Rangelands

Society for Range Management
Vol. 16, No. 4, August 1994

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Life Sustaining members were highlighted in the June 1994 *Rangelands.*

Rangelands

FEATURE ARTICLES

DEPARTMENTS

COVER PHOTO

Fire burning on Loamy Hills range site. See related story by Dan Robinett starting on page 143.

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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 ot 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 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 or range management. Editorial comment by an idnividual is also welcome and, subject to acceptance by the editor, will be published as a "Viewpoint."

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Executive Vice-President's Report

I continue to believe that the *Journal of Range Management* and *Rangelands* are the heart and soul of the Society for Range Management. They have defined this Society (at least *JRM* has) from the very beginning. They remain the primary source for communicating, educating, and understanding. Furthermore, they provide the Society the publishing foundation for moving into other kinds of publication such as books, newsletters and brochures.

It is possible to contract outside for many of these services (and of course we do contract outside for all of our printing). There are a lot of people in this area looking to contract desktop publishing. The competition is fierce and the price appears to be very economical. But it doesn't always work that way because of the great variation in knowledge, skills, and ability as well as equipment among the contractors. It can require nearly a full-time contractor, the cost of which is not reflected in the bid price. Secondly, I have resisted this approach because when SRM heads down that path our internal publication expertise will soon be gone. The changes in publishing and printing over the last decade have been phenomenal and the change continues unabated. Any organization involved in publishing needs people who keep apprised of the changes through a network of colleagues in the industry. I shudder to think what it would be like around here without the two people (Patty Perez and Tawyna Castillo) who routinely handle the myriad of details connected with SRM's publications. It is a lot more complicated than creating a document on a computer file.

I believe all of you know that we are in the process of moving to desktop publishing. The July issue of the *JRM* was the first to be entirely published on desktop equipment. Of course, the equipment is **NOT** paid for yet and those of you who forgot to send in your $25 donation please do so. Desktop equipment offers many advantages. It reduces much of the redundancy of retyping and enables the direct incorporation of photographs and figures. When completed, the entire Journal is available in digital form to go directly to the printer, copied to another disk (including CD-ROM) or transmitted over telephone lines. It is highly likely that entire volumes of future issues will be available on CD-ROM. I personally hope that SRM can one day afford to have all previously published volumes of *JRM* and *Rangelands* transferred to a CD-ROM. Think of the possibilities of having all 27,437 pages of *JRM* and *Rangelands* on one small disk. That could provide major relief to those sagging library shelves or improve the spouse's attitude about the stacks in the basement.

I also believe that our publications are key to our external education programs and have the potential to relieve much of SRM's financial distress. All we have to do is be clever enough to increase membership, subscribers or both. A very high proportion of the publication costs (true of Journals and Books) is tied up in the first issue that rolls off the press. The cost of each additional copy is greatly reduced. SRM can purchase an additional 1,000 copies of *JRM* for $637 and that includes the average cost for bulk mail distribution. Comparable costs for *Rangelands* is $429 per 1,000. We currently distribute about 5,000 copies per month to members. Is it possible to imagine distributing and additional 5,000, 10,000, or 20,000 copies? There is an old saying in the sports world that "the mind must conceive it before the body can achieve it." I believe it is much the same problem for SRM. In this great big world I know there are more than 20,000 people interested in some aspect of rangeland. Why aren't they SRM members or *Rangelands* subscribers? The answer to that question is crucial to SRM.

The Mexican Grey Wolf Plan

Jim Brunner

There is a plan to return to the wild some captive grey wolves, offspring of a single female captured in Mexico in 1980. (Fish & Wildlife Serv. 1982, Bednarz. 1988). The location suggested is the White Sands Missile Range in south central New Mexico. (Bednarz, 1989). The Range is roughly 100 miles north-south and thirty miles east-west. Running north through the Range for about seventy miles is a narrow mountain range, the San Andres. Further north are the Oscura Mountains, which are lower and not as precipitous as the San Andres (Neher and Bailey, 1976).

Fig. 1. Location of White Sands Missile Range.

The original recommendation suggested an area of at least 5,000 square miles. The Range contains 3,200 square miles, and was found to be the largest area of federal land in the former range of the Mexican gray wolf.

The foothills of the mountains are a lovely black grama grass range with sideoats grama on the better sites, while the flats are gypsum deposits that support alkali sacaton on stabilized portions. Some areas are sand dunes, such as are found on the integral White Sands National Monument. The pinyon-juniper type (about 613,000 acres in extent) is important as wolf habitat since it supports the deer herd, and the small antelope herd (Neher and Bailey, 1976: Bednarz, 1989).

This wolf no longer occurs in the United States, and may be found in small numbers (ten-fifty) in the mountains of northern Mexico (Fish and Wildlife, 1982). It has been classified as a rare and endangered species in the United States.

Fig. 2. Locations of the San Andres and the Oscura Mountains.

Author is from Medford, Ore. 97501.

The wolf has long been considered a terrible predator intent upon destruction. So why try to reintroduce such an animal? The Endangered Species Act requires that any particular species in danger of extinction be fully protected and all possible means used to safeguard and increase the species. The U.S. Fish and Wildlife Service is charged with this task.

A pregnant wolf captured in northern Mexico in 1980 gave birth, was bred back to one of her sons, then bred again to another captured wolf who was probably another of her sons (Fish and Wildlife, 1982). Today, there are about forty grey wolves held in zoos and Fish and Wildlife Service breeding stations. In addition there are, mostly in private zoos, captive grey wolves. Most of these have changed drastically over the years until they no longer resemble the wild grey wolf. Still, in a pinch, some of these wolves may be used in the breeding program to increase the gene pool available (Fish and Wildlife, 1982).

Inquiry by the Fish and Wildlife Service found most zoos are not interested in grey wolves. Only two have volunteered to help in raising and breeding the grey wolf but only for a short period of time and only for release. For the Fish and Wildlife people, time is running out, especially since the Rare and Endangered Species Act must be reapproved by Congress in 1994. If the wolf is to be released into the wild, it must be soon (Parsons, 1991). Should the attempt fail, a few will be kept in pens by the government to preserve the gene pool.

Studies of wolves have been a popular avocation for years. The early studies concentrated on the northern or white wolf in Canada and Alaska and most of our information on wolves comes from these studies.

Mr. McBride (1980) is my authority for the following description of the habits of the Mexican grey wolf. Since the 1930's, the grey wolf in Mexico has lived on an almost exclusive diet of beef, with an occasional horse or colt thrown in. Mexican cattle will try to protect a calf, so the wolf does not waste energy trying to cut out a calf from a herd, it goes for the yearlings. With the large supply of beef at hand, the grey wolf does not appear to eat rodents, it makes one meal from one steer. Even if last night's prey is still alive, the grey ignores it and goes after fresh animal. The grey chases an animal, tears out a big piece of hide and flesh from a hind quarter, usually on the inside. After a few bites from those enormously powerful jaws, the steer can no longer run.

McBride,(1980) who lived and worked against the wolf in Mexico for several years, describes the wolf's uncanny ability to avoid traps. There were few wolves in Mexico even in the early 1980's but they took a terrific toll. One 74 pound female wolf killed 110 steers and heifers in a two year period. Another killed 18 steers in a month.

The Fish and Wildlife people understand this and plan to make every effort to prevent a grey wolf from leaving the White Sands Missile Range to kill local livestock (Bednarz, 1989; Parsons, 1991).

They hope the range will be large enough and furnish enough native prey so the wolves will stay on the range. Elaborate plans have been made to fit each wolf with a radio-collar so it can be monitored (Parsons, 1991). The Fish and Wildlife people are depending heavily on methods developed in the introduction of the red wolf (actually a coyote-wolf hybred) in the eastern U.S. (Bednarz, 1988; Bednarz, 1989; Fish and Wildlife, 1982; McBride, 1980).

The grey wolf 'recovery' (i.e. planting) plan envisions taking a bred pair of wolves to White Sands Missile Range and placing them in a stoutly fenced pen. When the female whelps, this area will be home to the pups and the pups are expected stay in that area. The parents will no longer be fed a dog food-cat food mixture, but dead game animals from the area will be tossed into the pen. Since the biologists think the wolves will eat mule deer in the wild, this animal will most likely be the one fed to the wolves. As the pups grow and become stronger, live deer will be placed into the pen for the pups to chase and practice killing. After

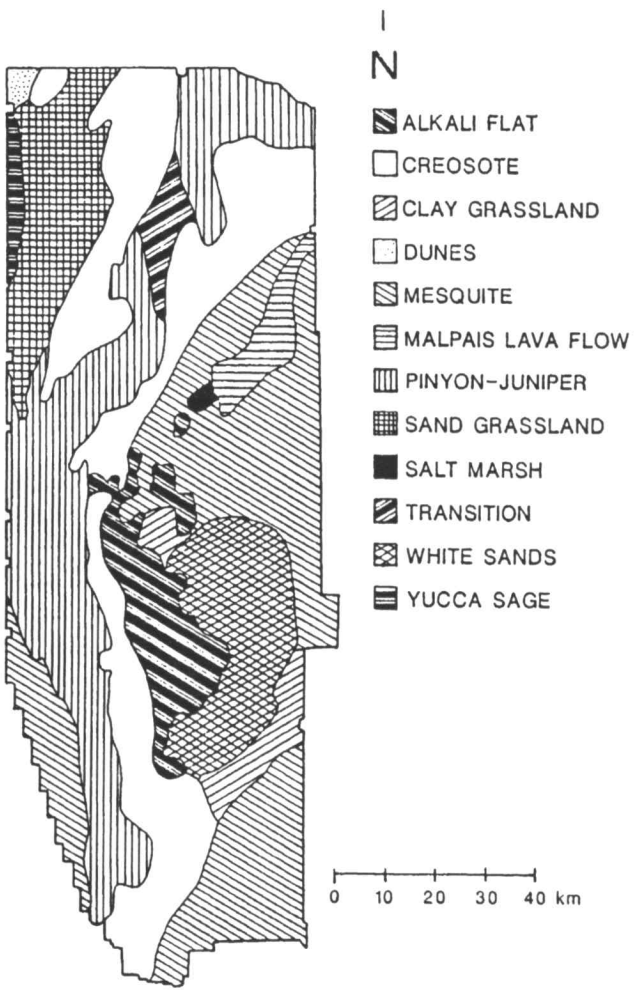

Fig. 3. *General vegetation cover map of White Sands Missile Range (D. Taylor, unpublished* data).

six months or so, when the pups are nearly full grown, the parents will be moved to another pen to raise another set of pups and the original pen will be left with the gate open so the pups can roam and find their own food (Parsons, 1991). There is a general assumption that the freed wolves will eat venison.

The effect of some fifty mountain lions on the mountains is largely ignored in the present plan. The on-going study of these lions is quite intense. Mountain lions eat deer at a rate of one deer per week. (Barker, 1946). Simple multiplication shows a harvest by lions of some 2,500 deer a year. No firm census of deer is available. However, the young lions seem to move off the Range when mature, which may indicate there is not room for additional lions. There are plans by the New Mexico Fish and Game Commission to capture and move some lions off the Range, so perhaps a little slack will develop here. If the wolves cannot or will not elect to chase the fleet deer through the rough rocky steep slopes of the mountain, and here the wolf is not at his best, then some other large herbivore will be chosen. There are presently some dozen antelope on the Range, but they stay on the open flats on the west side of the San Andres mountains and frequently drift onto the Jornada Experimental Range, forced by the herd of feral horses which has grown from about two hundred head to over one thousand three hundred head (Personal communication) which have preempted the waters on the east side of the mountain.

It seems a bit far-fetched to assume that the wolf will take the antelope as a primary food source. Wolves can run 25 mph, but the fleet antelope can easily our-run them. Another possible prey is the oryx or gemsbock, an import from Africa that has become a resident on the Range. There are about 600 oryx in the area (Personal communication). The oryx has a lovely long pair of horns with which to fight a predator and this may be one reason that the mountain lions seldom take an oryx. (Personal communication). The oryx is able to live without free water and can range far from wolf habitat. (Personal communication and an undated study of gemsbock on the Range.).

There are perhaps 25 bighorn sheep on the spires of the mountain, certainly not in wolf habitat (Bednarz, 1989). That leaves only one large herbivore, the feral horse, which occurs in great plenty, is easy to catch and kill. Due to threatened tourist boycotts by wild horse organizations, the horses continue to multiply.

An important impact of the grey wolf introduction plan that has been largely ignored is that of the effect upon the vegetation. Wolves do not eat much vegetation, yet an effect may be there. It is generally agreed by wildlife scientists that the Mexican grey wolf will not tolerate coyotes within its range (Fish and Wildlife 1982 and Personal Communication). The mainstay of the coyote diet is rodent; mice, rats, ground squirrels. These small herbivores eat green grass and weeds when they are available, but after the grasses have dried and lost nutrients from weathering, the rodent turns to seed-caches for food. These seeds, mostly from plants like mesquite and four-wing salt bush, are laboriously collected, one cheek pouch full at a time and buried an inch or so deep. The population of rodents is limited by the coyote and weather patterns. Coyotes have been found with as many as thirty mice in-stomach.

When (if?) the planned thirty to forty grey wolves are established on the Range, wildlife technicians agree that the coyotes will be killed or driven away. This will result in a population explosion for the rodents, many more seed caches will be buried. Some caches are forgotten, some are abandoned when a rattlesnake recycles a rat into the environment. The seeds can await, perhaps for years, a proper combination of temperature and moisture for germination. Almost all brush plants in the semi-desert or desert sprout from rodent seed caches. Over time, the land may well change from grass land to brush land. This effect may be hastened by the overgrazing of the enormous horse herd.

Occasionally Man can take an action that will have far reaching effects. The reintroduction of the Mexican grey wolf may well be one such step.

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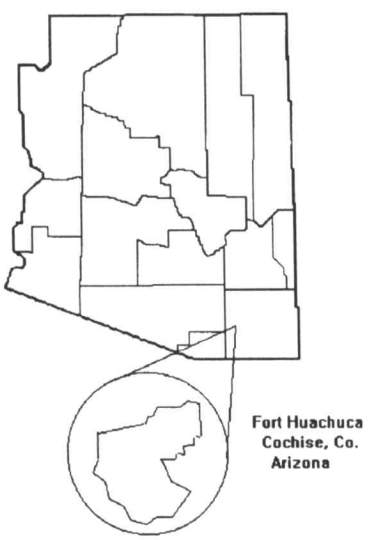
Fire Effects On Southeastern Arizona Plains Grasslands

Dan Robinett

Wildfires played an important role in shaping desert and plains grasslands in southeastern Arizona (Pase 1977). Lightening in early summer storms or Indians using fire to hunt, clean up favored campsites or accidental starts from their campfires, were common prior to the turn of the century (Bahre 1985 and Leopold 1924).

Natural fire frequencies for grasslands in southeastern Arizona have been estimated at between 10 and 20 years (Wright 1980). A variety of cultural and environmental impacts since Anglo settlement have greatly reduced the frequency and spread of wildfires (Bahre 1991). Over the last one hundred years very little of Arizona's grasslands have burned.

One of the few areas where fires have burned frequently is Fort Huachuca in Cochise Country. Fort Huachuca is a US Army installation established in 1877 as an outpost in the southwest to quell Apache raiding. In 1916 it played an important part in General Pershing's punitive expedition into Mexico after Pancho Villa (Wallmo 1951). Since then the 72,000 acre military reservation has grown to become the headquarters of the US Army Communications Command. It continues to accommodate troop training from regular and National Guard units in Arizona and from around the country. Several firing ranges and their associated impact areas occur on the 40,000 acre main post. These ranges are for live fire from troops and tanks. Wildfires caused by tracers are common each year.



This study was done in 1992 to help determine how frequently fires can burn the major range sites without long term negative impacts to the soils or plant communities. This study gives some insight into the adaptation of the major species to fire.

The grasslands around these training ranges are some of the finest in Arizona. Ecological condition is good to excellent in most areas. Although they have a long history of grazing in the past, most areas have not been grazed except by wildlife since the mid 1960's when the last of a small buffalo herd was removed from the post (Wallmo 1951).

Elevations range from 4,800 to 5,400 feet in this area. Average annual precipitation is 16 inches (NOAA 1992). Precipitation pattern produce two growing seasons. Cool season moisture tends to be frontal storms with moisture supplies from the Pacific and summer rainfall comes as convective storms of high intensity and short duration from moisture supplies originating in the Gulf of Mexico.

Fire history data has been kept on Post since 1977. The extent at each burn was delineated on a training range map along with the time, dates and a brief explanation of how it started and how it burned. Using this data and a recent soil and range survey of the Post, sampling areas were selected (USDA 1992).

A combination of three different fire frequencies on the four major range sites in the area were evaluated. The three burn frequencies are; one burn since 1977, two or three times since 1977, and five or six burns since 1977. All fires were in the hot season of May through July. The one burn areas had from 6 to 8 years since the burn; the two and three burn areas had from 4 to 6 years since their last fire; and the last burn on the five and six areas was in 1990 or 1991.

The four range sites sampled included; Loamy upland, Sandy loam upland, Loamy Hills, and Granitic hills (USDA 1988).

The loamy upland range site is characterized by deep soils classified as ustollic haplargids and haplustalfs (USDA 1992). They have thin (1 to 3 inches), coarse textured surfaces over clayey subsoil's. Slopes are 1 to 5%. The native potential plant community is an open grassland dominated by warm season mid-grasses.

The sandyloam upland range site is characterized by similar soils but with a thicker (4 to 10 inches), coarse textured surface. Slopes are 1 to 3% and the potential native plant community is similar to Loamy upland except production is higher.

The loamy hills range site has deep soils classified as ustollic paleargids or haplargids and argiustolls and paleustalfs (USDA 1992). They have thick (8 to 16 inches), very cobbly and gravelly, dark colored, sandylaom surfaces over dense clay subsoil's. Slopes are from 10 to 35%. The potential native plant community is a grassland with a moderate percentage of low shrubs and succulents.

