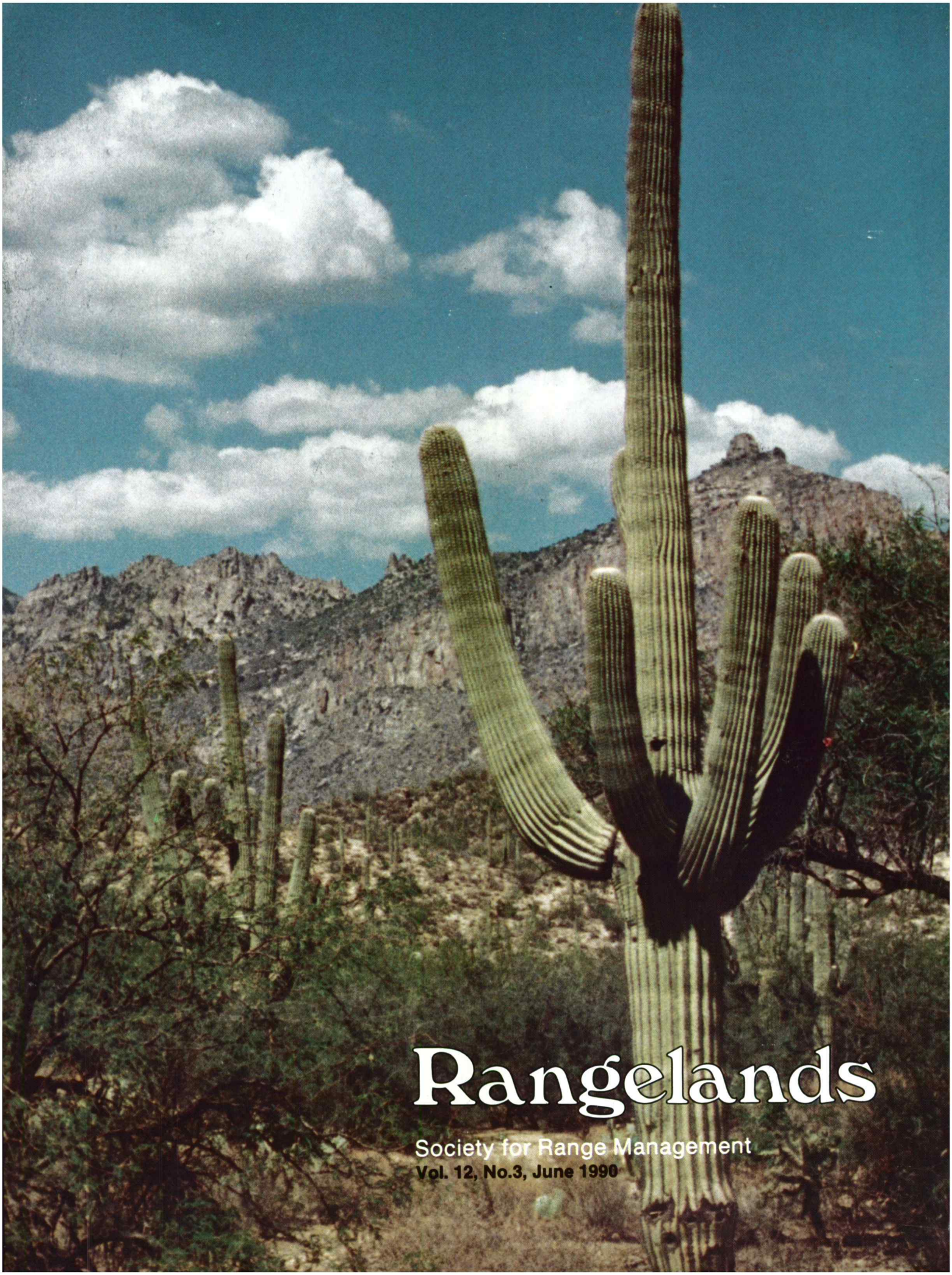

Rangelands

Society for Range Management
Vol. 12, No.3, June 1990

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The Trail Boss ®

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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 to 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.

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Rangelands

Volume 12, No. 3
June 1990

FEATURE ARTICLES

DEPARTMENTS

COVER PHOTO

FRONT: Entrance to Sabino Canyon, Coronado National Forest near Tucson, Arizona. Photo by Larry Allen.
BACK: Nomadic herders camp on the Tibetan Plateau at about 14,000 feet in northeast Qinghai Province, China. Photo by Daniel J. Miller. See related story on page 159.

Coming!

Being an Effective Witness

Riparian Grazing for the International Region

Early Use of Soapweed Yucca

Woodland Drag Chain Seeder

Evolution of Grazing and Land Tenure Policies on Public Land

Broom Snakeweed Poisoning

Forage Grass for Tropics

Published bimonthly—February, April, June, August, October, December

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President's Notes

Pack Your Suitcases

Mexican bands with trumpets blaring, guitars, marimbas, flashy costumes! It gives me goosebumps to remember them from the Mexican City Annual Meeting in 1975! I can't wait until Monterrey. Don't miss the summer meeting. Our Mexican friends will have plenty of exciting music for us—not to mention the rest of the first class programs and embellishments.

An Unusual Annual Meeting

The 1991 Annual Meeting Committee is in full swing for the D.C. meeting in January 1991, too. It's going to be an exciting non-traditional meeting with five different emphasis days and five shorter-than-normal plenary sessions. Each plenary session will have a keynote speaker and a "success story" speaker pertinent to the day's theme. The search for inspirational speakers is in full swing. I joined the committee for their planning meeting the last week of April and observed first hand the enthusiasm that has been generated.

Remember, in my last notes I mentioned BLM Assistant Director Mike Penfold intended to try and put the 1991 Annual Meeting in the BLM Training Catalogue? Mike got it done. This speaks to the quality of the meeting. Top Management in BLM views the meeting as worthy of a training experience in itself. So a word to BLM'ers—keep your eye open for the 1991 Training Catalogue.

The Race Starts Now!

More on my membership challenge to all officers and committee members to recruit one new member this year. Membership Committee Joe Kraayenbrink and I have decided to fold all parent Society officers and committee members back into the Sections for tracking and for competition. The competition will be between Sections exclusively. Winners and placers will be calculated as a percentage: the percent of all parent Society and Section officers and committee members in each Section who recruit at least one new member this year. The Denver staff are presently scratching their heads figuring how to track progress so we can give a boxscore for everyone to see each month. The year will be from January 1, 1990, until December 31, 1990. There will be prizes for the first three places in the contest. *Note to officers and committee members*—you can get your new members any time now. Set the pace!

CRM on a Roll

In my last notes, I also mentioned how I had asked three committees to triple their efforts to the end that all who are interested in rangelands "Work Together" at all levels, because it is an idea whose time has come. I have a progress report from the CRM Task Group. In Montana six one-day CRM training sessions have recently been completed in six locations around the state. Approximately 300 participants in all received the training. The six sessions resulted in additional training requests from Bureau of Indian Affairs, Environmental Coordination Groups and a Governors' Conference on Range in May 1991. I also note the Idaho Section is devoting its entire summer meeting to CRM. The State of Wyoming is doing some serious soul searching at options to improve its CRM and Stewardship structure. Colorado has a new CRM in the Craig BLM District and progress is being made on development for a State MOU. Oregon has some meaty "citizen involvement" efforts going in the name of "Working Groups"—their own recent variation on CRM. A lot is happening on this scene—I've only touched the tip of the proverbial iceberg.

United for Science Day

I had a productive week in Washington, D.C., the last week of April. One neat opportunity I had was to attend the local 10th Annual Science Day activities. They had a full day of thought-provoking speakers and activities sponsored by five professional society local chapters. Our own Society for Range Management National Capitol Section joins forces with chapters of the Wildlife Society, The American Fisheries Society, The Society of American Foresters, and The Soil and Water Conservation Society to host this event annually. I took note not only of the quality of material and substance presented, but also of the healthy and enthusiastic teamwork by the five professional society chapters. It struck me that a similar joint effort could be promoted by any of our sections as both a community service and an effective means of developing strong alliances with other professional societies. If anyone is interested in more detail, contact me or Don Nelson, National Capitol Section President.

Allied Professionals

On the subject of professional society alliances, Past President Tom Bedell initiated a fine effort nationally last fall which I had the privilege of attending. Six societies met for a day to share and build on areas of commonality. In addition to SRM, they included the Wildlife Society, The American Fisheries Society, The Society of American Foresters, The Soil and Water Conservation Society, and the American Society of Agronomy. The time spent was clearly worthwhile and worth building on. While in D.C., I took the opportunity to have breakfast with Rich Duesterhaus, President of the Soil and Water Conservation Society, and Bob Barnes, Executive Vice-President of the American Society of Agronomy (and SRM member). The purpose of the breakfast was to build momentum for a

(continued on page 155)

Executive Vice-President's Report

The Science and Art of Range Management. We have all heard these words used in our Society since its creation. But what does it really mean? To me, it is especially important due to my ranching background, for we practice the art of range management on our ranch. In other words, we apply to our rangeland what others have discovered and perfected.

But that is only part of the story. What can we as ranchers really do without the scientist and researcher? Well, I guess we could perfect the art if we were to try enough things. Like the proverbial blacksmith who *did* make a plowshare out of cold iron, he got his plowshare, but he wore out his shoulder in the process.

What is really basic is that we all must work together. We need the scientist practicing the science of range management. We also must be patient as they carefully try one thing after another, patiently comparing a thousand kinds of methods, plants, and uses as they develop a body of knowledge for use that we haven't the time to wait, and try, while making mistake after mistake. But there is a third basic leg on the stool: How do we know when a great breakthrough occurs? The scientists don't have time to go to each of us and explain and demonstrate. They would never accomplish anything. We must have the academic world to communicate the knowledge we need so badly and is basic to our very existence. So to sum this all up, the science is basic to discover what is unknown, the educator (extension person) must carry the news and teach us so that we, as rangeland managers, can apply the art to the rangeland.

In our Society we seem to ebb and flow, depending mostly on our leadership. First, we will have a predominance of scientists in key positions and the Society's actions lead many people to think that is all that anyone thinks about; then academia comes to power and the pendelum swings back to their side. But it seems without failing the pendulum swings again and the Society appears to be a production-oriented organization, and that is not wrong. I wonder how often we have all said, "If we could only strike a perfect balance, what a wonderful thing we would have." That simply won't happen, so we must live with the system and be patient, for our individual day will come—we can depend on that simply from our past experience.

In recent years, because of modern communication and transportation, a new kind of people has discovered the rangelands and found them to their liking. But they have never experienced the practical side of range management. What they continue to express is their need to quickly learn the basics—things that our first membership took for granted but are not generally taught in school, for no other reason than a lack of time.

In a small effort to answer some of these expressed concerns for the need for practical knowledge and the worry that the SRM has become too scientific of late, the Society has accepted a request by VREW to have for sale at the Denver office three excellent practical publications. The first is *Water-Pumping, Piping, Damming, and Storing*, which is priced at $6.00 plus postage; second is *Facilities for Handling, Sheltering, and Trailing Livestock Fences* priced at $5.00 plus postage; and third is *Fences*, a much larger volume priced for $10.00 plus postage. We will have a limited number on hand because of the cost and the need to know what the demand will be. If a second printing of any one of the three volumes is needed we are set up with the printer to do this rather quickly.

As a person who should have known every single thing in these publications, I found them an excellent source of good practical information, and I would recommend them to everyone experienced or otherwise.

Monterrey Mexico is a Wonderful City

I have recently returned from a pre-meeting planning trip to Monterrey. I found Monterrey to be a grand old city. The hotel, The Ambassador, is as modern and clean as any here in the United States—frankly, a lot better then some I have endured in my travels for SRM.

In addition, the planning committee people are so concerned that we receive only the best treatment, they went to a second hotel only a very short block away, that is equally grand and completely renovated, and bargained a lower rate there for our consideration. The facility is named Gran Hotel Ancira Inter Contential. The room rate is $63.00 plus tax and they do have a toll free reservation number 1-800-83060. Nothing would stop those folks from giving me a complete tour of the hotels, (and are they nice!). From there we enjoyed each of the social events that are scheduled. I hope you can stand high quality entertainment because that is what is in store for everyone who attends.

Speaking of attending, just simply forget any bad press you have heard. All that is needed to cross the border is a voter registration card. There are many flights per day into the Monterrey Airport, and for the faint of heart the hotels are completely air conditioned.

So let's all make plans right now to attend the summer meeting of SRM. We are on a roll and there is lots to do. It will be a fun-filled working meeting that could match almost any vacation anywhere. See you in Monterey if not before, and thanks for all your great help.—**Peter V. Jackson,** Executive Vice-President, SRM.

The Desert Tortoise in Relation to Cattle Grazing

Vernon Bostick

The Historical Evidence

Early History

The desert tortoise has inhabited the Mojave and Sonoran deserts in the southwestern United States and Mexico for thousands of years. For the past three or four centuries, the desert tortoise has shared its habitat in Mexico and California with cattle.

There is no information on tortoise abundance in pioneer days, but we do have good information on cattle abundance and range conditions a century ago. The build up in livestock numbers in the 1870's and '80's, which is well documented in Arizona (Griffiths 1901, Thornber 1910), occurred over all the western range. Stoddart and Smith (1955) estimated that about 85 percent of livestock on the range perished in the late 1880's. We know that desert tortoises survived this severe overgrazing because they didn't become extinct.

World War I encouraged a second build up in range livestock numbers. Beef sold at high prices and the range was free. Universal overgrazing was the inevitable result.

The decade of the Thirties was ushered in by the severest drought of record. In addition to peak numbers of livestock, the western range was plagued by hordes of rabbits, rodents, and grasshoppers (Vorhies and Taylor 1933). Ranchers burned the spines off cactus in an attempt to save their cattle from starvation. Death losses from starvation and invading poison plants were severe. The destruction of the western range is documented in Senate Document 199 (US Forest Service 1930).

In view of the concern expressed by some people for the past ten years, it is amazing that any tortoise survived the many years of unregulated livestock grazing that preceded enactment of the Taylor Grazing Act of 1934. From a single census in a single year, Schneider (1980) drew the following conclusions: 1. That the population is declining rapidly towards extinction. 2. That overgrazing by cows is responsible. 3. That desert tortoises should be listed as endangered. 4. That their habitats should be closed to grazing. Schneider summed up his report with this statement: ". . . the outlook for the future of the species [desert tortoise] in the state [Arizona] appears grim."

Mortimer and Schneider (1983) censused a desert tortoise population with the highest density known in Nevada. Their data showed a 45 percent increase in population over a census made five years before by another biologist. Nevertheless, Mortimer recommended that this habitat be closed to cattle grazing for 15 years so the tortoise population could recover. He summed up his report with this statement: ". . . habitat and wildlife managers must determine if livestock grazing operations can co-exist with tortoise and other wildlife on the Mojave Desert Biome."

The Taylor Act

The Taylor Grazing Act of 1934 ended the free-for-all, get-all-you-can-while-you-can, uncontrolled grazing which had destroyed the range resource on the public domain. Every decade since the original reduction of roughly 50 percent in grazing use, the Bureau of Land Management has made reductions in the amount of livestock use permitted. Permitted use today is only about ten percent of the livestock use that occurred during the free range days. If the conservative grazing management that is being practiced today has such a detrimental impact on desert tortoise populations, how could the species have survived through all those years of uncontrolled livestock grazing?

Dr. Kristin Berry interviewed all the long-time residents in the Mojave and Sonoran deserts she could find and questioned them about the abundance of desert tortoises years ago.

The following quotation is from Dr. Berry's *Tortoises For Tomorrow:*

> "Long-time desert residents in California noted extraordinary densities [in the early Thirties] that could have been as high as 2,000 per square mile."

The evidence that Dr. Berry accumulated is ample to support her conclusion, but I will review only one interview: A member of a survey party in Antelope Valley in 1933 saw over 100 tortoises in one place at one time. He told Dr. Berry that tortoises "were everywhere. . .all over the ground."

A density of 2,000 tortoises per square mile is three tortoises per acre. The year 1933 was the third year of the great drought, and the culmination of years of overgrazing by livestock. Let's assume that forage production was 90 pounds per acre (on an overgrazed desert range in a drought year, this is a liberal estimate).

Cattle were starving; we can assume that they grazed the range as closely as possible. This means that cattle would have consumed about 90 percent of the forage produced. If there were any sheep on the range, forage use by livestock would be even greater. At the very most, there was only three pounds of forage left for each tortoise for the year. But in the early Thirties western ranges were overrun by jack rabbits (Vorhies and Taylor 1933)

Editor's Note:
Readers may also wish to read the article "Habitat Management for Desert Tortoise in Nevada" by Joseph V.H. Ross, *Rangelands*, 8(6):286-290, December 1986.

and heavily infested with grasshoppers.

Grasshoppers feed all day; jack rabbits all night; tortoises about 7 hours per week if the weather is not too hot or too cold for them to leave their well insulated burrows (calculated from data presented by Nagy and Medica 1986).

While livestock, jack rabbits, and grasshoppers were busy grubbing the range to stave off starvation, the tranquil tortoise whiled away the time snoozing in its burrow. Then how did they survive? Easy enough—they used a different food source.

The toothless tortoise is ill equipped to harvest and masticate range forage. The tortoise can harvest only tender vegetation, and it can't masticate even that. The tortoise can't process enough bulky, low analysis forage fast enough to meet its nutritional requirements (Nagy & Medica 1986). They solved this problem long ago—they allow other animals to do it for them. Desert tortoises feed primarily on dung. The more animals using the range, the more dung, which makes more food available for tortoises.

