with high infiltration and percolation rates.

Larger wetlands classified as semipermanent and permanent wetlands (seasonally to permanently flooded) are generally lower on landscapes and are classified by hydrologists as flow-through and discharge wetlands. At least part, if not most, of the water these larger wetlands receive is through groundwater flow from shallow aquifers created by recharge wetlands positioned higher on the landscape.

Soils of semipermanent and permanent wetlands are typically impermeable and most hydrologists agree that they perform little to no recharge function. Through evaporative discharge, semipermanent and permanent wetlands act to discharge water through evapotranspiration and other surface outflows and, thereby, lower the groundwater level of the surrounding region. However, these types of wetlands can be adversely affected by large-scale domestic or industrial groundwater removals.

Large-scale well withdrawals of water near discharge wetlands may cause a reversal of groundwater flow such that the affected wetland becomes a recharge wetland (Richardson and Vepraskas 2001). This alteration of the groundwater flow could potentially have adverse affects on the quality and quantity of groundwater supply as well as the integrity of the wetland itself.

As with many other wetland functions, the role prairie wetlands play in groundwater systems is still, for the most part, unclear. More work is needed to fully understand the "service" prairie wetlands may perform in groundwater recharge.

Flood Attenuation

The role prairie wetlands play in flood attenuation or protection is a hotly debated issue. This issue usually arises following a flood event that causes losses in human life and/or damages to private property. Therefore, floods and the role wetlands play during these events become an emotional issue rather than an environmental issue. Furthermore, floods occur erratically in time and space making "scientific" study difficult at best.

Despite the debates, floods cause billions of dollars in damages to homes, properties and crops each decade. Policymakers, agencies, cities, researchers and the public are constantly attempting to discover means to reduce the number and severity of floods. Wetlands, transitional areas between terrestrial and aquatic ecosystems, are often viewed as areas needing legislation or restoration for mitigating flood magnitudes and recurrences.

Wetlands, in some circumstances, influence regional water flow

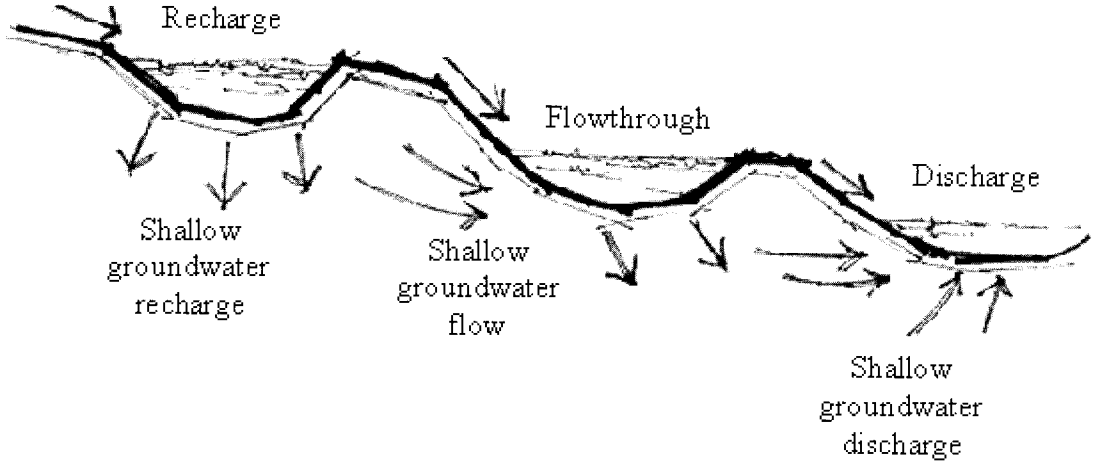

Figure 1. ***Generalized surface and subsurface water flow in a glaciated prairie landscape containing recharge, flowthrough and discharge wetlands.***

regimes by intercepting and storing at least some storm waters, thus reducing flood peaks and creating longer time periods of discharge. Hubbard and Linder (1986) concluded, in the Altamont Moraine of northeastern South Dakota, that smaller prairie wetlands (potholes) lowered flood discharges. They calculated that 213 small wetlands over a 1600 acre area stored an estimated 160 acre-feet (160 acres of water to a depth of one foot) of water. By extrapolation, they reasoned that small wetlands in this region could hold large quantities of storm runoff and lower flood discharge volumes.

Figure 2. ***Typical prairie wetlands landscape in the Prairie Pothole Region of the northern Great Plains.***

A modeling study by the U.S. Army Corps of Engineers (1994) in the Mississippi River Basin suggested that, by restoring upland wetlands that had been previously drained, flood peaks could be reduced by 10 to 23% in watersheds with larger, deeper wetlands. The model showed a 5 to 9% reduction in flood peaks from watersheds containing smaller, shallower wetlands. The model indicated that wetlands were most effective at mitigating flood damage during typical 25-year or less storm events.

Novitzki (1985) reported that a watershed comprised of 4 to 5% wetlands would have a 50% reduction in peak flood period compared to a watershed lacking wetlands. Demissie and Kahn (1983) agreed with Novitzki by concluding that a 50-year flood event on the Kankakee River in Illinois was 50% less than a similar 50-year flood event on the Iroquois River in Indiana (where wetlands had been drained) because of wetlands being present in the Kankakee River watershed despite the two watersheds being equal in size.

Wetland location within a watershed in relation to their flood attenuation properties is also debated. Some have suggested that small wetlands remaining in the upper basin of watersheds were more effective for flood control than larger, downstream wetlands. In contrast, others have claimed that the further downstream larger wetlands were located, the more value the wetlands would play in reducing flood peaks.

Knight (1993), in a review of these and other studies, summarized that small wetlands naturally occurring in the upper reaches of watersheds were best for attenuating normal, high frequency downstream floods, while natural downstream wetlands were best at controlling larger than normal, low frequency flood events. Shultz (1999) stated that due to the complexity and interactions of rainfall, wetland volume, and prior water conditions, that it is difficult if not impossible to generalize on the effects prairie wetlands have in flood attenuation. Arguments arise that if wetlands are already full of water, as is often the case during wet periods and before storm events, then little to no storage is available to retain runoff. Hence, prairie wetlands are not very effective for flood protection or prevention.

Bluemle (1997) researched floods in the Red River Valley at Grand Forks, North Dakota, and reported from eyewitness accounts that the Red River experienced at least six extremely severe floods (>50 feet) between 1800 and 1855. A severe flood in Grand Forks is defined as one that exceeds a gauge level of 40 feet. Despite floods in the early 1800's being poorly documented, numerous severe floods were noted when the environment of the Red River Valley was essentially unaltered. Official flood level records have been maintained from 1882 to present and during this time severe floods have occurred every 4 to 5 years. Bluemle concluded that severe floods in the Red River Valley occur naturally during cycles of increased rainfall and snowmelt and were not "caused" by wetland drainage.

In summary, proponents of wetlands as flood attenuation features argue that it seems reasonable that prairie wetlands catch and retain overland water flow in watersheds, thereby decreasing peak flows downstream. The opposite argument is that it seems logical when wetlands are already full of water, as is the case in a flood year, then their potential for water storage is not available during a flood event, hence they play little to no part in regulation of downstream peak flows. As was previously stated, little "scientific" data is available supporting either side of the debate. Further research will be needed to answer the question, "What role do prairie wetlands play in flood attenuation?"

Unlike wildlife habitat and livestock forage, societal values of wetlands are not easily observed, measured or valued. Despite this, numerous acts and laws have been passed by congress and states throughout the 1980's and 1990's to protect these ecosystems. There are also numerous incentives for land owners to preserve wetlands, including drainage disincentives and ecological restoration incentives. However, the ecological functions wetlands play in improving our environment are

not well understood and are in need of study.

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References

Adamus, P.R. and L.T. Stockwell. 1983. A method for wetland functional assessment. I. Critical review and evaluation concepts. U.S. Dept. Transportation, Federal Highway Admin. Rep. No. FHWA-IP-82-23.

Bluemle, J.P. 1997. Factors affecting flooding in the Red River Valley. Proc. N.D. Acad. Sci. 51:17-20.

Demissie, M. and A. Kahn. 1993. Influence of wetlands on streamflow in Illinois. Rept. 561. Illinois State Water Survey, Hydrology Division, Champaign.

Hubbard, D.E. and R.L. Linder. 1986. Spring runoff retention in prairie pothole wetlands. J. Soil and Water Conserv. 41:122-125.

Knight, R.I. 1993. Ancillary benefits and potential problems with the use of wetlands for nonpoint source pollution control. p. 131–150 in R.K. Olsen, (ed.) Created and natural wetlands for controlling nonpoint source pollution. Off. Wetlands, Oceans, and Watersheds, USEPA, Wash. D.C.

Novitzki, R.P. 1985. The effects of lakes and wetlands on flood flows and base flows in selected northern and eastern states. in H.A. Gromman, et al. (eds.) Proc. Wetlands Conf. of the Chesapeake. Environ. Law Institute, Wash., D.C.

Richardson, J.L. and M.J. Vepraskas. 2001. Wetland Soils, Genesis, Hydrology, Landscapes, and Classification. Lewis Publishers, New York. 417 pp.

Shultz, S.D. 1999. The feasibility of wetland restoration to reduce flooding in the Red River Valley: A case study of the Maple (ND) and Wild Rice (MN) watersheds. Agri. Econ. Rep. No. 432, North Dakota State Univ., Fargo. 59 pp.

U.S. Army Corps of Engineers. 1994. Sharing the challenge: Floodplain management into the 21st century. Report of the Interagency Floodplain Manage. Rev. Comm., Wash., D.C.

A Close Look At Locoweed Poisoning On Shortgrass Prairies

Management recommendations to help reduce the risk of locoweed poisoning to livestock.

By Michael H. Ralphs, J. David Graham and Lynn F. James

Locoweed poisoning is a significant impediment to livestock production, particularly on shortgrass prairies. Early observations confused locoweed poisoning with starvation since the incidence of poisoning increased during seasons of feed shortage and on overgrazed rangelands (Marsh 1909).

Animals started eating locoweed in the late winter and early spring before new grass started growing. They seemed to thrive at first, then rapidly fell off in body condition as poisoning progressed. Marsh concluded that an abundance of good feed resulting from improved range conditions would greatly reduce and perhaps eliminate the problem.

Range conditions have improved greatly over the last 100 years, yet locoweed poisoning continues to be a significant problem. Many of the semiarid locoweed species experience extreme population cycles; increasing in wet years and dying out during drought (Ralphs and Bagley 1988, Ralphs et al. 2001a). The large seed bank in the soil (56 to 370 seeds/ft^2, Ralphs and Cronin 1987) allows it to exploit environmental conditions and maintain the "boom and bust" populations cycles. During the outbreak years, catastrophic livestock losses continue to occur.

This review of locoweed research presents several management recommendations to reduce the risk of poisoning.

The Effects Of Locoweed Poisoning

Table 1 lists the *Astragalus* and *Oxytropis* species that have caused locoism, or have been shown to contain the toxic alkaloid swainsonine. Swainsonine inhibits essential enzymes in glycoprotein metabolism, resulting in buildup of hybrid sugars which "constipate" the cells in all body systems, and disrupt hormone and enzyme synthesis and receptor binding (Stegelmeier et al. 1999).

Outward effects on animals include reduced fertility of both sexes, neurological disturbances ranging from extremes of depression to aggression, compromised immune system resulting in increased disease, and impaired ability to eat or drink leading to weight loss and eventual starvation.

Reproductive loss is the greatest economic cost associated with locoweed poisoning (Panter et al. 1999). Abortions are common. Offspring that are born are small and weak, death rates are high, and they are often retarded and lack the instinct to nurse. Young that survive, and even healthy offspring, receive swainsonine through their mothers milk and become lethargic, depressed and have lower weight gains.

Stocker cattle loose weight while grazing locoweed and do not gain again for several weeks after they stop eating the poisonious plant (Ralphs et al. 2000). Torell et al. (2000) estimated moderately poisoned steers lost $75 per head, and severely poisoned steers lost $282 per head.

Locoed steers going on to the feedlot were slower to start gaining weight, and finished approximately 66 lbs. lighter than healthy steers from the same lot (Duff, unpublished data) – thus increasing the time and expense of finishing to the desired market condition.

A secondary, but significant effect is the compromised immune system (Stegelmeier et al. 1998a), leading to other feedlot diseases and poor immunologic response to vaccines.

Although the signs and effects of poisoning linger, swainsonine is rapidly cleared from the body (Stegelmeier et al. 1998b). A conservative withdrawal period of 28 days from the time animals consume locoweed to slaughter will satisfy food safety requirements.