The granitic hills range site has shallow soils classified as

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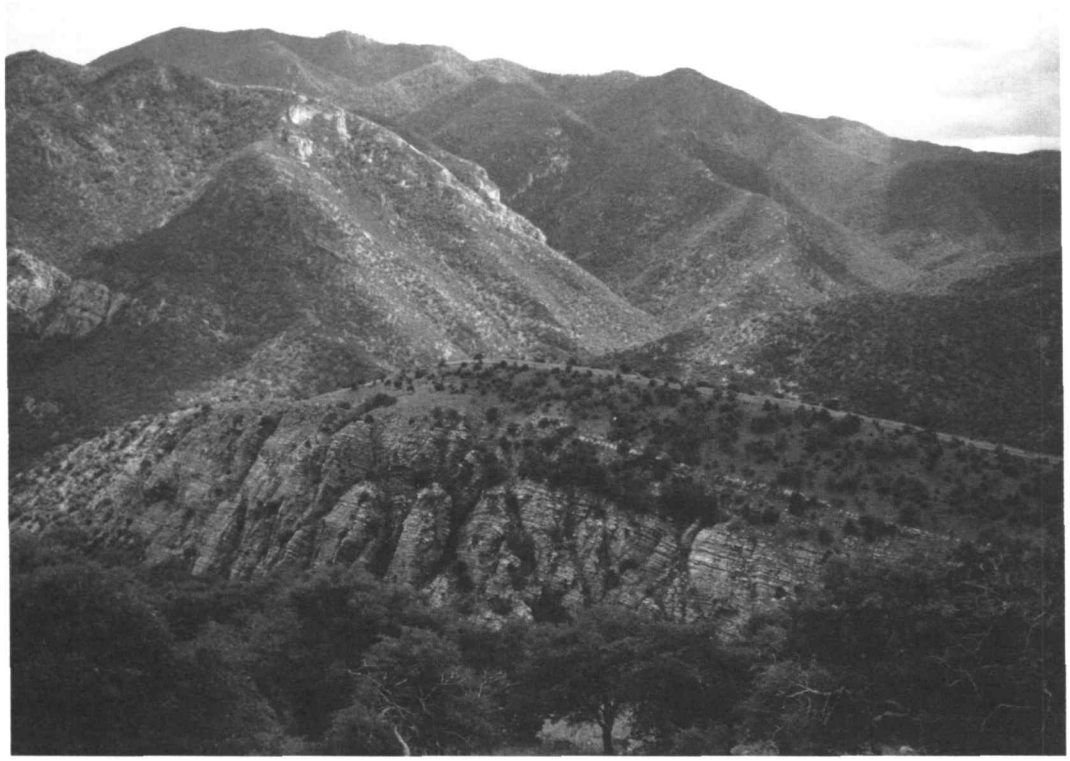


Huachuca Mountains, Ft. Huachuca-Cochise Co., Arizona.

lithic haplustolls and lithic argiustolls (USDA 1992). They have very cobbly and gravelly surfaces, are dark colored loams and sandyloams over slightly weathered granite bedrock. Slopes are from 20 to 50%. The native potential plant community is savannah with a 10 to 25% canopy of Mexican live oaks and an understory of warm season midgrasses, perennial forbs and low shrubs.

One sampling area was selected for each of the range site-burn frequency combinations. Site selection was heavily biased to represent what appeared to be average conditions for the area being studied. This was not a research effort. It was an investigation designed to produce some information about fire effects in a short period of time with a reasonable amount of effort.

Transects used different techniques to measure different attributes of the plant community. Basal, rock and gravel cover were measured as line intercept along three 100 foot steel tapes. Canopy cover was measured as shaded line intercept along the steel tapes at mid day. Frequency data was collected using a 40 square centimeter quadrat in a 100 plot transect. Plant species composition data was determined using the same quadrat size and transect and the Dry Weight Rank method (Ruyle 1988). Plant production data also used the same transect and quadrat size and the Comparative Yield method (Ruyle 1988).

Loamy Upland

This site appears to be the most affected by repeated fires. This site naturally produces a lot of runoff in the summer rainy season. The thin, coarse textured surface cannot capture all of the larger rainfall events. If the surface is not protected by grass and/or gravel cover, accelerated erosion can begin. Basal cover, annual herbage production and number of plant species all declined as fire frequency increased. (Figure 1).

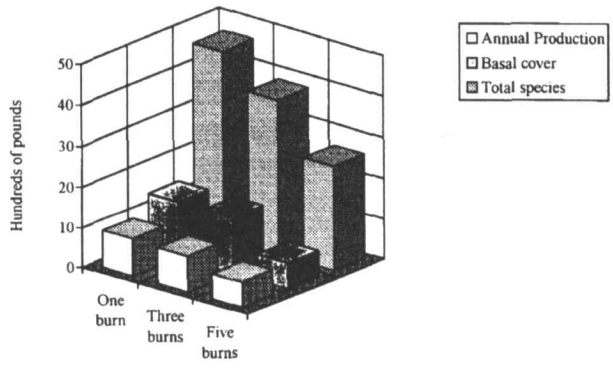


Fig. 1. *Cover, production and total species on Loamy Upland range site*

Basal cover on the one burn and three burn sites was about 15% and no erosion was evident. The site that had burned five times in the last 15 years had only 6.5% basal

Loamy Upland Range Site-five burn area with soil erosion.

cover and visible signs of accelerated erosion. As this site looses its surface horizon to water erosion it becomes less effective in capturing and storing intense summer rainfall. With enough soil loss, the potential productivity declines and the site can no longer support its natural plant community.

Another observation on this site was that even with 5 fires in the last 15 years there was little or no mortality of mature velvet mesquite trees. It appears that, at these elevations (4,800 ft.) and with 16 inches of annual precipitation, established mesquite trees can survive a very frequent summer fire regime.

Due to the delicate nature of this site, a recommended fire free interval would be a minimum of 6 or 7 years. This would allow adequate recovery of the grass cover and minimize soil erosion. An ideal interval would be 10 to 15 years.

Sandyloam Upland

This site, with thick coarse textured surfaces, produces very little runoff in the summer rainy season. Even with repeated fires this site showed no signs of accelerated erosion. Basal cover was nearly the same for all three burn frequencies. This site is the one most favored by Lehmann lovegrass in southeastern Arizona. Lehmann lovegrass is a warm season, perennial bunchgrass, introduced into this area from southern Africa in the 1930's. Since then it has steadily spread across southeastern Arizona developing into nearly monotypic stands on this range site.

Grazing, fire and drought have been implicated in the invasion of native grasslands by this species (Ogden 1988). The opportunistic nature of this species to respond to openings in native plant communities caused by fire (Cable 1965, 1971) and drought (Robinett 1992) has been documented in this region. Frequency of Lehmann lovegrass went from 9% on the one burn site to 96% on the five burn site. This was at the expense of sideoats and black gramas and plains lovegrass (Figure 2). Although annual production and cover remained nearly the same among the three

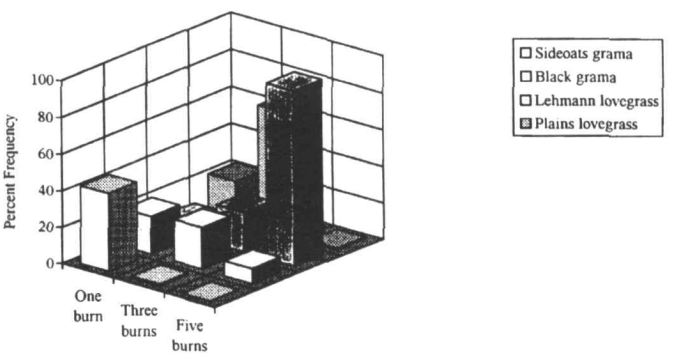


Fig. 2 - *Frequency of grass species on Sandyloam Upland range site*

burn frequencies, total number of plant species declined from 47 on the one burn area to 29 on the five burn area dominated by Lehmann lovegrass.

The ability of mature velvet mesquite trees to withstand frequent fires was noted again on this site. Another observation was that there was considerable decadence of native grass species; sideoats grama, cane bluestem and plains lovegrass in the one burn area (fire in 1984). Correspondingly there was a much higher percentage of annual forbs like goldeneye and aster in the plant community on the one burn area. This was not noticed in the three burn area (last fire in 1988). Regular disturbance, fire or grazing may be needed on this site if the objective is to keep mid grass stands healthy and vigorous. A recommended fire free interval on native stands would be a minimum of 4 to 5 years. An ideal interval would be about 10 years. The presence of Lehmann lovegrass on or near areas of this site poses a dilemma in fire management. With very frequent fire regime the plant community can become a monotype of Lehmann lovegrass. Soil protection will be more than adequate and for some uses like intensive military training this plant community may even be desirable.

Loamy Hills

Loamy Upland Range Site five burn area showing velvet mesquite.

This site has thick coarse textured surfaces, well protected by covers of stones, cobbles and gravels. Even on steep slopes, sites with frequent fires showed no sign of erosion. Basal cover, total number of species and production were the same for all three burn frequencies. Differences in species composition are within the range of variability for major grass groups in the potential plant community on this site (Table 1). Midgrasses like sideoats grama, Arizona cottontop, tanglehead, cane bluestem and green sprangletop are included in a group at 20 to 30 percent on the published range site description (USDA 1988). Range condition scores on the three areas ranged from 70 to 72.

Table 1. Species composition on Loamy Hills range site.

	One burn	Three burns	Five burns
Plain lovegrass	22	24	40
Lehmann lovegrass	0	1	2
Tanglehead	32	6	3
Sideoats grama	6	13	8
Slender grama	1	3	10
Cane beardgrass	6	8	2
Green sprangletop	8	5	4
Fall witchgrass	1	4	10
Threeawns	4	10	3
Arizona cottontop	0	13	1
False mesquite	11	11	16
Palmer agave	4	2	4
Ann. production	2375	2151	2360
Basal cover	15	15.5	16
Cobble cover	14	16	18
Total species	34	37	32

Surface rock fragments on this site not only protect the soil from accelerated erosion but also appear to protect the bases of perennial mid grasses from damage by hot season fires.

This site is a primary habitat for Palmer agave in southeastern Arizona. The blossoms of this agave are a major food source for a nectar-feeding bat which is listed as a endangered species. The lesser long-nosed bat uses saguaro and organpipe flowers in May and June and agave flowers in July and August during its migration from tropical Mexico to Arizona each year. Seedling agave plants are easily killed by hot season fires while older plants appear fire tolerant. One visible difference in the five burn plot on this site is that there are no carcasses of dead agave plants left on the area. Palmer agave lives 15 to 25 years, flowers and dies. The large heavy seeds fall from the panicle straight down and a high proportion of seedling establishment occurs around the base of the dead adult carcass. Frequent fires consume the dry dead plants and intense heating kills any seedlings growing nearby.

Although this site and its herbaceous plant community appear to be very resilient to repeated fires, the recommended fire free interval where Palmer agave is present would be at least 10 years. This interval would allow seedling agave to establish around the dead adults and

achieve enough size to survive burning. It would also allow enough time for the carcass of the parent to decompose reducing the fuel loads around young plants.

Again it was noted that there was considerable decadence among midgrasses like tanglehead, plains lovegrasses and sideoats grama on the one burn area (burn in 1984). This was not noted in the other burn areas. If plant community objectives are to maintain vigorous stands of native grasses on this site, regular disturbance by fire or grazing should be applied. If plant community objectives are to allow for a higher percentage of annual forbs like goldeneye and cudweed on the site, it should be protected from disturbance for longer periods of time.

Grantic Hills

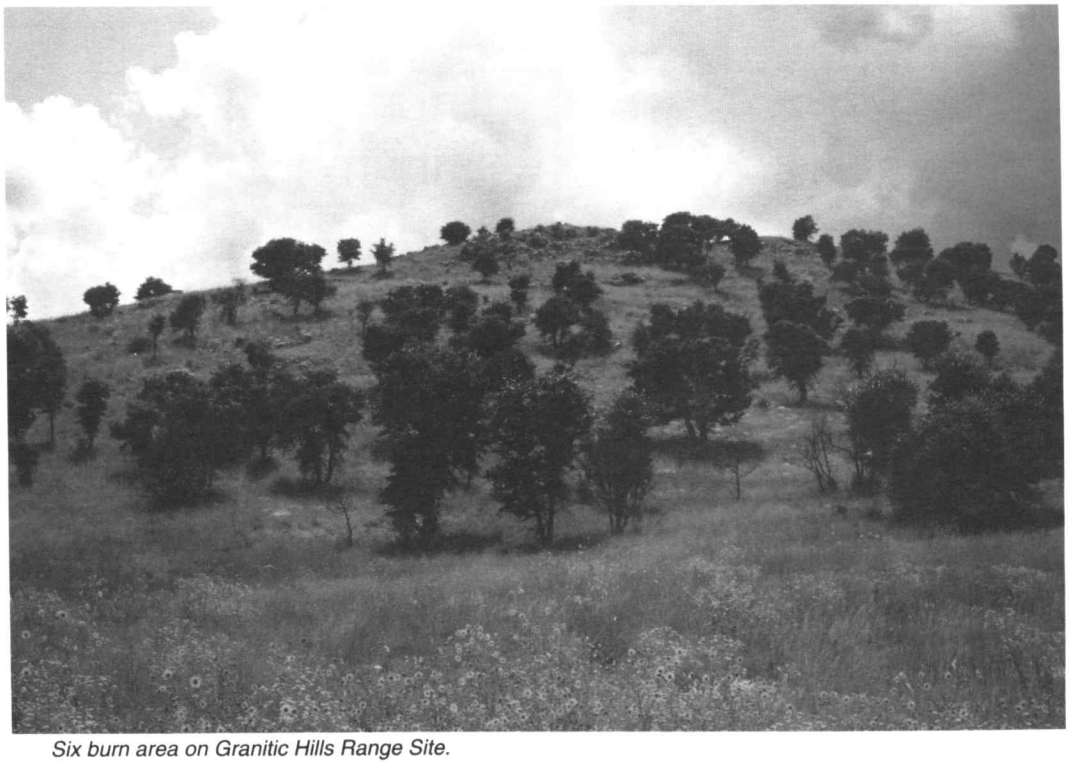
This site has shallow, coarse textured soils well protected by covers of stones, cobbles and gravels. Even on very steep slopes the only area showing signs of accelerated erosion was the 6 burn hillside. The area with three burns in the last 15 years showed no signs of erosion and illustrates the effectiveness of rock fragments and grass cover in protecting the soil and the remarkable adaptations of dominant grasses like Texas bluestem, plains lovegrass, bullgrass and sideoats grama to frequent fires.

Basal cover, annual production and total number of species were not different between the three areas of this site (Table 2). One visible difference was in the crown canopy of oak species found on the site. The 6 burn area had about half the tree canopy of the 1 burn area. These species of evergreen oak are very fire tolerant and vigorous sprouters but a few dead individuals were present on the 6 burn area and the repeated burning appears to prune the tree canopy and reduce it's lateral extent. As expected shade tolerant understory species like sedges and stolon daisy were much more common in the 1 burn area with double the canopy of the 6 burn area.

Table 2. Species composition on Granitic Hills range site.

	One burn	Three burns	Six burns
Texas bluestem	22	21	19
Plains lovegrass	5	11	16
Beggartick threeawn	24	13	6
Sideoats grama	3	25	4
Bullgrass	0	3	15
Squirreltail	5	0	2
Sedge	16	4	8
Oak species	4	3	2
Wedgeleaf haplopappus	3	0	0
Wild bean	4	1	2
Herbaceous sage	1	8	8
Stoloniferous daisy	6	2	0
Ann. production	938	1214	1098
Three canopy cover	23	13	10
Basal cover	8	12.5	9.5
Rock/cobble cover	16	15	16
Total species	57	51	47

The study plots on this site were all on northern aspects. Observations on southern exposures in this same area indicate that Lehmann lovegrass is invading the native plant communities where fires are frequent. Vehicles driving firebreak roads in this area are the probable mechanism for seed dispersal up the slopes.



Six burn area on Granitic Hills Range Site.

The recommended fire free interval for this site would be a minimum of 5 years. A longer interval of 8 to 10 years would allow for higher canopy covers of oak trees on the site. Protecting areas of this site from fire for very long periods of time can lead to thickening of the tree cover to the point where herbaceous understories are greatly reduced. This appears to have happened in the last hundred years in the mountain ranges nearby where grazing reduces fine fuels and protection from fire occurrs (Humphrey 1987). A comparison of photographs from the 1880's taken on Fort Huachuca in areas which have not burned in the last 30 or 40 years, show a thickening of the tree cover in present day scenes. When areas like this do eventually burn, erosion can be serious because there is insufficient grass cover to hold soils in place. Actions to stop the dispersal of seed Lehmann lovegrass onto these slopes will prevent it from invading areas of this site where fires occur.

The general information resulting from should be of interest to landusers and managers in nearby areas. Allowing fires to burn these plant communities at what is thought to be natural intervals of 10 to 20 years does not appear to diminish resource values or productivity. It may actually be beneficial on many sites to keep ungrazed grasslands vigorous and healthy.

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Viewpoint

Dangerous Changes
Rangeland Reform '94—Part One

Heather Smith Thomas

The USDI-Bureau of Land Management and USDA-Forest Service proposed rule changes for public land grazing are very disturbing to ranchers who depend on public lands. It appears that the agencies are trying to reduce or eliminate grazing. Many of the proposed changes will hinder rather than help the permittees, making the use of their ranges more difficult and precarious. The tone of the plans is negative, implying that current grazing practices are somehow damaging the resource, that the livestock industry is guilty of many past and present evils and that the land must now be protected from such abuse. This view ignores actual history and the great strides in range improvement that have been made by ranchers and the BLM over the past 60 years.

There is no credit for years of good stewardship, no recognition of healthy rangelands and increased wildlife. Instead, the agencies seem to be looking at the permittee as some kind of criminal or potential criminal whose use of the land must be more carefully controlled, curtailed or eliminated. All of the proposed rule changes are geared toward less flexibility, more penalties, more constraints on the people using the land for grazing. Violation of any environmental law or regulation could mean cancellation of a permit—even a new or minor law the rancher may not be aware of. Environmental regulations have proliferated so much in recent years that sometimes even the regulators are not sure what is legal.