In the millennia preceding the advent of domestic livestock on the range, tortoises subsisted on pellets excreted by rabbits, deer, and bighorn and scats of predators. Tortoise populations adjusted to the amount of dung available; their numbers were low (Mollhausen 1854).

The Western Regional Extension Publication No. 39: *By-products and Unusual Feedstuffs in Livestock Rations* (Bath et al. 1980) states: ". . . it is commonly estimated that 80% of the total nutrients in feeds are excreted by animals as manure." The desert tortoise is well adapted for making use of cow dung. Four days elapse between meals. This allows plenty of time for the tortoise to complete the digestion that began in the cow's stomach. The digested food moves slowly, ever so slowly, through tortoise intestines. This trip takes 17 days (Nagy and Medica 1986).

It is a biological law that all organisms tend to increase to the limits of their food supply. Therefore, it is natural and to be expected that desert tortoise numbers and livestock numbers peaked on the public domain at the same time.

It is also a natural law that if the food supply is diminished for any population, that population will adjust to come in balance with the reduced food supply. For 50 years BLM has been reducing the numbers of livestock permitted on the Federal Range. For 50 years desert tortoise populations have been declining.

Beaver Dam Mountains

We can be fairly certain that before the Mormon colonization of this area in the late 1850's, Beaver Dam Mountains in Utah was a Joshua-tree savannah with a bunchgrass understory similar to portions of the McCullough Mountains in Nevada that have never been grazed for lack of water (Bostick 1973).

Because of their persistence as relics, we know that bush muhly and Indian ricegrass were members of this pristine grassland community. Ten years after settlement Mormon cattle had become numerous and were grazing the range too closely to permit Indian ricegrass to mature seed. The original grassland was converted to typical Mojave Desert dominated by creosote bush and white bur-sage with an understory of exotic annuals from the Mediterranean region.

The intense competition for forage by livestock owners was halted by the Taylor Grazing act of 1934. The big reduction in grazing use in 1936 (about 50 percent) didn't bring about any noticeable range improvement, and another cut in authorized use was made by shortening the length of the grazing season. It was after this second cut that Woodbury and Hardy (1948) reported a desert tortoise population density of 150 tortoises per square mile.

BLM made further cuts in grazing use in the early fifties and again in the sixties. In 1970 1,500 acres of tortoise habitat were fenced and closed to all grazing by livestock. Sheep use was eliminated. Four years later Coombs (1974) reported 39 tortoises per square mile. Between Hardy's census in 1948 and Coombs' census in 1974, livestock grazing was reduced 100 percent. There was a 74 percent reduction in tortoise density.

Rabbits were abundant in the exclosure until 1982, and tortoises could meet their protein requirements by eating rabbit pellets. Rabbits were scarce after 1983. The tortoises were doing so poorly that a veterinarian, Dr. James Jarchow, was consulted. Dr. Jarchow (1987) found that the six tortoises from the exclosures that he examined were all suffering from osteoporosus. He attributed this condition to insufficient protein in their diet.

Dr. Jarchow wrote a prescription for these tortoises.

1. He recommended a predator control program "designed to eliminate those individual predators preying chiefly on this species."

2. He recommended that "desert tortoise habitat should be managed to promote the resurgence of *Muhlenbergia porteri* growth. . .and seeding campaigns should be instituted."

3. "Supplemental feed, in the form of scattered timothy or bermuda hay, should be provided in times of drought and midsummer."

4. Additional exclosures should be erected in critical areas."

This prescription is not backed by clinical experience; there is no evidence that any of these remedies prescribed are practical and beneficial. Years of management by untested theories have brought this once thriving population to the verge of extinction.

Dr. Jarchow examined five tortoises from the Littlefield plot, which is open to cattle grazing. For three of these he reported "No abnormalities were evident." The abnormalities noted in the other two specimens were not related to their diet. He also took blood samples from each tortoise and sent them to a laboratory for a complete analysis. From these data he concluded they ". . .were considered presently healthy and well nourished."

Although it is coincidental and not planned, these two plots in the Beaver Dam Mountains demonstrate the relation of cattle grazing to desert tortoise welfare. Cattle have been excluded from the Utah plot for 19 years; the tortoises exhibit symptoms of protein starvation, associated

with high mortality. The Arizona plot is open to cattle grazing; the tortoises are healthy and well nourished.

If tortoise biologists are correct, then areas from which livestock have been excluded for a long time should have thriving tortoise populations. On the other hand, the science of range ecology predicts that excluding cattle will reduce the tortoise population and they will become rare.

Cattle Excluded Areas

Cattle have been excluded from the Nevada Test Site and the Desert Wildlife Range for many years. Tortoises are rare and doing poorly at both sites.

A small tortoise population was studied intensively for ten years in Rock Valley on the Nevada Test Site from which cattle had been excluded for 40 years. These tortoises were under continual stress. They suffered from a scarcity of water, insufficient nitrogen (protein) in their diet, and an excess of potassium.

They could excrete the potassium in their urine as other animals do, but urinating would have left them dehydrated. Tortoises urinate only when they have water to drink. They could have converted the potassium to an insoluble form and excreted it in their scats. This requires nitrogen, which would have had to come from catabolizing their own tissues (Nagy and Medica 1986).

This stress could be relieved if these tortoises had access to their natural food source, cow dung. Fresh cow dung is 85 to 90 percent water. Bees and butterflies drink from fresh cow pies. Cow dung could also supply the high quality protein tortoises require. The excess potassium came from consuming plant material high in potassium but low in other nutrients.

Thousands of years of adaptation to a highly nutritious dung diet has left the desert tortoise ill prepared to switch to a bulky diet of fresh plant material. Nagy and Medica (1986) found that during the spring active period, desert tortoises would not or could not eat enough plant material to maintain their body weight. During the lush spring period desert tortoises were on a reducing diet.

Summary and Conclusions

The historical record shows that:

1. Desert tortoises have coexisted with cattle for 300 years in California and Mexico and at least 100 years elsewhere.

2. The highest tortoise densities known occurred at a time when overgrazing by livestock was the severest ever known.

3. The fewer the cattle on a range, the fewer the number of tortoises.

4. Excluding cattle for many years endangers the tortoise population.

It is known all over the world and is very well understood in the developing countries of Africa that overuse of the range by one species of animal will degrade the range for that species and its numbers will decline, but this same overuse will improve the range for another species and its numbers will increase. Severe overgrazing of the public domain by livestock after World War I improved the habitat for tortoise and brought on a population explosion similar to the famous deer irruption on the Kaibab.

BLM's conservative grazing management program is designed to restore ranges degraded by years of overuse by livestock. Restoring the range is beneficial to some wildlife, bighorn for instance, but it is detrimental to tortoises. Like jackrabbits and mule deer, desert tortoises thrive on deteriorated range lands. Declining numbers of desert tortoises since the Taylor Grazing Act of 1934 is a direct result of decreased livestock grazing and improved range conditions.

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Livestock Control with Electrical and Audio Stimulation

Thomas M. Quigley, H. Reed Sanderson, Arthur R. Tiedemann, and Michael L. McInnis

Conflicts between livestock and other users of rangelands in riparian areas are forcing resource managers and ranchers to find better ways to control livestock distribution. Current control techniques involve extensive fence construction, including corridor fences along riparian areas.

Radio-activated electrical stimulus is an alternative to traditional fencing to control cattle distribution. Our hypothesis was that cattle could be trained to respond to electrical stimulus to avoid an area (aversion area) that would be defined by a signal from a radio transmitter. In practice, the animals to be controlled would wear a collar containing a radio receiver and an electrical stimulator with contacts touching the animal's skin. When a collared animal moves into the aversion area, the transmitter signal activates the receiver in the collar, and an electrical stimulus is applied to the animal. If the animal remains in the aversion area, the stimulus is repeated at periodic intervals until the animal leaves the aversion area. As a safety factor, the receiver would be designed to stop the electrical stimulus if it exceeded a predetermined length of time.

An abundance of literature focuses on the behavior of domestic livestock (Arnold and Dudzinski 1978, Fraser 1985, Hafez 1975) but little on learning by cattle in the range environment (Kiley-Worthington and Savage 1978). Albright et al. (1966) demonstrated that dairy cattle respond to and can be herded with auditory stimulus. Karn and Lorenz (1984) successfully used electrical stimulation to separate range cattle into groups for supplemental feeding. Aversive training with audio and electrical stimuli is an accepted and successful technique for training dogs (Tortora 1982) and has recently been used to train cutting horses (personal communication Chad James, Tri-tronics Inc., Tucson, Arizona).

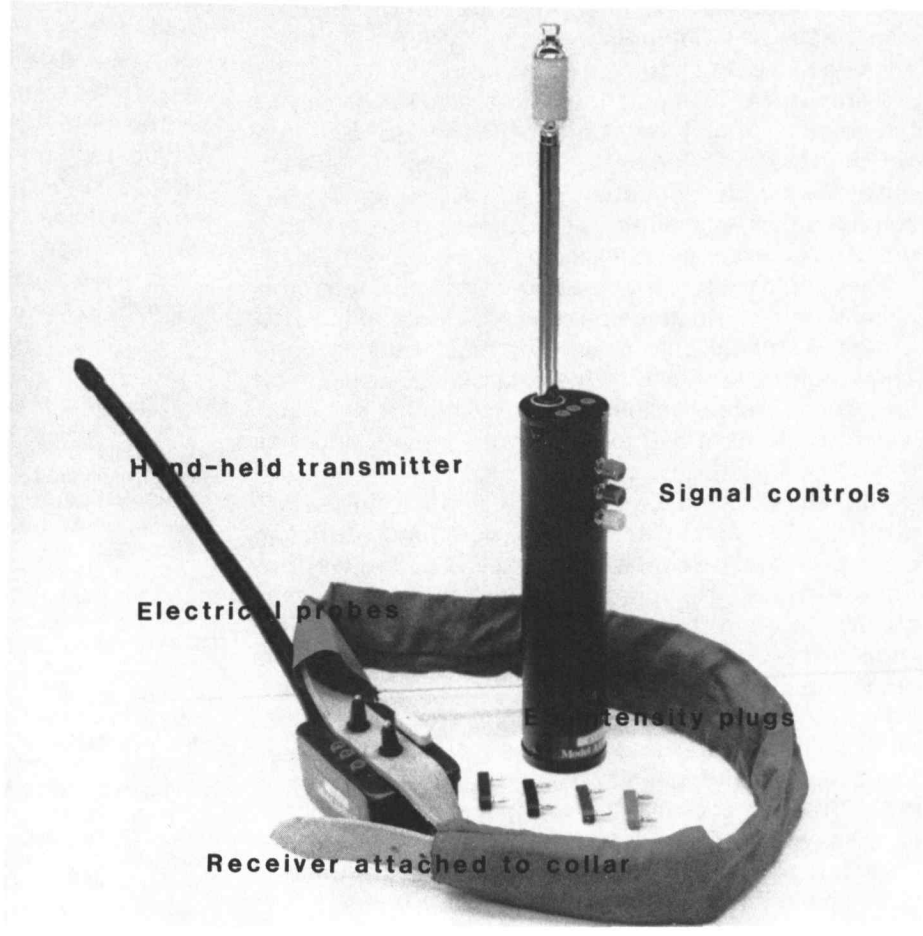

Fig. 1. *Radio transmitter and receiver used to apply audio-electrical and audio stimulation.*

Methods

Four yearling Hereford steers weighing about 650 pounds each were used in all experiments. These animals had been grazing with other yearlings in pastures bounded by electric fences. The study area was at the Oregon State University, Eastern Oregon Agricultural Research Center at Union, Oregon.

We used four Tri-tronics A1-90[1] remote trainers designed for dogs (Fig. 1). A training unit consisted of a hand-held transmitter and receiver mounted on a collar with two probes that emitted electrical stimuli. Each training unit operated on a separate frequency to individually control each receiver. This model training unit

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[1]The use of trade name does not imply endorsement or approval of any provided product by the USDA Forest Service to the exclusion of others that may be suitable.

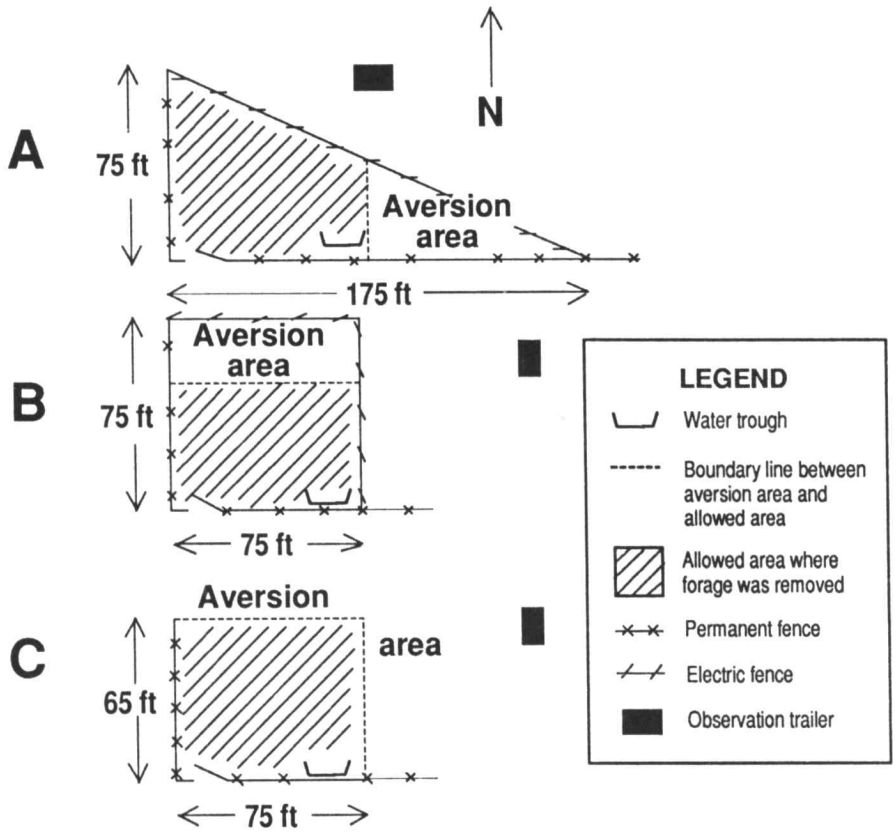

Fig. 2. *Pasture configurations used in training and testing steer response to audio-electrical stimulation: A. Training area. B. Trial pasture. C. Fenceless trial pasture.*

provided two audio signals and one level of electrical stimulation. The electrical stimulation was provided by rapid discharge of a capacitor across two probes on the inside of the collar.

Receivers were designed to provide a warning audio stimulation, an audible buzz tone, when one button was pushed on the remote transmitter. A short-buzz audio stimulation was followed by an electrical stimulation when the second button was pushed. The electrical stimulation could not be executed independently. The equipment thereby provided an audio-electrical stimulation.The audio stimulation had a constant tone and volume, but the electrical stimulation intensity could be varied through five levels—with level one the least intense and level five the most intense. Each receiver had a safety mechanism to terminate electrical stimulation after 10 seconds, a feature designed to prevent injury.

The first step was to determine the animal's response to the equipment and to determine the appropriate electrical stimulus level. The second step was to determine the response of the test animals to aversion training. The third step was to determine the results of the aversion training in a simulated real-pasture setting. Visual observations of animal behavior were documented with a video camera.

The desired behavior was to have the test animals change their direction of travel away from the aversion area. The level of electrical stimulation was to be sufficient to create this response and no greater.

Animal Response

Each animal was fitted with a collar of a different color to identify individuals and an electrical stimulation intensity of either two, three, four, or five. The collars were snugly fitted to the animals' necks. The collars fit the narrowest portion of the neck with no apparent effect on eating, drinking, or breathing. Each collar was adjusted so that the electrodes remained in contact with the skin below the animal's jaw on the lower side of the neck.

After the steers were collared, they were herded into a small corral. The steers appeared to adjust to the collars within five minutes. We began with the level two electrical stimulation. This level caused the steer to lower its head, bawl, jump forward, and run. This was a more dramatic response than anticipated, indicating that level two was too high. Two steers were refitted with level one electrical stimulation plugs and two with level two plugs. The animals showed only mild responses to level one and level two electrical stimulation, such as laying their ears back and not moving. We have no explanation for the first steer's initial reaction to level two electrical stimulation, but it was obvious that level two was inadequate. We changed the plug levels to three and four with two steers in each level. At level three the steers shook their heads and laid

Table 1. Animal response to audio-electrical stimulation.

Category	Day 1	Day 2	Day 3	Day 4	Total	% correct
	Correct response/incorrect response[1]					
Steer 1	1/1	2/0	15/1	8/0	28/2	93
Steer 2	1/0	2/0	27/0	17/0	47/0	100
Steer 3	2/0	4/0	16/0	4/0	26/0	100
Steer 4	1/0	5/1	13/1	12/0	33/2	94
Total	5/1	13/1	71/2	41/0	134/4	
% correct	83	93	97	100	97	
Hours steers were in pasture	4	6	7	3	20	
Hours of recorded observations	4	5	6	3	18	

[1]Correct response = animal left the aversion area and returned to the allowed grazing area. Incorrect response = animal remained in the aversion area after receiving AES.

their ears back. Level four electrical stimulation consistently caused the animals to turn about 90 degrees and jump. All electrical stimulation levels were changed to level four, and tested twice more. All steers responded in the same manner, and level four electrical stimulation was selected for the grazing trials.