Livestock Find Locoweed Palatable

The early literature suggested locoweeds were distasteful and animals were forced to start eating them because of hunger (Kingsbury 1964). However, once started, animals seemed to become addicted to locoweeds. Recent research showed that locoweeds are not addicting, but are relatively more palatable than associated forages during various seasons of the year (Ralphs et al. 1989). Both sheep (Ralphs et al. 1991) and cattle (Ralphs et al. 1993) that were severely locoed, ceased grazing lo-

Table 1. Locoweed (*Astragalus* and *Oxytropis*) species, habitat and distribution

Species	Common name	Habitat	Distribution
A. allochrous	Rattleweed	Desert grassland	AZ, NM
A. asymmertricus	Horse loco	Annual grasslands	CA
A. bisulcatus[1]	Two-grooved milkvetch	Limestone, shale, high in Se	MT, ND, WY, CO, NM, Ut
A. didymocarpus		Creosote deserts	CA, AZ, NV
A. drummondii[1]	Drummond milkvetch	Prairies, sage, oak, P/J	MT, WY, CO, NM, UT
A. emoryanus[2]	Red stem peavine	Creosote, Mesquite, P/J	NM, TX
A. humistratus	Ground cover milkvetch	P/J woodlands	AZ, NM
A. lentiginosus	Spotted locoweed	salt-desert shrub, sage, P/J	AZ, UT, NV, ID
A. lonchocarpus	Great rushy milkvetch	P/J woodlands	CO, UT, AZ, NV
A. missouriensis	Missouri milkvetch	Shortgrass prairies	Canada to TX
A. mollissimus	Woolly loco	Shortgrass prairies	CO, KA, OK, TX, NM
A. nothoxys	Beaked milkvetch	Oakbrush, P/J woodlands	AZ
A. oxyphysus	Diablo loco	Desert grasslands	CA
A. praelongus[1]	Stinking milkvetch	Sandstone, shale high in Se	UT, NM, AZ
A. pubentissimus	Green river milkvetch	Salt-desert shrub	CO, WY, UT
A. purshii	Pursh loco	Sagebrush, P/J woodlands	WY, MT, ID, NV
A. pycnostachyus	Brine milkvetch	Salt marshes and beaches	CA
A. tephrodes	Ashen milkvetch	Oakbrush, P/J woodlands	AZ, NM
A. thurberi	Thurber milkvetch	Creosote, Oak, P/J woodlands	AZ, NM
A. wootoni	Garbancillo	Creosote desert	AZ, NM, TX
O. besseyi	Red loco	Gravely hill tops	MT, WY
O. campestris	Yellow loco	Prairies, Mt. meadows	MT, Canada
O. lambertii	Lambert locoweed	Short and mid-grass prairies	MT, ND, SD, WY, CO, NM
O. sericea	White locoweed	rocky soils, foothills and Mt.	MT. SD, WY, CO, NM, UT

[1]Also contains selenium.
[2]Also contains nitro toxins.
There are many varieties, especially of *A. lentiginosus, A. mollissimus,* and *O. sericea,* that have been referred to as separate species in the past.
Species taken from Marsh 1909, Molyneaux et al. 1991, Smith et al. 1992, Fox et al. 1998.

coweed when green grass became plentiful.

Preference for locoweed is relative to what other forage is available. Many locoweeds are cool-season species that green-up and start growth early in the spring, then resume growth in fall. Livestock generally prefer the green-growing locoweeds to dormant grass. Sheep preferred the regrowth foliage of Green River milkvetch to dormant grasses during late fall and early winter on desert range in eastern Utah (James et al. 1968). Cattle readily grazed Wahweap milkvetch in proportion to its availability on desert winter range in southeastern Utah (Ralphs et al. 1988).

In a series of grazing studies in Northeast New Mexico, cattle readily grazed white locoweed in March, April and May, but stopped grazing it in June as warm-season grasses became abundant and white locoweed matured and became coarse and rank (Ralphs et al. 1993–2001c).

On mixed grass prairies on the eastern foothills of the Rocky Mountains in northern Colorado, cattle ceased grazing white locoweed when it matured following flowering in mid June, and became rank and unpalatable in 1998. However they continued to graze it throughout the summer in 1999 when abundant summer precipitation caused locoweed leaves to remain succulent (Ralphs et al. 2001b).

Management Strategies That Didn't Work

Supplements—Many minerals and feed additives have been investigated to prevent poisoning. Mineral supplements did not prevent poisoning, nor delay symptoms in sheep fed Garbancillo (James and VanKampen 1974), or prevent cattle from grazing white locoweed (Allison and Graham 1999).

Electrical charges on clay minerals may bind to swainsonine, but a variety of clays and minerals were not effective in preventing or reducing locoweed poisoning (Bachman et al. 1992, Pulsipher et al. 1994). Neither did vitamin E/selenium injections hasten recovery from locoweed poisoning (Richards et al. 1999).

On the other hand, there was concern that growth implants may enhance locoweed poisoning. An estradiol implant did not cause steers to select more locoweed in a grazing trial, and did not affect the degree of poisoning or rate of recovery in a locoweed feeding trial (Mikus et al. 2001).

Anecdotal evidence suggested cattle on a higher plane of nutrition, such as alfalfa hay or grazed on win-

ter wheat, may be more inclined to graze locoweed in the spring. However, these practices did not increase locoweed consumption (Ralphs et al. 2001c, Ralphs et al. 1997b).

Native Cattle and Breeds— Poisonous plant literature is filled with statements that native livestock are less likely to be poisoned than new, inexperienced livestock. Locoweed poisoning does not follow this general trend. Cattle that are familiar with locoweed will likely select it first (Ralphs et al. 1987).

Early observations by Marsh (1909) suggested that black cattle and black-faced sheep were more inclined to be poisoned by locoweed than white-faced cattle and sheep. In a recent grazing study comparing breeds, Brangus steers consumed more locoweed than Hereford and Charolais steers (Duff et al. 2001). The gregarious nature of Brangus cattle may have facilitated the social acceptance of locoweed among the steers.

Grazing Management Recommendations

1) Restrict Access. Livestock should be denied access to locoweeds during critical periods when they are relatively more palatable than associated forages. On short-grass prairies of northeastern New Mexico, stocker cattle should not be turned onto locoweed-infested rangelands until warm season grasses start growth in late May or early June. Cattle on rangeland year-round should be removed from locoweed-infested areas in the spring when it is green and growing, and warm season grasses remain dormant. They can be returned to locoweed-infested pastures in summer when warm season grasses are abundant.

Most locoweed species are endemic, growing only in certain habitats or on specific soils. Fences could be constructed on soil or vegetation boundaries to provide seasonal control of grazing. Reserving locoweed-free pastures for grazing during critical periods in spring and fall can prevent locoweed poisoning.

2) Consider herbicide controls. Locoweed-free areas can be created by strategic herbicide use (McDaniel 1999, Ralphs and Ueckert 1988). However, natural population cycles should be considered to determine the practicality of spraying large areas and the potential lifetime of control. With the abundant seed bank in the soil, locoweeds are sure to germinate and reestablish when environmental conditions are favorable.

3) Sort out animals that graze locoweeds. Animals that start eating locoweed may influence others to start. Social facilitation or peer pressure is a very strong influence inducing others to start eating locoweed (Ralphs et al. 1994b). Graham developed the "eat and pull" management strategy, whereby livestock should be watched closely and removed if they start eating locoweed to prevent poisoning and prevent them from influencing others to start (Torrell et al. 2000).

4) Don't overstock locoweed-infested areas. Grazing pressure can also force cattle to begin grazing locoweed when they run short of desirable forage (Ralphs 1987, Ralphs et al. 1994a). Ranchers should not overstock locoweed-infested ranges, but rather should ensure adequate forage is always available.

Improper use of some grazing systems can cause livestock to graze locoweed. Rest-rotation grazing systems are designed to force livestock to uniformly graze all forage in a pasture. This caused cattle and horses to start grazing spotted locoweed in western Utah (James et al. 1969). Changing to a 3-herd, 4-pasture deferred rotation grazing system stopped locoweed poisoning by reducing the grazing pressure and allowing the cattle to select alternative forages in preference to white locoweed (Ralphs et al. 1984). The heavy grazing pressure associated with short-duration grazing systems may also induce poisoning problems.

5) Train animals to avoid locoweed. Conditioned food aversion can be used as a management tool to train animals to avoid grazing locoweed (Ralphs et al. 1997a). In the conditioning protocol, animals are brought into a pen and fed fresh-picked locoweed, then lithium chloride (an emetic that causes gastrointestinal distress) is administered by stomach tube. The animals associate the induced illness with the taste of the plant and subsequently avoid eating it. Naive animals that are unfamiliar with the target plant form strong and lasting (> 3 years) aversions following a single dose.

Averted animals must be kept separate from non-averted animals on locoweed areas to prevent social facilitation from extinguishing the aversions. Aversion conditioning may be feasible where losses are heavy and persist year after year.

Conclusions

Locoweed is the most widespread poisonous plant problem in the western U.S. Knowledge of sites where locoweeds grow and environmental conditions when they cause problems is necessary to manage livestock and prevent poisoning.

Since locoweeds are relatively palatable and many locoweeds are the first plants to start growing in the spring and may also regrow in the fall, livestock generally prefer the green-growing locoweeds to other forage that is dormant in the fall, winter, and spring.

The most effective management strategy is to deny livestock access to locoweeds during critical periods when they are more palatable than associated forage. Reserving locoweed-free pastures or controlling existing locoweed populations with

herbicides can provide "safe" pastures for critical periods. Watching animals closely and removing those that begin eating locoweed can prevent further intoxication and prevent them from influencing others to start. Condition food aversion is another effective practice and may be economical where losses are large and persistent.

Bottomline, good range management and wise grazing strategies can provide adequate forage for livestock and avoid critical periods of the year when locoweed is relatively more palatable than associated forages.

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References

Allison, C. and J.D. Graham. 1999. Reducing locoism with management decisions. pp. 64–66 in: T.M. Sterling and D.C. Thompson (eds), Locoweed Research Updates and Highlights, New Mexico Agr. Exp. Sta. Res. Rep. 730.

Bachman, S.E., M.L. Galyean, G.S. Smith, D.M. Hallford, and J.D. Graham. 1992. Early aspects of locoweed toxicosis and evaluation of a mineral supplement or clinoptilolite as dietary treatments. J. Anim. Sci. 70:3125_3132.

Duff, G.C., M.H. Ralphs, D. Walker, D. Graham, J.D. Rivera, and L.F. James. 2001. Influence of beef breeds (Hereford, Charolais, Brangus) on locoweed consumption. J. Anim. Sci. (in review).

Fox, W.E., K.W. Allred, and E.H. Roalson. 1998. A guide to the common locoweeds and milkvetches of New Mexico. New Mexico Agr. Exp. Sta. Cir. 557.

James, L.F., K.L. Bennett, K.G. Parker, R.F. Keeler, W. Binns, and B. Lindsay. 1968. Loco plant poisoning in sheep. J. Range Manage. 21:360–365.

James, L.F., K.R. Van Kampen, and G.R. Stacker. 1969. Locoweed (*Astragalus lentiginosus*) poisoning in cattle and horses. J. Am. Vet. Med. Assoc. 155:525–530.

James, L.F. and K.R. VanKampen. 1974. Effect of protein and mineral supplementation on potential locoweed (*Astragalus* spp.) poisoning in sheep. J. am. Vet. Med. Assoc. 164:1042–1043.

Kingsbury, J.M. 1964. Poisonous Plants of the United States and Canada. Prentice-Hall, Englewood Cliffs, NJ.

Marsh, C.D. 1909. The loco-weed disease of the plains. USDA Bur. Anim. Ind. Bull. 112.

McDaniel, K.C. 1999. Controlling locoweed with herbicides. pp. 52-53 in: T.M. Sterling and D.C. Thompson (eds), Locoweed Research Updates and Highlights, New Mexico Agr. Exp. Sta. Res. Rep. 730

Mikus, J.H., G.C. Duff, C.R. Krehbiel, D.M. Hallford, D.A. Walker, J.D. Graham, and M.H. Ralphs. 2001. Effects of an estradiol implant on locoweed consumption, toxicity, and recovery in growing beef steers. Prof. Anim. Sci. 17:109–114.

Molyneux, R.J., L.F. James, K.E. Panter and M.H. Ralphs. 1991. Analysis and distribution os swainsonine and related polyhydroxyindolizidine alkaloids by thin layer chromatography. Phytochem. Analys. 2:125-129.

Panter, K.E., L.F. James, B.L. Stegelmeier, M.H. Ralphs and J.A. Pfister. 1999. Locoweeds: effects on reproduction in livestock. J. Nat. Toxin. 8:53–62.

Pulsipher, G.D., M.L. Galyean, D.M. Hallford, G.S. Smith, and D.E. Kiehl. 1994. Effects of graded levels of bentonite on serum clinical profiles, metabolic hormones, and serum swainsonine concentrations in lambs fed locoweed (*Oxytropis sericea*). J. Anim. Sci. 72:1561–1569.

Ralphs, M.H. 1987. Cattle grazing white locoweed: influence of grazing pressure and palatability associated with phenological growth stage. J. Range Manage. 40:330–332.

Ralphs, M.H. and V.L. Bagley. 1988. Population cycles of Wahweap milkvetch on the Henry Mountains and seed reserve in the soil. Great Basin Nat. 48:541–547.

Ralphs, M.H. and Cronin, E.H. 1987. Locoweed seed in soil: density, longevity, germination, and viability. Weed Sci. 35:792–795.

Ralphs, M.H. and D.N. Ueckert. 1988. Herbicide control of locoweeds: a review. Weed Tech. 2:460–465.

Ralphs, M.H., L.F. James, D.B. Nielsen, and K.E. Panter. 1984. Management practices reduce cattle loss to locoweed on high mountain range. Rangelands. 6:175–177.

Ralphs, M.H., L.V. Mickelsen, and D.L. Turner. 1987. Cattle grazing white locoweed: diet selection patterns of native and introduced cattle. J. Range Manage. 40:333–335.

Ralphs, M.H., L.F. James, D.B. Nielsen, D.C. Baker, and R.J. Molyneux. 1988. Cattle grazing Wahweap milkvetch in southeastern Utah. J. Anim. Sci. 66:3124–3130.

Ralphs, M.H., K.E. Panter, and L.F. James. 1989. Feed preferences and habituation of sheep poisoned by locoweed. J. Anim. Sci. 68:1354–1362.