Grazing can be modified or eliminated where deemed "detrimental to the health of the ecosystem". Who is to determine whether or not it is detrimental? Under the proposed changes, anyone who wishes can become an "affected interest" to be consulted in development of Allotment Management Plans and annual operating plans on an allotment. Decisions may be affected by individuals with a grudge against grazing, the livestock industry, or a certain permittee. The proposed new make-up of advisory boards could also have a negative impact if some of the new representative interests (who could now outnumber grazers 15 to one or even make up the total board) have a personal bias against grazing. How can the stockman be assured of fairness?

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It seems that range science is being thrown out the window in favor of a more emotional and less easily defined "majority rule" on what these lands should be used for. People with no knowledge of plant health, wildlife ecology or historic trend of a range area can now, in a one -point-in-time impression or evaluation, have as much say about the management and future of an allotment as the rancher who has worked with it for 30 or 40 years.

The new rules seem intent on doing away with any semblence of fairness we had in the past. Base property leases (the traditional way for young people the get started in ranching) would be penalized with higher grazing fees. Suspended non-use would be wiped out (some ranchers voluntarily gave up some of their numbers in earlier years to help the range improve) and there would be no way to ever get the numbers back. Permits would be given for shorter terms, which could jeopardize a rancher's ability to obtain financing for their total operation. This would also discourage ranchers from investing money in range improvements and facilities maintenance.

The change in how range improvement funds are used (giving more flexibility to BLM over their use) would mean that some districts would consistently come up short. At present, 25% of funds must be used in the district in which they are collected.

The rule changes on range improvement ownership and water rights seem intent on taking away any last vestiges of a permittee's "rights" as does exempting certain administrative actions from the appeals process. The rancher is totally at the mercy of the agency.

The proposed national standards and guidelines for grazing leave us with serious questions. We have little faith in the centralization of such rules or in the judgment of BLM employees or other range "evaluators" who haven't seen a specific range or see it only once. Many ranges have had no scientific monitoring nor trend studies. The "evaluators" may not be able to tell if it is improving or deteriorating. A range that has been steadily improving under the present permittee (but which is not yet totally "healthy" in the eyes of the evaluator who did not see it 10 or 20 years ago, or "by the book "criteria in national standards and guidelines) may be classed as unsatisfactory and the permittee penalized. All too often, past progress is not recognized.

Some ranges were severely overgrazed in early years,

due to the inadequacy of the homestead laws which did not fit the arid West—where it takes more that 160 or 320 acres for a grazing operation. Ranchers had to pasture their stock on adjacent public land. Early government policy forced the stockman into a situation where he had to complete with his neighbors and itinerant sheepmen for the grass. Ranchers couldn't legally own and control their grazing lands like the farmer-homesteaders who owned their farms. The government's unwillingness to address the western land needs was at the root of the grazing problem, and stockmen begged for some kind of solution, to no avail, until the Taylor Grazing Act was finally passed in 1934. Now the BLM and "environmentalists" are trying to blame the stockman for past abuses that we all must take the blame for, as a nation. The present ranchers, on the whole, have done much to improve the ranges, and on many ranges this improvement is still in progress. These good stewards should not be penalized for past abuses that were not of their doing.

The BLM document states one of its goals for rangeland management is to provide for long-term needs of society. If that term is true, BLM should recognize our country's increasing need for food, fiber and raw products, with a wise ***use*** of our natural resources. As our population increases, we'll need more meat and livestock by-products, not less (all of us use the by-products, whether or not we eat meat). Why try so hard to reduce or eliminate grazing, when past experience has shown good grazing management to be very compatible with other uses and values on public lands, and the livestock industry to be crucial to the stability and economic well-being of western counties.

Healthy rangeland depends upon the grazing animals. Forage grasses evolved under grazing (this is the "natural" condition) and are healthiest if grazed at some point in their growing season. Ungrazed grass becomes coarse, less productive and less vigorous, less palatable to wildlife, and creates a fire hazard.

There are a lot of differences of opinion on what constitutes "overgrazing". Some people think any grazing is too much, not understanding plant ecology and the symbiotic relationship between grass and grazer. There is also a tendency to think that riparian areas are fragile (partly because of all the furor surrounding this controversial issue) when in fact riparian areas are much more resilient than arid uplands. Because they have more water, these areas bounce back faster after grazing, and can withstand more grazing pressure.

A one-point-in-time observation of a range (which some "interested parties" may make, or even some BLM employees) doesn't give the full picture. A range must be looked at over time, in different seasons and different years, to evaluate its plant life. "By the book" guidelines and standards are too arbitrary and will not fit all cases. Riparian areas are unique, as are the allotments in which they exist. Local managers need flexibility in which to judge and care for them, site by site, not arbitrary rules that may not fit the situation.

Viewpoint

Proposed Raise in Grazing Fees
Rangeland Reform '94—Part Two

Heather Smith Thomas

The USDI-Bureau of Land Management and USDA- Forest Service are proposing a substantial raise in grazing fees in their "Rangeland Reform "94". This is a political move to satisfy the people who think fees are too low and that the ranchers are receiving a "subsidy". What many people do not understand is that the "low" fee is just one small portion of the rancher's many costs in using public land. The total costs amount to much more than renting private pasture, yet the rancher is locked into this situation, totally dependent on the public range. He can't just walk away if the fee gets too high, and rent pasture elsewhere; there is not sufficient private pasture available.

The West, being mostly public land, is short on private pasture. If grazing fees get too high, the rancher is out of business. Some will try to pay the higher fee and keep going, but to do so they will cut costs elsewhere, going without something they considered essential before— which may include maintenance and management they performed on federal lands with their own money (improvements that benefit wildlife as well as livestock). The stewardship of our federal lands will be hindered rather than helped by fee increases.

Ranchers don't understand why BLM and FS keep trying to use private land leases as some kind of base for federal lease rates. They are in no way similar. The rancher using public land doesn't have an exclusive or guaranteed use (it could be terminated tomorrow), nor the same value of forage. Private pasture cattle outweigh public range cattle at market. On private pasture the rancher doesn't have to contend with hunters, loggers, miners, oil-drillers, off-road vehicles and other users who leave gates open or camp around the only water sources. On public land there may be predators the rancher cannot legal control, wild horses eating the grass or driving the livestock away from watering areas. On private pasture a rancher can work with the owner to make the pasture better or more workable for livestock (reseeding pastures, putting in corrals or fences, spraying poisonous plants, etc.—things that are often prohibited on public land). The owner of private pasture keeps the fences and facilities in good shape; private pasture rent is higher than federal grazing fees because it is worth a lot more.

Public rangeland usually requires more acres to support a cow, with reduced weight gains, but with higher costs to the rancher in fencing and management. The difficulty in locating and doctoring sick or injured animals (due to the large areas and often rugged terrain) adds to the rancher's costs in death losses. Other out-of-pocket costs are investment in the permit (price of the base ranch included the attached grazing privilege), maintenance of fences and water facilities (signed agreements with BLM to be responsible for their upkeep), and riding to check fences, water and cattle. The rancher also has the expense of moving cattle from pasture to pasture (extra costs of keeping horses or hiring a rider), trucking costs if the range isn't adjacent to the ranch, and many riding days to find and gather all the cattle at the end of the grazing season.

If cattle are bred on the range, investment in bulls is higher, since cattle are widely scattered and it takes more bulls. Conception rates are never as good as on private pasture. Bulls also have to be replaced more often to prevent inbreeding, since all the cattle run together. The rancher cannot manage public range like he would private pastures; there isn't the option of having a separate breeding pasture for the heifers. Thus a bulls must be replaced every two years or they may be breeding their own daughters.

Most ranchers would prefer private pasture (more profitable) but they don't have the choice. Many counties are 90% or more federal land, with little private pasture available. Whenever ranchers are driven off public range by permit cuts or higher fees, the competition becomes even stiffer for private pasture. One reason private lease rates rose so rapidly in the 1960's was the increased demand for the limited private pastures, due in part to drastic reductions of BLM permit numbers.

Grazing fees have been traditionally low because of the rancher's investment in these lands and the acknow-ledgement of their costs in using them. Now these factors are being ignored. Most western ranches are not viable units without the public range. Base property in the Southwest usually consists of a few acres with water; together the public pasture and private water make a workable unit. In the Northwest, many ranches have no agricultural value other than producing winter feed to supplement a range livestock operation. The ranch can't grow crops (because of high altitude, short growing season, rough terrain or not enough water). Even the hay production costs are too high to be profitable. But the ranchers costs average out if there is cheap summer pasture, allowing them to stay in business. Ability to use the range, at a relatively low fee, is crucial to the complete operation.

The proposed new fee formula is skewed when based on private lease rates. The private lease is an artificial base, which will continue to rise as competition becomes more intense. Public range leases cannot begin to compare with private leases, especially as more constraints are placed on using public land. Ranchers on BLM are not leasing pasture

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used solely for grazing nor managed for optimum livestock use, as the proposed rule changes make quite clear. For instance, BLM states that "land treatment solely oriented toward meeting livestock forage requirements will be discontinued". All the proposed changes in **Rangeland Reform '94** are aimed at less emphasis an grazing, yet the BLM wants to charge the rancher ***more*** for something that is being made much more difficult to use. The rule changes make it clear that the rancher is now leasing something worth much less than private pasture, but with additional constraints and an unsure future.

Ranchers have to be able to make a profit using public lands, or they can't afford to use them. The Public Rangelands Improvement Act requires that grazing fees remain reasonable. All the legislative history involving FS and BLM fees show that grazing fees were intended to be based on the rancher's ability to pay, not on some arbitrary value of forage or budget needs of the administrative bureau. The ranchers should not be priced off the range in an attempt to make them pay some mythical "fair market value" that does not take their costs of doing business into account nor their prior commitments tied to use of the grazing (ranchers are different from a buyer in a competitive open market, since the range user is not free to negotiate fees nor quantities of forage, and is a tenant with limited flexibility and mobility—the rancher can only use one specific range since it is the one best used in con-junction with his base property). When the fee gets so high as to put a rancher out of business, this isn't fair market value. A fair market requires a willing seller and willing buyer; fees must be within the rancher's ability to pay.

One of the current arguments for higher fees is that present fees don't cover administrative costs, pointing to the discrepancy between what the agencies take in from fees and what they spend on range management. In 1983, for instance, the agencies collected $24.1 million in grazing fees and spent $60 million on their range program, but as pointed out in an article (September 17, 1984) in *Western Livestock Journal,* only $16.7 million of that was for range improvement and activities directly related to forage production. The agencies spent the other $43 million on non-grazing activities such as planning, recreation programs, wildlife habitat, wild horse and burro management. The $24.1 million income and $60 million outgo didn't mean the ranchers were getting a subsidy; it means the federal bureaucracy is costing the taxpayers more money and blaming the ranchers for not paying the whole tab!

Another aspect of the funding problem is that wildlife interests feel range improvement funds should be spent on projects that specifically benefit wildlife. Thus "range improvement" programs take on costs and projects (and more agency employees) that have less and less to do with grazing, yet the ever-proliferating program is basically funded by grazing fees. If taxpayers want more projects just for wildlife, that's fine, but they shouldn't expect the ranchers to pay for them. That funding should come partly from other interests and users. As the agencies keep growing and hiring more people, the gap between fee revenues and administrative costs continues to widen.

But the costs escalation won't go away, even if grazing is eliminated. The other programs continue to require more money. Some of these programs are dependent on grazing, and there would have to be ***more*** money spent on them if grazing is removed. Rancher improvements and water developments benefit wildlife and wild horses. The BLM would have to construct and maintain water developments and take over the costs now done by the ranchers out of their own pockets. Some of the rancher-owned water developments would not be available to wildlife and wild horses if ranchers are forced off public land and decide to fence off their water or subdivide.

The BLM's present programs would be almost as costly, even without grazing, and more costly in terms of ecological and environmental stability. The ranchers on the land can always do a better job of range management (and at no cost to the already overburdened taxpayer)) than government employees who spend most of their time in an office and are transferred several times in their career.

The agencies should not jeopardize our public lands by ousting the best soil, water and range conservationist. On the marginal lands of the West, these family owned ranches have had to practice good management. The ranchers who wants to stay in business and have a future for their children and grandchildren have taken good care of the land, benefiting all other users at the same time. In many areas private feed and water make up much of the forage and water used by wildlife. If we oust the rancher, we'll also lose that habitat.

For the past 40 years the government agencies have depended upon the financial input of private landowners to help with the protection and care of public land, since federal appropriations for conservation and improvements have never been enough. Let's not hinder the ranchers. It is a basic truth that conservation and good management of natural resources do not thrive in a climate of economic adversity. A permittee making a reasonable satisfactory net income is likely to do a better job of conservation and public land improvement than a permittee who is barely one jump ahead of the creditors. Higher fees will lead to less rancher improvements, which in turn leads to the need for more federal expenditures for the necessary work, a deterioration of the resource (since "government" will not and cannot put the same time and care into improvements like the resident rancher will, who is personally involved and affected) and lead to decreased total fee revenue, since many ranchers will give up their permits.

The most efficient and cost-effective management is by the ranchers. If they have the incentive to maintain and improve the range, through security of tenure (rather than fear of being priced off or having permits reduced or eliminated) they will increase the value of the government's land, enhancing it for wildlife, recreation and aesthetic enjoyment. Letting a tenant improve the land (benefiting themselves and the landlord) is merely good business. By contrast, higher fees lead the rancher to expect a similar trend in the future, discouraging investment in these lands. The BLM's proposals could be very damaging, not only to the ranchers, but also to the lands they are caring for. We need the ranchers as stewards, and agencies should be trying to work with them instead of against them.

Supplemental Winter Feeding

Henry M. Kozak, Robert J. Hudson and Lyle A. Renecker

Farmed wapiti are managed rather intensively for economical reasons (Renecker and Kozak 1987). Supplemental feeding is practiced to habituate and control stock, increase carrying capacity, and complement pasture forage. Taming is facilitated by the reinforcement of controlled daily feeding. Higher stocking rates can be maintained by changing the physical form or chemical composition of the feed. Concentrates may be offered where winter pasture is available but of low quality, whereas sun-cured forage may prove more practical when animals are simply maintained through lean periods (Kozak 1988, Cheeke 1991). This study was conducted to evaluate the physical form of supplemental feed on the performance, natural foraging behavior, and economics of winter feeding of wapiti on game farms.

Methods

Study Site

The study was conducted at the Ministik Wildlife Research Station located approximately 50 km SE of Edmonton, Alberta, Canada. The station is located in the Cooking Lake moraine within the southern fringe of the aspen-dominated boreal forest zone (Rowe 1972) and is comprised of approximately a 265 ha area surrounded by a 2 m high game-proof fence. The station is divided into a game ranch portion containing 194 ha and a game farm portion containing 65 ha.

Table 1. Formulation of the alfalfa/barley pellet used to supplement wapiti hinds at the Ministik Wildlife Research Station, Alberta, Canada.

Ingredient	Dry Matter Composition (%)
Dehydrated Alfalfa	26
Barley	31
Wheat Shorts	14
Beet Pulp	16
Soybean Meal	9
Molasses	4
Trace Min. Salt	<1
Vitamin A D E	<1
Permapellet	<1

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Wapiti grazing on native range without supplementation during winter at the Ministik Wildlife Research Station, Alberta, Canada.

Treatments

From November 1, 1984 to May 1, 1985, four wapiti cows were pastured on 194 ha of native aspen-parkland range without supplementation. Eight others were pastured on 65 ha and offered alfalfa/barley pellets (Table 1) free choice. From December 1, 1985 to May 1, 1986, six cows and two calves grazed 32 ha of native pasture and were supplemented free choice with grass/alfalfa hay. Seven cows and two calves were allowed to graze a similar pasture and

Wapiti being weighed during winter at the Ministik Wildlife Research Station, Alberta, Canada.

were supplemented free choice with an alfalfa/barley pellet. Seven cows and two calves were pastured on 194 ha of native pasture supplement. All animals were given access to trace mineral salt blocks. Animals were randomly placed in groups according to age and body size.

Measurements

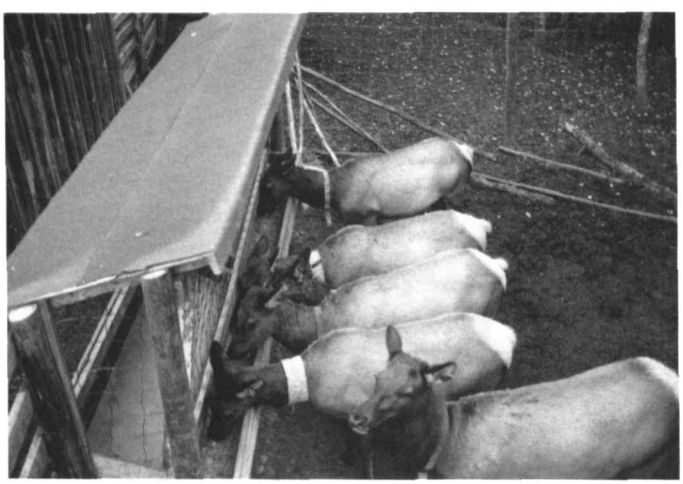
Animals were weighed by-weekly. Supplemental feed was withheld for a period of 2 to 4 days prior to weighing to entice the animals into corrals, bur forage and water were not restricted.

Daily feed consumption (kg/hd/day) was calculated from average monthly feed consumption and the number of animals in each group corrected for the days feed was withheld. Feed was offered in specially constructed feed banks which minimized wastage. Random samples of each feedstuff were collected monthly and analyzed for gross energy, protein, neutral detergent fiber, acid detergent fiber, and lignin (Goering and Van Soest 1970) (Table 2). Digestible dry matter was estimated using the in situ nylon-bag technique and a ruminally-fistulated adult female wapiti maintained on tame grass pasture (Hawley et al. 1981, Fargey and Hawley 1989).

Table 2. Chemical composition of feeds (dry matter basis) used to supplement wapiti hinds at the Ministik Wildlife Research Station, Alberta, Canada.