During these trials, the steers seemed to associate the audio stimulation buzz with an electrical stimulation that followed. The audio stimulation caused them to lay their ears back. This observation indicated that audio stimulation alone might be used to control cattle distribution.

Training

A 0.1-acre triangular training area was established in a pasture where two sides were permanent fences joined at a 90 degree angle and the third side was an electric fence (Fig. 2a). Forage was uniformly distributed and water was available. About one-third of the pasture, including the narrowest end, was designated as the aversion area. The aversion area was defined by an imaginary line identified by landmarks outside the training area. Because the aversion area narrowed to a point, it was speculated the animals would recognize that moving further into the aversion area would reduce their options for escape.

Feed was taken away from the test steers about 12 hours before the trials to encourage feeding activities during our observations. The steers entered the training area in the "allowed" access portion of the pasture and explored and grazed at will. As soon as a steer moved into the aversion area, the observer administered an audio electrical stimulus. If an animal continued further into or did not leave the aversion zone, it was given additional stimulation at about 5- to 10-second intervals. Each audio electrical stimulus provided an electrical stimulation of five seconds or less.

The first steer entered the aversion area within two minutes of entering the training area and was subjected to audio electrical stimulation. The steer jumped forward and ran further into the aversion area. A second signal was applied, and the steer ran into the narrow neck of the aversion area. A third signal was given, and the animal turned quickly and ran out of the aversion area. A second steer entered the aversion area before the first steer exited and was also given an audio electrical stimulation signal; the second steer spun and ran out just ahead of the first steer. Both of these animals were again grazing with 10 seconds after the last audio electrical stimulation. The steers were observed and received audio electrical stimulation signals as necessary for the next 4 hours. During the first afternoon of training, two steers received stimulations twice and two steers once (Table 1). Following the initial audio electrical stimulations to the first steer, only one signal was administered for each entry in the aversion area because the steers immediately returned to the allowed area. After 4 hours of training, the steers were returned to the holding corral and provided a bale of hay.

There was an abundance of forage in the allowed area and the steers had no incentive to go into the aversion area. To accelerate training, most of the forage was removed from about two-thirds of the allowed area.

The next morning (day 2), the steers were returned to the training area after the excess forage was removed. The animals grazed slowly toward the aversion area and received an audio electrical stimulation when they entered the forbidden area. After each audio electrical stimulation they generally turned about 90 degrees and continued to graze outside the aversion area. In some instances they took one step backwards, turned, and continued to graze. It appeared they were treating the aversion boundary as a barrier. The animals behaved in a predictable manner, and only one steer responded incorrectly and received a second audio electrical stimulation before he exited the aversion area (Table 1).

Trial Pasture

On day 3, the training area was reconfigured into a 0.1-acre rectangle with permanent wire fences on two sides and electric fences on the other two sides (Fig. 2b). The allowed grazing area of the training pasture was retained as the allowed grazing area for the newly configured trial pasture. The aversion area was the north one-third of the trial pasture. The intent was to remove the narrowing feature of the training area and provide a new aversion area to determine if the steers had learned to respond correctly to the audio electrical stimulation or if they had only learned the location of the aversion boundary.

Steer response was essentially the same as observed in the training area. Two steers each responded once to one stimulation signal by moving forward further into the aversion zone—an incorrect response; but when given a second signal, they responded correctly by turning and exiting the aversion area. During the 6 hours of observations recorded on day 3, 97 percent of the responses to audio electrical stimulation signals were correct (Table 1).

Fenceless Trials

Advanced trials were conducted on the afternoon of day 3 and the morning of day 4. We removed the electric fences from two sides of the trial pasture and left the permanent fences on the other two sides (Figure 2c). The allowed grazing area remained about the same size, and the aversion area was the rest of the pasture—about 50 acres. As the cattle grazed into the aversion area, they received an audio electrical stimulation signal. The four steers were kept in the allowed grazing area with only an occasional signal. The animals appeared to accept the invisible barrier and responded in the desired manner whenever audio electric stimulation was applied (Table 1). When a steer moved into the aversion area it received a signal and turned away from the line of travel, took a step backward or sideways, and continued grazing within 10 seconds. There was no apparent deterrent to the animal's grazing behavior, only the

location of the grazing.

After we completed our observations on day 4, we examined the steers' reactions to only audio stimulation for a 1-hour observation period. The audio stimulation alone was applied as the animals crossed into the aversion area. In all instances the animals responded as though they had received audio electrical stimulation. Their reaction was to turn, step away from the aversion area, and continue grazing. Occasionally, when two steers were grazing together and only one steer received audio stimulation, both animals would respond by changing direction and moving away from the aversion area. This same behavior was also observed during audio electrical stimulation trials.

Conclusions

Cattle can be trained to avoid an area without a fence-defined boundary by using a remotely controlled audio electrical stimulation. After less than 2 days of training, the four steers responded to the signals in the desired way. Although the steers responded to audio stimulation in the same way, we did not determine the length of time the steers retained their learned response to audio stimulation. We observed no adverse affects because the steers resumed grazing soon after receiving either audio electrical or audio alone.

Electrical stimulation may have the potential to control livestock distribution and to reduce the costs of fencing and herding if cattle respond in the same manner under range grazing conditions. Audio-electric stimulation may be an economical alternative for controlling livestock in riparian areas (where corridor fencing is the standard practice), forest regeneration sites, and other areas sensitive to grazing. Fenceless livestock control also has aesthetic appeal as an alternative to barbed wire or other fences. Such a method could be made essentially invisible by camouflaging the transmitter. Further research is needed on equipment development, effective training methods, and retention of audio stimulation training.

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President's Notes (cont'd)

second annual meeting this fall. It will happen about the first of November and Rich Duesterhaus will take the lead in arranging and hosting this year's event. Good things are growing out of the rather loose alliance so far. Not only are we sharing in ways to enhance our professionalism, but we also have generated a much broader based support for range management funding.

Boost for Range Research

Another opportunity I had in D.C. was to participate in a day's activities sponsored by the National Research Council's Board of Agriculture. The Board invited about 20 professional societies to participate in discussions on the National Research Initiative. I used that opportunity to get up to date on well-orchestrated efforts to promote research funding. Range Research is an integral part. I also took the opportunity to visit with four Congressmen and Senators to specifically promote Range Research funding. From a global perspective Range Research is critical to mankind and I am proud to be working to this end. I was graciously received.— **Rex Cleary,** President, SRM

Controlling Eastern Redcedar on Rangelands and Pastures

Jon Wilson and Thomas Schmidt

A growing problem on many rangelands and pastures is the invasion of eastern redcedar *(Juniperus virginiana).* The encroachment of this coniferous, non-sprouting tree has reduced the amount of available forage on grazing lands and increased livestock handling problems. If a program of eastern redcedar control is not initiated by landowners, the ultimate result could be a significant loss of grazing on these lands.

Using Nebraska as an example, the status of eastern redcedar in Nebraska has been rapidly changing. Recent inventories show an increase in acreage infested by eastern redcedar while other forest types were declining. Total woodland acreages in Nebraska declined about 10% from 1955 to 1983. In 1955, approximately 2% of all woodlands were predominately eastern redcedar (Stone 1961). In 1983, over 15% of all woodlands were occupied by eastern redcedar (Raile 1986). Eastern redcedar expanded from approximately 54,000 acres in 1955 to over 188,000 acres in 1983.

Size class distribution gives another view of what is transpiring with this species. Over 54% of the eastern redcedar trees are currently in the one to five inch diameter breast height (DBH) size class. Over 40% of the trees are in the 5-11 inch DBH size class while only 6% are over eleven inches in DBH (Raile 1986). This indicates a young eastern redcedar population.

Where is this expansion occurring? Most of the increase is occurring in non-commercial forest land, which is typically pasture and rangeland with scattered trees. The following table shows the acreages of eastern redcedar in Nebraska by land class for 1983 (Raile 1986).

Table 1. Acreages of eastern redcedar by land class in Nebraska, 1983.

Land Class	Acreages of Eastern Redcedar
Commercial Forest Land	42,200.
Non-commercial Forest Land	112,100.
Windbreaks	21,300
Wooded Strips	13,200.
Total	**188,800.**

The justifications for controlling eastern redcedar have been to maintain/increase forage availability and reduce livestock management problems. Forage production is reduced or eliminated under an eastern redcedar canopy and is difficult for the livestock to graze. Small trees replace very little grass; however, a large cedar tree may occupy nearly 500 square feet. This represents a significant loss of forage from the area occupied by each tree. A typical rangeland that is being invaded by eastern redcedar can have hundreds of small trees per acre. If they are allowed to grow, the potential for forage loss is great.

Livestock management problems created by eastern redcedar also contribute to the need for control programs. Livestock are hard to check daily, hard to round-up, and tend to underutilize the available forage in rangelands with significant densities of eastern redcedar. These areas become inaccessible by vehicles, horses, and sometimes man which makes round-up a major task.

Control

Controlling eastern redcedar requires periodic treatments every 10-20 years. Initially, several different treatment methods may be needed if the existing eastern redcedar stands are composed of a wide range of age classes or sizes. Once the trees are reduced to an even size class, they can be managed effectively by one treatment method. The type of control program is dependent upon many variables including average tree size, density, topography, equipment availability, manpower availability, understory type (warm- or cool-season grasses), amounts of forbs and woody vegetation, and fuel loads for carrying a prescribed fire. All of these variables will have an impact on the cost and effectiveness of the control program.

The successful implementation of a control program may be enhanced by the opportunity to produce saleable wood products from the trees. Potential wood products from eastern redcedar are fence posts, lumber, shavings, cedar shingles, and firewood.

The minimum size necessary for producing a saleable product is based on the minimum specifications for a line post, typically 6.5 feet long with a small end diameter of 3 inches. Trees larger than this can be used for corner posts or, if of sufficient size, for lumber, shavings, or shingles.

Control Methods

Recognized methods of treating or controlling eastern redcedar are: mechanical, chemical, and prescribed burning. Which control method is selected will depend on the characteristics of each site; equipment, manpower, and financing available; and the average size of the eastern redcedar to be treated.

Mechanical Control Methods

A) - Hand Control

Traditionally, the most common control method has been hand removal. This method is effective but only small tracts of land can be treated at any one time. Hand removal of eastern redcedar is labor intensive. Hand re-

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moval has often been directed toward removing larger trees for fence posts. Limiting factors are the benefit-to-cost ratio and the time and labor available. An advantage of hand removal is that it may be done during the owner's, or hired man's, off-season, which allows for more uniform utilization of time. Hand removal often misses small plants because they are hidden in the grass.

B) - Machine Control

Machine removal has been underutilized due to the lack of adaptable equipment and terrain restrictions. This method can be used to effectively treat more trees per time period than by hand. Most of the equipment described below is available for contracting.

1) *Tractor-mounted buzz saw.* The buzz saw mounts horizontally to the three-point hitch and is operated with the power take-off. Contact with the tree is made by backing the tractor into the tree, extending the saw blade, and severing the tree at ground level. Disadvantages include: slowness of operation due to continual backing, high hourly cost, relatively low production rate, blades dull rapidly from soil contact, and use is limited by topography.

2) *Tree-shears.* This equipment consists of a pair of hydraulically operated blades mounted on front-end loader arms or three-point hitch that is operated hydraulically to shear trees at ground level. Advantages include: relatively fast to operate, moderate hourly cost rate, and can be home built with small initial investment. Disadvantages include that it is only effective on trees between 1 and 8 inches in base diameter, very small trees can easily be missed, and it is limited to areas accessible to farm-type tractors.

3) *Plow-blade.* This equipment has a solid metal blade with either a hardened steel edge or twin rows of hardened steel teeth that attach to a dozer blade or front-end loader. The plow-blade cuts trees by knifing through the stem. Advantages include: it can be used on almost any size tree, a small initial investment to produce or purchase the blade, and less labor intensive than hand removal. Disadvantages include: it requires a large horsepower tractor, it often takes more time than some other mechanical methods because it usually requires 2-3 approaches to complete shearing of the tree, and it is limited to equipment accessible areas.

Eastern redcedar encroaching rangeland in Nebraska.

Example of lost forage production under eastern redcedar canopy.

Chemical Control Methods

Chemical control methods involve hand or aerial application of selected herbicides. Hand application is normally on a tree-by-tree basis while aerial application is generally used for an entire area. The most effective application procedure is to treat individual trees or groups of trees by

hand. Hand chemical application can be accomplished by basal injection, backpack sprayers, or hand spreading granular materials. A number of herbicides are available that have proven effective for controlling eastern redcedar (Smith 1986, Wilson 1984, and Engle 1987).

Advantages of chemical control include: it can be effective on all sizes of trees, it is not limited by topography, it can be cost effective, aerial application can treat large areas at one time and is not labor intensive, and hand application allows for selection of individuals to treat. The disadvantages of chemical control include: initial expense of the chemical and application equipment, application may be difficult, desirable plants may be killed, time of application may be limited, and environmental concerns.

Eastern redcedar post harvest to convert invaded pasture back to open rangeland.

Prescribed Burning Control Methods

The use of fire to control woody vegetation on rangelands has been a highly successful and inexpensive method. It is relatively low cost and holds potential for controlling eastern redcedar. The problems with this method are: 1) inadequate quantity and continuity of fuel; 2) burning under optimum and correct environmental conditions; 3) non-uniformity in size of trees; and 4) anti-burning ethic of local landowners.

Prescribed burning has had limited impact due to size restrictions on how many areas can be treated by a prescribed fire. Where implemented, burning has been a very effective method of control for smaller sized trees. Once the trees reach a height where complete crown kill due to heat or flames is not probable, the effectiveness of burning diminishes.

The single most limiting factor in obtaining a successful burn is the scattered nature of the cedar trees and inadequate fuel loads. Without proper fine fuels, it is difficult for the fire to spread over the area and the result is a sporadic control pattern.

Burning may not kill large trees. Burning is most effective at controlling trees less than three feet in height. Small trees are those that are typically missed during a mechanical control operation, thus fire provides an excellent method of controlling small eastern redcedar. A cost-effective control plan could include burning first and then follow-up with a mechanical control method. By burning first, the need for mechanical removal is lowered, which is important because the cost per tree for burning is less than that for mechanical removal. Prescribed burning has advantages over other methods because it is not limited by topography, it can be inexpensive, and it is one of the best methods to maintain cedar-free rangeland.

Summary

Many ranchers are faced with an invasion of eastern redcedar on rangeland which is reducing the available forage for livestock and creating problems in handling livestock. A major increase in the acreage infested by eastern redcedar has occurred during the last 20-30 years. There is currently a wide variation in tree sizes. This disparity in size makes initial control very difficult. A recommended approach to eastern redcedar control is the initiation of a program that relies on several control methods.

The questions of whether or not to undertake control of eastern redcedar on rangelands will depend on the value placed on range forage and livestock management. The longer a landowner waits to address an existing eastern redcedar problem, the greater the cost will be to accomplish control. However, with larger sized trees, there is a potential for a commercial harvest. New equipment, lower costs of herbicides, or a higher value placed on forage will make treatment more cost effective. The opportunity to realize an income from harvested eastern redcedar trees will improve the cost effectiveness of eastern redcedar control.