Ralphs, M.H., K.E. Panter, and L.F. James. 1991. Grazing behavior and forage preference of sheep with chronic locoweed toxicosis suggest no addiction. J. Range Manage. 44:208–209.

Ralphs, M.H., D. Graham, R.J. Molyneux, and L.F. James. 1993. Seasonal grazing of locoweeds by cattle in northeastern New Mexico. J. Range Manage. 46:416–420.

Ralphs, M.H., D. Graham, and L.F. James. 1994a. Cattle grazing white locoweed in New Mexico: influence of grazing pressure and phenological growth stage. J. Range Manage. 47:270–274.

Ralphs, M.H., D. Graham, and L.F. James. 1994b. Social facilitation influences cattle to graze locoweed. J. Range Manage. 47:123–126.

Ralphs, M.H., D. Graham, M.L. Galyean, and L.F. James. 1997a. Creating aversions to locoweed in naive and familiar cattle. J. Range Manage. 50:361–366.

Ralphs, M.H., D. Graham, M.L. Galyean, and L.F. James. 1997b. Influence of over-wintering feed regimen on consumption of locoweed by steers. J. Range Manage. 50:250–252.

Ralphs, M.H., D. Graham, G. Duff, B.L. Stegelmeier and L.F. James. 2000. Impact of locoweed poisoning on grazing steer weight gains. J. Range Manage 53:86–90.

Ralphs, M.H., D.R. Gardner, J.D Graham, G. Greathouse and A.P. Knight. 2001a. Influence of defoliation on locoweed vigor, longevity and toxicity. J. Range Manage. (in press).

Ralphs, M.H., G. Greathouse, A.P. Knight and L.F. James. 2001b. Cattle preference for Lambert locoweed over white locoweed throughout their phenological stages. J. Range Manage. (in press).

Ralphs, M.H., G. Greathouse, A.P. Knight, D. Doherty, J.D. Graham, B.L. Stegelmeier and L.F. James. 2001c. Prior feeding practices do not influence locoweed consumption. J. Range Manage. (in press).

Richards, J.B., D.M. Hallford and G.C. Duff. 1999. Serum luteinizing hormone, testosterone, and thyroxine and growth responses of ram lambs fed locoweed (Oxytropis sericea) and treated with vitamin E/selenium. Theriogenology 52:1055-1066.

Smith, G.S., K.W. Allred, and D.E. Kiehl. 1992. Swainsonine content of New Mexican locoweeds. Proc. West. Sec. Amer. Soc. Anim. Sci. 43:405–407.

Stegelmeier, B.L., P.D. Snyder, L.F. James, K.E. Panter, R.J. Molyneux, D.R. Gardner, M.H. Ralphs, and J.A. Pfister. 1998a. The immunologic and toxic effects of locoweed (*Astragalus lentiginosus*) intoxication in cattle. pp. 285-290 in: T. Garland and A.C. Barr (Eds), Toxic Plants and Other Natural Toxicants. CAB International, Wallingford, Oxon, GB.

Stegelmeier, B.L., L.F. James, K.E. Panter, D.R. Gardner, M.H. Ralphs and J.A. Pfister. 1998b. Tissue swainsonine clearance in sheep chronically poisoned with locoweed. J. Anim. Sci. 76:1140–1144.

Stegelmeier, B.L., L.F. James, K.E. Panter, M.H. Ralphs, D.R. Gardner, R.J. Molyneuc, and J.A. Pfister. 1999. The pathogenesis and toxicokinetics of locoweed (*Astragalus* and *Oxytropis*) poisoning in livestock. J. Nat. Toxin. 8:35–45.

Torrell, L.A., L.P. Owen, K.C. McDaniel, and D. Graham. 2000. Perceptions and economic losses from locoweed in northeastern New Mexico. J. Range Manage. 53:376–383.

Photo taken south of Buffalo, South Dakota. Photo by Aaren L. Nellon.

Listening To The Land

Pursuing Passion and Professionalism

By Thad Box

This past year I did a series of one page essays under the title *Listening to the Land*. My goal was to examine where we came from and what we are. I tried to express it in plain English, albeit with my personal biases. I sought two outcomes. First, to stimulate discussion about how our roots give form and substance to our society. Weaver students trenched the Great Plains to understand the ecology of the prairie. I thought my diggings might generate letters and viewpoint articles that would help us reaffirm who we are and why we exist. There has been little response in our publications.

Next, I hoped the essays would be picked up and republished to reach a larger audience. Whether it is my inability to make the subject interesting or just that others do not read *Rangelands*, that hope withered like seedlings in drought. To my knowledge none has appeared on op ed pages or been reprinted in other media.

Writing the essays convinced me that whatever we may claim to be, however we organize ourselves, whatever name we choose to meet under, we must become a full fledged profession.

I once taught the following operational definition: A profession is a calling that requires specialized know-ledge often acquired by rigorous academic training, supervised apprenticeships, and successful practice. Those thus qualified are governed by a code of ethics and their practice is disciplined by its members. A unique body of literature guides and inspires the calling. Members of the profession contribute to the growth, refinement, and quality of the literature and are primarily responsible for its interpretation.

I think we are growing into a profession although we do not yet meet the strict criteria. We have open membership. Interest is the only requirement. We have taken steps to codify training and experience necessary to be professional through accrediting range curricula, certifying range consultants, and monitoring range management professionals.

My egalitarian spirit fully supports open membership. We should never be a closed group. We need certification on measurable contributions, not paper trails. Contributions should be evaluated with a test or examination of products. Such things as an implemented management plan, a publication, or land health could be used. I do not think attendance at meetings, reading books, taking classes or other well intentioned inputs can properly evaluate a professional. Professionals should be determined by output---accomplishments, not input driven merit badges.

At the Society's first meeting in 1948 someone proposed membership for conservation ranchers certified to have a good crop of grass on their lands. Fred Renner said that was reasonable, but the same criteria should be required of all members—Land Utilization Project managers, National Forest supervisors, and regional graziers [now BLM regions]. Fred, membership based on results is still a worthy goal.

We publish admirable objectives in the front of every *Journal of Range Management.*They are worthy of a profession. But a profession is governed by its code of ethics. We have one. I, a member for 43 years, know of no one disciplined because he did not meet our code. A student once asked why we publish our contribution policy in every journal, but we never publish our code of ethics. She wondered if we would accept a million dollars from a person who overgrazed and sub-divided his rangeland. Would we?

We have attempted to develop a unique and meaningful literature. We publish a good journal and a lay magazine. A number of books, monographs, and pamphlets bear our name. Our members regularly contribute to our literature's growth. Editorial boards try to improve it. We do fairly well except in publishing. We do less well in interpretation of our knowledge.

Synthesis papers contribute greatly to an understanding of our subjects. But for the most part, our papers are descriptive, analytical and reductionist. Such papers are a needed first step in professional literature, but we need ideas, principles and theories. Where are our philosophers? Where are papers that ignite our spirit and lift our soul? Who sets ideals to guide us? Why is there so little professional discourse in our letters and viewpoint articles?

A friend recently remarked that most our letters to the editor are about someone's ox being gored—defense of dogma rather than exegesis of a position. *Rangeland* will never be served through repeating Clement's beliefs from soap boxes like a Bible School graduate textproofing his faith. Paucity of thinkers willing to expose themselves intellectually to those who disagree may be our greatest shortfall in our quest for professionalism.

Terry Tempest Williams, in her new book, *RED*, starts with a simple equation: place + people = politics. Her simplicity becomes complex as abstractions turn into battlegrounds— grazing on public lands, water rights, waste dumps, designation of national monuments and wildernesses. These actions provoke divisive positions, each needing articulate, professional spokespersons. We claim to speak for rangelands. The land deserves a clear voice.

Williams suggests seeking solution through story that "offers a wash of images and emotion that returns us to our highest and deepest selves, where we remember what it means to be human." In DESERT QUARTET she writes: "Earth. Rock. Desert. I am walking barefoot on sandstone, flesh responding to flesh.....I stop. The silence that lives in these sacred hallways presses against me. I relax. I surrender. I close my eyes. The arousal of my breath rises in me like music, like love.....there is no partition between my body and the body of the Earth."

The subtitle of RED is Passion and Patience in the Desert. Who among us has the passion to describe our love of rangelands? Who has the patience to interpret our science in metaphor that will move people in asphalt jungles and penthouses to love these lands as we do?

SRM Awards

Presented at the Society's 55th Annual Meeting in Kansas City, Missouri on February 17, 2002
Presenting the awards is SRM President Jim O'Rourke

Frederic G. Renner Award

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

Dr. John C. Buckhouse

Dr. John C. Buckhouse, Oregon State University, has clearly demonstrated his leadership in the field of Range Management in a variety of ways. He has been the primary researcher in rangeland watershed sciences for over 170 publications. He is a highly rated classroom teacher in range management, hydrology, watershed management, and social aspects of rangeland uses. He is a stalwart in adult education through the Extension Service as exemplified by his work with the Oregon Cattlemen's Association program in watershed and ecosystem management. He is co-chair of the Governor's Independent Multidisci-plinary Science Team and has been asked by Vice President Cheney to assist in developing national policy for management of rangeland watersheds. He is an outstanding past president of the Society for Range Management and a continuing worker for the Society. John Buckhouse is truly one of the most prominent leaders in the Rangeland Resources discipline today.

It is in recognition of his many achievements and continuing efforts to assure the improvement and proper use of range and watershed resources that the Society for Range Management recognizes Dr. John C. Buckhouse with the Frederick G. Renner Award.

W.R. Chapline Research Award

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

Dr. Ronald E. Sosebee

Dr. Ronald E. Sosebee is a pioneer in the field of ecophysiology of rangelands having been instrumental in development of the connection between plant physiology and ecology. He is recognized today as one of the premier authorities in range plant ecophysiology. Ron Sosebee's research programs have been critically important to the range livestock industry in Texas, the United States and the International range community resulting in significant positive effects on the conservation of rangelands and economic improvement for the range livestock industry in Mexico as well as the U.S.

In addition to his work as a research scientist, he is also a teacher and outstanding faculty member who involves his students, both graduate and undergraduate in rangeland research accomplishments. He has been active in the Texas Section and in the parent Society for Range Management having served as a member of the Board of Directors. Dr. Sosebee has been a leader in basic and applied research to address and solve natural resource problems throughout the western rangelands and internationally.

Ron Sosebee has clearly demonstrated his capabilities as a superior researcher, scholar and teacher and for these reasons he is deemed worthy of the W. R. Chapline Research Award.

W.R. Chapline Stewardship Award

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

Wallace C. Butler

For over 30 years, **Wallace C. Butler** has been directly involved in land stewardship as a ranch manager, livestock company owner-operator, ranch and range management consultant and as region manager and specialist for the Idaho Farm Bureau Federation. During this time he has also been active in the Society for Range Management primarily in the Idaho Section. He has been responsible for developing range and ranch management plans, including several grazing systems, breeding programs, timber harvest and restoration and facility construction. His efforts have resulted in improvement of the range and increased carrying capacity. As a consultant in range and ranch management, his clients have included many private ranch operations, corporations, conservation districts, insurance companies and agricultural organizations.

Mr. Butler has contributed generously of his time and efforts on behalf of professional organizations involved in natural resource issues, especially those of forests and rangelands, and likewise on behalf of service organizations involved in community betterment. His land stewardship efforts have included improvement of wildlife habitat and riparian areas and soil stabilization. He has spoken publicly on such subjects as use of stock dogs for low stress livestock handling, livestock man-

agement for weed control and use of grazing to manage fire fuel loads. He has even served as interim instructor of integrated rangeland resource management and planning at the University of Idaho with excellent results.

Outstanding Achievement Award

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

Dr. Michael M. Borman

As a Rangeland Resources Extension Specialist, **Dr. Michael M. Borman** has excelled in anticipating natural resource issues that drive the activities of public and private land managers in Oregon and the western U.S. Land managers commonly consult with him for technical information to solve complex and controversial natural resource problems including issues of water quality, riparian management and ecology, grazing management and juniper and weed ecology and management. Although full time extension, Dr. Borman has maintained an active and creative research program, has been productive in publishing and has mentored graduate students, serving as major professor. He is incoming Pacific Northwest Section president.

Taylor Brown

As an agricultural broadcaster since 1979, **Taylor Brown** has made significant contributions to the rangeland resource on a local, state, regional, national and international basis. Throughout his career, Taylor's voice has been on-the-air to dozens of radio and television stations regularly where he has been a tireless supporter of agriculture and the rangeland resource. Through an aggressive public speaking schedule, he has told of the contributions of agri-business to hundreds of members of various clubs, organizations and units of government, including testifying at the Montana state legislature.

Across the nation and around the world, Taylor Brown continually uses every opportunity to improve public understanding of agriculture's role in economic and environmental issues. In these settings, the rangeland resource has a knowledgeable and supportive voice in Mr. Brown.

Dr. Stephan L. Hatch

Dr. Stephan L. Hatch is widely known as a teacher of plant taxonomy who challenges students to master the art and science of plant identification. He has had a long and distinguished career in the range profession, specializing in range plant taxonomy, wetland plant taxonomy and range grasses.

Steve Hatch is best known in SRM as the man who puts together those challenging plant identification exams at the annual meeting. But little is known of the faithful dedication involved in preparing the test, updating the plant list and communicating with schools that send teams of students to meet the challenge.