Item	Alfalfa/Barley Pellet	Alfalfa/Grass Hay
	x	x
Dry Matter (%)	87[a]	85
Protein (%)	17[a]	9
Gross Energy (kJ/g)	18	18
Digestibility Energy (kJ/g)[b]	15[a]	13
Neutral Detergent Fiber (%)	32[a]	57
Acid Detergent Fiber (%)	16[a]	32
Lignin (%)	3[a]	4

[a]Significant difference (*P> 0.05*) between means.
[b]Estimated using in situ nylon-bag technique.



Wapiti supplemented with alfalfa/barley pellets during winter at the Ministik Wildlife Research Station, Alberta, Canada.

During January, February, and March 1986, dawn-to-dusk (10-hr) behavior scans were conducted on cows (accompanied by calves) in the alfalfa/grass hay- and pellet-supplemented groups. Time spent in behavioral activities was determined by instantaneous scan sampling by a close-observer at 10 min. intervals (Jacobsen and Wiggins 1982). Behavioral categories included: *feeding* (supplemental feed only), *browsing/grazing* (native pasture), *active* (non feeding), and *inactive*.

Results and Discussion

Voluntary intake declined from November to April (Fig .1). Intake of hay was approximately 1 kg/hd/day lower than

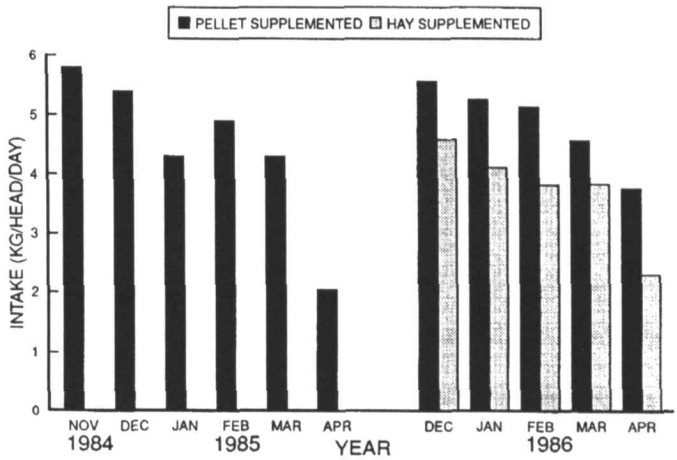


Fig. 1. *Estimated daily voluntary intake (kg/head) of supplemental feed by wapiti hinds on 2 different rations during the winters of 1984-85 and 1985-86 at the Ministik Wildlife Research Station, Alberta, Canada.*

that of the pellets in all months. The lower intake of pellets in 1984-85 compared to 1985-86 is unexplained since higher intakes might be expected under more harsh conditions. Higher intakes by the pellet- in comparison to the alfalfa/grass hay-supplemented group may be attributed to the greater density and faster rate of passage of the diet. Feeding pelleted alfalfa to penned wapiti has been observed to result in a 22% greater intake, 91% faster rate of passage, and 12% lower digestibility than if long alfalfa is fed (Thorne and Butler 1976).

During the harsh winter of 1984-1985, the monthly weights between the supplemented and pellet-supplemented groups were significantly different (Fig. 2). Unsupplemented animals underwent rapid weight loss (11% of the peak November weight) until February when they were given controlled quantities of supplement until spring green-up. The pellet-supplemented group gained weight until March. In the milder winter of 1985-86, there was no difference in weights between the pellet- and alfalfa/grass hay-fed groups (Fig. 2). Unsupplemented animals

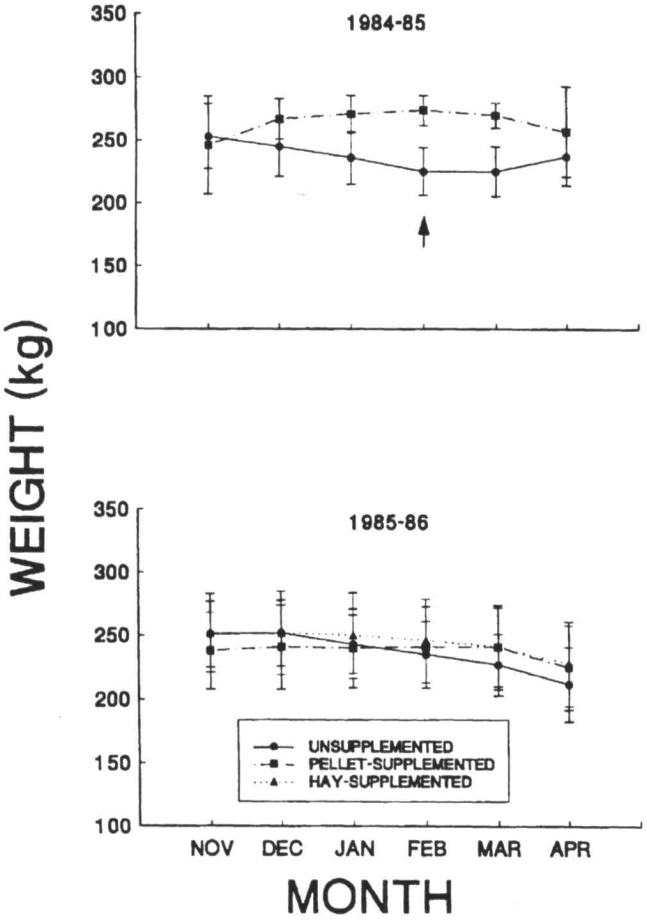


Fig. 2. *Mean ±SD monthly winter body weights of unsupplemented, alfalfa/hay-, and pellet-supplemented wapiti hinds during the winters of 1984-85 and 1985-86 at the Ministik Wildlife Research Station, Alberta, Canada. The symbol ↑ indicates when the unsupplemented group was taken off of pasture and supplemented with alfalfa/grass hay.*

lost 16% of their peak December weight, followed by the hay group (9% of their peak December weight), and the pellet-supplemented group (6% of their peak December weight).

Overwinter weight loss of up to 30% is common in wild populations of red deer (Mitchell 1972; Moore and Brown 1977). Free-ranging white-tailed deer lost 16-20% of their weight during winter while supplemented does lost 8% weight during this period (Ozoga and Verme 1982). High arctic wild reindeer on Svalbard Island lost up to 29% body weight overwinter (Tyler 1987). In the present study, pellet-supplemented wapiti hinds gained weight during winter which is what Dean et al. (1976) observed for wapiti in Wyoming.

A significant difference was found in the foraging patterns between wapiti that were fed the pellet supplement and those offered only alfalfa/grass hay. Alfalfa/grass hay-fed animals spent more time eating their supplement, little time foraging, and in February, more time resting (Fig. 3). Wapiti supplemented with a pellet diet spent from 15% to 39% of their daytime activity foraging on native vegetation compared to the hay-supplemented wapiti which did not spend any time foraging on native range.

Thorne and Butler (1976) found that free-ranging wapiti fed pelleted alfalfa spend much more time foraging on native vegetation than do wapiti fed baled or cubed alfalfa. The overall higher levels of foraging exhibited by pellet-fed wapiti in our study may be a result of fiber deficiencies, either total fiber or fiber length, since protein and energy were not limiting in the diet. This was demonstrated by the maintenance of over-winter weight by the pellet-fed group. The lack of grazing/browsing behavior by the alfalfa/grass hay-fed group indicates the supplement met the dietary requirements. The pellet-fed wapiti possibly increased the fiber component of their diet through browsing and grazing.

Perinatal calf mortality and an abortion were both observed in this study (Kozak 1988). Chances for calf survival fall below 50% when birth weight is below 11.4 kg (Throne et al. 1976). It is possible that the abortion was a

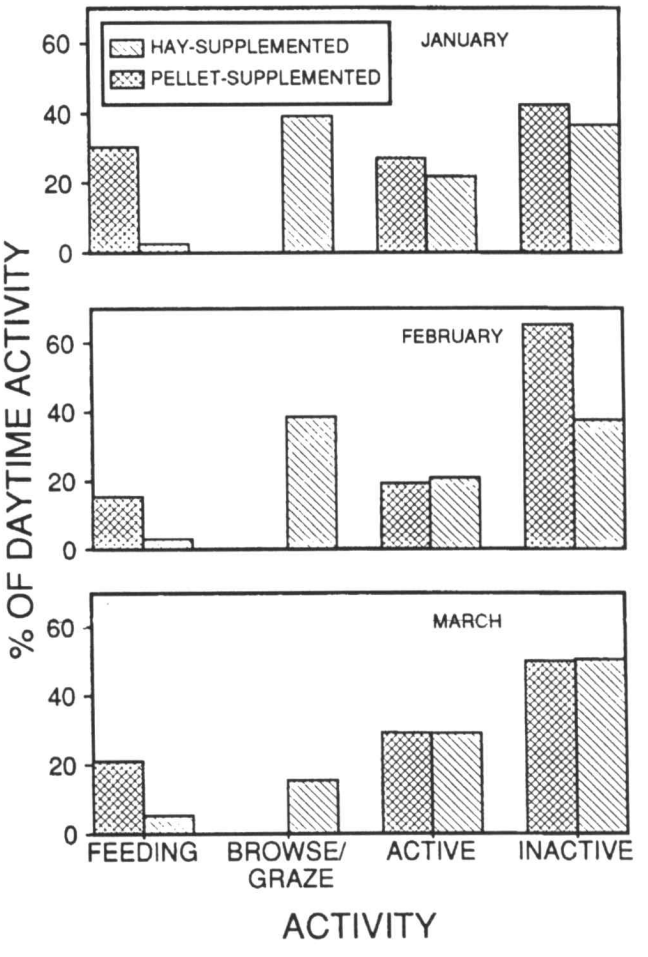


Fig. 3. *Percent daytime winter activity of alfalfa/grass hay- and pellet-supplemented wapiti hinds from January-March, 1986, at the Ministik Wildlife Research Station, Alberta, Canada.*

result of a loss in body condition, because the un-supplemented group underwent weight losses of 11% by February.

A major consideration of any winter feeding program is cost. The cost of pellets was approximately 2.5 times more than long alfalfa/grass hay, the pellet group cost US $0.70 hd/day to feed in comparison to US $0.23 hd/day for the alfalfa/grass hay group over the January to March period. Thorne and Butler (1976) calculated that pelleted alfalfa cost 21% more per tonne than baled long alfalfa, but about 15% less was required for maintenance of body weight (due to wastage of baled alfalfa on the feeding grounds). Pelleting alfalfa did not provide an economic advantage. In the present study, feed was supplied free choice and resulted in higher feed costs by feeding the pellet diet due to its higher consumption. In addition, practical nutritional management of over-wintering wapiti hinds recognizes the need for animals to lose some weight in order to avoid possible calving difficulty the subsequent spring (Fennessy et al. 1991; Fennessy and Milligan 1987). Of course, allowable weight loss always depends on peak autumn weight (condition) of the pregnant cow.

Conclusions

Concentrate diets which are low in fiber content can be used to increase the utilization of winter pasture. Conversely, a bulk diet which is high in fiber can reduce grazing pressure. Feeding a supplemental pelleted diet results in a rapid rate of gastrointestinal passage of solids (Uden 1988) which is advantageous in livestock feeding where quick gains are the objective and feed is relatively unlimited. When feeding wapiti for maintenance and successful gestation and parturition at minimal cost, rapid gastrointestinal passage rate and high intake characteristics of pelleted rations may be undesirable. Calving difficulties can occur in obese females. Under these conditions, roughage diets are more suitable.

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CHANGE ON THE RANGE . . . MONGOLIAN STYLE

Michael R. Frisina and Raul Valdez

It was an atmosphere charged with change and optimism that we found upon arrival in Mongolia during the fall of 1993. We were invited to Mongolia to assist the government implement improved rangeland and wildlife resource management. Our main objective was to survey the wild Argali sheep and to assist the Mongolian people initiate management programs designed to maintain this economically important rangeland resource. This article documents our general observations related to rangeland resources in Mongolia during a historic time of change.

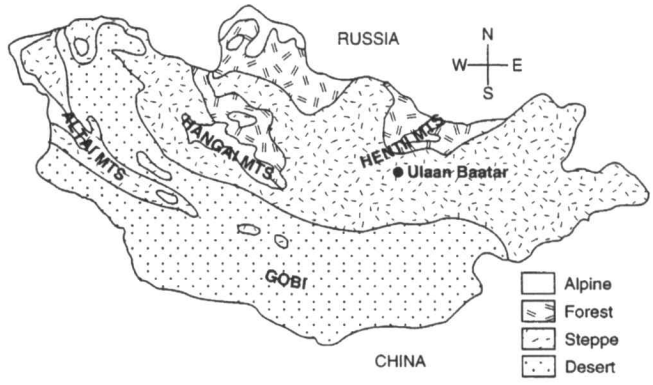
Possibly the most significant change to occur in Mongolia since Ghengis Kahn and his Mongol cavalry conquered China and eastern Europe during the twelfth century happened in 1990. The Mongolian Peoples Republic, a Soviet satellite since the 1920's, suddenly found itself free of Russian domination and faced with the challenges of self determination. Mongolia is a country in rapid transition, redefining itself and reclaiming its cultural heritage and sense of history.

Mongolia: An Overview

Mongolia, a romantic and mysterious land, is a large isolated nation of 2.5 million people. Boxed between China and Russia, for over 60 years it was valued by the Soviet Union as a protective buffer with China.

The country's only large city and capital, Ulaanbaatar, is home to about one third of the nation's population. Mongolia's low population density is in itself an anomaly for Asia. Due to a lack of infrastructure, people live their lives isolated from most of the world with few modern conveniences. Some estimates indicate there are about 13 domestic livestock per person in the country. Horses and sheep provide both a basis for Mongolia's culture and means of sustenance from which most products of survival are produced in this agrarian society. The lifestyle and living conditions remind one of western pioneers who maintained an existence in the arid lands of the American West.

For thousands of years, Mongolians have survived by practicing animal husbandry as nomadic or seminomadic herdsmen. People live scattered about the countryside, tending herds of horses and flocks of sheep and goats, living in small round mobile tents called yurts by westerners and gers by Mongolians. Much of Mongolia's cultural heritage, including language, religion, and history, was almost lost under Communist rule. Mongolians are currently rediscovering their past with great enthusiasm. Ghengis Kahn has been reaffirmed as the greatest Mongolian national hero of all time. Societal upheaval is occurring with hardship. The Russians left taking with them the country's economy. Mongolia was dependent upon the Soviet Union for manufactured goods; the Soviets were their major trading partner. However, due to ethnic homogeneity, transition is occuring without the violence currently common in Eastern Europe.



Map of Mongolia illustrating the country's land form and vegetation.

Physical Description

Mongolia is a landlocked country approximately the size of Alaska or two and one half times the size of Texas, encompassing 604,103 square miles. The climate is continental with long cold winters and short humid summers. January is the coldest month with temperatures often -22 degrees F or colder in contrast to over 95 degrees F during July, the warmest month. Rainfall is highly variable averaging 18 inches in the mountains and 4 inches in the Gobi Desert. Sudden downpours causing extensive flash flooding are common. Mongolia is famous for its clear, sunny days, which create a visual openness across its landscape.

The landscape is complex with great diversity both in land form and vegetation. Mongolia's land base is composed of high mountains, plateaus and uplands varying in elevation

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from about 1,640 feet in the Gobi Desert to 14,331 feet on Mount Monch Chajrchan in the Altai Region. Bespalov (1964) classified Mongolia's land form and vegetation into four major plant communities as they are generally located from north to south.

Alpine and High Mountain Tundra: Due to poorly developed soil cover, vegetation is concentrated mainly in small turfy patches. Fescues, meadow-grasses, and reed grasses are common. Sedges and rushes also occur. Thickets of willow, dwarf birch and occasional cedar add to the landscape's diversity.

Forest: Forests are very limited in a distribution of discontinuous patches, localized chiefly along northern slopes. The patchiness of forests is likely due to the dry climate. Pine is common with some larch and cedar also present. Spruce occurs along some river courses. Aspen and birch occur only at lower elevations. A variety of berry bushes grow within Mongolian forests.

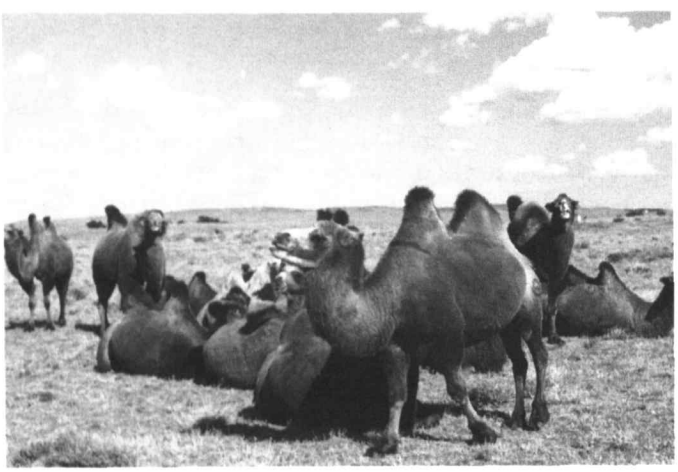
Steppe: The Mongolian steppe plant communities occur on either gently rolling plains or as grasslands at the edge of forests or sometimes within forest clearings. Grass covers 60 to 80 percent of the soil surface. Stipa, fescues, wheatgrasses, brome grasses and meadow grasses commonly occur. A variety of forbs, shrubs and sedges also contribute to the broad vegetative diversity.

Desert: The desert type comprises most of the Gobi Region and is characterized by extreme sparseness and low growth of herbage particularly in southern portions. Large portions of the Gobi are also often referred to as semi-desert or desert steppe. Although many plants are hard and coarse, a characteristic of the Gobi is a more frequent occurrance of vegetative succulance than other deserts. Wild onion, shrubs of the pea family, sages, feather grasses and stipas are key components of the Gobi's plant communities.

The horse is important culturally and agriculturally in Mongolia.