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Grasslands of the Tibetan Plateau

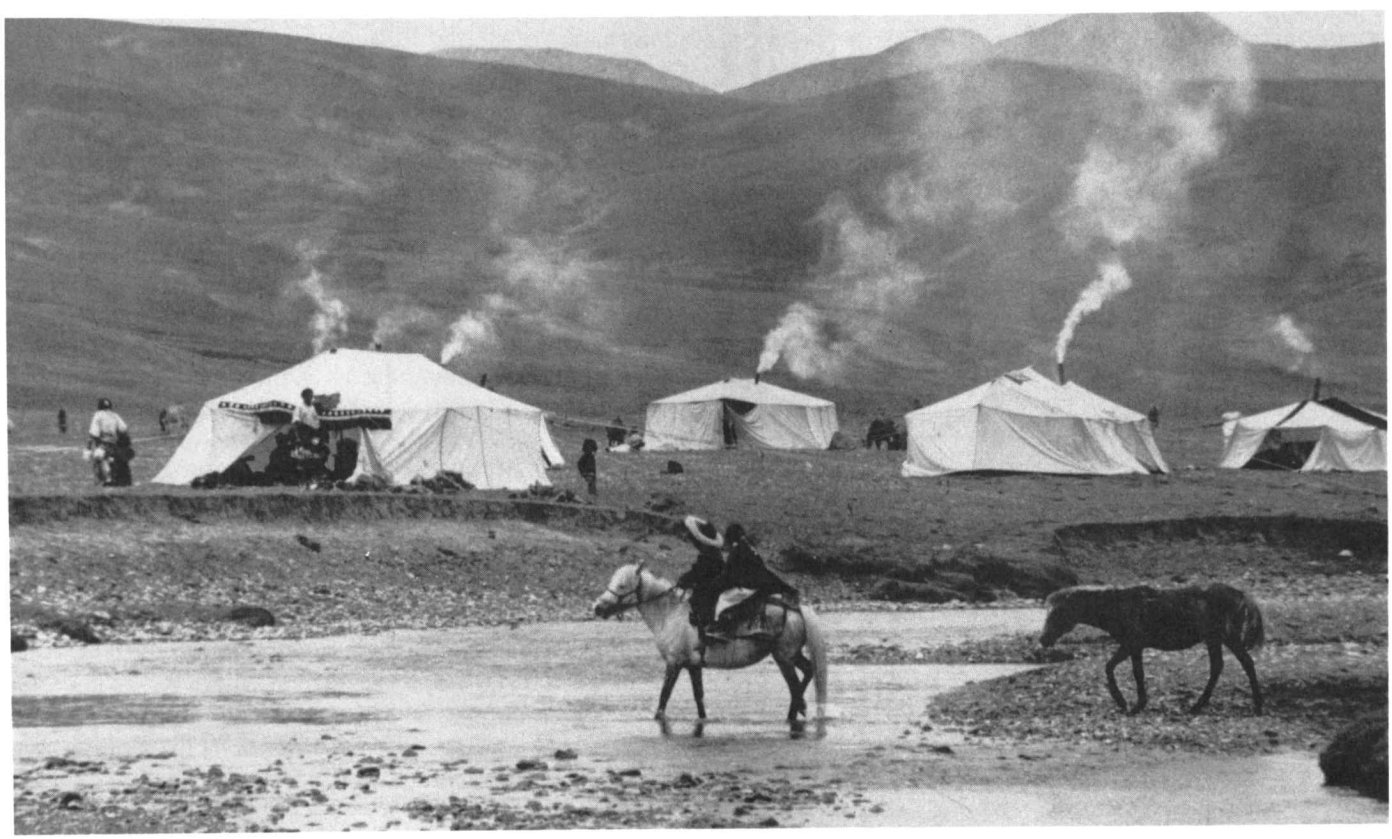
Daniel J. Miller

Nomads' tents were scattered across the valley floor. Made out of belts of woven yak hair, supported with poles, and staked out with yak hair ropes, they resembled giant black spiders. Thin columns of smoke rose from the tents as the sun came over the top of the mountains. Flocks of sheep moved slowly across the valley floor like thick, low-lying fog. Large herds of yaks were being herded by young boys, skillfully employing slingshots that snapped like rifle shots. Men in sheepskin clothing and with long braided hair trotted past on stout ponies. Sitting on elaborately woven saddle carpets, with rifles slung over their shoulders, and long swords dangling from their waists, these horsemen had an air of confidence about them. They looked like they owned the place, these proud nomads on horseback riding across some of the last of the open range: the grasslands of the Tibetan Plateau.

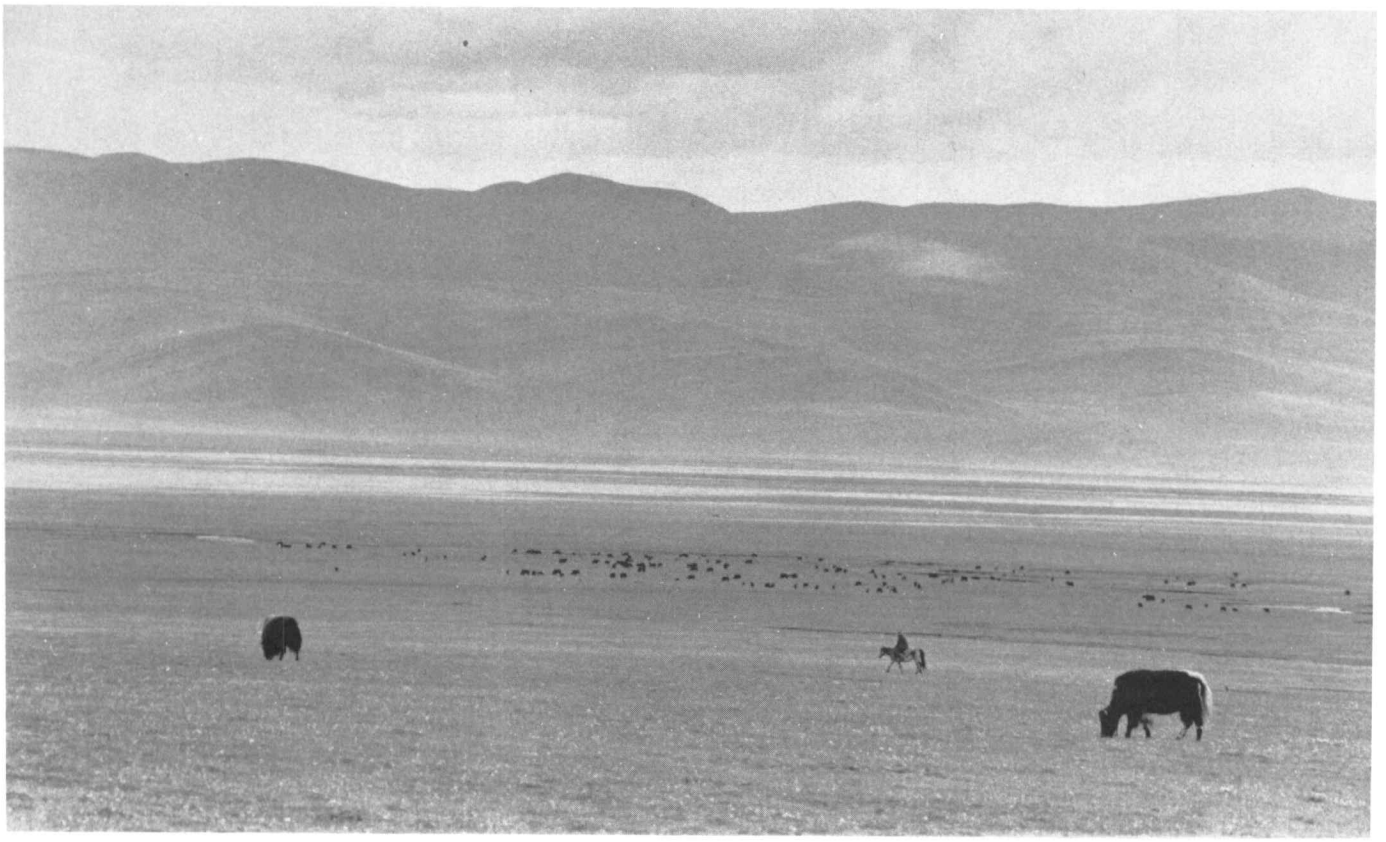
These grasslands have, for centuries, supported a pastoral culture. Though remote, these grassland ecosystems are coming under pressure from factors such as increased demand for livestock products generated by economic growth in the People's Republic of China. The "personal responsibility system", which has replaced the commune system, has also contributed to an increase in livestock numbers.

The recent increases in livestock numbers on these grasslands do not recognize the carrying capacity nor the need to improve range management techniques. Modern techniques of range management are not well understood in Tibet. If well managed, the grasslands have the potential to support productive livestock populations.

In the summer of 1988, I was fortunate to be able to travel across some of the grasslands of the Tibetan Plateau. Accompanied by a wildlife biologist from the Northwest Plateau Institute of Biology located in Xining, Qinghai Province, and two other researchers from the University of Montana we were looking for study areas to begin collaborative research on wildlife and rangelands on the Tibetan Plateau. From Xining, we drove across the



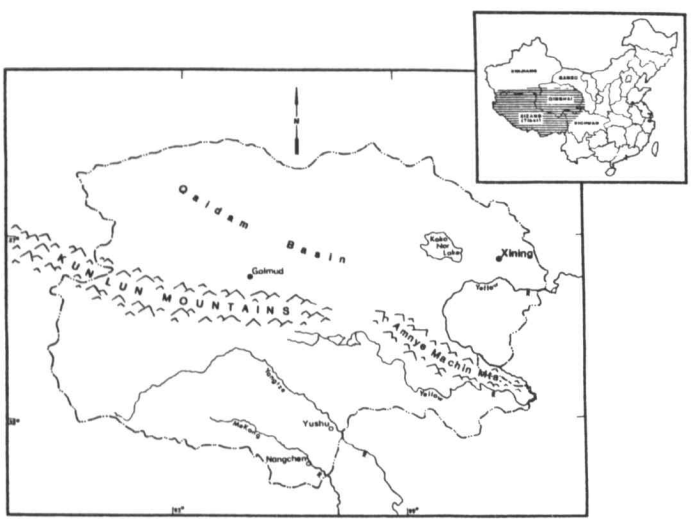
Glok nomads' summer encampment in northeastern Qinghai Province.



Grasslands of northeast Tibetan Plateau at about 14,000 feet with yaks.

northeast part of the Plateau, known in Tibetan as Amdo, south to the town of Nangchen on the banks of the Mekong River and further south into the Tibetan region of Kham on the border between Qinghai Province and the Tibetan Autonomous Region. We covered approximately 1,500 miles, almost all of it on gravel roads.

The Tibetan Plateau is the most extensive high elevation region on earth. Known as the "Roof of the World", it encompasses almost one million square miles of the People's Republic of China, equivalent to the combined area of the states of Montana, Wyoming, Idaho, Utah, Nevada, Colorado, Arizona, and New Mexico. The Tibetan Plateau stretches for about 800 miles from north to south and over 1,000 miles from west to east. The Plateau is found between 28 and 38 degrees North Latitude, about the same latitude as New Mexico. The Qinghai-Xizang Plateau, as it is termed by the Chinese, includes all of the Tibet Autonomous Region, most of Qinghai Province, the northwestern part of Sichuan Province, the southwestern part of Gansu Province, and the southern border area of Xinjiang Uygur Autonomous Region—approximately 20 percent of the total land area of China.



The Tibetan Plateau is literally the heart of Asia, where some of the major rivers of Asia such as the Yellow River, Yangtze, Mekong, and Brahmaputra originate. The Plateau is bounded on the north by the Kunlun Mountains and by the Himalaya Range on the south. Numerous mountain ranges with peaks over 20,000 feet crisscross the middle of the Plateau. It is big, wide-open country with extensive grasslands. Approximately 70% of the total land area of the Tibetan Plateau is grazing land.

Vegetation on the Plateau varies remarkably, depending on altitude, temperature, and precipitation. Almost all of the Tibetan Plateau is at elevations over 10,000 feet and extensive areas are located above 14,000 feet. Little vegetation is found above 16,000 feet. Temperatures throughout the year are cold and growing seasons are short. Snow can fall every month of the year. Precipitation varies from about 30 inches on the southeastern edge of the

Golok woman and child. Sheepskin robe is trimmed in otter fur and with embroidered silk. Amber and coral beads are in the hair.

Plateau to less than 4 inches a year in the northwest. The decrease in precipitation from southeast to northwest provides a moisture gradient from humid to arid with a corresponding vegetational gradient from forest and meadow to steppe and desert. Precipitation on the Tibet Plateau is influenced by the Southwest Monsoon coming from the Indian Ocean in the summer and the Westerlies in the winter. Most precipitation occurs during the summer and winters are generally cold and dry. Heavy snowfalls can occur during the winter.

The Tibetan Plateau has been divided into five main vegetation zones. These are: (a) the moist high-cold meadow and low scrub in the east; (b) the arid and high-cold steppe in the north and central region; (c) the high-cold desert of the northwest; (d) the temperate desert zone in the west; and (e) the arid steppe and shrublands in the south around the Tsangpo (Brahmaputra) River Valley. The first two types of vegetation are the most predominant on the Tibetan Plateau.

The grasslands of the northeastern part of the Tibetan Plateau have long been regarded as some of the best grazing lands in all of Asia. Numerous explorers to Tibet in the 19th century wrote at length about the lush pastures, large herds of livestock, and incredible wildlife of this region. The rangelands of northeast Tibet are the kind of country cowboys dream about. It's Marlboro Country. It is a land of numerous snow peaks, large mountain valleys with clear running streams and good grass, and cold, wind-swept steppes where you can ride for hundreds and hundreds of miles and never see a fence. It is still "open range".

From Xining, which is situated on the edge of the old Silk Route, we crossed the Qinghai Nan Shan mountains onto the northeastern edge of the Plateau. The first valley to the south of Koko Nor Lake is a large loess plain at about 10,000 feet. Common grasses here were splendid grass *(Achnatherum splendens),* alkaline grass *(Leymus secalinus),* and *Orinus kokonorica.* The two-humped Bactrian camels could be seen grazing with cattle, yaks, and sheep among large sand dunes. Ascending out of this loess plain we crossed the secondary ranges northwest of the main Amnye Machin Mountain Range. (For a period in the late 1940's Amnye Machin was thought to be higher than Mount Everest.) Shrublands of willows and shrubby cinquefoil were common on the mountainsides. Numerous species of wildflowers wove a tapestry of colors into the green meadows.

Traveling across the Tibetan Plateau reminds one of the cold deserts of Nevada or the plains of eastern Montana. The country rolls on and on, with endless ridges merging into a purple haze on the horizon. Numerous lakes are found on the Plateau and nowhere in the world are skies so blue. You can see clearly for miles and miles. Distances are deceiving.

High elevation meadows dominated by sedges of the genus *Kobresia* comprise a large percentage of the total grassland area of the Tibetan Plateau. These cold, wet meadows provide an important grazing resource for livestock during the summer. Purple feathergrass *(Stipa purpurea)* is one of the most common grasses of the high-cold steppes of Tibet. Other common grasses are *Littedalia racemoa, Roegneria kokonorica, Ptilagrostis dichotoma* and *Koeleria cristata.* Near many settlements, grazing lands have been fenced to provide emergency winter grazing areas or to be used as hay meadows. One of the dominant grasses in these grasslands is a wildrye grass, *Elymus nutans.*

The northeastern part of the Tibetan Plateau is the territory of the legendary Golok tribesmen. Considered among the best horsemen of Asia, they are also renowned for having the best horses of all the Tibetan tribes. The Goloks descended from ancestral nomads who considered it bad manners to walk even when exchanging greetings between one tent and another. For centuries these wild, nomadic Tibetan tribes raided and plundered caravans crossing Tibet and stole horses and livestock from other tribes in the northeastern regions of the Plateau. The Goloks were always known as some of the toughest mounted warriors in Asia and successfully thwarted many attempts by early explorers on the Tibetan Plateau to reach Lhasa through Golok country.

A large encampment of Goloks is an impressive site. During the summer, these nomads will gather in one place for a week or more to hold festivals and trade or sell their wool. At these summer festivals most of the tents are large, richly decorated canvas tents, a departure from the traditional tents made of woven yak hair. The nomads dress in their finest clothes, their sheepskin robes decorated with embroidered silk and trimmed with otter fur. Women wear large necklaces of amber, coral and turquoise, gold and silver jewelry, and plait large amber beads into their hair. Many of the men and women wear Stetson-like felt hats and leather boots. Most men still wear their hair long with bright red tassels braided into their hair and wrapped around their heads. Hundreds of horses graze around these camps, where horse races and other horseback contests are held.

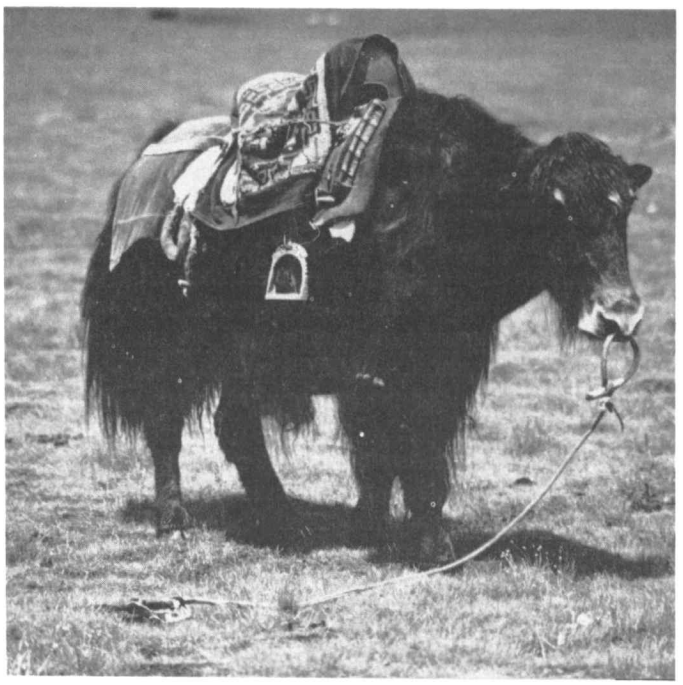
Horsemanship is a highly regarded skill in this part of Central Asia. Numerous legends attest to the Tibetans' prowess with horses. In one well-known Tibetan tale, the kings of India, Persia, Turkestan, and Tibet sent envoys to the Chinese court, each seeking the emperor's daughter as a bride for their king. These envoys were subjected to a number of tests. In one of the tests set to the envoys, 100 mares were kept in one place, 100 foals in another, and the envoys had to identify the offspring of each mare. When the Tibetan envoy succeeded in this, the Chinese emperor waved the matter aside, saying, "The test is not a fair one, for Tibet is known as the land of horses."

Everyone thinks of the Mongols as the great horsemen of Central Asia, which indeed they were. However, the Tibetans came galloping over the steppes 500 years before the Mongols did. Tibetan civilization was a horse-oriented society and there is evidence that Tibetan kings assumed the throne as soon as they could ride a horse, which was supposedly at the age of thirteen. The height of Tibetan expansion in Central Asia was in the 7th and 8th centuries. There is historical proof that by the late 700's the Tibetans were the greatest military power in Central Asia. In 763 A.D., Tibetan cavalry seized the Chinese Tang Dynasty Imperial capital in Xian, and in 790 A.D., Tibetan troops rode to the Oxus River in northern Persia. These daring exploits could have only been accomplished with well-trained mounted warriors. The Tibetans even developed a "pony express" for carrying dispatches across their vast territories almost 1,000 years before the Spanish brought the first horses to North America.