Steve Leonard

As a Rangeland Ecologist and Grazing Management Specialist, **Steve Leonard** has served on two well known and widely recognized national teams, the Interior Columbia Basin Science Assessment Team and the National Riparian Service Team. He stands out as an intellectual leader understanding complex ecological relationships of vegetation, hydrology, and erosion/deposition. Mr. Leonard has published 34 technical and scientific papers on rangeland, ecology, hydrology and riparian management. An excellent communicator, he repeatedly demonstrates his ability to share information in ways that others can understand and use.

Dr. Richard F. Miller

In a relatively short time, about 20 years, **Dr. Richard F. Miller** has become recognized as one of the top ecologists in the Intermountain and Great Basin regions. He has made major accomplishments in our understanding of historical

changes in vegetation patterns in western juniper woodlands and sagebrush-grass vegetation types. He is a prolific publisher, with 43 Journal articles and other refereed publications, 2 book chapters, 60 technical and special reports, 14 extension publications, and 51 abstracts plus numerous speaking presentations. He makes his research available in a variety of media. The quality of his research is equally impressive. Dr. Miller is also an excellent mentor of graduate students and an internationally known ecological authority.

Dr. Walter H. Schacht

Dr. Walter H. Schacht has been described as a "master teacher who gives freely of his time and energy to his students." He has demonstrated exceptional national and international contributions in teaching the art and science of range management. His dedication and energetic commitment to sound principles of range management are evident as he works to promote the objectives of SRM. Dr. Schacht has served in academic positions overseas where he trained locals in principles of range management often under trying and primitive conditions. His insights in range related teaching and research issues are frequently sought and his contributions are always of the highest quality because of his intense enthusiasm and outstanding expertise. He has been tireless in his efforts to meld ecology and agronomy in academic programs in the College of Agricultural Sciences and Natural Resources at the University of Nebraska. He effectively advocates that sound natural resource management and livestock management are compatible when ecological principles are followed.

Fellow

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

George S. Cook

George S. Cook has been an active member of the Society for Range Management since his days as student at Utah State University and throughout his distinguished career as a range conservationist with the Natural Resource Conservation Service, with time out to serve his country in the military during the Vietnam War. He has been Southern Chapter president and Utah Section president as well as the section's newsletter editor.

His most significant contribution has been his interest and active support of youth programs. His leadership led to the success of the Utah Range Camp and later the Natural Resources Field School, where he spends the entire week each year helping 25 or more students learn about range management and natural resources. He promotes and actively supports the High School Youth Forum. George organized the Utah Section "Dutch Oven Crew" to prepare meals for various gatherings with proceeds going directly into the youth endowment fund ($5,000 in 1999 alone).

Dr. Herman Mayeux

Dr. Herman Mayeux is a highly recognized and respected leader in the profession of range management. He has served the Society for Range Management on numerous committees, task forces and special assignments, including a variety of forums involving academic, scientific and industry groups. Dr. Mayeux is a distinguished scientist and an internationally recognized authority in ecology and management of problem species on rangelands, particularly those with a complex array of herbaceous and woody plants in the southern plains and desert southwest. In his 25-year research career he has authored or co-authored more than 75 publications. He is recognized as an effective manager of scientific research and as a motivator and facilitator of creative scientific work.

His efforts have substantially advanced the art and science of range management and have helped to further the goals and objectives of the Society for Range Management.

Dr. Milton J. Trlica

Dr. Milton J. Trlica is an avid supporter of proper range management as an educator, research scientist and active member of the Society for Range Management.

He has been president of the Colorado Section and has served on 8 committees of the parent society sharing 4 of them. He has made a major impact on range management at the international level during his distinguished career and has assisted foreign countries to develop range research programs. A hallmark of Dr. Trlica's career has been his ability to redirect his research to stay on the cutting edge of range science as exemplified by filling a void in knowledge in proper management of riparian areas. He has provided unique learning opportunities for many graduate and undergraduate students.

Dr. Milton J. Trlica has been recipient of SRM's Outstanding Achievement Award and the W.R. Chapline Research Award.

Sustained Lifetime Achievement Award

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

Jerry W. Goodman

Jerry W. Goodman's primary contributions to range management have been as a public land manager and in his leadership capacity. He has been able to influence others with his passion for natural resources taking a holistic view of resource management issues. He has worked hard to resolve conflicts with a firm but fair and balanced approach. Jerry's contributions in wildland fire rehabilitation, weed management, wild horse and burro management, wildlife interactions and grazing administration are significant.

Outstanding Young Range Professional Award

The Outstanding Young Range Professional Award was inaugurated by SRM in 1988 to recognize the promise and potential of our younger members. One of the major criteria for this important award is the age of the nominees, who mmust have been less than 35 years old on January 1, 2002.

Daniel G. Bell

Daniel G. Bell is a second generation rancher who has moved his family operation into the forefront of technological advances in range management in the face of adversity, involving endangered species on a public land grazing permit. He has monitored impacts of grazing on the species involved and modified his operation to assist in its survival.

Mr. Bell serves on several statewide committees and groups involving range management. He is proactive in grazing issues and has the communication skills to work through a variety of problems and challenges. His dedication to furthering the art and science of range management is obvious including the fact that he pays his own way and participates in range activities including SRM on his own time.

Dr. Justin D. Derner

Dr. Justin D. Derner has demonstrated extraordinary potential and promise as a range management professional. Since receiving his Bachelor's of Science ten years ago, he has earned a Master's of Science and a Ph.D, published 13 articles, taught several college courses and conducted research on global warming and carbon sequestration. Justin coached Texas A&M's URME team to three consecutive first place finishes. After starting in a research scientist position, he volunteered to write and conduct the URME competition for SRM.

RSEC Undergraduate Teacher Award

Donald Kirby

Donald R. Kirby has been a mainstay in the Department of Animal and Range Sciences at North Dakota State University (NDSU) since 1980. He has developed and taught courses in 8 subject areas of range management and serves as advisor to numerous student organizations including the NDSU Range Club and URME Team. Don has been recognized by the NDSU Mortar Board Honor Society as an Outstanding Acadmic Advisor and Preferred Professor.

Don is truly an exemplary educator who respects students and makes them his first priority. He is a dedicated advisor and spends many hours counseling undergraduate advisees and graduate students. He is a "cheerleader" for range management education and maintains an attitude that is always positive and highly motivational.

He has an energy and enthusiasm for range science that is contagious. Many former students have praised him for the lasting impact he has had on their academic, professional and personal development. His love for the field of range science and dedication to his students is evident in every lecture.

Don uses a diverse array of teaching methods that is flexible and considerate of the various learning styles of his students. He excels in offering quality classes that are recognized for their up-to-date content and organization. Dr. Kirby provides students with a mixture of field experience, exposure to current events and in-class discussion. He stimulates students to independently explore issues and encourages them to become life-long learners. His ability to tie together the most current scientific data with common sense solutions and humorous anecdotes makes him one of the top educators of his discipline.

In addition to his excellence in teaching and advising, Professor Kirby supports undergraduate education through leadership roles in the Range Science and Education Council, the Society for Range Management and the NDSU Curriculum Committee.

Distinguished Service Award

Jeffery B. Burwell

During his tenure under an agreement with the Natural Resources Conservation Service (NRCS), **Jeff** was invaluable in extending the professional presence of SRM both within and outside the organization.

He filled in as Executive Vice President for a four-month period during the changeover in that position. Under his leadership and personal effort new visual exhibits were developed. Several special reports were completed under agreement with federal agencies, concerning subjects such as Farm Bill legislation, federal conservation policy, a transition program for the new presidential administration and a white paper with our affiliated societies on the role of NRCS in conservation delivery.

Most significantly, Jeff worked with the officers and committee to implement the Certified Professional in Rangeland Management program. Without Jeff, it would have been almost impossible to bring this program online. The success this program enjoys today is the result of Jeff's hard work.

Dr. Gerald W. Tomanek

Dr. Gerald W. Tomanek was born and raised on a farm near Quinter, Kansas. He received his B.S. and M.S. in Botany from Fort Hays State University and a Ph.D. in Botany (Ecology) from the University of Nebraska.

For 40 years, Dr. Tomanek served FHSU as an instructor, administrator, and eventually as President. During the first 25 years at FHSU he was associated with the Biology Department where he was an instructor, full professor, and Department Head. He served as President of the University from 1975 to 1987. Dr. Tomanek and his late wife Ardis were the parents of three daughters.

During his tenure at FHSU, he was active in research and published numerous papers in state, national, and international journals. Over his career, he has given hundreds of illustrated, non-technical talks on plants and animals of the prairie, as well as many technical presentations at professional meetings. He has received numerous awards including the FHSU Alumni Achievement Award, Kansan of the Year Award by the Native Sons and Daughters of Kansas, Conservation Educator of the Year Award by the Kansas Wildlife Society, Distinguished Service Award by the Kansas Association of Soil Conservation Districts, and the Trail Boss Award by the Society for Range Management.

But Dr.Tomanek's greatest award is the love and admiration he has earned from his family, friends, colleagues and particularly former students. This admiration stems from the positive impact he has had on hundreds if not thousands of students. In 2000, he published a book entitled "Beyond the Classroom". This book contains information on approximately 330 students that were Biology graduates from FHSU between 1947 and 1972 and were associated with Dr. Tomanek. Amazingly, > 60% of these students went on to finish their Masters degree with > 25% completing their Ph.D. The fundamental reason for these successful endeavors can be affectionately summarized in two words—Dr. Tomanek.

SRM Accredited Universities

Colorado State University
Oregon State University
New Mexico State University
Texas A&M University
Texas Tech University
University of Arizona
University of Idaho
University of Wyoming
Utah State University
Washington State University

2002 Annual Meeting Winners

High School Youth Forum Winners

1st Place: *Travis Brown (Northern Great Plains) and President Jim O'Rourke.*

2nd Place: *Zeb Barth (Oklahoma Section) and President Jim O'Rourke.*

3rd Place: *Meghan Johnson (New Mexico Section) and President Jim O'Rourke.*

4th Place: *Jamie Swan (South Dakota Section) and Jim O'Rourke.*

5th Place: *Dan Bergstrom (International Mountain Section) and Jim O'Rourke.*

Undergraduate Range Management Exam Winners

Team

1st Place: *(Brigham Young University) (Alphabetically) Jeff Burnham (Assistant Coach) Danae Cann, Jennifer Coleman, Daniel Eddington, Taina Matheson, Amber C. Swanson, Tim Royer* ***Jeff Taylor (1st Place Individual),*** *and President Jim O'Rourke.*

2nd Place: *(University of Alberta) (Alphabetically) Grant Chapman,* ***Brent Finnestad (2nd Place Individual)*** *Heather Fossum, Sarah Green, Terri Mappin,* ***Chris Stefner (4th Place Individual),*** *and President Jim O'Rourke.*

3rd Place: *(Oregon State University) (Alphabetically) Kennon Fellows, Jody Nartz, Casey Matney, Kristy Miller, Travis Miller, Tara Ristoff, Aaron Roth, Steve Sharrow (Coach), Lorraine Thomas, Amanda Wright, and President Jim O'Rourke.*

Individual

1st Place Individual USFS Award: *President Jim O'Rourke, Jeff Taylor (Brigham Young University and Jeanne Wade Evans.*

2nd Place Individual Award: *Brent Finnestad (University of Alberta) President Jim O'Rourke*

3rd Place Individual Rachel Fugal's photo was unavailable.

Team

4th Place: *(Texas A&M) (Alphabetically) Jenny Cearley, Stephanie Doell, Mort Kothmann (Coach), Brett Lain, Ryan Vice, Theresa Swihart, Noah Worley, and President Jim O'Rourke.*

5th Place Tie: *(Colorado State) (Alphabetically) Jennifer Abbott, Julie Allen, Allyson Connally, Collin Ewing, Kelly Frisby, Deb Gonima, Joanne Kelly, Dan Kuber (not shown), Yasuko Matsuoka, Larry Rittenhouse (coach) Meghan Smith, Tarah Sullivan, Lars Santana, Jennifer Woodward, and President Jim O'Rourke.*

5th Place Tie: *(South Dakota State University) (Alphabetically) Gene Baker, Chris Fischer, Nicole Hansen, Christopher Kopp, Matt McPherson, Thomas Nadgwick, Matthew Odden, Brian Pavel, Luke Perman, April Schultz, Mike Wooters, and President Jim O'Rourke.*

Individual

4th Place Individual Award: *Chris Stefner (University of Alberta) and President Jim O'Rourke.*

5th Place Individual Award: *Taina Mathesen (Brigham Young University) and President Jim O'Rourke.*

Range Plant Identification Winners

Team

1st Place: *(Universidad Antonio Narro) (Alphabetically)* ***Catalina Cruz Cerecedo, (3rd Place Individual) Abid Francisco Moo Cruz****, Javier Ochoa Espinoza, Agustin Hernandez Gutierrez,* ***Luis M. Villegas Ortiz (4th Place Individual), Julian Cerano Paredes (2nd Place Individual),*** *Damian Gaytan Quiroz, Juan M. Martinez Reyna (Coach),* ***Edgar G. De Anda Villarreal (5th Place Indiviudal),*** *and President Jim O'Rourke.*

2nd Place: *(South Dakota State University) (Alphabetically) Gene Baker, Chris Fischer, Nicole Hansen, Christopher Kopp, Brian Pavel, Mike Wooters, and President Jim O'Rourke.*

3rd Place: *(Brigham Young University) (Alphabetically) Neal Bryan, Danae Cann, Jennifer Coleman, Daniel Eddington, Rachel Fugal, Taina Matheson, Tim Royer, Jason Scott, Amber C. Swanson, Jeff Taylor, and President Jim O'Rourke.*