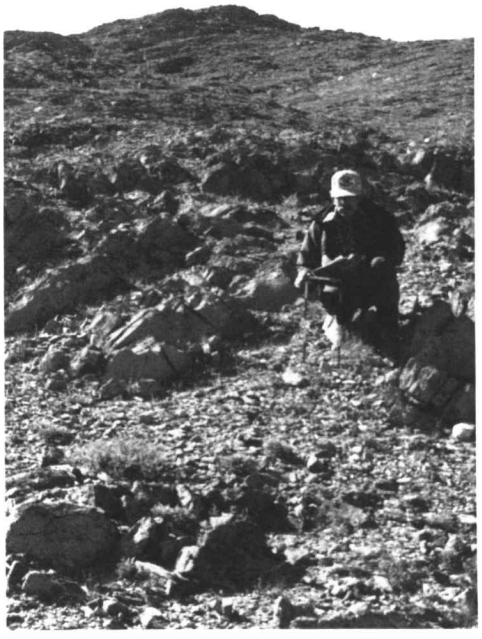
Rangelands

Approximately 79% of Mongolia's land area is rangeland, 10% is forest, and 1% is arable. Mongolia's rangelands have been the country's source of sustenance since time immemorial and therefore its most valuable natural resource. Nomadic and seminomadic livestock herders are as much a component of Mongolia's landform as the vegetation. Human activity related to livestock grazing exerts a major influence on Mongolia's landscape. Mongolia's 12 million domestic sheep constitute 59% of its 22.5 million livestock and provide 60% of the nation's meat and 73% of its wool. In addition, 4.3 million goats, 2.4 million cattle, 2 million horses and .5 million camels utilize Mongolia's grazing lands (Academy of Sciences MPR, 1990). Most of Mongolia's population is scattered throughout the countryside tending their flocks. Their culture and life-style is simi-



Camels are an important source of dairy products in the Gobi region.

Gobi Argali utilize upland desert habitats.



Assessing wild sheep habitats was an important aspect of our work in Mongolia.

lar to Mongol herders in China's Inner Mongolia described by Frisina (1992).

Wildlife

Although Mongolian wildlife is an economically important rangeland resource, only general surveys have been conducted. The principal studies of Mongolian mammals are those of Allen (1938 and 1940) and Bannikov (1954) which is written in Russian. Allen's work was part of a multivolume series based on the American Museum of Natural History's Central Asiatic Expedition led by Roy Chapman Andrews (1939). After 1930, Mongolia was accessible only to Soviet and Eastern European biologists. Oddly enough, western hunters have been allowed access since 1967 due to the high prices they are willing to pay.

American and European hunters were lured to Mongolia because of the widespread big game populations which were then largely unexploited. Wild sheep have always been particularly alluring to American hunters. Mongolia supports populations of two subspecies of argalis or giant sheep of Central Asia, namely, Altai and Gobi argalis. Altai argalis attain horn lengths of 71 inches and basal circumferences of 23 inches. Argalis are widespread in the Gobi Desert and occupy portions of the Altai Mountains. European hunters prefer Ibex which occur throughout southern and western Mongolia. However, the most important big game species in terms of numbers harvested by foreign hunters, is the Mongolian wapiti. Wapiti occur throughout the forested regions, portions of the steppe, and sporadically in extreme western Mongolia. Other forest game include wild pigs, roedeer, moose, and brown bears. Caribou occur only in the extreme northwestern border of Havsgol Province. Plains game include goitered or black-tailed gazelles in desert and steppe regions and white-tailed gazelle or zeren in eastern grasslands. Wild equids include wild onagers or asses in southern Mongolia and a recently re-established population of Przewalski horses, the original steppe horse, which were extirpated during the early twentieth century. Economically important furbearers include red foxes, Corsac foxes, wolves, weasels, and long-tailed susliks (a rodent) and marmots.

Similarities between mammalian components of North America and Mongolia come as a surprise to many American biologists. Indeed, it is difficult to differentiate Mongolian and American elk or wapiti. Faunal similarities are due to the fact that most North American big game mammals including elk, moose, caribou, and brown bears or grizzlies originated in Asia and migrated to North American within the last 15,000 years via the Bering land bridge.

Resource Management in Transition

Mongolia has initiated the difficult process of developing an open society based on private enterprise and a democratic government. Mongolians are beginning to realize the need to efficiently manage natural resources for economic and social benefits. The country's economic collapse since the Russian exodus has added further impetus to find solutions. Its increasing human population is once again almost totally dependent upon livestock production. It is imperative that Mongolia develop effective long-range management strategies to maximize use of its rangelands without degradation. Its rangelands are being overutilized and mismanaged in many areas. Much of Mongolia's rangelands occur in fragile desert and semidesert environments. Unfortunately, there exists practically no modern rangeland management expertise within the country. Mongolia is aware of its lack of expertise and has initiated rangelands studies with foreign technical assistance.

Until recently, a desire to emphasize wise management of important wildlife species such as argali wild sheep also was lacking. Wildlife, although important economically and culturally, was all but taken for granted by the former Communist government. The effects of unregulated land use and habitat degradation received little consideration.

Mongolian wapiti is the most important big game species in terms of numbers harvested by foreign hunters.

Mongolia's ecotourism and hunting industry is dependent upon clients from western countries who have a concern for wise utilization of rangeland resources and a strong wildlife conservation ethic. These factors, in combination with intensified use of natural resources, has created an urgent need for technical assistance in order to develop long-term solutions rapidly.

A concern for the status of argali wild sheep populations, one of the most desired big game trophies of American hunters, resulted in our involvement in a field survey in 1993. We conducted preliminary field surveys in the Gobi Desert and Altai Mountains where we collected essential baseline information needed to integrate management of wild sheep populations with livestock grazing, the dominant land use. Mongolian private enterprises and governmental agencies, in cooperation with western hunter conservation organizations, initiated the survey to determine abundance and distribution of Mongolian populations and habitat preferences. Like American hunters, Mongolian hunters organizations are actively participating in creating an awareness of the value of wildlife and demanding governmental conservation programs.

As in western North America, wildlife will continue to be a secondary land use. Livestock grazing by Mongolia's nomadic herdsmen will continue to be the foundation from which the country's cultural and economic needs are based. However, as we have demonstrated in the United States, by implementing resource management programs giving consideration to multiple values, both the products of society and thriving wildlife populations can be maintained. Successful wildlife management in Mongolia will depend upon implementing strategies for managed livestock grazing that maintain the health of soils and vegetation while providing for the habitat needs of wild animals and the human society. A successful approach will also require integrating western techniques with the knowledge Mongolian herdsmen have gathered over several thousand years of interdependency upon the grassland.

Conclusions

Mongolia's sudden leap into a capitalistic economic system will require efficient management of natural resources in order to compete in the free market place. Presently, livestock and rangeland management programs are in need of modernization. It will require much effort in cooperation with livestock producers to implement management strategies to protect Mongolia's rangeland resource. However, the process to implement management that combines maintenance of wildlife habitat while producing livestock related products has begun.

In the final analysis, it is truly a small world. Even though Mongolia is a remote land, far removed from our culture, the country's natural resource management issues are only a 14-hour airplane ride from our own.

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Are Small-acreage Livestock Producers Real Ranchers?

R. C. Rowan

During the gradual approach flight into Dallas/Ft. Worth airport one night several years ago, I peered out the window at the numerous lights that dotted the rural landscape and wondered about the folks living there. Most likely, I was viewing the yard lights of various Texas "ranches." In some areas the lights were in close proximity, and in other instances there was considerable distance between them. Obviously, some of the ranches were large and many were small. I mused about the reasons that might have caused people to settle those particular spots in what we call the "country." I could not from my bird's-eye view know the reasons why or how small-acreage ranchers remained on the land. But those are questions that are, or should be, of interest to the rangeland discipline. The trend in ranch size in the U.S. is towards smaller units. Texas ranches are no different. There are still many large ranches in Texas, but the majority are small.

For example, more than three-fourths of all farms/ranches in Texas are less than 500 acres (U.S. Dept. of Commerce 1987). In addition, eighty-one percent of beef cattle farms/ranches in Texas have fewer than 50 cows in their livestock inventory and these operations produce more than thirty percent of the total number of beef cows. Less than one percent of all farms/ranches in Texas have more than 500 cows in their operations, but they produce nearly twenty percent of all beef cows.

In a statewide mail survey of Texas ranchers (Rowan and White 1994) the median ranch size (650 ac) was much smaller than the mean size (5,660 ac). The distribution was skewed towards a relatively large number of smaller-sized ranches. Much of the emphasis of extension programs and publications has been to assist the traditional full-time agricultural clientele, with larger than average acreages. Traditional economic rationale presupposes that ranchers who, at the very least, aspire to the goal of economic security should manage their resources to attain that goal. But Gessaman (1989) noted that few ranchers have actually identified their goals and those few who have identified goals rarely achieve them.

Obviously, much more information is needed about rancher's knowledge of ecological principles, about the information sources they utilize in the decision-making process, and about how their decisions impact rangeland resources. Personal interviews of ranchers can be a valuable source of information as well as a vehicle to disseminate information. However, the objectives must be specific. The kinds of information that the researcher expects to collect must be carefully considered in order that the interview process does not degenerate into just a listening session. In addition, when objectives are unstructured the researcher will obtain many answers, but the relationship to specific questions is ambiguous (Taylor-Powell and Marshall 1989). Therefore, researchers come away from the interview with data of little value and the rancher feels that the researcher does not value the lessons learned from experience.

Small-acreage operators in Texas may have specialty enterprises, such as thoroughbred race horses, even though the owner's primary occupation is off-ranch.

To change rancher's perceptions of economic and ecological consequences of management decisions one must consider the reasons why ranchers enter their chosen vocation and what they hope to achieve. Therefore, this study was designed to profile the characteristics of small-acreage operators and to identify their strategic, tactical, and operational management goals.

Methods

From the 1990 statewide survey of Texas ranchers, smaller sized ranches were more frequently encountered in the eastern part of Texas and most notably in the Blacklands/Cross Timbers region (Rowan and White 1994). The median size ranch in this region (271 ac) was used as the critical mark below which ranches were considered to be small-acreage ranches. Respondents from the mail survey in counties within the Blacklands/Cross Timbers region

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conforming to this size restriction were eligible for personal interviewing.

A random list of 50 names was selected from the eligible list and each received an introductory letter during the fall of 1991 to solicit interest in the interview process. A self-addressed, stamped postcard was enclosed with the letter so that ranchers could record their consent to be interviewed. Replacement names were randomly selected from the eligible list until sufficient ranchers consented to be interviewed.

Interviews were designed to collect information about personal and ranch characteristics, as well as strategic, tactical, and operational management goals. Ranchers were supplied a list of goals within each category and asked to rank their most important goals. This portion of the personal interview questionnaire was adapted from Total Ranch Management material. Ranchers attending those workshops often cite the following strategic ranch goals as important: maintaining ranch ownership for children's inheritance, meeting family living expenses, having adequate security against catastrophic losses, and making a profit for investment and improvements (White 1987). Ranchers attending Total Ranch Management workshops represent various sized operations, and thus had goals ranging from profit-oriented to family-oriented. Different strategic goals may warrant different management of resources. Thus, hierarchical goal formation leads from strategic goals to personal/resource goals which include: lifestyle, financial, rangeland, animal, physical, and human. Within each category, respondents were asked to identify those tactical goals that most closely matched their management approach.

For any pair of strategic goals, resource goals may overlap (complementary) or they may diverge in different directions (antagonistic). Consequently, resource goals chosen by ranchers were compared to determine if those ranchers who set a specific strategic goal differed in the way they chose resource goals from those ranchers choosing resource goals under a different strategic goal.

Some tracts serve as retirement homes where livestock gives the owner "something to do."

The survey instrument was pretested on three ranchers who were not part of the eligible population. Each rancher operated approximately the same sized Blacklands/Cross Timbers ranch as the targeted group.

Respondent ranchers from the Blacklands/Cross Timbers region were statistically compared against nonrespondents from the same region to determine if interviewed ranchers were representative of all small-acreage ranchers in that region of Texas. Statistical tests were performed on variables for age of rancher, number of acres in the ranch, number of acres of owned rangeland, number of years operating the current ranch, and number of years of total ranching experience.

Results

A total of 128 respondents from the statewide mail survey matched the restrictions set out in the Methods section. Approximately one-half of the eligible small-acreage ranchers eventually responded by postcard. Of this number, approximately one-half consented to be interviewed. Twenty eight ranchers representing 24 Texas counties in the Blacklands/Cross Timbers region were interviewed (Fig. 1).

No differences were discovered between the interviewed group of ranchers and nonrespondents within that region for any of the interval variables measured. The means for respondent age, years ranching, and years operating the current ranch were similar to means for all Texas ranchers (regardless of size) from the statewide mail survey (Rowan and White 1994). Therefore, interviewed ranchers were accepted as representative of the small-acreage ranching group in the Blacklands/Cross Timbers region of Texas and that in-depth information could be applied to all small-acreage ranchers in that region.

Respondent Profile

Small-acreage operators averaged 58 years of age. Eighty-six percent were married and most had children. The average respondent had been ranching nearly a quarter century, of which seventeen years were on the current ranch. Nearly all of the ranches were operated as single proprietorships. Two-thirds of the small-acreage ranchers lived on the ranch they operated. For those not living on the ranch, the average distance to their ranch was 28 miles. Nine of ten small-acreage ranchers qualified for agricultural exemptions on their county property taxes. Using the midpoint of the income categories ($10,000 increments), the average off-ranch income for the respondents was $30,000. Average gross income from all sources was approximately $65,000. Primary investments included savings accounts (70% of respondents) and certificates of deposit (74% of respondents). Only twenty-nine percent of respondents were employed off of the ranch due to the high percentage of persons over-65 years of age in the sample. However, nearly two-thirds of the married rancher's spous-

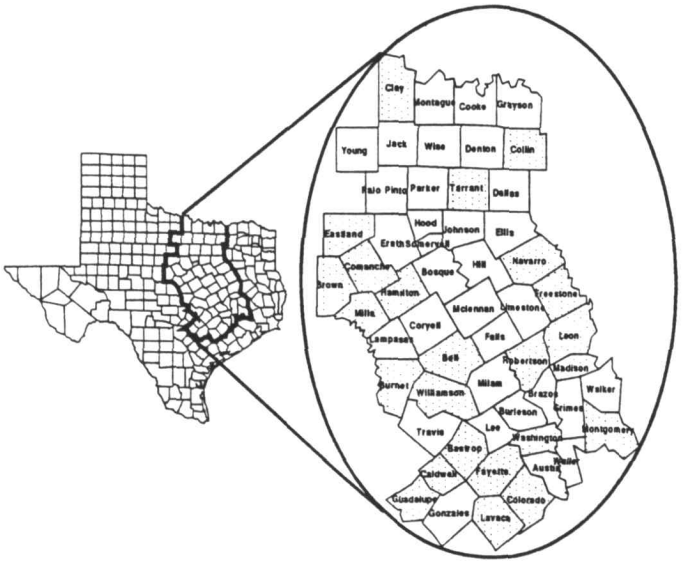


Fig. 1. *Map of Blacklands/Cross Timbers region of Texas with counties highlighted where ranch interviews took place.*

es worked off of the ranch. For those respondents with off-ranch jobs, three-fourths considered the income from their jobs critical for meeting family living expenses and nearly two-thirds considered their incomes critical for meeting ranch finances. However, when respondents were asked to characterize their spouse's jobs, more than three-fourths of the respondents described their spouse's incomes as critical for meeting family living expenses, but just over one-fourth described their spouse's income as critical for ranch finances.

Table 1. Personal and ranch characteristics of small-acreage rancher sample with mean values and number of respondents for selected questions.

Variable	n	Mean
Total number of acres in the ranch	28	172
Number of acres of rangeland	22	57
Number of acres of pasture	24	80
Number of acres of buildings	26	3
Number of acres of cropland	9	32
Number of acres owned	28	129
Number of acres leased from someone else	7	43
Number of acres managed for someone else	1	0
Number of acres purchased in last 10 years	3	21
Number of acres sold in last 10 years	2	7
Number of years in ranching	28	23
Number of years operating this ranch	28	17
Average hours/week respondent works on ranch	27	30
Average hours/week spouse works on ranch	23	6
Average number of children	26	2.5
Average age of respondent	28	58
Average age of children	25	32
Average hours/week children work on ranch	6	27
Distance in miles to most used auction barn	23	12

The average small-acreage rancher operated 172 acres, of which 129 acres were owned and 43 acres leased from someone else. None of the ranchers interviewed were leasing any land to someone else. Acquisition of the average owned acreage (129 acres) was a combination of purchases (109 acres) and inheritance (20 acres). Land acquisition by the average small-acreage rancher was fairly static (Table 1). Fifty-nine percent of ranchers with purchased acreage owned the land without debt. When asked to disclose the amount of current debt on land (same categories as income), the average debt level was $27,000. The most common lending source utilized by nearly half of small-acreage ranchers with real estate debt was commercial bank financing.

Half of respondents were utilizing a commercial cow/calf enterprise solely or in combination with another animal enterprise. Forty-three percent were operating registered cattle operations. Only a few had stocker cattle enterprises. None of the Blacklands/Cross Timbers ranchers utilized commercial or registered sheep enterprises. Only one rancher had spanish goats and none had Angora goats.

Since the ranches under consideration were small, wildlife enterprises were not common. A few ranchers (11%) were cognizant of wildlife when preparing management plans, regardless of whether they derived income from wildlife. One rancher operated, exclusively, an exotic wildlife enterprise.

When asked if they set financial goals for their animal enterprises, only thirty-seven percent of ranchers responded positively. Setting goals for each enterprise would allow ranchers to evaluate movement toward these goals. Without some form of evaluation it would be hard for ranchers to know how effective their chosen enterprises were moving them towards their goals. For ranchers who had set enterprise goals, only a third indicated they were satisfied

Other small-acreages are weekend spots to escape fast-paced urban life.

with progress toward achieving their goals while more than one-half were dissatisfied. Dissatisfaction with current enterprises did not necessarily equate with change because thirty-six percent of respondents said they had no reason to change the type of enterprises on their ranches. If changing their operation was considered an option, available capital and labor requirements were the largest obstacles to change. Neither fear of failing in a new enterprise nor insufficient information to begin a new enterprise were considered obstacles to change.