It is estimated that there are about 12 million yaks in China, the majority of which are found on the Tibetan Plateau. Over 30 million sheep and goats utilize the grasslands on the Plateau. Herds of thousands of animals are not uncommon. Yaks provide milk products, meat, hair, wool and hides. The wool from Tibetan sheep has long been regarded as a fine carpet wool and about three thousand tons of wool is exported every year to Nepal for its thriving carpet industry. The fine, inner wool from Tibetan goats (cashmere) is used for making expensive pashmina shawls. In the 1880's the British Raj in Tibet made numerous unsuccessful attempts to obtain control of the wool and cashmere trade in Tibet.

Nomadic pastoralism on the Tibetan Plateau has been in existence for thousands of years. Pastoralism became the prevalent land use on the Plateau, by at least the 7th century, which marked the beginning of the expansion of the Tibetan civilization.

The survival of pastoral groups on the Tibetan Plateau indicates that the strategies of rangeland utilization and animal selections developed centuries ago are well-adapted responses to the different range and environmental conditions. These practices established sustainable range-livestock production under a system which developed without scientific knowledge of range ecosystems and expensive inputs.



Riding yak. Some yaks are naturally polled.

With the opening of the Tibetan Plateau and improved communications with the People's Republic of China, the equilibrium of the traditional Tibetan pastoral system was placed under considerable pressure to support more intensive livestock production. Economic growth in China is placing more demands for livestock products. This should stimulate interest in technologies related to livestock production from rangelands on the Tibetan Plateau. There is evidence that the "individual responsibility system" now being implemented is leading to an increase in livestock numbers. Rangeland condition may decline if more animals are kept than the rangelands can realistically support on a sustainable basis.

Pressure increase from human populations and livestock numbers are threatening wildlife species in many areas. In the short time we were on the Plateau, we saw Tibetan gazelle grazing along side the road, wild ass, wolves, and blue sheep in the mountainous rough country. In high elevation spruce forests in southern Qinghai

Province, we saw musk deer, small, secretive animals. One of the few members of the deer family without antlers. The males have large canine teeth. Males produce musk, used in traditional medicinal practices and perfumes, which has resulted in widespread poaching. White-lipped deer (Thorold's deer) and red deer are also found in high elevation forests and shrublands on the Plateau. Marmots and pikas were common in the Tibetan grasslands, in contrast to the Rocky Mountains where the pika inhabits rocky areas. Many large raptors are found in the eastern part of the Tibetan Plateau probably due to the large numbers of pikas.

In the more isolated valleys in the western part of the Tibetan Plateau, there are still large herds of huge wild yaks. Big bulls can stand six feet high at the shoulders and weigh up to a ton. The horns from the wild yaks were used as milk pails by early nomads. Tibetan antelope are also found on the Tibetan Plateau. Mongols believe that a whip handle made from the horns of an antelope will, in the hands of the rider, prevent his horse from tiring. Tibetans used two antelope horns as rests to help steady their rifles. Once widespread, Przewalski gazelle are now found only along the northeastern shore of Koko Nor Lake. Tibetan argalis are found in many of the mountain ranges in the Plateau as are snow leopard. Numerous lakes and marshes provide habitat for a wide variety of waterfowl and shore birds. The first American to really explore Tibet in the late 1800's called the country around the upper Yellow River "the most wonderful hunting ground in Asia".

This rich abundance of wildlife on the Tibetan Plateau is being increasingly threatened. Large numbers of blue sheep are killed every year for meat markets in Europe. Musk deer are poached for the valuable musk and red deer and white-lipped deer are killed for their velvet antlers. Knowledge on the numbers of wildlife and ecology of wild animals on the Tibetan Plateau is limited.

Tremendous potential exists for improving the productivity of the rangelands and livestock production of the Tibetan Plateau. To overlap appropriate range policies and development interventions for sustainable use of the range resources, the dynamics of the pastoral ecosystems need to be clearly understood. More information is required on the ecology of the grasslands and the carrying capacities of the different ecosystems. Remote sensing imagery is a valuable tool for analyzing forage production which has important potential given the vastness and remote nature of the rangelands of the Tibetan Plateau. Information is required about the livestock and wild ungulates utilizing the range resources to plan range improvements for efficient utilization of the range. Development strategies must build upon the best aspects of traditional management systems, rather than imposing complete new systems upon them. Local pastoralists need to be involved in the planning and design of development interventions. Investigations are needed on plant-animal interactions. Range and animal scientists must work together. Better grazing management needs to be promoted that considers appropriate stocking rates and proper seasons of use of the range. Grazing systems need to be designed to ensure the efficient and sustained use of rangelands. Hay meadows should be developed to provide supplemental forage during the winter. Development interventions have to be practical. Instead of introducing expensive tractors and forage harvesting machinery for the Tibetan Plateau, it may be more feasible to introduce horse-drawn mowing machines and technology that was widely used on range operations in the western USA not many years ago. Wildlife are an important resource on the Tibetan Plateau and their needs must also be considered when designing range management programs and development interventions.

The grasslands of the Tibetan Plateau are a unique and vital resource. Little attention has been given to the wise and scientific management of these rangeland resources. The rugged terrain, harsh environmental conditions, diverse vegetation types, and interesting pastoral people will make the application of range management principles on the Tibetan Plateau a very challenging and extremely exciting task.

The Woodsman's Designs to Extinguish the Western Cattleman and His Grass

Walter M. Kollmorgen

Consider the remarkable similarities between the fates of the American Indian and the western cattleman. At a distance the Indian was extolled as a noble savage, a fine expression of natural man. Increasing proximity and conflicts over territory soon found him a brutal savage, denying the interlopers a share of their rightful inheritance. Conflicts increased and with the aid of mortal diseases, superior numbers, and arms, he was either destroyed or expelled to smaller and smaller refuges, usually areas that promised nothing to the intruder. Finally he became an occupant on restricted reservations, his way of life destroyed, and living in large measure on gratuities supplied by his conquerors.

The cattleman's fate did not reach this extreme, but he survived on restricted areas that promised little to the challenger, the woodsman. When the cattleman first made his appearance on the western horizons, he was hailed as an innovative entrepreneur who would make the western grasslands the grazing lands and pastures of the nation. With cattle and sheep he would harvest the bounty of nature and contribute to the economy. By supplanting the subsistence Indian hunters, he would pacify an area known for conflicts with the natives. Then came increased proximity with another species of land user, the man with the plow, largely a woodsman.

The woodsman's purpose was to turn the grasses upside down and cultivate the land in small farm units. He brought fences and numerous homesteads that despoiled the wide open country. Conflict arose, often to the point of gunfire; space could not accommodate both intruders. The woodsmen not only outnumbered the cattlemen, but were also tied more closely to Washington and legislators; so the conflict took on serious legal aspects.

The Specter of the Great American Desert

It is noteworthy that the cattleman's empire evolved in the Great American Desert of the Plains, a desert which never really existed in modern terms. To the woodsman its treeless nature was enough to condemn it as agricultural land. Early in the American history it began beyond the wide Missouri and extended to the mountains and beyond. With westward expansion it was pushed to about central Kansas, or the 20-inch rainfall line. Then came the rainmakers and the weather modifiers who erased it east of the Rocky Mountains. With this changing vision the American cattleman found himself in retreat.

Historic pronouncements on the Plains, as well as settlement policies, give some important clues regarding the fate of the area. Descriptive terms darkened the prospects of the Plains, such as "irredeemable sterility," "steppes of Tartary and Asia," "a land where no one permanently abides," "a land of restless and ferocious hordes of savages," and the "Great American Desert." Lieut. Zebulon Montgomery Pike was the first American to enter the Southwest, in 1806, and in his observations we find all the ingredients of a desolate waste. The area "may become as celebrated as the sandy deserts of Africa, . . . not a speck of vegetable matter existed, ... It would be a means of restricting the population to some certain limits and thereby insure the permanency of the Union, . . . incapable of cultivation"; white settlements must be halted near the borders of the Missouri and Mississippi, leaving the desert to "wandering and uncivilized aborigines of the country," Major Stephen H. Long, who came in 1819, likewise condemned the area as a waste land and coined the term "Great American Desert." This negative term was now fixed for several decades and appeared in many publications, including geography texts.

The imaginative Washington Irving also saw a great threat in the largely empty areas. They would be gathering places of displaced Indians, as well as lawless elements ejected by the Spanish and American settlements, forming a marginal race of predators on horses who would plunder the settlements. This negative image lingered in the minds of woodsmen, who even transferred lawlessness to cattlemen.

Several basic dates and developments reveal much about the changing image of the desert Plains area. In 1541 Coronado penetrated the Plains to central Kansas and later recorded "after having journeyed across these deserts seventy-seven days, I arrived at the province they call Quivira." When Jefferson, two and a half centuries later, purchased the Louisiana Territory, largely to solve the Mississippi navigation problem, he found the boundary "involved in some obscurity" and settlements "separated from each other by immense and trackless deserts." By the 1830s the government decided to solve the eastern Indian problem by the Indian Removal Act which assigned them to the desert Plains so long as the grass grows. Thus, up to that date the Plains held no attraction for settlers or cattlemen because there was no contest for space.

After the 1820's and '30's, things began to stir in the

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Plains area. The Santa Fe and Oregon trails were established and the Mormons and gold seekers began their trecks westward. New Englanders moved to eastern Kansas in the 1950's to hold the area against slavery, although local Indian tribes had not ceded the lands. Encroachment began soon along a wider front.

A New Meteorology

The fate of the western cattleman cannot be understood without recognizing the new dimensions in the field of meteorology which occurred during the nineteenth century. Up to this time weather and climate were of primary interest to physicians concerned with the quality of air with relation to disease. Early in the century the Surgeon General of the U.S. Army instructed the scores of military outposts to gather sample weather data for the purpose of furthering the field of medical geography. Several important publications were prepared to establish the disease-weather connection. Rather suddenly during the 1840's, this activity fell into the hands of James Pollard Espy, who was interested in the anatomy of storms and the physics of the air. His famous *The Philosophy of Storms*, published in 1841, made him world renowned for his work on the role of moisture in energizing air movements. He gave insight into the adiabatic process of heating and cooling air and its moisture holding capacity. He also became the first American to champion weather prognostication with the use of weather maps. He was preceded in this work by William C. Redfield, who first noted the nature of whirlwinds and storms. After Espy, William Ferrel gained almost instant immortality by formulating Ferrel's Law. Elisas Loomis gained fame by preparing the first synoptic weather charts during the 1830's. The field of meteorology was fast maturing and weather forecasting was officially established in the U.S. Department of Agriculture early in the 1890's.

The above pioneer meteorologists or weather men posed no threat to the cattleman of the West, but as fate would have it, another set of prominent professionals came forth after the Civil War propounding a new set of meteorological concepts that challenged the deserts and grasslands of the West and so placed large cattle grazing operations in total jeopardy. The new meteorology focused on the landscape and only indirectly on the conditions and processes of the air[1]. The meteorology found important precipitation enhancers in trees, the plow, managed electricity, and stored water. These could all be supplied by man, making him an important rainmaker. Westerners were especially delighted with these prospects and saw unlimited homesteads in the West, including the grasslands of the cattleman.

It should be remembered that many of the new rainmakers were prominent professionals in the arts and in government, not secretive operators promising to end droughts with smelling salts, powers, and electrical gadgetry. These professionals were far better known than the scores of investigators in pure meteorology who were seeking to solve the mysteries of the air and weather. Most of them were also tied to prominent government offices and so commanded public attention, especially in the West where settlers were sought. There landscape meteorology was fatal, directly, or indirectly, to the large ranchers.

Consider some of the names of the advocates of the new meteorology: George P. Marsh, F.G. Hough, Nathaniel Egleston, and B.E. Fernow. These men all qualified for *Who's Who in America.* The last three played prominent roles in the office of Commissioner of Agriculture and used its publications to promote the tree-rainfall syndrome, and, indirectly, close settlements. It was Marsh, however, who provided the basic bible of these advocates in his *Man and Nature, or, Physical Geography as Modified by Human Action,* first published in 1864, but followed by more printings and new editions. In his service as diplomat in Italy, Marsh noted the many ruins of civilization bordering the Mediterranean lands. He, as well as the many sources he cites, attributed their decline largely to deforestation and overgrazing. Apparently precipitation had also been reduced and the tree-rainfall syndrome is strongly implied.

Marsh's work strongly impressed Franklin B. Hough, a trained physician, statistician, and conservationist. As a member of the American Association for the Advancement of Science, he presented a paper before that organization in 1872 which led to a memorial to Congress pleading the case of forests and their close relationship to climate and precipitation. Congress responded by creating a Division of Forestry in the Commission of Agriculture office under the auspices of Mr. Hough. There, with limited funds, he prepared a long report in which more than 100 pages are devoted to "Connection Between Forest and Climate." This same topic was then labored in subsequent reports of the Division for the rest of the century by Nathaniel Egleston and B.E. Fernow. Numerous similar articles also appeared in the annual and special reports of the Commissioner of General Land Office, U.S. Geological Survey, and even in reports of the Smithsonian Institution.

To the above apostles of tree planting we should add the name of Sterling Morton, a pioneer Nebraska farmer who became Secretary of Agriculture in Washington and also served as President of the American Forestry Association. His initiative gave us Arbor Day, now recognized in many countries. In a speech in 1887 he envisioned "gigantic groves and towering forests of waving trees" on the western prairies and plains. So firm was the belief that trees would enhance precipitation that Senator Hitchcock of Nebraska introduced a bill in 1872 that became the Timber Culture Act of 1873. It provided for 160 acres free, on the condition that 40 acres of trees be planted. The bill was strongly supported by Congressman Haldeman of Pennsylvania who asserted "To produce rain it is literally true that a forest is as good as a mountain." The Act produced much chicanery, few trees, and no precipitation.

[1]See Walter Kollmorgen and Johanna Kollmorgen "Landscape Meteorology in the Plains Area," *Annals,* AAG, vol. 61, Dec. 1973, pp. 424-41.

In such western states as Kansas and Nebraska, the cattlemen were also far outnumbered by a complex of farmers, real estate agencies, money sharks, farm agencies, government agencies, and also railroad promotors. Land promoting agencies were established by state governments, but equally important were academies of science and agricultural and horticultural societies. These latter groups hailed the new meterology and saw the day when petty yeomen would prevail to the Rockies and beyond.

The Plow

In the 1860's the tree was supplemented with another powerful tool to erase the desert and the grasslands. This important discovery must be credited to two important Nebraskans, namely, Samuel Aughey and C.D. Wilber. Aughey joined the staff of the University of Nebraska in the early 1870's; his close friend and collaborator, Wilber, was a promoter and real estate operator but also an imaginative and gifted writer. Aughey, by observation and experimentation, found that plowed ground absorbed about eight times as much moisture as unplowed ground and this moisture not only sustained crops, but also fed springs and rivers and even the clouds. Hence more rainfall. These apparent results prompted Wilber to coin the popular phrase "Rain Follows the Plow." This electric discovery, which soon echoed from coast to coast, did not augur well for cattlemen in the grasslands. Why permit them to appropriate large tracts of grasslands when cultivators and tree planters could modify the elements?

The reputation of grasslands deteriorated with the advance of rainmaking ideas. Even before the Civil War it was discovered that grasslands created an almost impenetrable sod—a questionable concept. Vivid expressions were coined to describe this situation, such as, "vegetable canvas," "asphalt covering," "impervious as a cow-boy's slicker," "compact as a rock," and "brick-like surface." Hence rainfall, instead of nourishing local vegetation, ran off in gutters to the sea. The plow could serve as the redeemer of this largely wasteland. Wilber in his uninhibited enthusiasm even dared to assert that all deserts are only "temporary conditions of the earth's surface" and "can by the industry and skill of man, be changed into fertile and productive fields." Indians, on the other hand, "have always been co-workers" with forces that maintain desert conditions. Cattlemen, whom Wilber disliked lustily, were as bad as the Indians.

Electrical Influences

Electricity was more of a mystery in the late 1800s than now, and to numerous observers it seemed to play a role in precipitation. Joe S. Wilson, who served as the Commissioner of the General Land Office in the 1860's, was impressed by Marsh's report and promoted the idea that the grasslands of the West could be salvaged for the cultivator. He surmised, among other things, that tree planting in the West would expedite electrical forces. He pointed out that "a growing tree is a good conductor of electricity, and with more trees increased electrical forces would influence the local masses of vapor." At any rate, he believed that precipitation had decreased where woods were destroyed.

Other speculators noted that railroad and telegraph lines were spreading all over the frontier and these were good conductors and transmitters of electricity. Obviously lightning and thunderbolts had something to do with storms and so a greater charge of electricity flowing over rails and wires seemed to assure more rain. H.R. Hilton of Topeka presented a more complex theory. He found that the plow and resultant changes in vegetation enhanced the rainmaking potential of upper moisture-bearing clouds. Unplowed surface was hard, hot, with little vegetation, and shed much of the precipitation. With increased soakin came a thick cover of vegetation not only transmitting more moisture to the clouds, but also reducing the insulating blanket of hot air at the surface. Increased moisture in the surface air improved "electric courtesies" between surface and upper air, leading to more precipitation.