Individual

1st Place BLM Award: *(Universidad Antonio Narro) President Jim O'Rourke, Abid Francisco Moo Cruz and Tim Reuwsaat.*

2nd Place: *(Universidad Antonio Narro) Julian Cerano Paredes and President Jim O'Rourke.*

3rd Place: *(Universidad Antonio Narro) Catalina Cruz Cerecedo and President Jim O'Rourke.*

Team

4th Place: *(University of Alberta) (Alphabetically) Grant Chapman, Brent Finnestad, Heather Fossum, Sarah Green, Terri Mappin, Chris Stefner, and President Jim O'Rourke.*

Individual

4th Place: *(Universidad Antonio Narro) ELuis M. Villegas Ortiz and President Jim O'Rourke.*

5th Place: *(University of Wyoming) (Alphabetically) Cotton J. Bousman, Jordana LaFantasie, Michael Henn, Michael Henn, Judi Mott, Curtis D. Nixon, Zachory N. Palm, Joshua R. Sorenson, Michael J. Wells, and President Jim O'Rourke.*

5th Place: *(Universidad Antonio Narro) Edgar G. De Anda Villarreal and President Jim O'Rourke.*

Undergraduate Public Speaking Contest

1st Place: *(Texas A&M) Austin Blaney and President Jim O'Rourke.*

2ndPlace: *(Chadron State College) Kellie Carr and President Jim O'Rourke.*

3rd Place: Jessica Rose (Texas Tech University) (Photo Unavailable)

University Student Display Contest Winners

1st Place: *(Oregon State University) (Alphabetically) Jody Martz, Casey Matney, Kristy Miller, Travis Miller, Tara Ristoff, Aaron Roth, Lorraine Thomas, Amanda Wright, and President Jim O'Rourke.*

2nd Place: *(Colorado State University) (Alphabetically) Jennifer Abbott, Julie Allen, Deb Bonima, Allyson Connally, Collin Ewing, Kelly Frisby, Joanne Kelly, Dan Kuber (not shown), Yasko Matsuoka, Lars Santana, Meghan Smith, Tarah Sullivan, Jennifer Woodward, and President Jim O'Rourke.*

3rd Place: *(Chadron State College) (Alphabetically) Debra Grephtell, Myra Hipke, Ben Keep, Kelly Phillips, Carmen Williams and President Jim O'Rourke.*

Masonic Scholarship

Daniel Bergstrom (International Mountain Section) and President Jim O'Rourke.

High Combined Award Winners

Rachel Fugal NRCS High Individual Combined Award (URME and Plant ID) Photo unavailable.

2nd High Combined: *Jeff Taylor (Brigham Young University) and President Jim O'Rourke.*

3rd High Combined: *Chris Stefner (University of Alberta) and President Jim O'Rourke.*

4th High Combined: *Nicole Hansen (South Dakota State University) and President Jim O'Rourke.*

5th High Combined: *Mike Wooters (South Dakota State University) and President Jim O'Rourke.*

Graduate Student Paper Award Winners

Ph.D. category

1st place: *Lance Vermeire, Texas Tech University—Patch burning effects of cattle grazing distribution in sand sagebrush rangelands. Lance T. Vermeire, Robert B. Mitchell, and Samuel D. Fuhlendorf.*

2nd place (tie): *Kelly W. Creighton, University of Nebraska-Lincoln—Weaning date for spring calving cows grazing Sandhills range. Kelly W. Creighton, Jacqueline A. Johnson-Musgrave, Don C. Adams, Russell E. Sandberg, and James A. Gosey.*

2nd place (tie): *Brent J. Racher, Texas Tech University - Prescriptions for burning saltcedar in New Mexico. Brent J. Racher, Rob B. Mitchell, Justin B. Bryan, and Charles Schmidt.*

M.S. category

1st place (tie): *Ted O. McArthur, Oregon State University - Fire rehabilitation and native plant use. Ted O. McArthur and David A. Pyke.*

1st place (tie): *Elizabeth A. Didier, Utah State University - Innovation adoption on Utah's rangelands. Elizabeth A. Didier and Mark W. Brunson.*

Congratulations to all of the SRM Award Winners of 2002!

Viewpoint

Should SRM Make Major Changes?

By Mort Kothmann

The purpose of this and subsequent Viewpoints is to expand on the ideas that led me to write the Viewpoint in the December issue of *Rangelands*. I do not want these expressions of opinion to be viewed as "lecturing" or "preaching" at the membership. I want to enter into dialogue with you on what we want SRM to become during the 21st Century. Change will only occur if there is a broad consensus of our members who agree on both the need and the direction of change that is needed, not just because Mort Kothmann may think change is needed.

I hope that you have read the series of short articles that Dr. Thad Box has written for *Rangelands* over the past year. Thad has called for us to examine our "roots" as range management professionals and to consider where we are going. A study of history leads to the conclusion that change is constant and inevitable. During the recent meeting in KC, Dennis Phillippi reminded me of a quote from Will Rogers, "You can be on the right track, but if you stay in the same place too long, you can still get run over".

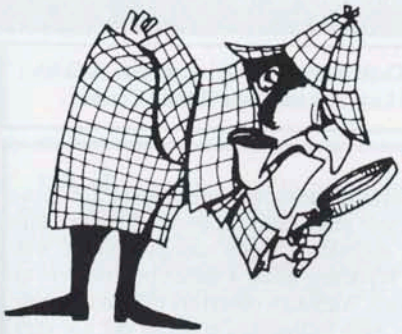
Professional societies are a business in that they have products to market; i.e., memberships, meetings, publications, policy/position statements, etc. For a society to be successful, it must have good products, good management, and good marketing. If any of these components is weak, the society is weak. For the first 25 years, SRM was a "growth" society; however, membership of SRM has been in a steady decline for the past 20 years. This should be a cause of great concern for every committed member of SRM. I think that we need to objectively examine all aspects of SRM: products, management, and marketing, to determine how we can change from a declining society to once again become a growth society.

Much good work has already been done and more is in progress. We have good programs and activities and a sound organization, so please do not interpret these viewpoints as a criticism of any current or past leadership of SRM; that is not my intent! I support the actions and policies of the officers and board. SRM is not alone; many professional societies are experiencing declining membership, but that does not mean that we must accept decline as inevitable and simply strive to slow the rate of decline. My concern is that simply doing what we have been doing, even doing it better, will not solve our membership problem.

Joseph F. Pechanec (*JRM*, October 1948) listed four reasons for the formation of a new professional society, the American Society of Range Management. Basically, it was formed to give professional stature to range workers. He defined the role of range workers as achieving "...the greatest productivity and fullest utilization of the forage resource consistent with maintenance of soil and forage." The society was to provide "...a common meeting ground for the highly varied group in the field." Liberal membership requirements were designed to permit professional workers with highly varied basic training to become full members with an equal voice in society affairs. I think the majority of SRM members would agree with the mission statement Pechanec described 55 years ago. The questions we need to answer are; "Why are we not successful in recruiting more new members?" and "Why are retention rates of new members so low?"

I plan to address these two questions in several more of these short viewpoints for *Rangelands* on issues such as; **1.** Will the term range be appropriate to define our professional society in the 21st century? **2.** What is the history of professional societies and why are many professional societies related to production agriculture declining? **3.** What are the changes that are occurring in societal values and land ethics, and who will be the ministers to the land in the 21st Century? I will be expressing my viewpoints and ask you to discuss these issues with your fellow members and with me. Our banquet speaker at the KC meeting, speaking on change, made the case that the rate of change in technology and societal values is increasing exponentially with no decrease in sight. Let's study history and try to predict the direction and nature of change over the next decade or two and then make the necessary changes in SRM to make it a growing, vital professional society during the 21st Century.

Note: Viewpoints expressed are those of the individual author and not the entire SRM membership.



Sneek A Peek At The Upcoming Issue Of *The Journal Of Range Management*

White-tailed Deer Habitats In The Central Black Hills

Christopher S. DePerno, Jonathan A. Jenks, Steven L. Griffin, Leslie A. Rice, and Kenneth F. Higgins

Most management agencies believe habitat deterioration is the primary cause for the decline of white-tailed deer in the central Black Hills. From July 1993–July 1996, adult and yearling doe (n = 73) and buck (n = 12) white-tailed deer were radiocollared and visually monitored in the central Black Hills of South Dakota and Wyoming. Results supported low habitat quality as a factor involved with the decline of the deer population. It is recommended that habitat management techniques, such as aspen regeneration and prescribed burns be used to improve the habitat base in the central Black Hills.

Nutritional Quality Of Forages Used By Elk In Northern Idaho

Mathew W. Alldredge, James M. Peek and William A. Wall

The nutritional level and forage quality of industrial forests in relation to elk requirements is not known. The digestible energy, crude protein and minerals of 7 elk forages in an industrial forest in Northern Idaho was assessed for 4 time periods from May to November. Crude protein and mineral concentrations were adequate for adult gravid or lactating cows throughout the periods, but the forages provided adequate digestible energy only during May. In this area, summer and fall forage quality may be critical to lactating cow elk.

Establishment Of Silver Sagebrush In The Northern Mixed Prairie

J.T. Romo and R.W. Grilz

Interest has been expressed in using silver sagebrush in restoring the Northern Mixed Prairie of Saskatchewan. The effects of seedbed manipulation treatments and late autumn or early spring sowing on establishment of silver sagebrush were evaluated on sites previously seeded to native, perennial grasses. Density of seedlings establishing was greatest when the seedbed was tilled, but acceptable stands were established with less intense seedbed preparation. Establishment of silver sagebrush appears primarily limited by low numbers of seedlings emerging, indicating very specific safe site requirements for this shrub.

Water Stress And Triclopyr On Clopyralid Efficacy in Honey Mesquite

Andrea R. Roche, Rodney W. Bovey and Scott A. Senseman

Water stress may affect herbicide efficacy in herbaceous and woody plants. A greenhouse study evaluated the influence of water stress and triclopyr on the absorption and translocation of clopyralid in honey mesquite. Clopyralid absorption and translocation in honey mesquite was not altered by water stress extremes when evaluated 4 and 24 hours after treatment. The reasons for reduced uptake and 24 hour post treatment translocation of clopyralid when applied with triclopyr at high water stress are unclear, but have implications for field applications.

Steer Nutritional Response To Intensive-Early Stocking On Shortgrass Rangeland

Kenneth C. Olson, John R. Jaeger, John R. Brethour, and Thomas B. Avery

Intensive-early stocking at stocking rates exceeding that considered sustainable under season-long stocking has been shown to be unsustainable. We evaluated how vegetation changes resulting from nine years of season-long or intensive-early stocking at three stocking rates influenced nutrient intake by steers during the final two years of the study. Intensive-early stocking at rates exceeding that used for season-long stocking reduced nutrient concentration in steer diets, but forage intakes were similar. Reduction in herbage availability at higher stocking rates restricted the ability of the steers to graze selectively, with concomitant reduction in steer growth.

Drought and Grazing: II. Effects On Runoff And Water Quality

William E. Emmerich and R. K. Heitschmidt

Grazing and drought interaction effects on runoff, erosion, and nutrient transport have not been evaluated. A 3 year study near Miles City, Montana used rainout shelters over lysimeters to evaluate the interaction of heavy grazing and drought on runoff, sediment production, and nutrient transport. Limited runoff precluded definitive conclusions, but there was a tendency for runoff and sediment yield to increase from the combination of grazing and drought. The increases in runoff and sediment from grazing and drought were evaluated against controls and when compared to the natural variability and water quality standards, they were concluded to be minimal.

Irrigation Impact On Harvest Efficiency In Grazed Old World Bluestem

W.R. Teague and S.L. Dowhower

Maintaining pasture at lower heights provides greater leaf densities and a diet proportionally greater in live leaf and nutrients. Old World bluestem was maintained at 2 levels of soil water and 2 grazing heights, using continuous variable stocking. Increasing soil moisture level and grazing intensity interacted to increase the proportion of leaf produced that was harvested (harvest efficiency), reduce the proportion of dead leaf, and increase production of new tillers and winter tiller survival. Harvest efficiency under continuous grazing is higher when maintaining a standing crop of 1,500 kg ha^{-1}, than if standing crop is higher.

Evaluation Of A Technique For Measuring Canopy Volume Of Shrubs

Mark S. Thorne, Quentin D. Skinner, Michael A. Smith, J. Daniel Rodgers, William A. Laycock and Ayniyi Sule Cerekci

The addition of height measurements to conventional 2 dimension cover data provide a more practical description of shrub communities. A technique for estimating shrub canopy volume was evaluated at 2 locations in Wyoming using 4 different observers to sample each community twice. Although observers differed in their estimate of canopy volume, each individuals estimate did not vary between sample periods. This study indicates that this canopy volume technique can be applied with minimal training and is precise, efficient, and repeatable.

Snakeweed: Poisonous Properties, Livestock Losses And Management Considerations

Kirk McDaniel and Timothy T. Ross

Snakeweed is a toxic plant that seldom causes direct livestock losses but if it becomes dominant on rangelands can retard growth of desirable forage and indirectly affect animal health. Animals grazing snakeweed infested areas typically display symptoms associated with a low-plane of nutrition such as lack of gain, emaciation and occasional death. To reduce snakeweed dominance and improve range condition, management interventions such as herbicide or fire control may be necessary. While snakeweed is a relatively short-lived perennial and may be eliminated by natural causes, knowing the plant's population pattern in a given area greatly enhances management decisions.