Livestock marketing practices are often a function of ranch size. This was no exception for the small-acreage ranchers. Ninety-six percent indicated they used an auction barn in their ranching operation. When ranchers utilized an auction barn, most of the time it was the auction barn closest to their ranch, an average distance of 12 miles. As an alternate marketing source, nearly half of small-acreage ranchers utilized private-treaty sale of livestock either exclusively or in combination with other marketing strategies. None of the ranchers utilized advance marketing or the futures market.

Record keeping is a practice often overlooked by ranchers. This was clearly demonstrated by responses to questions about the type of records kept by ranchers. Forty-six percent reported keeping a balance sheet, thirty-one percent kept an income statement, twelve percent kept a cash flow statement, and none used a budget.

Table 2. First, second, and third choice strategic ranch goals selected by Blacklands/Cross Timbers' respondents ranked in descending order of importance of first choice goal.

Strategic Goal	First Choice	Second Choice	Third Choice
	-- % of all respondents- -		
1. Like to live in the country	43	4	11
2. Want to work with livestock	14	21	18
3. Improve the land	14	18	14
4. Want the ranch to be retirement home	11	7	0
5. Want children to grow up in the country	11	11	0
6. Want ranch to help meet financial needs	7	0	25
7. Want to stay in the ranching business	0	14	0
8. Want to make an economic profit	0	7	18
9. Want the solitude and serenity	0	7	4
10. Want to be own boss	0	4	7
11. Want to protect the environment	0	4	0
12. Enjoy ranching more than anything else	0	4	0
13. Make enough money to buy more land	0	0	4
	100	100	100

Management Goals

Ranchers had the opportunity to pick from a list of overall (strategic) ranch goals that they set for their operations. Respondents ranked their choices according to first, second, and third choices (Table 2). The top three first-choice strategic goals were: 1) that they wanted to live in the country, 2) they wanted to work with livestock, and 3) they wanted to improve the land. The two most important second-choice strategic goals were that they liked to work with livestock and wanted to improve the land. Most important third-choice strategic goals were that respondents wanted the ranch to help meet financial goals, they wanted to work with livestock, and they wanted to make an economic profit.

Overall ranch goals have an impact on the way resources are managed. Respondents were questioned about their goals for six resource categories. Under each category, they were presented a list of goals and asked to identify those goals that corresponded with their ranch management. Most frequently selected first and second choices are shown in Table 3. Respondents mostly enjoyed the "ranching" lifestyle and sought to maintain or improve upon it, desired the ranch residence during retirement, wanted to increase livestock carrying capacity, wanted to own and manage livestock, wanted to maintain a home for themselves, and wanted to learn new and better ways of doing tasks.

Table 3. Proportion of all respondents selecting their first and second most important personal/resource goals.

Personal/Resource Goals[1]	First Choice	Second Choice
	- - - % - - -	
Lifestyle goals:		
Enjoy the lifestyle and seek to improveupon it	57	11
Enjoy working with livestock	14	32
Enjoy viewing wildlife and manage accordingly	14	4
Desire the ranching experience for children	11	25
Financial goals:		
Want the ranch to be residence during retirement	32	29
Plan for the ranch to be estate for children	32	29
Desire the income for living expenses	14	7
Want to increase real estate value	7	11
Need this occupation in retirement	7	11
Rangeland goals:		
Want to increase livestock carrying capacity	46	14
Want to prevent soil erosion	21	36
Want to increase animal production/acre	18	18
Improve range condition and trend	4	18
Animal goals:		
Want to own or manage livestock	96	0
Want to manipulate production potential of livestock	0	68
Physical goals:		
Maintain home for rancher	64	0
Maintain barns/shops/other outbuildings	11	50
Make improvements such as fences or ponds	11	29
Human goals:		
Want to learn new and better ways of doing tasks	50	21
Want each family member to share talents on ranch	18	4
Want to be own boss	14	11
Want to minimize labor requirements	7	50
Want to maximize time for recreation	7	11

[1]Only the most frequent responses are listed. Percentages within a goal may not equal 100.

When respondents were grouped according to the three most popular first choice strategic goals, respondents whose primary goal was to live in the country were overwhelmingly committed to that lifestyle. They also enjoyed viewing wildlife, and managed accordingly. Almost half of this group expected to retire on the ranch and they maintained livestock to augment their lifestyles. Making land improvements (fences, ponds, etc.) were not as important as maintaining residences and buildings.

Respondents whose primary goal was to work with livestock were equally split on enjoyment of the lifestyle and

One or two of these makes retirement in the country that much sweeter!

caring for livestock. Ranching to them was more than a rural residence. They wanted their children/grandchildren to be the recipients of their labor. One-fourth were satisfied enough with owning the ranch that they wanted to ranch during retirement. One in four respondents in this group were ranching because they wanted to be their own boss and the same fraction liked improving the ranch with fences and ponds.

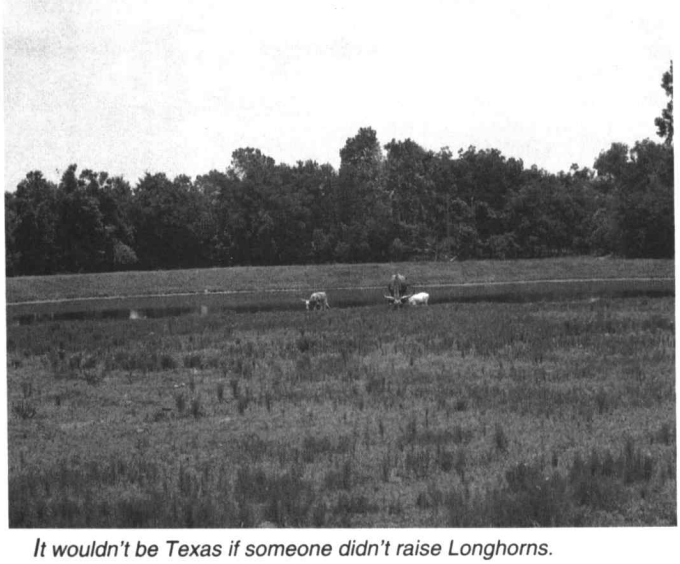
Ranchers who liked improving the land were more diversified in their lifestyle goals. They weighted equally goals for enjoyment of the lifestyle, working with livestock, ranching for themselves, and desiring the ranching experience for their children and grandchildren. They set financial goals exclusively for their children/grandchildren's future benefit. However, this group of operators who liked to improve the land overlooked the opportunity to identify goals for improving range condition and trend or preventing soil erosion. They did indicate they wanted to return the land to its natural state and to provide more wildlife habitat. Evidently they viewed these goals as consistent with improving land.

Conclusions

Though the question posed in the title of this paper is rhetorical in nature, the results should prompt the reader to ask what the difference is between a rancher and a "rancher." From experience, some would say that small-acreage ranchers differ from full-time ranchers in their approaches to economies of size, management inflexibility, capital constraints, off-ranch employment income, and selection of strategic goals. Although the process of goal selection should be invariant for all ranchers, the actual goals differ. However, it appears from this study that ranchers do not have much difficulty in recognizing their goals, especially if they are presented with a list of potential goals. Ranchers often make decisions based on multiple goals and most can recognize what goals are important to them, but the difficulty for some is in prioritizing important goals and putting them into practice.

Some may conclude that full-time ranchers embrace goals of securing an economic profit (a short-term survival goal) and increasing net worth (a long-term security goal) in order to reduce the risk of catastrophic losses. If ranch income is the sole source of income, or nearly so, the number of years in which a profit is earned should exceed the numbers of years in which one is not. Therefore, if these are the goals of full-time ranchers then small-acreage ranchers do not embrace the same goals. Making an economic profit was not selected as the number one strategic goal by any of the respondents interviewed. It was a second choice by only two respondents. Although respondents would not verbalize the words "economic profit" they indirectly implied such when they agreed that the ranch helped to meet financial needs. Income necessary to meet current family living expenses can be charged as an expense against current ranch revenues, but the result may be that a profit is not realized (Workman 1986).

It appears, therefore, that the goals set by Blacklands/Cross Timbers' small-acreage ranchers are non-economic and are generally dominated by lifestyle choices (like to live in the country and/or want to work with livestock). Nearly all respondents owned/managed livestock, probably because the original database was built on livestock producers but also because livestock is an essential element in qualifying for an agricultural exemption on property taxes (90% of respondents had exemptions). Even so, the desire to "work" with livestock was a common thread across the most important strategic goals. Perhaps one difference separating these respondents from "real" rangeland operators is that full-time ranchers are, or should be, forage managers while small-acreage ranchers tend to be animal managers. This was emphasized when almost



It wouldn't be Texas if someone didn't raise Longhorns.

half of the respondents desired to increase carrying capacity as their first choice rangeland goal, while only a few desired to improve range condition and trend as their first choice rangeland goal. There appeared to be either a lack of knowledge or too much reliance on quick fix technology to achieve increased carrying capacity. In lieu of improving range condition and trend, almost three-fourths of respondents were seeding introduced grasses and forbs to achieve their goal of increased carrying capacity. Perhaps these are valid differences that separate small-acreage landowners and full-time ranchers in their practical approaches to increasing livestock carrying capacity and/or improving the land. The challenge facing change agents is to find news ways of reaching the small-acreage clientele with information that will help them meet their lifestyle goals and still be consistent with established ecological principles. Perhaps the first step is to reconsider what is important to small-acreage landowners and how they define and practice principles of range/livestock management. A key point to remember in efforts to disseminate range management and/or natural resource conservation information is that the strategic, tactical, and operational goals of small-acreage operators probably differ from more traditional economic-unit ranches.

Because the Agricultural Extension Service has a commitment to improving the quality of life in rural areas, new programs that address specific management deficiencies in the small-acreage community are needed (DeBord 1991). The ultimate level of community satisfaction is dependent, in large part, on the individual's quality of life (Ladewig 1977), therefore, greater attention by academic/extension administrators should be focused on the goals that small-acreage ranchers set for themselves. Whatever their goals, economic or social, educational opportunities could help this clientele focus resource goals and management practices towards the achievement of strategic ranch goals. Some may not consider this clientele to be real ranchers but small-acreage landowners' contribution to livestock production and to the potential impact on the land resource is substantial.

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White Rocks Road Immigrant Forage Kochia Trial Seedings

Richard J. Page, V. Philip Rasmussen, Howard H. Horton, Robert L. Newhall, Duane E. Wilson, Gary W. Kidd, and Thomas C. Roberts, Jr.

Much of Western Utah Bureau of Land Management (BLM) Great Basin rangelands now support annuals, such as cheatgrass, halogeton, and tumbleweed, rather than shadscale saltbush, bottlebrush squirreltail, and other native perennials. This annual vegetative type covers more than 1 million acres of Utah's desert ecosystems.

Experience by BLM, Agricultural Research Service, and Utah State University personnel and others indicate the Immigrant forage kochia (*Kochia prostrata* var. Immigrant) can be successfully seeded into desert ecological sites (Rasmussen and Newhall, 1989 a-c). The Immigrant strain was selected ". . . for its ability to compete with cheatgrass and halogeton on depleted rangelands" (Soil Conservation Service management fact sheet). A 1989 study by Stevens and McArthur (1989) found that Immigrant forage kochia essentially replaced halogeton over a 7-year period. They found that "after emergence forage kochia continues to grow but halogeton remains in the two-leaf stage." A study by McArthur et. al. (1989) showed that forage kochia and bulbous bluegrass were not materially affected by burning.

In Rush Valley, Utah *Kochia prostrata* ssp. grisea and virescens transplants (closely related to Immigrant) were found to have an average survival rate of 94 percent after 6 years and 62 percent at the end of 12 years (Pendleton, et. al. 1992). This U.S. Forest Service study showed cheatgrass and other introduced annuals ". . . tended to be absent in kochia-dominated areas."

The decline of native vegetation on desert ecological sites has been associated with burning. In 1983, two large fires totaling 250,000 acres occurred in the Cedar Mountain Range and adjoining Skull Valley. These fires virtually eliminated the remaining unburned islands of shadscale, sagebrush, and other natives. By 1993, bottlebrush squirrel had become reestablished on a nearby monitoring plot which previously supported annual vegetation composed of cheatgrass, halogeton, burr buttercup, and/or Russian thistle.

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The objective of these trial seedings was to field test establishment potential of forage kochia, on a desert loam ecological site, using a variety of conventional seeding techniques.

Location and History

Seeding trials were established approximately 7 miles north of Dugway, Utah, on a Timpie silt loam, deep, well-drained soil. This desert loam site (028AY124UT) receives 5-8 inches of annual precipitation. The site has been mostly occupied by annual species for the last 25 years. Parker 3-step vegetative transect studies showed that during the late 1950's, vegetative cover over most of the area was shadscale saltbush and bottlebrush squirreltail. By 1965, repeated fires had caused a vegetative shift to cheatgrass, halogeton, or other annuals, with scattered bottlebrush squirreltail. The composition of the potential natural vegetative community should be approximately 5 percent forbs, 10 percent grass, and 85 percent shrub.

Methods

Individual trial field plots were approximately 50 by 1,320 feet. Forage kochia seed was applied using either a Tye Pasture Pleaser (a minimum-till drill with 1/4-inch-deep bands) or a cyclone broadcast seeder mounted in the bed of a pickup. Seedbed conditions include: no preparation, cultivation with a spring toothed cultivator prior to seeding, and spike toothed harrowing before and after broadcast seeding. Seed was applied at 1, 3, and 6 pounds pure live seed (PLS) per acre during fall, winter, and spring seasons. Seed was applied to the previously mentioned range conditions by drilling, broadcasting, or harrowing before or after broadcasting. A total of 24 different planting treatments were conducted during each planting season.

The fall seeding was made on November 4 and 5, 1991, when the soil surface was dry and unfrozen. The winter seeding was made on December 9 and 10, 1991, with a 20-40 percent snow cover on frozen soil. The spring seeding was made February 27, 1992, when surface soils were moist and unfrozen.

Forage kochia seedling density and associated plant cover measurements were made using a Daubenmire 20 by 50 centimeter (cm) frame during late May and early June 1992 and 1993. Twenty vegetative observations were made at 5-foot intervals along a 100-foot tape in each

seeding treatment. In 1992, cheatgrass had grown to a height of 2-4 inches and dried. All forage kochia seedling had developed secondary leaves and were at least 1/4 to 1/2-inch tall. Many well-established forage kochia plants had developed by 1993.

The precipitation records for the 1992 water year for Dugway, Utah, (7 miles south) was 7.07 inches (87 percent of normal). Precipitation during March 1, 1992, to May 31, 1992, (seedling establishment period) was only 1.38 inches. The month of April was unusually hot and dry in 1992 (0.04 inches). In the 1990 and 1991 water years, precipitation was well below the average, and this extended drought resulted in key forage plants being in low vigor, with little or no production. Tall and pubescent wheatgrass appear to be diminishing because of drought.

Results

Successful seedings (where 0.9 forage kochia plants or more per square foot were established) resulted in 63, 69, and 6 percent of the trials evaluated in 1993 from fall, winter, and spring seeding dates, respectively. Seeding in the winter produced the greatest number of trials having a plant density of 0.9 plants or more per square foot. Some new, young plants were observed in 1993 indicating delayed germination. Broadcast seeding resulted in higher plant densities in the 1992 and 1993 evaluations. The minimum-till drill produced the greatest number of successful drilled stands in the winter season (shallow seeding depth easier to maintain). Spring seeding is not recommended since only 2 out of the 24 different trials conducted produced successful stands. Tilling prior to seeding produced slightly higher plant densities compared to the nontilled sites. Generally, tilling and harrowing prior to seeding produced slightly higher plant densities compared to no treatment. Sufficient increased plant establishment, however, did not give results which would justify using tilling or the spike-toothed harrowing treatments in the fall and winter prior to seeding. Results show that the higher the seed application rate, the higher the seedling and 2-year-old plant densities. Broadcast treatments at all seeding rates produced successful seedings during the fall and winter season. Treatments which produced the higher number of seedlings suffered the greatest reduction in plant density when followup measurements were made the second year. This is a reflection of the productive capacity of a desert ecological site.

In summary, these trials confirmed that successful stands of forage kochia can be established by broadcasting in the fall or winter at 1, 3, or 6 PLS/lb./ac. rate. This option provides land management agencies/owners, etc., with a alternative seeding procedure for replacing undesirable annuals on desert ecological sites in the Great Basin desert ecosystem.

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Readers Write

To the Editor:

I have had my attention drawn to yet another item published by your magazine which denigrates me personally. This time a letter by Jon Skovlin in your February issue. After many years as a member of the Society I resigned in protest at the constant personal attacks. I was persuaded by office bearers of the Society to rejoin. Almost immediately more personal and derogatory poetry was published and once more I resigned in protest at such unethical behavior.

There is to be an international symposium/conference in Tucson in October sponsored by many members of the Society. The title of the conference is "Desertification in Developed Countries: Why Can't We Control It?" This is the greatest single problem facing humans. Your members, including Skovlin, have no solution. My crime it appears is that after years of failures as I followed some clues in Africa, I have discovered what is causing it and how to reverse it. It truly appears the most dangerous thing any scientist can do is discover something new.

Surely with the seriousness of the situation—eroding soil from our croplands and rangelands is now America's greatest single annual export, outweighing all others combined I believe—we should try to move forward. This applies especially to a Society like yours which is conspicuous by it's absence from any leadership in this global problem.

Skovlin implies that I am dishonest in that I claim successes which are not borne out upon inspection by himself and others. He claims this on the basis of his correct observation of the failure of many "SDG systems." Had Skovlin read my textbook or attended my talks he would long ago have known that I have condemned SDG since the 1960's before he probably even heard of it. I long ago knew that no grazing system can ever work. For that reason I developed the grazing planning process I and former clients of mine and practitioners of Holistic Resource Management today still use. If Skovlin can provide a single case where the grazing planning I advocate and which is so clearly laid out in both my textbook and its accompanying workbook has failed will he please disclose it?

The Liebig's ranch case he quotes is an excellent example of what I am saying when he goes on quoting failures of the SDG system in southern Africa up to the early 1980's, For his interest I left Africa in 1978. Up till that time we did not have a single failure of the short duration grazing planning process (and we still have not had one to date). At the same time every SDG system I am aware of failed. It seems that Skovlin is incapable of mentally grasping the vast difference between a SDG system and the grazing planning process outlined in my textbook. They are opposites in every sense of the world and not semantics.