Enhancing Atmospheric Moisture and Rain

Even while the prophets of pluvial culture were erasing the desert, even grasslands, irrigation developed in isolated places of the West. Such projects were under way in California and Utah by mid-century, came to Colorado in the 1870's, and to the Arkansas Valley in Kansas in the 1880's. An ambitious but largely futile irrigation project was initiated in the Arkansas Valley in the 1880's. Shortly one of the observers reported that these works were moving the rainbelt westward, and even with small projects in western Kansas "there has never been any scarcity of rainfall." Even John Wesley Powell, the most noted name associated with the drier west, and a promoter of irrigation, asserted that increased irrigation, as well as water storage, would increase the humidity of the air and so the precipitation. The result would be less and less reliance on artificial watering.

A Mr. Hay developed the theory of moisture enhancement of the sky a step further. Not only did he approve of expanded irrigation works, but the harvesting of much of the runoff with thousands of small artificial lakes. These would send columns of moisture into the air and trigger necessary showers.

Irrigation projects were at first modest because the meteorology would modify the larger landscape. But periodic droughts appeared, created havoc here and there, and then came the classic drought of the late 1880's and early 1890's, which brought about a major abandonment of newly settled lands. The ranks of the rainmakers were seriously depleted but the ranks of proponents of irrigation greatly augmented. Private and state projects usually failed, and so powerful forces developed in the West demanding federal programs. The Reclamation Act of 1902 followed.

Of interest here are the promises that brought this Act into existence. No longer were irrigation projects viewed as islands in the desert, but as empires of small, happy

settlers. Little attention was paid to available water and technology, and so estimates of irrigable lands ranged from 70 million to 600 million acres. All these figures meant major intrusions into the domain of the cattleman if we consider the appropriation of streams. Only in the most rugged areas could he survive, and only if he could find water.

Cost of projects was also dismissed as nearly irrelevent, mostly up to $10 per acre and $25 at most. Such small investments would soon provide land for millions of small, happy farmers whose land would be valued at $500 to $1,000 per acre. How could Congress deny such a bonanza?

Like the rainmakers, the irrigators harvested bitter fruits. Costs were much higher than expected, most settlers found difficulty in finding suitable crops, failed to make repayments, and bankruptcy was common. Large operators became common on subsidized projects; migrant workers living under deplorable conditions did much of the work. In time, the entire West became dependent on Eastern subsidies to finance larger and larger water projects. The extent to which cattlemen survived is the measure of the failure of the Reclamation Act. At most, federal irrigation projects amount to about 10 million acres, nearly all of them subsidized.

The Promise of Dry Farming

While federal irrigation projects went forward from 1902, it was soon realized that water for irrigation was not available to large areas with terrain suitable for farming. At that time certain cultivators discerned the rudiments of what became known as dry farming. At first this was a simple program of deep plowing, allowing good soak-in, but fallowing was combined with it in places. But fallowing did not become widespread in the Plains area until the 1930's when encouraged by government subsidies. Like other panaceas, it passed through stages from hyperbole to a complex system of land treatment.

Beginning in 1907, a series of Dry Farming Congresses promised to redeem nearly all the grasslands and much of the desert area of the West from the cattleman. Practically all crops could be produced by dry farming, including corn, fruits, and garden products. Production would equal and even exceed that of the cornbelt because the cornbelt really had too much rain, certainly in some years. In fact, dry farming would make the western half of the United States the more productive area of the Union. J.A. Widtsoe, a champion of the new method, claimed that a conservative estimate of the potential area of dry land farming amounted to 600 million acres. Obviously, this left little space for the cattleman.

Dry farming became more complex through time, and its introduction in the Plains area was generally encouraged by agricultural support programs. It did not prove a panacea. It was extended much too far into marginal areas where crop failures became more and more common. Both this program and irrigation rely on Eastern capital and are now among the highest subsidized economies in the country. In the absence of these subsidies, periods of hunger and starvation would be experienced, just as in marginal farming lands in Africa and elsewhere. In these foreign lands, transfer of wealth is usually precluded because of general poverty.

Land Alienation Laws

It should be clear by now that the proposals and programs of the rainmakers, the irrigationists, and dry farmers, plus the deep bias against large land holdings and cattlemen, did not permit the development of rational land alienation laws. As the late Walter Prescott Webb pointed out years ago: "There has never been written into Federal statutes a single law governing lands in the arid regions that meets the needs of the stock farmer or the ranchman." Important land alienation laws that were designed mainly to multiply family-farm operations and thus frustrated the stockmen numbered seven. These were, briefly:

1) The Preemption Act of 1841, permitting purchase of up to 160 acres at $1.25 per acre.

2) The Homestead Act of 1862, providing 160 acres free, other than filing fees.

3) The Timber Culture Act of 1873, providing 160 acres free, other than filing fees, and requiring that part of the holding be planted to trees.

4) The Desert Land Act of 1877, allowing purchase of up to 640 acres at $1.25 per acre, and calling for some irrigation developments.

5) The Kinkaid Act of 1904, essentially an enlarged Homestead Act, allowing entries up to 640 acres; applied only to the drier portion of western Nebraska, largely Sandhills.

6) The Enlarged Homestead Act of 1909, permitting entries up to 320 acres.

7) The Stock-Raising Homestead Act of 1916, permitting entries up to 640 acres.

Although these laws do show a tendency to enlargement, none of them met the needs or expectations of the stockman, and, in many cases, not even of the family farmer. Texas, it should be pointed out, did not cede its public lands when it became a state and so did not share these limitations.

Notice that the land alienation laws deal with units of 160 acres and multiples thereof up to 640 acres. In the western areas it takes from 20 to 40 acres to support one cow-unit. Three hundred and twenty acres would therefore support 16 cows under the 20-acre limit, about 11 cows under the 30-acre limit, and 8 under the 40-acre limit. If we expand the unit to 640 acres, the cattleman could support twice that number of animal units, or 16 cows under the 40-acre per-cow ratio. Obviously we are here dealing with pure fantasy. All of the enlargement laws were made in response to widespread bankruptcies and pleas by cattlemen for legal provision to achieve viable ranching units. A stockman commented on the Kinkaid Act in 1905 that this Act "was brought about by people who believed that there were yet fools enough to

populate the country and abandon it."

In 1957 Walter Prescott Webb published an article in *Harper's Magazine* titled "The American West, Perpetual Mirage." It provides an image that continues to haunt. He points to the eight mountain and intermountain states as the true and perpetual desert. Bordering it east and west are large areas into which the desert expands and contracts with some irregularity. Hence desert conditions pulsate forward and backward. The result is that the annual cycle of reaping and harvesting is broken and longer cycles of income prevail, to which the local economy is not attuned—so the reliance on outside support for survival. This image can also be applied to other desert margins, conspicuously in Africa. Famines as well as rescue help from outside sources are the result. This suggests a nomadic form of life, for man and animals. In this light we may well pay our respects to the Plains Indians, who followed the buffalo, who followed the grass, which followed the rains.

Changing Image of Grass

It is gratifying to know that the image of grasses has changed radically from pioneer days. Our remaining native prairie grasses are now judged one of our greatest resources. They not only support myriads of forms of life, stabilize soils against rain and winds, heal open wounds where grass has been exterminated by man or nature, but have given us some of our most productive soils by adding organic matter. Efforts to expand them or even to replant them are carried out with some urgency. Over a million acres of abandoned cropland has been re-seeded to native grasses in the state of Kansas alone. Our largest block of tall grass prairie is now found in the non-arable Flint Hills section of Oklahoma and Kansas. Some preserves of the original grassland, for edification of the public, have already been established and efforts are under way to expand this program. In a large measure our image of grass has come full cycle for the benefit of present and future generations.

Innovation, Creativity, with Only One Leg

Merritt "Bud" Parks

In the days before the government had decided it was wise to encourage soil and range conservation, an individual in Oregon stood out as an example of vision and foresight in coping with the severe problems of the time. He was John H. Harrison, whose intellect and sense of humor impressed everyone he met. The 35-year portion of his life spent on the Oregon Desert near Fort Rock left an indelible mark on the land as a prototype and pointed the way to the improved conservation methods of later years.

During the period of 1914 to 1917, when it became apparent that their situation was almost hopeless, homesteaders straggled out of the Fort Rock Valley and the Oregon Desert. With nine and one half inches of annual rainfall, it was not farming country.

Their hardships seemed to produce resourceful people who were able to find productive lives elsewhere. Many of the homesteaders, writing of the experiences later, thought of it less as the disaster which it was, but rather as a time of some adventure.

The land they left behind had taken a severe beating. Mercifully, some fields reverted to sagebrush; but others, exposed to wind erosion, wore down to hardpan and mineral earth where nothing has grown for over 75 years. For the few people who remained, the grim struggle for survival produced widespread uncontrolled grazing which, over the years, was probably more devastating than the plow. When the homesteaders left, many of their houses were later burned, leaving little to show for their efforts but a devastated landscape.

Harrison lived through the homestead era. His actions in the aftermath period appear astonishingly insightful, and his ideas left an imprint on a tremendous area of land.

Harrison was believed to be a native of Arkansas, had studied law, and had come west to be the Indian Agent at the Klamath Agency. It was said that he did not like the ethics and principles employed at the reservation and, believing he saw an opportunity at Fort Rock, resigned.

Arriving in 1908, he purchased a state-owned school section, Sec. 16, (T25S, R15E) three and a half miles north of the village of Fort Rock, Oregon, and homesteaded additional acres. He had a house and outbuildings to form a rather impressive compound.

After the homesteaders left, grazing in the valley was up for grabs as there was no entity with authority to control the abandoned areas. The remaining stockmen cut fences in corners where cattle might get trapped away from water, all the while trying to control some tracts with good fences where forage could be saved for use later in the season. This situation continued for nearly two decades and resulted in appalling overgrazing and wind erosion.

Harrison did not participate in this devil-take-the-hindmost operation. Rather, he rented or paid taxes on a huge blocked area of abandoned land to establish some sort of legitimacy. He then removed interior homestead fences and built good outside fences enclosing large areas. These were referred to as the North pasture, the 10,000 acre pasture, etc. At times he owned substantial

numbers of cattle and once had some sort of partnership with the Mayfields of Powell Butte, Oregon.

His fences were built using huge 2-foot diameter pitch pine posts for braces and gates, many of which are still standing after 65 years.

The Harrison headquarters was only a half mile from the Crampton Brothers' ranch, much too close for grazing substantial numbers in competition. If Harrison had fenced his square mile directly in front of the entrance to the Crampton Ranch it would have dealt them a severe blow. Instead he chose to abandon that tract and move his houses and buildings some 7 miles northeast, in the direction of the Devil's Garden to what is now known as the Harrison Place. This is in the midst of lava flows intermingled with rock-free areas of lake bed sediments.

Harrison never married. People who knew him as a young man noted that he was painfully shy around ladies.

About 1915 a hay derrick toppled with him and broke his leg. This region was far from medical help and later the leg required amputation below the knee. His sister came from Arkansas to help him but unfortunately treated the wound with water much too hot, which damaged the nerves, making it impossible to fit him with an artificial leg. From this time on he got around with a crutch.

Harrison was good with horses. He had a devoted saddle mare and with him sitting astride, with a short length of rope and a turn around the saddle horn, they would drag objects to where he needed them. Man and horse understood each other and each worked as an extension of the other. He worked teams in his crutch days and would locate and load his wagon with his massive pitch pine logs for gate posts. Sometimes he had help but often he and his horses would accomplish tasks which would seem impossible for a man with a crutch. Seemingly he did it almost as fast as a two-legged man.

He had resolutely followed his goal but sometimes good guys finish last. He was running out of money. His big dominion was in pathetically bad shape when he started. The grass recovered slowly. The timetable he had in mind was not attainable. His vision of an infinity of vigorous grassland was not so to be. The Great Depression was the final blow.

The bank took his cattle as part payment on his loan. He sold his deeded land to Reub Long, also to apply on the loan, and moved from his isolated location in the remote rock flats to Los Angeles. There he operated a news and magazine kiosk in the heart of the city. Years later he mailed Britt Webster a $100 money order asking that $50 be paid to Art Dunn in Paisley and $50 to Cap Gibbs in Lakeview. With that, he said, all his debts from his Fort Rock days were paid in full.

Harrison appeared to have a built-in code of honor which would not allow him to exploit either land or his fellow man.

People from here who visited him in Los Angeles say that customers of his news stand were impressed. They seemed to feel that they were in the presence of a profound intellect inside a man with an unprepossessing body and a crutch.

His enormous pitch pine gate posts still delineate his former domain. However, successive operators have found that the pressure to pay bills promotes overgrazing. Since he left the land has only slightly improved; it is still mostly brush, with a little grass.

Those who remember him regard those massive gateposts as a tribute to a man of vision, intelligence, and integrity. The magnificent dream for which he devoted the good years of his life has not come about. Harrison wanted it to be mostly grass but with enough brush to shelter livestock and wildlife—just as it was in his days as Indian Agent before the homesteaders.

Is Tansymustard Causing Photosensitization of Cattle in Montana?

James A. Pfister, John R. Lacey, Dale C. Baker, Lynn F. James, and Roger Brownson

Photosensitization of grazing cattle has been a persistent and perplexing problem in northern and eastern Montana for the past 5 years. In some herds and years, as many as 50% of lactating cows have been affected. Affected cattle develop severe phototoxic reactions in lightly pigmented areas of skin around the head, neck, and udder, and may lose large patches of hair and skin. Udders of lactating cows become inflamed, weepy, and scabby, and calves may not be allowed to nurse. Besides reduced weaning weights, many cows have delayed estrous cycles. Although photosensitization is not usually fatal, the economic impact has been substantial in Montana.

What is Photosensitization?

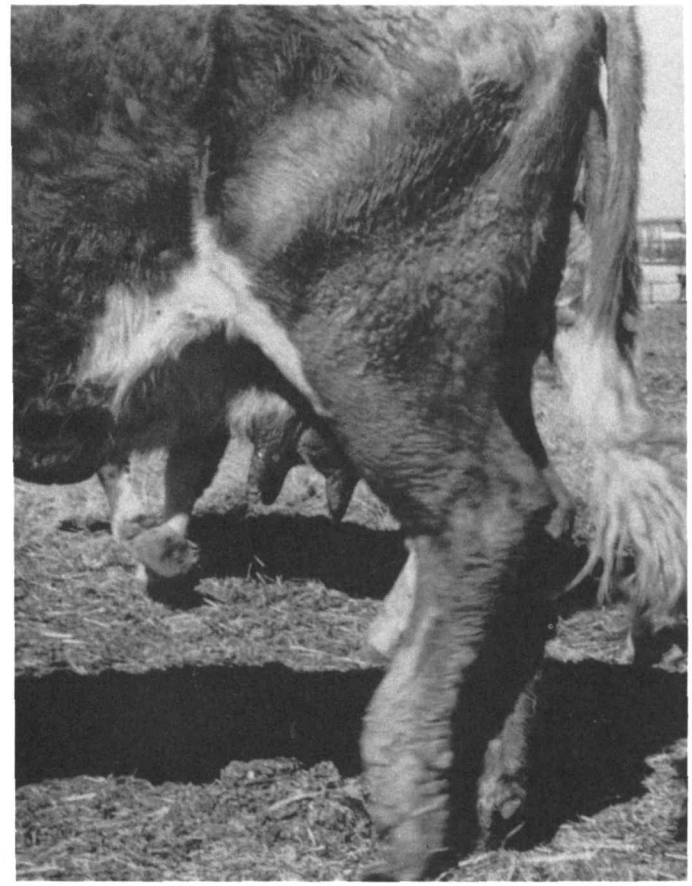
Two general types of photosensitization occur in livestock: primary and secondary (hepatic). Primary photosensitization occurs when animals graze a plant containing a phototoxic compound. The toxic compound in the bloodstream reacts with sunlight to produce a phototoxic reaction, which may resemble a severe sunburn. St. Johnswort *(Hypericum perforatum)* and spring parsley *(Cymopterus watsoni)* are two common range plants that contain phototoxic compounds and cause primary photosensitization.

Secondary photosensitization occurs when a plant toxin causes liver damage. The damaged liver is not able to normally excrete phylloerythrin, a breakdown product of chlorophyll. With the normal mode of excretion blocked, phylloerythrin then begins circulating in the bloodstream, and acts as a photodynamic agent to cause photosensitization. *Tetradymia* spp. (horsebrush) and *Senecio* spp. are two common forage plants that can cause liver damage, resulting in secondary photosensitization.

Feeding Trials

Numerous ranchers and extension personnel suspected that tansymustard *(Descurainia pinnata)* was causing the photosensitization in Montana. The plant was growing in most pastures where cattle were being affected, generally in grain stubble or fallow fields or in disturbed sites within the pastures.

Pfister and James are with the USDA-ARS Poisonous Plant Lab., Logan, Utah 84321; Lacey and Brownson are with the Dept. of Animal and Range Science, Montana State Univ., Bozeman 59717; Baker is with the Dept. of Pathology, Colorado State Univ., Ft. Collins 80523. This research was supported in part by a grant from the Montana Dept. of Agriculture and by the Utah Agr. Exp. Sta., Utah State Univ., Logan 84321. Journal paper 3772. The authors wish to thank P. Kechele, L. Kitchen, M. Brownson, O. Arthur, and R. Pfister for assistance. The cooperation of J.D. Singleton, Miles City, Mont., and F. Holiday, Roundup, Mont., in providing animals and facilities is greatly appreciated. A technical version of this paper appeared in *Veterinary and Human Toxicology*.



Photosensitization of lactating cows often results in early weaned calves, as the udders of cows become sore and inflamed. Note the dark appearance of the udder of this affected cow in eastern Montana.