Reproductive Losses To Poisonous Plants: Influence Of Management Strategies

Kip E. Panter, Lynn F. James, Dale R. Gardner, Michael H. Ralphs, James A. Pfister, Bryan L. Stegelmeier and Stephen T. Lee

Natural toxins from poisonous plants have powerful and often detrimental effects on biological systems and especially reproductive function. There are several poisonous plants on our western rangelands that can impair normal reproductive function in livestock and cause large economic losses to producers. The effects of lupines, locoweeds and ponderosa pine needles on reproduction is discussed. While understanding the mechanisms of how poisonous plants affect various livestock has improved, management strategies are still needed to minimize the impact of poisonous plants on the livestock industry.

Risk Management to Reduce Livestock Losses from Toxic Plants

James A. Pfister, Fred D. Provenza, Kip E. Panter, Bryon L. Stegelmeier and Karen L. Launchbaugh

Risk of livestock losses to poisonous plants can be reduced on many ranges through prudent management based on application of existing knowledge. Persistent livestock losses to poisonous plants may indicate that ranges are overgrazed or improperly managed. Aggressive management schemes that employ high stocking rates and grazing intensities may yield greater returns, but also increase risk if poisonous plants are present. Grazing livestock on ranges with poisonous plants should not entail excessive risk, providing managers take the best available information, combine it with personal experience and make rational decisions.

Halogeton Grazing Management: Past and Present

James A. Young

Halogeton is a fleshy, annual, introduced, herbaceous species that is rapidly spreading into many areas of the western rangelands. Crested wheatgrass and winterfat are 2 desirable species that have been planted to suppress halogeton and to provide alternative forage for livestock. In many parts of the Intermountain region, halogeton has declined in importance because of the reduced importance of the range sheep industry and improved range condition. In the south central Great basin, halogeton is still considered a serious problem.

Do Most Livestock Losses To Poisonous Plants Result From "Poor" Range Management?

Jerry L. Holechek

The issue of whether economically significant livestock losses from poisonous plants are a result of "poor" management practices has been a long term controversy. This review covers the influence of grazing management on poisonous plant availability, poisonous plant consumption and livestock losses from poisonous plants. Long-term studies were consistent in showing that heavy grazing intensities increased the proportions of unpalatable plants on most rangelands. Proper stocking and careful timing of grazing are critical management practices in minimizing livestock losses from poisonous plants.

Ecological Relationships Between Poisonous Plants And Rangeland Condition: A Review

Michael H. Ralphs

Overgrazing, reoccurring droughts, and lack of management contributed to large, catastrophic losses of livestock to poisonous plants in the past. Although rangelands have improved and poisonous plant losses have declined, poisonous plants still exist in some plant communities and cause losses. Species such as tall larkspur are part of the pristine plant community and will not likely decline with reduced grazing pressure or even elimination of grazing. Species such as locoweeds, milkvetches, lupine, and death camas are seral "increaser" species and have declined with improving range conditions, but their populations are cyclic; they increase in wet years and decline during drought.

Response Of The Mixed Prairie To Protection From Grazing

Walter D. Willms. Johan F. Dormaar, Barry W. Adams and Harriet F. Douwes

Evidence suggests that removal of fire and grazing could cause succession toward a more mesic community in the Northern Great Plains with the accumulation of litter or loss in productivity as nutrient turnover is delayed. The effects of protection from fire and grazing were evaluated on 70-year-old exclosures in a Mixed Prairie community in southeastern Alberta. Little evidence was found to show that protection from large animal disturbance reduced the production potential of the plant communities. The potential effect that reduced diversity might have on reducing production stability appears more than compensated for by increased litter mass.

Browsing The Literature

Jeff Mosley

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

Animal Ecology

Additional information on the distributions of small mammals at the Hanford Site, Washington. R.A. Gitzen, S.D. West, and B.E. Trim. 2001. Northwest Science 75:350-362. (College of Forest Resources, Univ. of Washington, Box 352100, Seattle, WA 98195). Great Basin pocket mice and deer mice were most abundant in antelope bitterbrush/Indian ricegrass communities and least abundant in cheatgrass sites.

Guanacos and sheep: Evidence for continuing competition in arid Patagonia. R. Baldi, S.D. Albon, and D.A. Elston. 2001. Oecologia 129:561-570. (Centre Nacionale de Patagonico, RA-9120 Puerto Madryn, Argentina). Domestic sheep compete for forage with guanacos, the only wild ungulate species widely distributed across the Patagonian steppe.

Influence of free-choice vs. mixed-ration diets on food intake and performance of fattening calves. S.B. Atwood, F.D. Provenza, R.D. Wiedmeier, and R.E. Banner. 2001. Journal of Animal Science 79:3034-3040. (F. Provenza, Dept. of Rangeland Resources, Utah State Univ., Logan, UT 84322). Cost of gain was less when beef calves had free-choice access to 4 feeds compared to when calves were fed a balanced mixed-ration diet composed of the same feeds.

Grazing Management

Effects of shelter tubes on hardwood tree establishment in western Oregon silvopastures. S.H. Sharrow. 2001. Agroforestry Systems 53:283-290. (Dept. of Rangeland Resources, Oregon State Univ., Corvallis, OR 97331). Tree survival was greater when hardwood tree seedlings were protected from browsing with solid plastic shelter tubes versus plastic mesh tubes.

The impact of buffer strips and stream-side grazing on small mammals in southwestern Wisconsin. E.W. Chapman and C.A. Ribic. 2002. Agriculture, Ecosystems & Environment 88:49-59. (Dept. of Wildlife Ecology, Univ. of Wisconsin, Madison, WI 53706). Species richness and total abundance of small mammals did not differ between management-intensive rotational grazing and continuous grazing.

Where the buffalo roamed—or did they? R.H. Hart. 2001. Great Plains Research 11:83-102. (USDA-ARS, 8408 Hildreth Road, Cheyenne, WY 82009). Before European settlement, bison grazing on the Great Plains was heavy and continuous and did not resemble a moderately-stocked, intensively managed rotational grazing program.

Hydrology/Riparian

The influence of a riparian shrub on nitrogen cycling in a Sonoran Desert stream. J.D. Schade, S.G. Fisher, N.B. Grimm, and J.A. Seddon. 2001. Ecology 82:3363-3376. (Dept. of Biology, Arizona State Univ., Tempe, AZ 85287). Seepwillow produced organic matter that stimulated denitrification by soil microbes, thereby limiting nitrogen loading to the stream.

Improvements

Effect of leafy spurge (*Euphorbia esula*) genotype on feeding damage and reproduction of *Aphthona* spp.: Implications for biological weed control. R.G. Lym and R.B. Carlson. 2002. Biological Control 23:127-133. (Dept. of Plant Sciences, North Dakota State Univ., Fargo, ND 58105). Different species of leafy spurge flea beetles preferred different leafy spurge genotypes, indicating that biocontrol programs could be more successful if biocontrol agents were genetically matched to their host plants.

Hydrologic and vegetal responses to fuelwood harvest and slash disposal in a pinyon pine and juniper dominated grassland. M.K. Wood and N. Javed. 2001. New Mexico Water Resources Research Institute Miscl. Report No. M27. (New Mexico Water Resources Research Institute, New Mexico State Univ., MSC 3167, Box 30001, Las Cruces, NM 88003). "The treatment of clearcutting with uniform scattering of slash led to the lowest runoff and erosion rates of all treatments including the untreated controls."

The response of good and poor aspen clones to thinning. M. Penner, C. Robinson, and M. Woods. 2001. Forestry Chronicle 77:874-884. (Box 407, Huntsville, ON P1H 2J6, Canada). Sixteen years after treatment, thinning had not increased the size or standing volume of quaking aspen trees.

Measurement/Sampling

Predicting leaf/stem ratio and nutritive value in grazed and nongrazed big bluestem. A.J. Smart, W.H. Schacht, and L.E. Moser. 2001. Agronomy Journal 93:1243-1249. (Dept. of Animal and Range Sciences, South Dakota State Univ., Brookings, SD 57007). Leafiness, crude protein, and fiber content of big bluestem forage were strongly related to a numerical index of a plant's morphological stage.

Wyoming rangeland monitoring guide. Wyoming Range Service Team. 2001. (Dept. of Renewable Resources, University of Wyoming, Box 3354, Laramie, WY 82071). Prepared by a partnership among state and federal agencies, the University of Wyoming, and the Wyoming Section of the Society for Range Management, this handbook describes several simple methods for monitoring uplands and riparian areas.

Plant-Animal Interactions

Aspen persistence near the National Elk Refuge and Gros Ventre Valley elk feedgrounds of Wyoming, USA. D.T. Barnett and T.J. Stohlgren. 2001. Landscape Ecology 16:569-580. (Natural Resource Ecology Lab, Colorado State Univ., Fort Collins, CO 80523). Aspen stands regenerated across elk winter range under a variety of elk densities, but regeneration was less where elk were more numerous.

Plant biodiversity on shortgrass steppe after 55 years of zero, light, moderate, or heavy cattle grazing. R.H. Hart. 2001. Plant Ecology 155:111-118. (USDA-ARS, 8408 Hildreth Road, Cheyenne, WY 82009). Plant species biodiversity was greatest in lightly- and moderately-grazed pastures.

Response of avian communities to historic habitat change in the northern Chihuahuan Desert. A.M. Pidgeon, N.E. Mathews, R. Benoit, and E.V. Nordheim. 2001. Conservation Biology 15:1772-1788. (Dept. of Forest Ecology and Management, Univ. of Wisconsin, Madison, WI 53706). Bird species richness was greater in desert shrubland than in black grama grassland.

Plant Ecology

Centaurea species: The forb that won the West. K.D. LeJeune and T.R. Seastedt. 2001. Conservation Biology 15:1568-1574. (Campus Box 450, Univ. of Colorado, Boulder, CO 80309). Suggests that yellow star thistle and the knapweeds have prospered due to increased deposition of atmospheric nitrogen, reduced fire frequency, and nitrogen fertilization from cattle urine and feces.

Fire and grazing regulate belowground processes in tallgrass prairie. L.C. Johnson and J.R. Matchett. 2001. Ecology 82:3377-3389. (Division of Biology, Kansas State Univ., Manhattan, KS 66506). Annual burning caused plants to increase root growth whereas bison grazing caused plants to decrease root growth.

Historic fire regime in southern California shrublands. J.E. Keeley and C.J. Fotheringham. 2001. Conservation Biology 15:1536-1548. (U.S. Geological Survey, Sequoia Kings Canyon National Park, Three Rivers, CA 93721). Historical records suggest that the natural fire regime in southern California shrublands was not much different from the present day fire regime that is dominated by massive Santa Ana wind-driven fires.

Positive and negative interactions between environmental conditions affecting *Cercocarpus ledifolius* seedling survival. I. Ibanez and E.W. Schupp. 2001. Oecologia 129:543-550. (Dept. of Rangeland Resources, Utah State Univ., Logan, UT 84322). In a dry summer mountain mahogany seedling survival was greatest under the canopy of mature mountain mahogany trees, but in a wet summer seedling survival was greatest in open interspaces rather than beneath trees.

Reclamation/Restoration

Ground work: Basic concepts of ecological restoration in British Columbia. D.V. Gayton. 2001. (Southern Interior Forest Extension and Research Partnership, 478 Saint Paul Street, Kamloops, BC V2C 2J6, Canada). This bulletin provides an introduction to ecological restoration, emphasizing the ecological concepts of succession, disturbance, and historical range of variabiliity.

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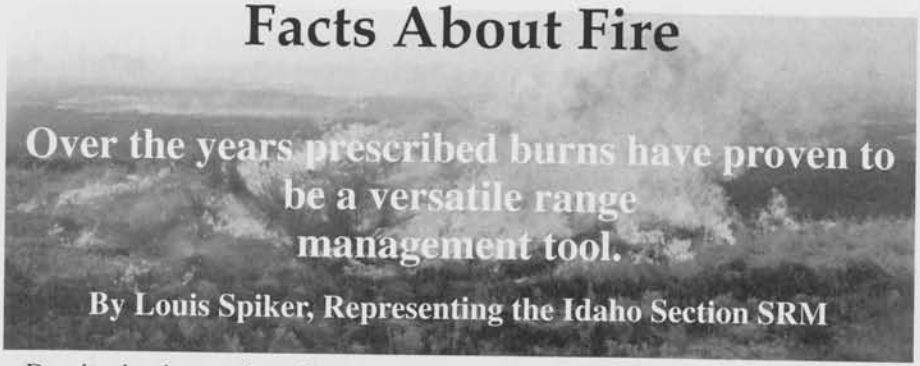
Facts About Fire



Over the years prescribed burns have proven to be a versatile range management tool.

By Louis Spiker, Representing the Idaho Section SRM

Despite the devastating effects a wildfire outbreak can have on homes and people today, prescribed burns are a well-planned program aimed at range improvement through the use of fire.

Historically, ecosystem integrity was maintained by fire. Lightning caused fires that burned every 3 to 28 years. Nearly one-third of these fires were large and usually preceded by above average precipitation and optimum growth conditions. These fires burned until they ran out of fuel and in doing so they controlled the densities of *Artemisia tridentata* (big sagebrush) and *Juniperus occidentalis* (western juniper).

Starting in 1924 with the Clark McNary Act the federal government enacted a policy of fire suppression. This has been a factor in the increasing density of big sagebrush and western juniper. But, fire has now come full circle. It is being used to manage ecosystem integrity, now introduced in the form of prescribed burns.