Skovlin quotes the failure of the advanced project as I called it Liebig's ranch in Zimbabwe. **Had he bothered with facts he could have read of this failure in my textbook.** For fifteen years I ran this project at three times the stocking rate through all manner of seasons. It was 4,000 acres of the worst land on major ranch of over 1 million acres made available to me to push my ideas to breaking point before we took any risk on the rest of the ranch. On this advanced project we produced five times the meat yield on average per year and we produced solid perennial grassland from what started as bare ground between shrubs and trees. For all fifteen years we could not cause its failure no matter how hard I pushed it under the planning process. Then in 1978 I left and was away for four years. In those four years the managers dropped the grazing planning process in favor of a one to two days SDG system. Over the next four years of unplanned grazing and SDG it collapsed completely and had to be destocked totally.

How Skovlin determines collapse four years after planning is stopped is due to the planning is beyond me— unless as mentioned he cannot grasp the difference between rotational grazing and planned grazing.

Skovlin then goes on to denigrate the results quoted on the Bowe ranch in east New Mexico where again 300% more profit has been made by the family since turning to the Holistic Resource Management decision-making process (which when livestock are run embraces planned grazing in place of any grazing system). Again he attempts to compare their family decision-making with grazing systems and completely misses the boat. Has Skovlin bothered to visit the family and see how decision are made?

If Jon Skovlin, or any other scientist, can point out any faults, lack of scientific validity or other adverse features of Holistic Resource Management we will willingly publish them ourselves.

Skovlin ends by reminding readers that "readers in North America should remember that Savory's original ideas 25 years ago and 10,000 miles away were not that successful". It is said that Thomas Edison failed many times before inventing the light bulb.

Had Skovlin read my textbook or heard one of my many talks he would know that I refer openly to all my failures and how much was learned from them until, finally in 1984, I discovered what was actually causing most of the desertification (rest, in brittle environments) and how to reverse it. Since them we have achieved consistent results. Incidentally, Skovlin is not even aware of the many failures I refer to as he keeps yapping up the wrong tree.

I still long for the day when the Society for Range Management becomes a leading force in reversing world (and US) desertification. Till then it is being bypassed by increasing numbers of people in many countries now as we proceed to train people how to make decisions in a better way which is providing encouraging and constant results.

Yours sincerely,

Allen Savory, Founding Director, Center for Holistic Resource Management

Dear Editor:

I have been following cattle management practices on the Tonto National Forest for several years and I disagree with the rosy description of their range program Eddie Alford pre-

sented in your December issue.

Mr. Alford's claim that 85% of the Tonto's 103 grazing allotments are under "proper management" because they gave plans incorporating livestock management strategies that are "meeting or moving toward meeting the objectives of the Forest Land Management Plan" is misleading.

First of all, I am not aware of any active grazing allotments on the Tonto that are meeting the objectives of the forest plan.

Secondly, the traditional practice of most of the Tonto's grazing permittees was to graze their animals yearlong, with periodic roundups being the only interruptions. So any sort of livestock management is an improvement. But just because a grazing allotment management plan (AMP) is improving the condition of an allotment doesn't mean the AMP includes measured sufficient to restorer the allotment's vegetation to its full natural potential.

In fact, most of the AMPs currently in place on the Tonto, and on most of out public lands, do not adequately manage livestock in the important riparian areas. A 1981 riparian habitat analysis of the Tonto found that 50% of all of its streams were in poor condition with only 7% in good or excellent condition and I don't believe the situation has improved significantly since then.

Riparian areas are important natural resources, especially in arid regions, and this is reflected in the Tonto's 1985 land management plan which states, "Management emphasis in riparian areas will feature wildlife needs over recreation and grazing."

However, despite this, most of the AMPs on the Tonto are simple multi-pasture rest/rotation systems which are designed for managing livestock on upland areas. These types of grazing systems do not restrict cattle from riparian areas and so they usually fail to rehabilitate them. (See enclosed photo of a Tonto allotment that's managed with a simple rest/rotation system and is considered to be ""moving toward" the forest plant objectives.) [Photo not published.]

Mr. Alford alluded to the need for further improvement in the Tonto's range program when he said the Tonto was entering a phase of livestock management which involves, "recognizing the value of other diverse uses on the rangelands such as recreation, wildlife, and fish, as well as other issues, such as threatened and endangered species, riparian condition, watershed condition."

Considering it's been 24 years since passage of the National Environmental Policy Act, 21 years since passage of the Endangered Species Act, 18 years since passage of the Federal Land Policy and Management Act and seven years since the non-point source provisions of the Clean Water Act were enacted, it's difficult for me to understand how the Tonto's range program can be considered progressive when they are just now getting around to applying these longstanding laws to livestock grazing.

Thus while Mr. Alford may have been accurate in stating most of the forest's allotments are improving and thus "moving toward" the forest plan objectives, it's not as good as it sounds. His characterization of the Tonto's range program reminds me of the often heard claim that the public rangelands are currently in better shape than at any time in this century. Both statements may be true but the issue isn't whether or not things are better than they should be, but, whether or not things are the way they should be.

Sincerely,

Jeff Burgess, Tempe, AZ 85283

Dear Editor:

The letter from Mr. Burgess disputing the message presented in my article: "Tonto Rangelands-A Journey of Change" (December 1993 issue), was disappointing. A tremendous amount of coordination has been accomplished with Federal and State Agencies, as well as environmental groups, publics and grazing permittees, to help us make the best management decision in order to maintain and or restore healthy rangelands. As a result costly compromises and mitigation have taken place including reductions in permitted numbers and even cancellation of livestock grazing from some allotments.

The article does not imply that all resource problems have been solved on rangelands and riparian areas. Instead it describes a course that was chartered by rangeland managers and success that was achieved in reaching goals. The goals included implementing management strategies to restore and maintain rangeland health. Also involved was reducing permitted numbers of livestock on some allotments. These are accomplishments that cannot be denied. The Tonto has 85% of it's grazing allotments under management, and permitted numbers were reduced from 390,000 to 280,000 animal unit months during the past fifteen years.

Mr. Burgess disagrees that significant improvement has occurred on the Tonto Rangelands or Riparian Areas regardless of changes in management. Results can be subject to ones own interpretation. However, the Tonto National Forest has measured outstanding success in achieving goals and objectives after implementing allotment management plans. One example of improved uplands can be illustrated on the Red Creek Ranch where some areas have improved from virtually no perennial grasses and mostly bare ground to a significant cover of perennial grasses four years after implementation of the improved management plan. Annual plot frequency measurements have shown continual improvements in vegetation ground cover plant diversity.

Riparian Area management is a priority on the Tonto. The current policy requires that every Allotment Management plan must have riparian objectives (if riparian areas exist). The objectives must focus on the needs for recovery and maintenance of the riparian area. We have measured some outstanding positive results with improved management in riparian areas. For example, Hess Canyon on the Sedow Allotment improved from an almost bare stream bed with a few scattered cottonwood trees to a dense stand of vegetation which provides continuous shade to the stream channel.

The condition of the area in photograph which Mr. Burgess

referred to is of concern to all of us, although it is not representative of most riparian conditions on the Cartwright Allotment. This location is a major trail crossing for both cattle and people riding for pleasure. The Integrated Resource Management (IRM) process has been implemented on the Cartwright Allotment, a part of which includes this crossing where the photograph was taken. The purpose of this process is to evaluate alternatives that will address any areas in unsatisfactory condition and meet Forest Plan objectives.

Although Mr. Burgess admits that there has been some improvement in rangeland conditions, he argues that the issue isn't whether or not things are better than they used to be, but whether or not things are the way they should be. Establishing goals, based on optimum ecosystem health and sustainability is the way to restore areas to their full potential. There are reference areas on the Tonto that have not been grazed for fifty years or more. These areas are used as bench marks to help us determine the potential of areas with similar soil and climate. Although Mr. Burgess will not admit there is a single allotment on the Tonto meeting Forest Land Management Plan objectives, we in fact have allotments adjacent to areas that have not been grazed for 50 years, the condition of which is equal to or better than the ungrazed areas, as measured by ground cover and diversity of species.

The health of rangelands and riparian areas certainly have room for improvement on the Tonto National Forest. However, there has been progress, and it is certain that rangeland managers will continue to strive to manage for health ecosystems and proper use of rangelands.

Sincerely,

Eddie Alford, Gilbert, AZ 85234

Dear Editor:

The letter by Harold Goetz (in response to one by George Wuerthner) alarmed me because it contained some seriously misleading statements. Professor Goetz "would challenge anyone to provide...conclusive evidence that *proper* grazing by livestock results in loss of biodiversity...." (emphasis his). It is—sadly—remarkably easy to produce peer-reviewed, published evidence that livestock grazing has had deleterious effects on native biodiversity, including a wide variety of taxa. I did exactly that in a review article to be published in the September issue of *Conservation Biology* ("Ecological costs of livestock grazing in western North America"). Goetz's argument is slippery because, even though he emphasizes the importance of "proper" grazing, he fails to define what he means by proper. This ambiguity is particularly ironic, as he concludes that "our first major assignment" is "to properly define what we mean by natural systems, landscapes, appropriate biodiversity for any given system, sustainability, and proper management ..." I would challenge Professor Goetz to follow his own direction, and clearly define "proper grazing." May I suggest that his definition begin by stating that grazing is only proper if it does not decrease native biodiversity, nor alter basic ecosystem functions (such as nitrogen cycling), or structure (such as simplification of vegetation stratification)?

Goetz also misinforms the reader with his statement that "total protection (non-use) from herbivory...generally leads to a decline in diversity and a more simple biota." In my previously mentioned article, I cite numerous examples where native species richness increased dramatically after only a few years of livestock enclosure. Encouraging as this may be, no one insinuates that restoring damaged lands is simple. That is exactly the reason we should consider more carefully the appropriateness of introducing exotic herbivores into Western ecosystems. As with humans, in ecosystems health an ounce of prevention is worth a pound of cure. To imply that removal of livestock is an invalid restoration strategy is decidedly misleading. A careful reading of the literature indicates that elimination of livestock is, in many cases, a necessary prerequisite to ecological restoration.

Professor Goetz's extreme resource extraction bias is revealed when he refers to enclosure of livestock as "total protection form herbivory." It will come as a surprise to many scientists that hundreds of *native species*, from pronghorn to grasshoppers, are no longer considered herbivores! That is the preposterous implication made by Professor Goetz.

Ultimately, the appropriateness of livestock grazing in the West involves choices among value systems. But the least the scientific community can do is get its facts straight. Let's let the public choose based on solid information, not on half-truths like those presented by Professor Goetz.

Sincerely,

Thomas L. Fleischner, Professor of Environmental Studies

Dear Editor,

While I was pleased to see Mr. Goetz acknowledge in his rebuttal to my letter to the editor which appeared in the February 1994 *Rangeland* that some landscapes are too fragile or dry to support domestic livestock production, overall Mr. Goetz defends continued livestock production in the arid West asserting that if properly managed there are few negative effects upon native species or ecosystem. Indeed, Mr. Goetz challenges anyone to provide conclusive evidence that proper grazing by livestock results in a loss in biodiversity. With regards to the adverse affects of livestock production on public lands, I would like to turn the challenge around and suggest it is really livestock advocates like Mr. Goetz who should shoulder the burden of proof. After all they are the ones who wish to foster exotic animals under unnatural conditions upon native species and ecosystems. I think there is abundant scientific evidence that suggests that livestock production—proper or otherwise—expropriates resources that would otherwise support native species, thus is counter to the goal of biological preservation, not only in the arid West, but worldwide.

Furthermore, while I will concede that better livestock management might mitigate, but not eliminate, the worse abuses and impacts associated with livestock production, we have to ask how realistic is it to believe that proper livestock management can or will be practiced. Without knowing exactly how Mr. Goetz defines proper management, I would suspect that

in many cases this will require additional fencing, riding, water developments, lower stocking rates, and greater range monitoring than occurs at present. All of these activities increase the costs of livestock production and makes it economically infeasible, particularly on public lands which, by and large, are less productive and more arid than private holdings. Even if proper livestock management were theoretically possible, the fact that it is uneconomical over much of the West, makes it irrelevant. Since we can produce livestock often at less cost in other parts of the country than on the arid public lands of the West, spending money to mitigate the negative impacts associated with livestock production frequently makes no good economic sense, nor is it good public policy.

The livestock bias of Mr. Goetz is further displayed by his interpretation that absence of livestock is somehow the same as "non-use". Removing livestock does not mean an end to herbivory. There are literally thousands of native species feeding upon plants and their remains from bacteria and nematodes in the soils to grasshoppers and rodents above ground that continue to "use" plants even if livestock are removed. And while I agree with Mr. Goetz that herbivory is an important part of most plant communities, that doesn't necessarily translate into the conclusion that introduction of a large, alien animal like the cow that dominates the resources of western rangelands does not adversely affect native species. In fact, the weight of evidence suggests just the opposite. Whenever we introduce a non-native species that occupies the same niche of existing species, we adversely affect those native species.

An analogy with forestry is appropriate. For decades foresters asserted that PROPER logging techniques did not jeopardize the forest ecosystem just as livestock advocates like Mr Goetz make similar claims today about proper livestock management. The foresters naively assumed that as long as trees grew back, everything was fine. We now know, (largely because of scientists from disciplines outside of forestry) that timber harvest has many **negative** effects upon a host of species and ecological functions. The loss of "overmature" trees as a result of logging results in a reduction in down, woody material essential for many ecosystem functions, including the creation of fish habitat in streams, stabilization of hydrological function as well as continuing to seedling establishment on the forest floor. The removal of "decadent" trees and snags means less habitat for everything from pileated woodpeckers to red backed vole. The compaction of soils by timber harvest machinery negatively impacts ant colonies which are a major predator upon other insects that attack trees, thus reducing natural defenses against disease and insect outbreaks. All this complexity has only recently been discovered, and as a result there is less certainty that any level of logging can be said to be completely benign.

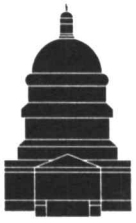
It is an oxymoron to suggest that any kind of management, proper or otherwise, is ecologically neutral. By management we make a conscious decision to influence how energy and resources are allotted and to change that allotment from what would , otherwise occur. Besides funneling collected solar energy into an exotic animal, livestock production usually results in some level of predator and pest control. Proper livestock management does little to prevent the spread of disease from exotic to native species as with domestic and bighorn sheep. In many ecosystems, soil crusts and lichens are trampled and destroyed by livestock, even properly managed livestock. Domestic animals are a major contributor to nonpoint water pollution and soil erosion, thus changing nutrient levels and other factors in aquatic ecosystems which in turn changes ecosystem dynamics. And even the resistance from the livestock community to the restoration of native species from the blackfooted ferret to the wolf can be considered a negative consequence of livestock production—proper or otherwise.

I could go on and on about the known and suspected negative ecological impacts associated with livestock production—proper or otherwise—unfortunately this is not the proper forum to present this great body of scientific evidence.

Finally, while we may debate some of the other evidence, there is one assertion with regards to that Mr. Goetz is dead wrong. He asserts urban users are the major consumers of western water. In reality, the opposite is the case, with the majority of water going towards forage production ultimately fed to domestic livestock. Indeed, even in California, the majority (85%) of water is consumed by agriculture with the lion's share of that agricultural use going towards production of forage consumed by domestic livestock, In other less populous western states, water use is even more skewed towards domestic livestock production. Dewatering fragments aquatic habits, leads to changes in water temperature quantity and quality, frequently leads to a shrinkage in riparian zones, and ultimately results in significant changes to natural systems. I can list several dozen western fish species that have been significantly impacted by dewatering and other impacts associated with livestock production. And the fish are only the tip of the iceberg.

One result of the growing body of scientific research has been a greater appreciation of the complexity of the natural world. The more we learn, the more fully we understand how little we really comprehend about natural systems. I am certain this same trend will apply to range management and science. Those in natural resource management or research would do well to bear in mind in the words of eminent Harvard biologist E.O. Wilson who has said "Ecosystems are not only more complex than we think, they are more complex than we can think;"

George Wuerthner, University of Oregon, Eugene, Oregon 97403



Capital Corral ··· ····· ····· ····· Ray Housley

The wiser man mourns less for what age takes away than for what it leaves behind.
Wordsworth

E. William Anderson, Charter Member and Past President of SRM has been selected the 1994 recipient of the Renewable Natural Resources Foundation's Sustained Achievement Award. The award, which was established to recognize outstanding achievements in the renewable natural resources fields, with an emphasis on interdisciplinary aspects, is scheduled to be presented at RNRF's annual meeting November 2. Bill, who turned 80 in July, retired from SCS in 1975. In the nearly 20 years since then, he has if anything accelerated his professional activity. Among his other accomplishments. Anderson is credited with conceiving and articulating Cooperative Resource Management Planning, which has become a model for interdisciplinary, interagency and multiple-interest land and resource planning and management, not only on rangelands, but on other wild and agricultural lands.

As House action on 1995 budget request wound up before the 4th of July recess, it looked like the FS will get about $5 million more in range than it had last year this is what the President's budget requested, if we interpret the crosswalk between old and new formats correctly. BLM did about as well, gaining between $4 and $5 million, mostly aimed at implementing rangeland measures. SCS and Agricultural Research Service apparently held their own. Since Senate marks were higher in some cases, conference action could provide slightly more funding for range activities.

If Rangeland Reform were not enough, BLM has undertaken a new organizational approach for headquarters, and in engaged in a major effort to develop new "Performance Measures" intended to convey in a cost-effective and objective manner, how well the agency is doing in accomplishing its mission. Interest group and other public representatives met with Acting Director Mike Dombeck in June to get started on the task, and another session is slated for August. While organizational change is not finalized, the shift is focused on a team approach to dealing with issues. Traditional functional units are expected to disappear and be replaced by staffs of specialists available for issue-related assignments. A draft of the *BLM Blueprint for Change* is expected to be available in July, it will set forth the latest mission statement vision statement and near-term strategic objectives. BLM won congressional concurrencefor a new, condensed budget structure comprising ten major line items with sub-headings under most. For example, under the Land Resources line item, the breakdown is

1-Soil, Water, Air 2-Range 3-Forestry 4-Riparian 5-Cultural Resources 6-Wild Horses and Burros. Wildlife-Fisheries, T&G Species and Recreation Management are separate line items.