We conducted 2 feeding trials during 1987 and 1988 to determine if tansymustard would cause photosensitization under controlled feeding conditions. The 1987 study was conducted in mid-May near Miles City, Mont., using white-faced range cattle familiar with the mustard. Three cow-calf pairs were put into individual pens and fed a mixture of tansymustard and *D. sophia* (flixweed) for 9 days. It is difficult taxonomically to separate the 2 species. Three other cow-calf pairs were fed hay only, and 8 other cows (4 dry and 4 lactating) were grazed in a 2-acre pasture where 45% of the vegetation was tansymustard. The penned cows receiving the mustard were fed several times each day. In order to increase intake, yellow sweet clover was mixed (about 10% of the feed) with the mustard. Bite counts were used to determine the diets of the grazing animals during the study.

Various clinical tests were used to determine if primary or secondary photosensitization occurred. At the beginning and end of the trial, blood samples were taken to monitor liver enzyme levels. A dye clearance test (BSP) was used to evaluate how rapidly the liver could break down a dye injected into the bloodstream. Liver samples were also taken by biopsy for microscopic examination of liver structure.

Penned cows consumed about 5.5 lb. (dry weight) of mustard each day during this trial. Blood values were generally within normal limits, and clearance of the dye was normal. The cows showed no evidence of photosensitization during the trial or during a subsequent 10-day period. The grazing cows ate from 0 to 40% of their diets as tansymustard. During the first 3 days, some animals ate from 15 to 30% of their diets as tansymustard, although they could have selected other forage, indicating that tansy was of moderate palatability. As forage was depleted, the animals were forced to consume more mustard. No photosensitization occurred in these grazing animals. About 20 cases of photosensitization were reported in this general area during spring, 1987.

The mustard was in the early to late flower stage during the 1987 trial, and the results may have been influenced by plant maturity; many poisonous plants become less toxic with maturation. Therefore, a similar trial was undertaken in 1988 while the mustard was still in the rosette stage.

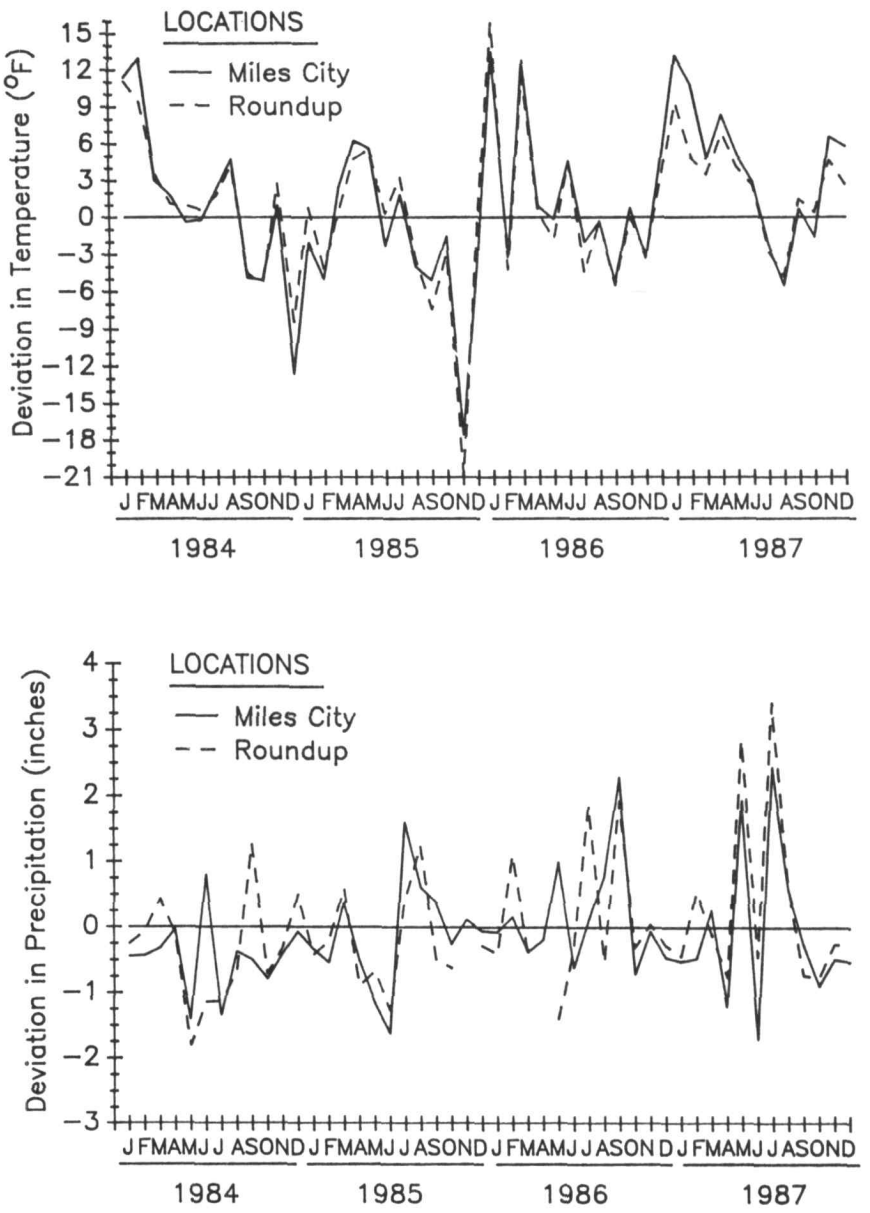


Fig. 1. *Monthly deviations from normal precipitation and temperature at Roundup and Miles City, Mont., during years of photosensitization outbreaks in cattle.*

The 1988 trial was conducted near Roundup, Mont. Twelve Hereford cow-calf pairs were purchased in western Montana; the animals had no known experience with tansymustard. The cow-calf pairs were assigned to 3 different groups during the 12-day trial: (1) 4 pairs fed only alfalfa hay, (2) 4 pairs fed only tansymustard, and (3) 4 pairs fed flixweed, with some supplemental hay provided because of the low palatability of this plant. A severe drought influenced forage growth in 1988. About 10 days before we began this trial, 2 inches of rain induced forage growth, including the mustards. The mustards were immature at the start of the trial, but matured rapidly, and many plants were beginning to flower at the end. The mustards were hand-harvested 3 to 4 times each day, and fed fresh to the cattle.

Blood samples, the BSP test, and liver biopsy samples were collected several weeks before the feeding trial was initiated, and repeated at the end of the trial to evaluate any changes in liver function.

The cows ate large amounts of the tansymustard, and smaller amounts of flixweed (Table 1). As the animals adapted to the feeding trial, daily consumption of tansymustard increased from 18 lb. per head to 62 lb. per head (wet weight) on day 12. Protein and phosphorus content of the tansymustard (rosette to the bud stage) was 22.4 and 0.38%, respectively. None of the cows showed any evidence of photosensitization. Blood chemistry values were within normal limits, as were BSP clearance rates. Liver biopsy samples indicated normal liver structure at the end of the trial. The cows were pastured

Table 1. Daily intake of tansymustard and flixweed by lactating cows during a 12-day feeding trial in Montana 1988.

Item	Tansy-mustard	Flixweed	Control
Mustard intake			
wet weight (lb/head)	39.6	24.0	0
dry weight (lb/head)	4.1	6.0	0
Mustard intake (% of body weight)			
wet weight	4.4	2.4	0
dry weight	1.0	0.6	0

for 2 weeks near Bozeman on lush forage after the trial to eliminate the possibility that photosensitization symptoms would appear later. No cases of photosensitization were reported in this general area during spring, 1988.

Weather Patterns

Precipitation is the dominant factor influencing plant growth in Montana, with temperatures playing a secondary role. Annual plants such as tansymustard germinate and initiate growth during wet, cool fall months. If subsequent springs are dry, mustards have a competitive advantage over perennial forage plants, and represent a much larger proportion of the herbage available for grazing animals. We suspect that climatic variability is responsible for much of the yearly variation in severity of photosensitization problems from area to area. Changes in weather influence amounts of a plant present in relation to other forage species, the rate of plant growth, and perhaps the concentration of toxic compounds

Extension service records were used to determine the location of reported cases of photosensitization in Montana from 1983 to 1987. Climatic data, provided by the National Climatic Data Center, Asheville, N.C., were analyzed to determine seasonal trends in rainfall and temperature during that period.

Monthly temperature and precipitation patterns (deviations from 30-year normal) for 2 locations that had photosensitization problems during April and May, 1985 to 1987, are shown in Figure 1. Photosensitization problems generally occurred during warm springs with above-normal temperatures and below-normal precipitation. However, cool weather, with above-average precipitation characterized the preceding July to September period. Winter temperatures were usually above normal from January to March.

Conclusions

The difficulty we experienced in reproducing photosensitization under controlled conditions is not unique to this study. Other plants such as horsebrush (*Tetradymia* spp.), kleingrass *(Panicum coloratum)*, smartweeds (*Polygonum* spp.), and rain lily *(Cooperia penduculata)* have been suspected causes of photosensitization, but have failed to cause the condition in research trials. The classic

This cow shows typical symptoms of photosensitization, including inflammation and peeling of bare patches of skin on lightly pigmented areas of legs and head.

case may be *Tetradymia,* which was fed in trials for many years with little progress. The problem was solved when it was observed that photosensitized sheep had been grazing on black sage *(Artemisia nova).* It was then verified that previous consumption of black sage predisposes sheep to photosensitization by horsebrush.

Tansymustard is readily grazed by cattle in the Southwest, but photosensitization has not been reported. However, the plant causes a condition known locally as "wooden tongue," in which cattle become partially blind and lose the ability to swallow. We saw no evidence of wooden tongue in our studies.

Note added in proof: Grazed tansymustard plants were collected from a Montana pasture with numerous photosensitized cows during 1989. This material, and tansymustard grown in a greenhouse, was fed to hamsters for 21 days. We found elevated liver enzyme levels in the grazed tansy group, but not the greenhouse group, thus providing the first direct evidence that tansymustard contains a liver toxin.

It appears possible that some unknown fator is operating in conjunction with consumption of tansymustard to cause the photosensitization problems in Montana. There is a possibility that mycotoxins from a fungus or mold growing on some plant causes liver damage. We plan to continue to investigate the problem by visiting affected herds, and by making detailed observations on pastures and animals.

Twenty Years of Rest-Rotation Grazing on the Arizona Strip—An Observation

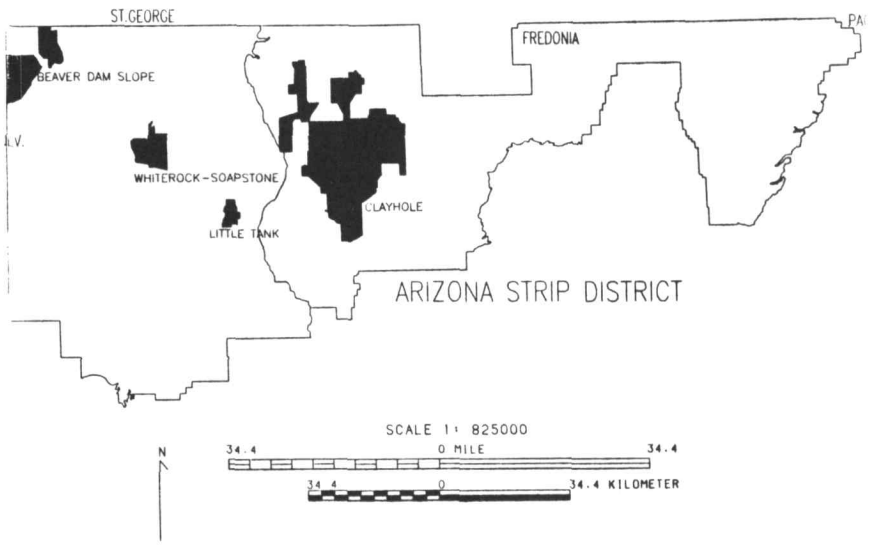
Lee E. Hughes

The year was 1968. The year was witness to many changes in the United States. The civil rights movement was maturing into law and action. The environmental movement was emerging. The Vietnam War was at its peak as were the anti-war protests. This caused changes in our foreign policy. The United States astronauts were preparing to walk on the moon. Our view of the world would be forever changed. During this time another little known change was taking place. This change involved how rangeland forage was to be managed. Rest-rotation grazing was being initiated on the Clayhole, Beaver Dam Slope, Little Tank and the Whiterock Soapstone grazing allotments on Bureau of Land Management (BLM) administered lands on the Arizona Strip.

Rest-rotation grazing was being promoted by August L. Hormay. He visited some of the Arizona Strip allotments to assist the BLM in establishing and implementing the grazing systems. This change incorporated systematic rest from grazing to benefit the forage species by allowing them to increase in their plant communities to a point where nature intended.

Cattle movements were planned in a prescribed manner to provide for set periods of rest and grazing. There were times the prescribed grazing system could not be followed for various reasons, such as drought; so cattle would enter another pasture that should be rested or cattle would not be put into the allotment. Flexibility in grazing systems is a requirement when dealing with nature and all its unknowns. But on most of the years the prescribed grazing systems were followed.

The author is District Range Conservationist on the Arizona Strip District.



BUREAU

The four described allotments were not the only ones placed on rest-rotation sequence on the Arizona Strip. They do reflect the whole spectrum of vegetation types of the district and have been on rest-rotation grazing consistently for 20 years. From these four allotments the potential and limits of rest-rotation grazing in the arid and semi-arid areas has been learned. The expression of utilization and weather in key forage trend has helped define the above limits and potential.

What is Rest-Rotation Grazing?

Rest-rotation grazing is explained from a pamphlet on the subject as:

> "Under rest-rotation grazing heavy emphasis is placed on restoration of vigor to the point where seed can be produced and where conditions are systematically created for establishment of seedlings of desirable forage plants.
>
> To obtain reproduction it is necessary to rest the range from grazing at three critical times for three main purposes: first, to restore plant vigor; second, to insure development and ripening of seed; and third, to insure establishment of seedlings. The general form of rest-rotation grazing, therefore, consists of four basic steps in the following sequence:
>
> 1. Graze the range for maximum livestock production.
>
> 2. Rest the range until plant vigor is restored.
>
> 3. Rest the range until seed ripens, then graze for maximum livestock production.
>
> 4. Rest the range until reproduction becomes firmly established.
>
> The number of years required to apply these steps depends on the growth requirements of the key species on the range, the one species most desired for forage and plant cover. The key species is usually one of the most palatable on the range and one easily destroyed by grazing. All other forage species on the range having growth requirements equal to or less exacting than those of the key species will also be maintained by the amount of rest that satisfies the key species." (Hormay and Talbot 1961.)

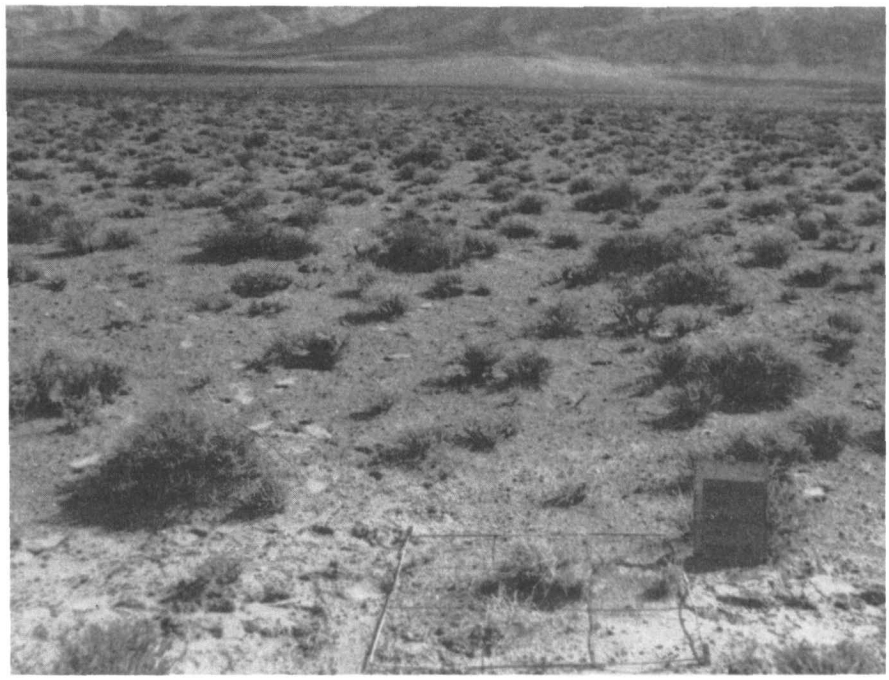
The Allotments

The Beaver Dam Slope allotment (about 36,000 acres) is in the Mohave Desert. Low rainfall (5–10 inches) and hot summer temperatures (115°-120° F) make for an arid environment. Vegetation are creosotebush and bursage complexes with attendant forages such as big galleta, Indian ricegrass, winterfat, and annuals like Indian wheat and cheatgrass. This is a three-pasture allotment.

Clayhole and Little Tank allotments (178,000 and 6,000 acres respectively) occur in the Desert Grasslands vegetation type with 5 to 12 inches of precipitation. The forage consists of black and blue grama, galleta, squirreltail, Indian ricegrass, shadscale, and fourwing saltbush. Clayhole is a nine-pasture allotment and Little Tank is a four-pasture allotment.

The Whiterock-Soapstone allotment (19,000 acres) is in the pinyon-juniper vegetation type. In the late 1960's around 7,000 acres of chainings with seedings, chainings without seedings, and sprayings were done. Seedings consisted of various perennial wheat grasses. The areas with land treatments provide most of the forage on the allotments. This allotment consists of three pastures. Precipitation generally amounts to about 15 to 18 inches per year.