Prescribed burns are a versatile range management tool. One of the benefits of introducing fire into an area with prescribed burns is an increase in the amount of available forage. In areas of dense sagebrush only half the palatable grasses and weeds are likely to be available to livestock. Prescribed burns can be utilized to improve the grazing capacity in this type of area. Studies have shown up to a sixty nine percent increase in grazing capacity as a result of prescribed burns. Any increase in forage available to livestock and wildlife is an improvement.

Prescribed fires also reduce the number of undesirable annual grasses and forbs that compete with more desirable perennials. Fire allows the perennial grasses to grow rapidly with out the extra competition. Prescribed burning is used to stimulate an increase of climax plant species and helps maintain low growth desirable brush while stimulating forb production. This improves the quality of the forage available to livestock and wildlife.

Benefits Soil, Water And Wildlife, Too

Another benefit of using fire as a range management tool is an increase in soil moisture and ground water. The increased soil moisture gives the more desirable perennial grasses better growing conditions. Where water is available to livestock is an indicator of whether an area may be cost effectively grazed. To graze livestock in the drier months of the year, producers must either have a natural supply of water or they must haul water to their livestock. When dense populations of western juniper and big sagebrush are burned more water becomes available, and often fills up creeks that serve as a water source for livestock and wildlife.

Wildlife also benefit from prescribed burns. Upland game birds like the sage grouse benefit from the habitat diversity resulting from a prescribed burn. Birds and other small game have more access to edge habitat where they can easily find cover and food. Large game such as mule deer and antelope also benefit from the increase in more usable forage.

Prescribed burns are a well-planned process. Each prescribed burn must include a fire use plan. The area's terrain and weather must all be researched to find a safe burn window. Land management objectives and treatment constraints are considered. Success of the prescribed burn is dependent on this process. Large areas of land need to have a long-term plan developed. The area should be divided into sections that will be burned in a 15 to 20 year rotation.

Prescribed burns are also a cost-effective management practice. The Idaho State Department of Lands has been able to conduct prescribed burns of western juniper and big sagebrush in areas in southwestern Idaho from $4.06/acre to $2.36/acre. Using a herbicide such as "Tordon" to treat an area would cost approximately $25/acre just for the herbicide. This is a significant savings. Large prescribed burns are more economical than smaller burns, because even though the burn is smaller it still requires the same amount of preparation.

Prescribed burns have proven themselves to be a valuable range resource management tool. They are able to improve the quality of the forage available to livestock and wildlife. They are a cost-effective way to control western juniper and big sagebrush density. They are a management tool that benefits wildlife. Even though prescribed burns are not suited for all locations they are an excellent range management tool that have the ability to leave areas that were once choked with juniper lush with forage.

This was the third place paper in the High School Youth Forum presentation competition at the 2000 SRM Annual Meeting at Boise, Idaho.

References

"Fire History and Western Juniper encroachment in sage-brush steppe." Richard F. Miller and Jeffery A. Rose. J. Range Management 52:550-559 November 1999.

"Sagebrush Burning...Good and Bad." Joseph F. Pechanec and George Stewart. USDA, 1948.

"Cattle and Fire—Important Tools Benefiting Wildlife." Joe Franklin and Rex Brand, Rangelands 13(4) August 1991.

Viewpoint

Does Nature Want Us To Kill Wild Animals?

Because we have interjected too many uncertainties into the natural systems, management of wildlife populations by man is essential.

By Walter Howard

As a youngster I was always distressed when my turtles, snakes and shrews killed and ate fish, birds and small rodents in my backyard menagerie. I still have a genuine love and deep protective feeling toward the welfare of birds and mammals, as many people do. My early childhood experiences put me on a path to try to understand what I call Nature's "life-death ethic."

As tragic as it is may seem at times, Nature's death ethic requires that most animals die before they become sexually mature to prevent populations from continuing to grow in size. Most of the animals that are born must die before they mature sexually to preserve the balance of Nature. Nature would not be able to cope with the huge population densities that would result.

The most valuable asset I have obtained during my 85 years has been learning to analyze Nature's death ethic objectively, not just emotionally. This is not easy. Those of us who love Nature and animals can't help but feel emotional about the welfare of animals, and we inherently want all animals to live to an old age despite Nature's death ethic. One of the main traps we fall into is that we become sentimental about "individual" animals. Yet Nature does not recognize individuals, only populations of animals.

Balance Of Nature

Since some undesirable exotic plants and animals in America are now permanently established and cannot be eliminated, we must learn how to live with them. The huge populations of people that exist today along with these exotic animals are here and can't be ignored. The high population of people and the well-established unwanted plants and exotic animals must be included in any management scheme we develop. We cannot leave the solution of managing the make-up of human-modified ecosystems to Nature. We have interjected too many uncertainties into the natural systems. Management by us is essential.

I am sure many people join me in my concern about the welfare of wild birds, mammals and other animals. Most of us want to preserve as much "natural" biological diversity as possible and to do what we can to conserve natural resources and to protect the environment. But at what cost? In 1982 I spent one month in Khana National Park, India, at a conference with 60 wardens from India's Tiger Preserves. The wardens told me that each year surplus tigers from their preserves annually killed about 150 villagers.

Now I think the number of fatalities each year is only around 50.

Could it be that despite our "good" intentions to protect "individual" animals and to conserve natural resources and the environment, we have inadvertently caused some populations of animals, such as deer, raccoons, foxes and others, to be exposed to needless suffering – because we have eliminated too many of their natural mortality factors?

After spending much of my life studying animals and how they interact with humans, I must say the answer to this question is unequivocally "yes." Just look at the degree of suffering deer sometimes have in suburban areas, and the plight of surplus bears, when populations exceed the food supply and they are reduced to rummaging through garbage for a meal.

Perhaps without realizing it, we have gone against Nature's ways because of our emotions and ignored a basic fact of life, i.e., Nature's life-death ethic. Our innate desire to want to preserve life interferes with the need for us to assist Nature in managing the population density, e.g., of skunks, foxes and other animals in human-modified environments, which then often develop rabies or other diseases because of their excessive density. Unfortunately, many of today's habitat modifications are well established and it is impossible to change them back to a pristine state.

Surplus Animal Populations

Our help is especially needed because the natural predator-prey balance, which is so important to an ecosystem, no longer exists in many altered habitats. Original natural balances have disappeared because either the original predators are no longer present or the altered habitat now enables such species as blackbirds, squirrels, rats, coyotes, deer, opossums, and skunks to overpopulate, sometimes with terrible consequences to the welfare of entire populations of these animals.

"Survival of the fittest? A shortsighted strategy at best. We should be willing to help Nature engineer healthy ecosystems that improve the lives of wildlife and the balance of Nature."

When plague occurs in the Sierra Nevada Mountains and local populations of golden mantled ground squirrels, chipmunks and woodrats die, public health has to temporarily close the campgrounds until the now hungry infected fleas in the unoccupied rodent burrows have been controlled. It is important to note that these plague epidemics in California have only occurred where human-induced environmental changes have enabled these rodent species to overpopulate.

Most people feel we should manage wild animals without killing them. Of course, when possible, but in practice this isn't just difficult; it is impossible. How should wild animals die? At what age? By what means? Are all wild animals entitled to a long and happy life? Or do you agree with Nature that to prevent overpopulation most animals of all species must die while young?

All animals produce surplus offspring to serve as food to others. It is difficult, isn't it, to separate one's emotions from the facts of Nature.

Many people think a good solution for dealing with unwanted animals, particularly larger mammals like bears, but also even mice, is to capture and release them somewhere else where we think they might survive. One can then rationalize that at least this approach gives the animal another chance to live. However, to do so, shows a lack of understanding of Nature's scheme. With radio telemetry we know that the odds are stacked against the survival of any translocated mammal – from rodents to bears – released into a strange environment. In fact, once released a mammal rarely settles down but tries to find its original home. How sad. In addition to the trauma of being put in a strange environment, they seldom survive. Therefore, capturing misplaced mammals and releasing them elsewhere is clearly a compassionate resolution for disposing of unwanted or surplus mammals.

In today's human-modified environments, which frequently are still changing, Nature's scheme usually cannot maintain a balanced ecosystem without our help. Natural or surrogate predators are essential in preventing species like rodents and deer from overpopulating and in maintaining a healthy balance of Nature.

To help Nature, people need to become surrogate predators, stalking the out-of-balance predator-prey relations like a hungry lion. Let's not make things worse by allowing animals to greatly overpopulate. In environments where the natural plant and animal communities have been permanently altered, and obviously can't be reestablished, we need carefully developed management schemes that will regulate the density of animal populations. And they must be grounded in sound science.

Survival of the fittest? A shortsighted strategy at best. We should be willing to help Nature engineer healthy ecosystems that improve the lives of wildlife and the balance of Nature. Self-limiting mortality factors – starvation, disease, territoriality, cannibalism, poor breeding success, and sexual battles – usually become more horrible and truculent in modified environments where the natural predator-prey balance no longer exists.

On Angel Island in San Francisco Bay, in the absence of predators or hunting, deer became so abundant and sickly that the public finally agreed that the only solution was for wardens to cull their numbers. First, some deer were captured and moved to the mainland, but they did not survive.

Morality of Nature

Nature is naturally harsh, of course, but where human-induced environmental changes have occurred, she is often forced to be much crueler, causing a higher percentage of animals to suffer from these self-limiting factors than occurs with natural mortality. Few wild animal deaths are as humane as those at the hands of humans.

When people cull animal populations, they are governed by many regulations designed to ensure that hunting, trapping or other lethal measures are as humane and selective as is feasible. Only we humans express compassion toward prey – certainly Nature does not. We must rise above our emotions and recognize the environmental importance of Nature's death ethic. We can't leave the needed management to the whims of Nature.

Death is an inevitable fact of life. The public and many biologists do not seem to realize that most wild animals of all species do die before they have a chance to reproduce. This early mortality is absolutely essential for a number of reasons. Without it every species would over-

Mule deer buck. Photo by Chad Prosser.

populate. Suppose every acorn grew into an oak tree or every pine nut into a pine tree. All species must have an effective mortality factor to prevent them from overpopulating and destroying both themselves and their habitat. For example, if the prairie deermice, whose livelihood I studied in the field in Michigan, had today's life expectancy of the human race, they would theoretically cover the earth in just a few years.

Nature must produce surplus offspring for a reason that may not be readily apparent. This is the source of energy that keeps Nature moving forward through time. Surplus young are the major food source of other organisms. That may sound harsh, but in Nature it is an eat-and-be-eaten reality and not many animals grow old. The bulk of the few animals that do grow old are either pets, domestic livestock, live in zoos, or Homo sapiens, all of which have been insulated from Nature's death ethic.

We must do everything we reasonably can – in today's increasingly human-modified world – to preserve as much of the original biological diversity as is feasible. Tools like the Endangered Species Act have been of tremendous help, but need to be modified.

We must find better ways of creating sustainable plant and animal communities that successfully incorporate the wanted or unwanted "exotics" we are stuck with. Many nonnative pests and undesirable plants and animals cannot be eliminated, hence must be incorporated in any management scheme we design. For instance, in California stripped bass, small and large mouth bass, brown trout, sunfish, and catfish are all introduced species, as also is the ring-necked pheasant. But you don't hear any complaints from most hunters and anglers about the presence of these species in the wild.

Surely we shouldn't always try to let all wild animals live a long life and die "naturally" It's ironic, but for the welfare of wildlife and the preservation of natural biological diversity it is paramount that we search for responsible balance-of-Nature management schemes in which we play an active role. Actually, a renaissance is needed on the ecology of animal deaths in human-modified environments. Let's develop a broader dialogue as to whether or not humans have an ethical and moral right to help Nature by serving as surrogate predators.

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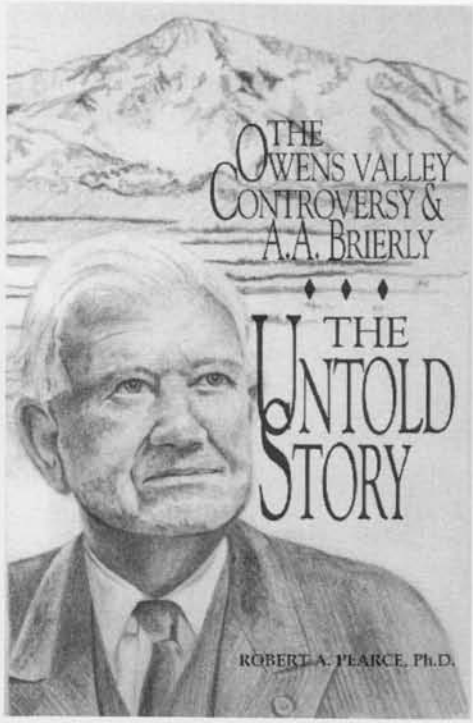
Note: Viewpoints expressed are those of the individual author and not the entire SRM membership.

Book Reviews



The Owens Valley Controversy & A. A. Brierly. The Untold Story. By Robert A. Pearce. 1999. Dageforde Publishing, Inc., 122 South 29th Street, Lincoln, Nebraska. 104 p. US$12.95paper. ISBN 1-886225-37-0.

" As little as possible..."
Jack Nicholson's final words in the film *Chinatown.*

The insatiable thirst of the City of Los Angeles for the water of rural Southern California has inspired the kind of ravenous human activities that have made for fascinating histories, novels and films. When Dr. Robert Pearce contacted me *via* e-mail that he had a book on the history of the water controversy involving Los Angeles and Owens Valley (California), described it briefly, and asked if I could have it reviewed for *Rangelands*, my one-line response by e-mail was simply "Sounds like *Chinatown*; send it." His e-mail response said simply "It is better and more accurate than Chinatown." I received the book a few days later.