The Forest Service has distributed *Architecture for Change,* a publication describing the main themes suggested by employees and the public during more than a half-year of intensive "Reinvention" effort. Described as a "work in progress", the thick booklet plays back these themes as several descriptions of "models". The report is intended to solicit additional views of the agency's stakeholders. Chief Jack Thomas gathered his top line and staff people to discuss the reinvention team's report in June in Houston, there were no reported charges that the FS was indulging in a resort location for the event.

Incentive grazing fee development is getting under way, and BLM/FS staffers are looking toward a facilitated meeting of a large committee including many public members gather ideas and inspiration for a workable system. The ideal system has eluded all who have worked on it to date. Phoenix in August?

Bertha Gillam was named Director of Range Management for the FS, succeeding Bob Williamson, who retired earlier this year. Gillam was Acting Director of Ecosystem Management, Environmental Coordination and Land Management Planning, she gets a shorter title if not an easier job. Earlier, she served as Forest Supervisor of the Bitterroot NF, Deputy Supervisor on the Wasatch and was District Ranger on the Black Hills NF. Bertha earned a botany degree at Montana State in 1970, a Master's in ecology (also at MSU) and did range work at the University of Wyoming and Colorado State. She was recently Chair of the Society of American Foresters Range Working Group, and is a member of SRM.

In other Senior Executive moves, The FS assigned Lynn Sprague as Regional Forester in the Pacific Southwest (aka California). Sprague, a second generation FS employee, has been Director of Minerals and Geology, and was Deputy Regional Forester in Alaska, he has a forestry degree from Oregon State, and a Master's from Colorado State. Lynn is a member of SRM and SAF. Sprague replaces Ron Stewart, who will be Associate Deputy Chief for Research. Hank Montrey, Associate Deputy Chief for the National Forest System will change responsibilities, talking over resource management activities in the job Dave Unger vacated. Janice McDougle, a wildlife biologist for four years in the FS headquarters and for 10 years with the Fish and Wildlife Service, succeeds Montrey, with responsibility for lands, engineering, minerals, recreation and other support functions. Mary Jo Lavin was promoted to Director of Fire and Aviation Management. She has been assistant in that staff, and was formerly Deputy Regional Forester in the Pacific Northwest after serving as deputy supervisor of the Washington State Department of Natural Resources. Lavin earned a Ph.D. at the University of Colorado, and is an alumna of Harvard's JFK School of Government.

Current Literature

This section has the objective of alerting SRM members and other readers of *Rangelands* to the availability of new, useful literature being published on applied range management. Readers are requested to suggest literature items—and preferably also contribute single copies for review—for including in this section in subsequent issues. Personal copies should be requested from the respective publisher or senior author (address shown in parenthesis for each citation).

Aquatic and Wetland Vascular Plants of the Northern Great Plains; by Gary E. Larson; 1993; USDA, For. Serv. Gen. Tech. Rep. RM-238; 681 p. (USDA, Rocky Mtn. For. & Range Expt. Sta., 240 W. Prospect St., Fort Collins, Colo. 80521) A taxonomic treatment of aquatic and wetland vascular plant for identifying over 500 plant species of the northern Great Plains; includes dichotomous keys, botanical descriptions, plant illustrations, distribution maps, and habitat preferences.

Bloat in Cattle; by R.E. Howarth, R.K. Chaplin, K.-J. Cheng, B.P. Goplen, et al.; 1991; Agric. Canada Pub. 1858/E; 34 p. (Communications Branch, Agric. Canada, Ottawa, Ont. K1A 0C7) Considers pasture bloat, stored and processed legume feeds bloat, and feedlot bloat; provides background on mechanisms/causes, management/prevention practices, and treatment.

Canopy Light Reflectance and Remote Sensing of Shin Oak (*Quercus havardii*) and Associated Vegetation; by James H. Everitt, David E. Escobar, Ricardo Villarreal, Mario A. Alandiz, and Michael R. Davis; 1993; Weed Sci.41 (2):291-297. USDA-ARS, Remote Sensing Res. Unit, 2413 E. Hwy. 83, Weslaco, Tex. 78596-8344) Concluded that aerial imagery is useful for detecting shin oak on smaller rangeland areas, whereas the satellite imagery is applicable in mapping large areas of shin oak distribution.

Comparison of Breeds and Mating Systems for Economic Efficiency in Cow-Calf Production; by Mike Tess, Margaret A. Lamb, and O. W. Robison; 1993; Mon AgRes. 10 (1) :22-24. (Agric. Mailing Room, Mon. State Univ., Bozeman, Mon. 59717) Concluded that the decision to practice crossbreeding is more important than the choice of breeds.

Comparison of Breeds and Mating Systems in Integrated Beef Production Systems; by Mike Tess, Margaret A. Lamb, and O.W. Robison; 1993; Mon. AgRes. 10(1):25-27. (Agric. Mailing Room, Mon. State Univ., Bozeman, Mon. 59717) Concluded that rotational crosses using moderate and large framed breeds are very competitive with crosses among similar breed types.

A Comparison of Midgrass Prairie and Old World Bluestem During Winter and Early Spring; by T.T. Marston, S.A. Gunter, F.T. McCollum, and R.L. Gillen; 1993; Okla. Agric. Expt. Sta. P-933, p. 363-366. (Agric. Mailing Room, Okla. State Univ., Stillwater, Okla. 74078) Midgrass prairie was higher in crude protein than old world bluestems at all collection dates and was sufficient in midgrass prairie to meet gestating and lactating beef cow requirements.

Comparison of Range Versus Shed Lambing in the Northern Great Plains; by P.J. Burfening and J.L. Van Horn; 1993; Sheep Res. J .9 (2):86-90. (Anim. & Range Sci. Dept., Mon. State Univ., Bozeman, Mon. 59717) Although improved production through shed lambing was accomplished, economic analysis of the data indicated that the increased costs of shed lambing impacted negatively on profit.

Evaluating Alfalfa Cultivars and Germplasms for Pasture Using the Mob-Grazing Technique; by S. Bittman and D. H. McCartney; 1994; Can. J. Plant Sci. 74 (1):109-114. (Agric. Canada Res. Sta., Agassiz, Br. Col. V0M 1A0) Their research suggested that *falcata* germplasms should be included in seed mixes for long-term pastures and that mob grazing be used to assess the persistence of alfalfa germplasms before they are recommended for use in pasture.

Fees on Public Lands: Not All Users Pay a Fair Share; by E. Bruce Godfrey; 1994; Utah Sci. 54 (3) :71-74. (Agric. Mailing Room, Utah State Univ., Logan, Utah 84322) Found that changes in the use of timber, grazing, and recreation on BLM lands between 1976 and 1991 were -51%, -6% +94%; for Forest Service lands, -12%, -16%, and 33%. "Essentially all users of public lands are subsidized to some degree;" subsidies range from minor on oil and gas, coal, and other minerals to moderate on timber and grazing, to high on recreation relative to convering costs of administering and providing use.

Field Bindweed (*Convolvulus arvensis*) Control with Various Herbicide Combinations; by Philip Westra, Philip Chapman, Philip W. Stahlman, Stephen D. Miller, and Peter K. Fay; 1992; Weed Tech. 6(4):949-955. (Colo. Agric. Expt. Sta., Colo. State Univ., Fort Collins, Colo. 80523) Compared mixtures of dicamba, 2,4-D, and picloram in controlling field bindweed in the central great plains region; mixtures containing 14 kg./h or more of picloram were the most effective, but were more effective in normal than in drought years.

Forage Intake and Digestion by Cattle Grazing Midgrass Prairie Rangeland or Sideoats Grama/Sweetclover Pasture; by Stacey A. Gunter, F. Ted McCollum III, Robert L. Gillen, and Les J. Krysl; 1993; J. Anim. Sci. 71 (12) :3432-3441. (Anim. Sci. Dept., Okla. State Univ., Stillwater, Okla. 74078-0425) Concluded that digestible organic matter (energy) intake was first-limiting for performance of cattle grazing either forage type during May; a high-energy, medium-protein supplement was suggested if enhanced performance was desired then.

Forage Yield, Quality, Compatibility, and Persistence of Warm-Season Grass-Legume Mixtures; by G.L. Posler, A.W. Lenssen, and G.L. Fine; 1993; Agron. J. 85 (3):554-560. (Dept. Agron., Kan. State Univ., Manhattan, Kan. 66506) Compared the forage yields, nutritive values, and stand persistence of pure stands of unfertilized switchgrass, sideoats grama, and indiangrass with binary mixtures of these grasses with selected native legumes under summer grazing.

History of Grazing Research in the Aspen Parkland; by D.H. McCartney; 1993; Can. J. Anim. Sci. 73 (4):749-763. (Agric. Canada

Compiled by John F. Vallentine, Professor of Range Science (Emeritus), Brigham Young University, Provo, Utah 84602.

Res. Sta., Box 1240, Melfort, Sask. S0E 1A0) Discusses the grazing-related research conducted on (1) extending the grazing season by using introduced perennial forage species, (2) getting proper utilization of native rough fescue grasslands while limiting brush invasion, and (3) the role of annual forages.

Impacts of Burning on Primary Productivity of Festuca and Stipa-Agropyron Grasslands in Central Saskatchewan; by R.E. Redmann, J.T. Romo, and P. Pylypec; 1993; Amer. Midl. Nat. 130 (2):262-273. (Dept. Crop Sci. & Plant Ecology, Univ. Sask., Saskatoon, Sask. S7N 0W0) The result of studies directed to developing guidelines for the use of fire in managing natural areas and grazing lands in C_3-dominated grasslands of the Canadian Prairie Provinces and similar vegetation in the U.S.

Increasing Lamb Survival by Supplemental Feeding Range Ewes During the Perinatal Period; by Peter J. Burfening and Rodney W. Kott; 1994; Mon. AgRes. 11(1):12-15. (Agric. Mailing Room, Mon. State Univ., Bozeman, Mon. 59717) Supplementation during late gestation and early lactation improved survival and growth rate for lambs born to ewes in relatively poor body condition.

Long-Term Responses of Plant Species to Meadow Fertilization; by E.G. Siemer and B.H. Gery; 1992; For. & Grassland Conf. 1992:116-120. (Colo. State Univ. Mountain Meadow Res. Center, P.O. Box 598, Gunnison, Colo. 81230) The results of research to determine whether fertilizing with nitrogen and/or phosphorus could reduce dominance of wild caraway and dandelion and increase grass or legume dominance.

Movement and Migration Patterns of Mule Deer in Southeastern Idaho; by Cecil G. Brown; 1992; J. Wildl. Mgt. 56(2):246-253. (Idaho Dept. Fish & Game, 1345 Barton Road, Pocatello, Ida. 83204) Deer fidelity to summer range was very high but somewhat lower for winter range; during mild winters the distribution of deer included areas not normally considered winter range.

Nitrogen Fertilization of Dryland Grasses; by Scott Lorbeer, Jeff Jacobsen, Harold Houlton, Dick Lund, et al.; 1994; Mon. AgRes. 11(1):7-11. (Agric. Mailing Room, Mon. State Univ., Bozeman, Mon. 59717) Introduced grasses responded well to fertilization while native grasses produced marginal returns from fertilization; 50 N/a. produced more profit than 100 N/a. over time in the study.

Pine Needle Abortion in Cattle: Effects of Diet Variables on Consumption of Pine Needles and Parturition Response; by R.E. Short, R.A. Bellows, R.B. Staigmiller, and S.P. Ford; 1994; J. Animal Sci. 72 (4):805-810. (USDA-ARS, Fort Keogh Livestock & Range Res. Lab., Miles City, Mon. 59301) Conclusions: (1) feeding high levels of protein increased pine needle consumption but not abortion rate, (2) weathered or aged needles had activity similar to or greater than that of dried needles, and (3) feeding corn silage prevented cows from eating pine needles.

Revegetation of Mining Wastes in Montana; by Dennis R. Neuman, Frank F. Munshower, and Doug J. Dollhopf; 1993; Mon. AgRes. 10 (1):3-7 (Agric. Mailing Room, Mon. State Univ., Bozeman, Mon. 59717) Concluded that on-site chemical immobilization of mine contaminants followed by revegetation is applicable to thousands of mining disturbances in western U.S.

Spatial Behavior of Free-Grazing Cattle: Movement from Patch to Patch; by R.S. Kidunda, L.R. Rittenhouse, D.M. Swift, and R.W. Richards; 1993; Amer. Soc. Anim. Sci., West. Sect. Proc. 44:255-258. (Range Sci. Dept., Colo. State Univ., Fort Collins, Colo. 80523) Animals recognized smaller patches and visited these patches more frequently; animals moved shorter distances when food was abundant, longer distances when food was scarce; vision may be important in patch selection.

Step-Up Protein Supplementation for Beef Cows Grazing Dormant, Tall Prairie; by E.S. Vanzant and R.C.Cochran; 1993; J. Prod. Agric. 6(2):236-240. (Dept. Anim. Sci., Kan. State Univ., Manhattan, Kan. 66506) Step-feeding (increasing levels of supplement with increasing stage of gestation) had no significant benefits over level-feeding for cows calving in moderate body condition.

Supplemented Native Range and Subsclover Pasture Improve Lambing Rates; by Martin R. Dally, Milton B. Jones, and Edward J. DePeters; 1994; Calif. Agric. 48(2):14-17. (Agric. Mailing Room, Univ. Calif., Davis, Calif. 95616) Grazing ewes on mature subclover pastures shortly before and during the breeding season was as effective as grazing them on native range and supplementing with alfalfa pellets at a rate of 2 lbs. daily; either treatment produced 21% more lambs than on unsupplemented native range.

Winter Forages and Diets of Elk in Old-growth and Regenerating Coniferous Forests in Western Washington; by Kurt J. Jenkins and Edward E. Starkey; 1993; Amer. Midl. Nat. 130 (2):299-313. (Ore. Coop. Park Studies Unit, College For., Ore. State Univ., Corvallis, Ore. 97331) Found greater dietary crude protein and dry matter digestibility during winter in a 1-35 year-old than in an old-growth forest ecosystem; makes other comparisons of elk response between old-growth and regenerating ecosystems.

Winterhardiness and Agronomic Performance of Wildryes (*Elymus* species) Compared with other Grasses in Alaska and Responses of Siberian Wildrye to Management Practices; by Leslie J. Klebesadel; 1993; Alaska Agric. & For. Expt. Sta. Bul. 97; 29 p. (Agric. Mailing Room, Univ. Alaska, Fairbanks, Alaska 99701) Summarized eight field experiments involving both native and introduced wildrye grasses conducted over a span of several years in southcentral Alaska.

The Great Master of Fire

Jeffrey L. Weeks

And it came to pass that the Texan went down into his ranch, in the county of King. And great was the size thereof.

But behold the pastures had become exceedingly corrupt; yea, all manner of juniper, cactus, and thorny shrubs were found thereon.

And it came to pass that the Texan did weep at the loss of succulent forage for his cattle

And it came to pass that the Texan did travel up unto the Tech, in the land of Lubbock, And at the Tech, did the Texan seek counsel from the Great Master of Fire.

And it came to pass that the Texan did desperately question the Great Master of Fire as to what manner of treatment should be done unto the pastures.

And it came to pass that the Texan and the Great Master of Fire did converse for a long time. And the Great Master did quiz the Texan concerning his pastures and the desires of his heart.

And it came to pass that together they did formulate a plan and did come into agreement concerning compensation.

Now behold, this did offer much comfort unto the Texan and he did again return to the County of King.

And it came to pass that a time passed away, when the season was right, the Great Master did gather his servants; yea, his graduate students, and they did travel down into the ranch of the Texan, in the County of King. And they did carry with them all manner of computers, kits, tools, vehicles, and machinery as to properly execute their plan.

And it came to pass that the servants did go and labor with all their mights; and the Great Master labored also with them; and they did obey the commandments of the Great Master in all things.

And it came to pass that they did take samples and make observances. And behold they did prepare and burn long strips of land according to their plan.

And it came to pass that after a time had passed that the Great Master and his weary servants did gather themselves and did return again to the Land of Lubbock.

And it came to pass that a time again passed away. And when the time was right, the Great Master and his servants did again travel down into the ranch of the Texan, in the County of King.

And it came to pass that they went with torches casting fire according to their plan. Now behold, the weather was exceedingly warm, and the winds came from the southwest. And it came to pass that the fire did travel quickly. And great swirls of smoke and fire did dance before the Great Master and his servants.

And it came to pass that they did rejoice exceedingly. For behold the fire did burn according to their plan and great was the cleansing of the pastures.

And it came to pass that when the fire stopped dancing, that the Great Master and his servants did once again gather themselves and did return to the Land of Lubbock.

And it came to pass that after a sufficient time that the Texan went down into his ranch, in the County of King. And great was the sight thereof.

And it came to pass that the Texan did rejoice exceedingly. For behold, their had been abundant moisture and the grass was exceedingly green and high. And the Texan did marvel at the great distance he could gander.

And it came to pass that the Texan did call the Great Master; yea, in the manner of cellular. And he did thank him and told him that it was good, even like as it was in the beginning.

And it came to pass that the Great Master did humbly counsel the Texan and admonished him that in time, the pastures would again become corrupt. And in that day the pastures should again be cleansed with fire.

And thus ended the conversation between the Texan and the Great Master.

But behold their association had begat much creditability and respect for the Great Master and his servants.

And it came to pass that world did travel throughout the land. And great was the increase in contracts and learning for the Great Master and his servants.

About the Author and Story

The author graduated from Brigham Young University, in Provo, Utah with a B.S. in Conservation Biology with a Wildlife Biology emphasis. He is currently pursuing his M.S. in Fire Ecology at Texas University, in Lubbock, Texas.

The Great Master is Dr. Henry A. Wright, a horn professor, in the Dept. of Range and Wildlife Management at Texas Tech University. King County is located approximately 100 miles to the East of Lubbock, Texas.

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