The first one-third of the book is mostly an annotated geneology, recounting the exploits of the author's ancestors, especially A. A. Brierly, his grandfather. In these pages is the story of the author's family as pioneers in the Owens Valley of southeastern California. Beyond a written account of family history, this third of the book includes testimony from various individuals to the integrity of A. A. Brierly, to establish his credibility for what follows. What does follow are the author's 16-page account of the water controversy, written nearly three decades ago based on the recollections of Mr. Brierly and another elderly local resident, and a 30-page transcript of an interview Dr. Pearce conducted with his grandfather 25 years ago. A brief chapter on the history of the dust problem in the Owens Valley, and a summary chapter on the outlook for the Valley complete the short book.

Part eulogy, part geneology, part history, part plea for preservation, *The Owens Valley Controversy & A. A. Brierly: The Untold Story* aims at a curious, if not entirely compatible, combination of objectives. But beginning with the family history, the book immediately gets personal. Shunning the cool detachment of good historical reportage, or for the matter, *Chinatown*, the book gets sentimental too. In a few places the sentimentality approaches what the WWII-era Southern California cafes that novelist James M. Cain liked to write about served on their waffles, i.e., *syrup.* As it usually does, sentimentality, even when sincere as it is here, weakens objectivity, and the regional history enhances the family history more than *vice-versa.*

However earnest the author's attempt to set history straight, the fact is that even including his grandfather's recollections, he has, relatively speaking, little to work with here. A written account by the author from 1974, and an interview from 1976, both involving the author's grandfather, A. A. Brierly, provide most of *The Untold Story*. Mr. Brierly's accounts are credible enough, and include descriptions of irrigation developments, personal threats, physical violence, an unwise bond election, and failure of the Inyo County Bank. But not only was Mr. Brierly over ninety years old at the time of these accounts, he was relating events which had happened decades earlier, mostly in the 1920's and 1930's. Neither the written account nor the interview has the kind of textured detail needed to add significantly to the story of the Owens Valley water controversy.

Even more important than the lack of detail in these first-hand accounts is the absence of significant other research to round out the story of the water controversy, an absence that is surprising considering the author's Ph.D. and commensurate research background. Moreover, the book's presentation, repetitive in places, is fragmented, and awkward or negligible transitions between the major sections add to that impression. So lacking the coherence that documented research and effective presentation would have provided, I can say that the book, while hardly comparable to *Chinatown* in any sense, is certainly not *better.*

Nor, for the same reason, can it ultimately be more *accurate* as history. The historical content of the book is one-dimensional such that saying it is a cross-section of the history of the times is too generous; it more resembles recollections of a point sample from the perspective of one man, A. A. Brierly. However perspicaceous he may have been, the situation there was a multi-dimensional one, involving years of agendas and activities of countless groups and individuals, and omni-directional quests for water and wealth and power. His observations minimize this complexity. Even Mr. Brierly's observations of the major, driving forces at work in the Valley's past are not developed effectively (either by him or the author) into coherent history, and are ineffective in driving the narrative. The piecemeal perceptions bring to mind the words of John Huston to Jack Nicholson in *Chinatown*, when he says: *You think you know what's going*

on, but you don't. Without analysis and development, accuracy is often illusory, and truth is elusive. The book does modulate some historical misperceptions, if mostly by assertion rather than by research, corroboration, and documentation. But because it lacks the intricate investigation and coherent development to address what is recognized as a complex history (See the better researched *Rivers in the Desert,* by Margaret Leslie Davis, Harper Collins, 1993), the broader story, at least in Dr. Pearce's work considered alone, remains untold. The book has a fragmented, underdeveloped linearity about it, like a drive down the fading remains of Route 66 through the California desert, without stopping.

The main messages of the book are that the Los Angeles Department of Water and Power's (DWP's) poor reputation is largely undeserved, that it has never been the land-grabbing, dust-generating force that it has sometimes been accused of being, and that it has been effective in preventing wholesale development of the Owens Valley. Pragmatically, the book suggests that whatever the DWP's undesirable aspects, ongoing and future efforts to weaken it will likely threaten the Valley with destructive development. To emphasize the point, Dr. Pearce, still sweetening serious business with sentiment, ends with the following wistful words:

> As a winter storm blows along the landscape,...I park my Jeep on a hilltop overlooking "my valley." I know this is a land worth saving, I hope those who promote development and removal of the DWP from the Valley look long and hard at their ideas. When all the facts are considered, including evaluating the alternative to DWP land ownership in the Valley, I know the positive value of DWP's presence will be seen. We can wander all over these vast and primitive lands, as if they belonged to each and every one of us. It is a privilege we should cherish and protect. Dark clouds fall from the Sierras and a mist falls from the sky as I close my eyes and wonder, how long will the serenity of the Valley survive?

So you see, Dr. Pearce's effort here has noble motivations, and regardless of anyone's criticisms of *The Owens Valley Controversy and A. A. Brierly: The Untold Story*, I suspect that the book has satisfied, and will satisfy, the author's *personal* objectives. Because decades after the 1930's of *Chinatown*, powerful forces are still at work in the sun-drenched Owens Valley—murky, inexorable, human forces seeking water and land and power that, as in any good *film noir*, will likely win out eventually. But whether that happens or not, forty years from now Dr. Pearce may be standing on that same hilltop, this time with eyes open, with his grandson asking him what he did to tell the family history, to tell what a great guy great-great-grandfather was, and to try to save the *Valley* from destruction by greedy people. This book, at least, ensures that his answer won't be *...as little as possible...—David L. Scarnecchia*, Washington State University, Pullman, Washington.

Environmental Issues In Pacific Northwest Forest Management. National Research Council. Committee on Environmental Issues in Northwest Forest Management, chaired by Norman Christensen. 2000. National Academy Press, Washington D.C., U.S.A. 259 p. US$45.00 paper. ISBN 0-309-05328-5.

The management of Pacific Northwest forests has always generated controversy. During the 1980's the controversy was mainly split along the issue of spotted owls vs. jobs and timber. Since then, it has expanded to include other issues, such as biodiversity, recreation, alternative forest products, and spiritual/aesthetic values. At the request of Congress in 1992, a study was undertaken to examine the status of Pacific Northwest Resources and their relationship to the supply and demand for forest products in other regions of the country. The study was envisioned to be a comprehensive examination of the challenges associated with forest management, including biodiversity, forest structure, economics, social well-being, forest dynamics, and forest products, culminating in this book.

Historically, people have been attracted to the Pacific Northwest by the opportunities presented by its rich and varied ecosystems. As time has passed, migrants to the Northwest have altered the region according to their needs, which has had the effect of increasing the regions' capacity to provide certain goods, while decreasing its capacity to provide others. Whether the region can continue to meet the demands society is placing on it is uncertain. The book describes three trends as possibly having an impact on the issues surrounding the forests' management. These trends are (1) the loss of the frontier, which intensifies conflicts with competing jobs and resources, (2) a changing knowledge base, as people become more aware of the ecological effects of different management strategies, and (3), changing social values, as people begin to demand recreation, aesthetics, and other values from the forests.

A history of the Pacific Northwest forests is given, with respect to human influences and uses, beginning with the Native Americans burning the landscape. Also described are the different types of forests in the region, forest management practices, and ownership patterns. This part should be interesting and informative for those with no familiarity with the region, and provide some new information for those already familiar with it. Structural qualities of old growth forests are explained, and the book points out that many terms are used interchangeably with "old growth," and that not all species or forests will obtain old growth status. The public perception of what is *old growth* also confuses the issue, since the term is not always the same as that used by scientists and managers.

The ecological effects of land use practices are explored in Chapter 4. Included here is a convincing argument in favor of biodiversity. An interesting point is that forest health is more than the absence of disease; it is also the ability to recover from stresses. This chapter emphasizes that

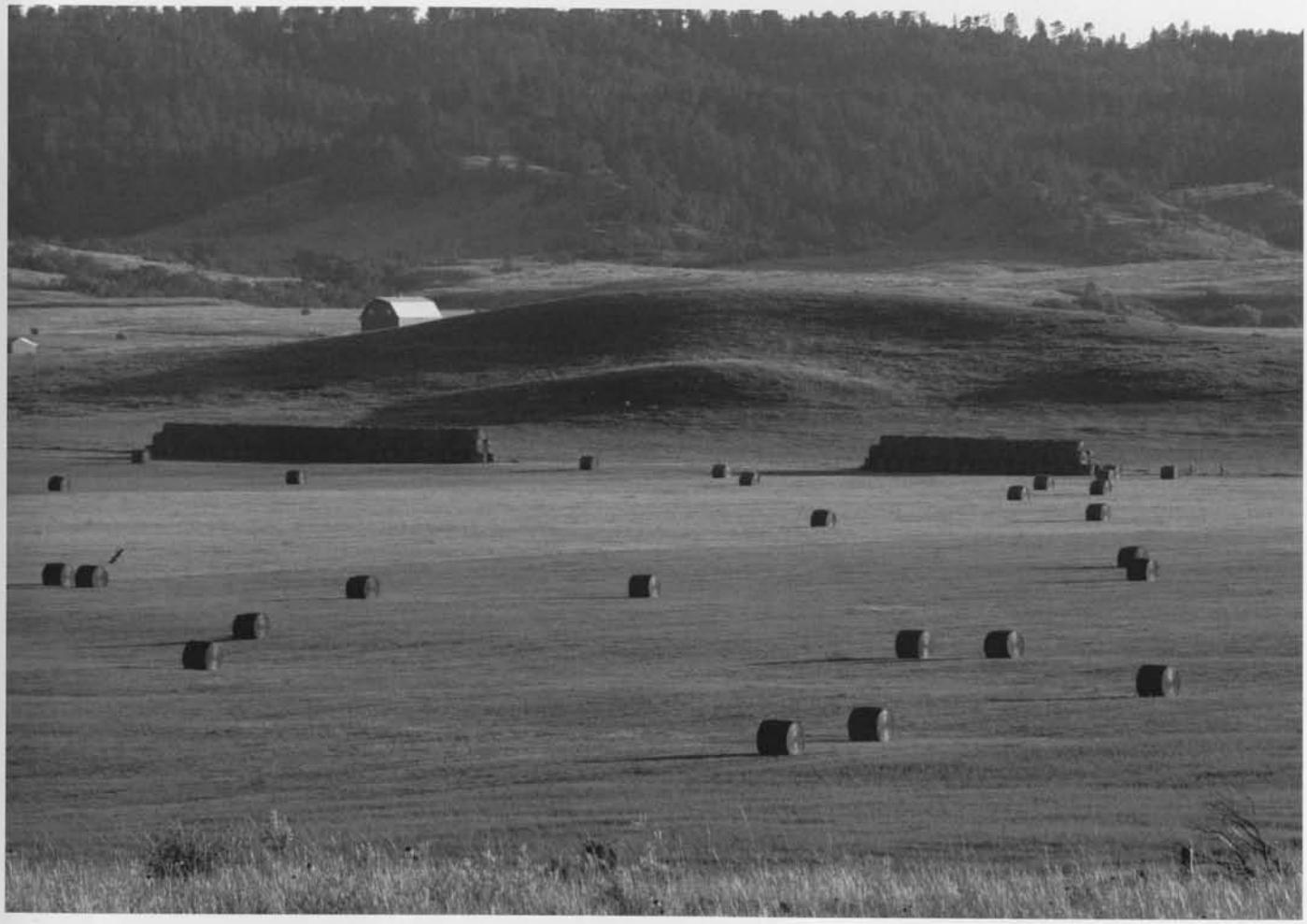
forest components are interrelated, so the health of the whole depends on the health of each part.

The importance of succession and natural disturbances are explained. Human activities have altered the natural fire regime, which has sometimes, but not always, increased the risk of catastrophic fires. The authors noted that natural disturbances sometimes occurred with the same frequency as timber rotations, and that just because an occurrence is natural does not mean that it is any more benign than a human activity. While logging can at times be an alternative to natural disturbances such as fire, it will not work in every situation.

Chapter 7 presents the sociologists view of the timber communities. The local peoples' challenges with the loss of the timber industry are explained, resulting in a loss of both identity and cultural values. Two points are noteworthy. According to the authors, while the economic loss is significant to an individual who has lost his job, the total economic loss due to restricted timber harvests is relatively small, and the cultural and identity losses may be greater than economic losses. Second, according to a 1993 study, social and spiritual values decreased with increased timber harvesting; the number of employees and churches decreased and the number of arrests increased with increased timber harvesting on national forests.

The last two chapters focus on constructing a framework of forest management that future generations can adapt for their objectives. Since the forest cannot provide all services and commodities at the same time and place, it may be necessary to manage different parts of it for different purposes. The last chapter provides recommendations for instituting a management plan, much of which involves continued study and protection of endangered or fragile ecosystems. One significant suggestion was for the exchange of land between public and private owners to achieve ownership patterns that will coincide with ecosystem boundaries.

Environmental Issues in Pacific Northwest Forest Management should be of interest to all who are concerned with sustainable management of forests and associated ecosystems. It is, however, a technical book, and can be challenging to read. Those with large assets in timber may find parts of it disturbing, since it leans against logging in general, recommending it only when it would either benefit the ecosystem in some way or have no detrimental effect.—*Eric Ek*, Washington State University, Pullman, Washington.



Rolled hay and rolling foothills fill this landscape at Custer National Forest near Ekalaka, Montana. Photo by Chad Prosser, USDA/ARS, Sidney Montana.