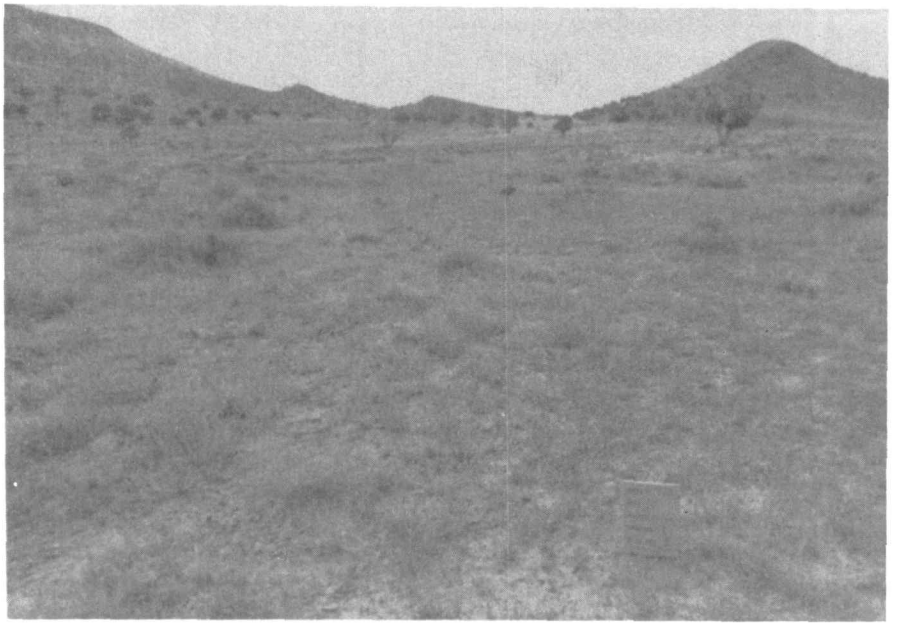
All four allotments have vegetation trend and utilization studies established and documented since 1968-70 to 1986-88. Trend studies from 1968-1980 used a three-foot by three-foot plot with pictures taken of the plot and its surrounding area. The plot's vegetation was measured by cover methods. After 1980 the trend plots were superceded by 200-plot frequency transects. Utilization studies were all done using the grazed class method, which determines utilization by percent of height/weight taken from key species. The trend and utilization studies were done in key areas. Upward trend indicated that the key species were increasing in composition, and vice versa is downward trend.



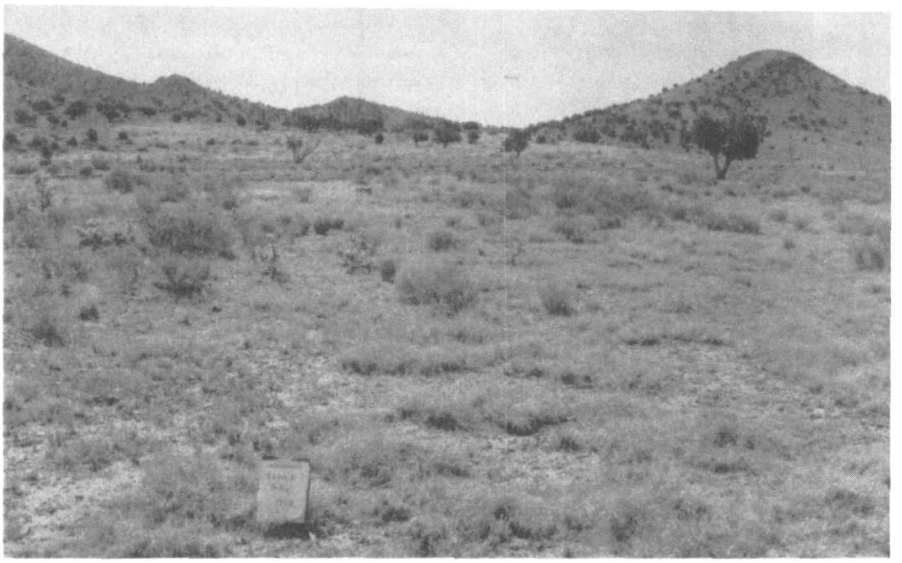
1974

1988

On the Beaver Dam Slope Allotment rest-rotation grazing has caused change. The big galleta has increased in area over 14 years.



1969



1988

Little Tank Allotment, *in the above key area, had annuals (Russian thistle) growing along with shrubs in 1969. Today, 20 years later, galleta grass has replaced the annuals.*

Key Species Trend on Allotments With:					
Greater Than 50% Utilization			Less Than 50% Utilization		
Up	*Static*	*Down*	*Up*	*Static*	*Down*
1	5	3	12	7	5

The Results

On the Beaver Dam Slope allotment, four trend plots from 1970-1982 were all static or down trend for key plant species. Utilization levels averaged 36% with a range 10-70%. The four trend transects from 1981 to 1989 all show upward trend on key species. Average utilization in that time was 22% with a range of utilization from 11 to 34%.

The Little Tank allotment has four key areas and the plots from 1969 to 1980 all remained static or were down. Utilization levels during this period averaged 57 to 63%, which is heavy. The transects show from 1981 to 1987, three key areas up and one static in key species trend. Utilization of the key species averaged from 31 to 48%, which is considerably less than the 1969 to 1980 time period.

The Clayhole allotment from 1969 to 1979 showed trend in two plots up, four plots static, three plots down with average utilization levels ranging from 41 to 60%. The trend transects from 1983 through 1986 showed four trend transects up, two static, two down with an average utilization ranging from 28 to 52%. Recent years have shown lower utilization levels and more up trends.

The Whiterock-Soapstone allotment from 1969 to 1979 showed all down trend in its three key areas and utilization averaged 19 to 68%. The trend transects from 1981 to 1987 showed one up trend, one static trend, and one down trend, with average utilization ranging from 24 to 48%. Much of the down trend has to be attributed to brush and tree invasion on the the chained and sprayed areas, a natural occurrence unrelated to grazing.

Summary

The study data demonstrates that utilization levels play a role in the trend of key species. Summarizing the trend data shows the following:

Utilization levels alone are not the cause of trend direction; weather and ecological succession play a major role. But lower utilization levels do allow for key forage species to

1969

1988

The Whiterock-Soapstone Allotment *was treated by chaining, burning and seeding in 1968. After the grass was established, a 3-pasture rest-rotation grazing system was implemented in 1969. The wheatgrasses have been well maintained for 20 years. The browse species, naturally reinvading, are bitterbrush and cliffrose.*

increase when weather and ecological conditions so permit.

The trends found in the past 20 years of rest-rotation on the Arizona Strip have also been demonstrated in more detailed studies in Utah and Nevada (Laycock and Conrad 1981, Eckert and Spencer 1986).

Conclusion

What then can be said about rest-rotation systems in semi-arid and arid environs? Real gain in increasing key species on native rangeland comes slowly and subtly. Improvement comes with below 50% utilization levels. Land treatments are better maintained under rest-rotation grazing than season-long use, but brush and tree invasion occurs regardless of management.

Rest-rotation grazing can bring improvement to arid and semi-arid ranges when there is potential for improvement or where land treatment sets back succession to allow for improvement. Our results show rest-rotation grazing must operate with below 50% utilization levels in grazed pastures in arid and semi-arid environs. Heavy utilization levels during use periods will negate the effects of a year to one-and-a-half years rest from grazing and cause static or downward trend.

One strong lesson of the rest-rotation grazing experience is that should a drought occur there is reserve forage in the rested pasture. And drought is a frequent visitor in the Southwest.

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Frontal Grazing: Forage Harvesting of the Future?

Jerry D. Volesky

Frontal grazing is a new method of grazing management. The frontal grazing system features a livestock-driven, sliding fence apparatus which allocates and controls grazing within a pasture. Livestock advance moveable fence to gain access to ungrazed forage by pushing on a cable with their foreheads. Forage loss due to trampling and defecation is minimized as the livestock, at a high stocking density, uniformly graze and advance the fence across a pasture. The equipment is a technological package that strives to make efficient use of the forage resource and human management or labor, maximize nutrient cycling, and make practical use of animal behavior.

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[1]The main components and equipment for frontal grazing are patented and manufactured by Fernando R. Pereda, Hipolito Yrigoyen 1534 Piso 3 "G" 1089 Buenos Aires, Argentina.

Mention of trade names, propriety products or specific equipment does not constitute a guarantee or warranty of the product by the USDA and does not imply its approval to the exclusion of other products that may also be suitable.

Development

The frontal grazing system was invented and developed by Fernando Pereda, an Argentine livestock producer and a graduate of Rensselaer Polytechnic Institute in New York[1]. The idea for the system arose in a dream about 20 years ago. This dream, however, was fueled by the marriage of a common occurrence on a ranch and a labor problem. The common occurrence was the observation of cattle placing their heads through and under fences in order to graze on the other side. The labor problem that Pereda faced was the movement of a temporary fence that was a barrier for a large flock of sheep that were strip-grazing a pasture. Each day the fence had to be moved to give the sheep access to about two more acres of ungrazed forage. The dream unified the common occurrence and labor problem and resulted in a vision of cattle pushing a fence whenever they needed more forage.

Frontal grazing relies heavily upon animal behavior and their inherent tendencies. The system has a strong basis with some animal behavior research by B.F. Skinner, a Harvard University psychologist. Skinner has demonstrated that animals will essentially manipulate their surroundings to get what they want.

Frontal Grazing System Components

The main components of the frontal grazing system include: 1) an electric wire and an insulated push-cable; 2) a centrally located pace-governor; 3) sleds which support the electric wire and push-cable; 4) two parallel, high-tensile lateral wires; and 5) a set of pulleys which travel along each lateral line and form the union with the frontal fence wire and push-cable. Peripheral equipment includes a water alley outlet post and a moveable backfence. Pasture arrangement of the fencing and equipment is shown in Figure 1.

The electric wire and push-cable of the frontal fence are about 28 and 8 inches above the ground, respectively. The supporting sleds are spaced at about 40- to 50-foot intervals across

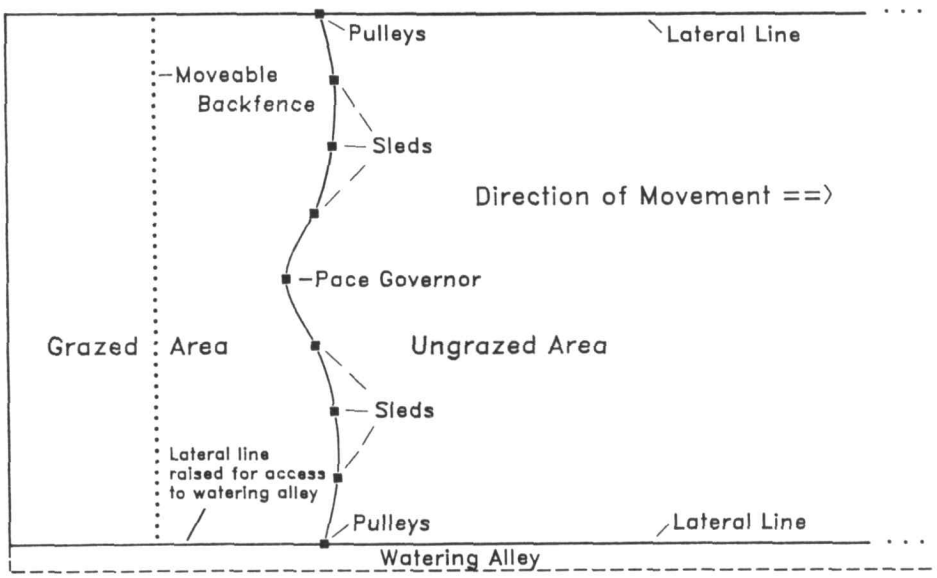

Fig. 1. *Pasture arrangement of the frontal grazing system and peripheral fences.*

the front and form an arc from each lateral line to the pace-governor (Fig. 1). The pace-governor, which acts as a tension regulator, is located in the center of the frontal fence and provides some resistance with regards to animal advancement of the fence (Fig. 2). The electric wires on each side attach to a spring-loaded scissor mechanism located on the upper front part of the pace-governor. When wire tension becomes high, the scissor mechanism opens, allowing a cogged wheel to roll forward about 8 to 20 inches. When wire tension is relieved, the scissor mechanism will close, stopping movement of the cogged wheel. The lower push-cables are simply attached to spools located at the rear of the pace-governor. Wires and cables can be rolled up on these spools when storing or moving the equipment to a new location.

Lateral lines, which guide the frontal fences are made of a single strand of at least 12.5 gauge high-tensile wire placed 28 inches above the ground. H-braces are used at each end of the lines. Wooden posts and guides which secure the lateral line wires are spaced at 100-foot intervals. The guides, through which the wires pass, are T-shaped and are bolted into the top of each wooden post in the lateral line. This allows the pulleys, which form the frontal fence and lateral line union, to track along the wire and pass each post (Fig. 3).

A backfence, which is moved by hand, is typically placed about 150 to 200 feet behind the frontal fence to prevent livestock from regrazing or trampling forage. Livestock water is located in an alley (15-30 feet wide) running parallel to one of the lateral lines (Fig. 1). Access to that alley is provided by an 8-foot pole which hooks onto and raises the lateral line. A length of wire with one end connected to the electrified lateral line is wrapped around the pole to prevent livestock from rubbing against it. Because this watering alley access pole is periodically moved as the frontal fence progresses across the pasture, a bell or plastic bottle is attached to it so that the livestock may

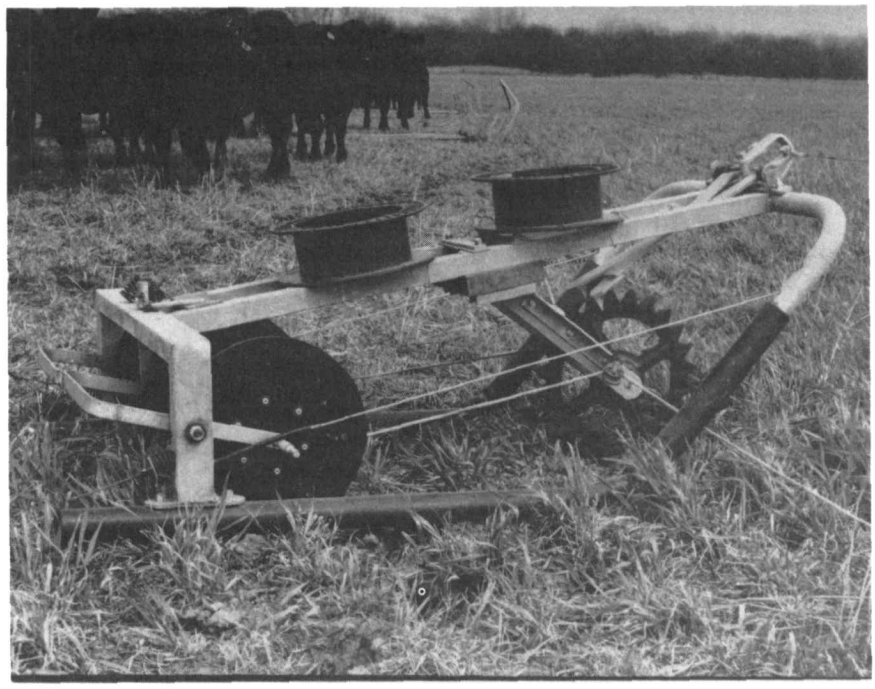

Fig. 2. *The pace-governor (tension regulator) which is located at the center of the frontal fence.*

Fig. 3. *Pulley apparatus which forms the union of the frontal fence and lateral line. Also shown is a lateral line post and wire guide.*

Fig. 4. *Cattle actively grazing at the frontal fence.*

more easily form an association with its location.

All wires of the frontal grazing system (excluding the push-cable) and the pace governor are electrified. The sleds are not electrified and have an insulated bracket which supports the upper 'hot' wire. As with all electric fences, charged wires of the frontal grazing system provide a psychological barrier and the push-cable provides a physical barrier.

There are about five frontal grazing systems currently in use in Argentina. Most have a width (distance between the 2 lateral lines) of 650 or 1,000 feet. The length can be as long as the available pasture and typically are from 2,500 to 4,000 feet. If the available pasture is of a shorter length, three lateral line fences could be constructed to create two frontally grazed fields. This would allow a grazing pass down one field and a return pass in the opposite direction on the second field.

System Operation and Management

Cattle used in the frontal grazing system should be electric fence trained prior to starting. It is also important that they be initially placed in the watering alley to allow them to learn the water tank and watering alley pole locations. This helps them overcome any fears of walking under the raised lateral line to and from the watering alley and grazing area.

A frontal grazing system begins with the frontal fence placed about 160 feet from one end of the pasture. A 328-foot (100-meter) wide system requires a minimum of 90 to 100 head of cattle (1 head/3.6 to 3.3 feet of frontal fence) for effective operation. Fewer cattle, may result in overconcentration on one side of the pace-governor and advancemnt of only half of the frontal fence. This causes wire tension and equipment problems. Frontal stocking as high as 1 head/2.5 feet of frontal fence has been used. Stocking density in a 328-foot wide system, for example, with 100 head and the initial allocation of 160 feet, is 83 head/acre. When all cattle are at the front fence during a grazing bout, they are essentially lined up should to shoulder (Fig. 4).

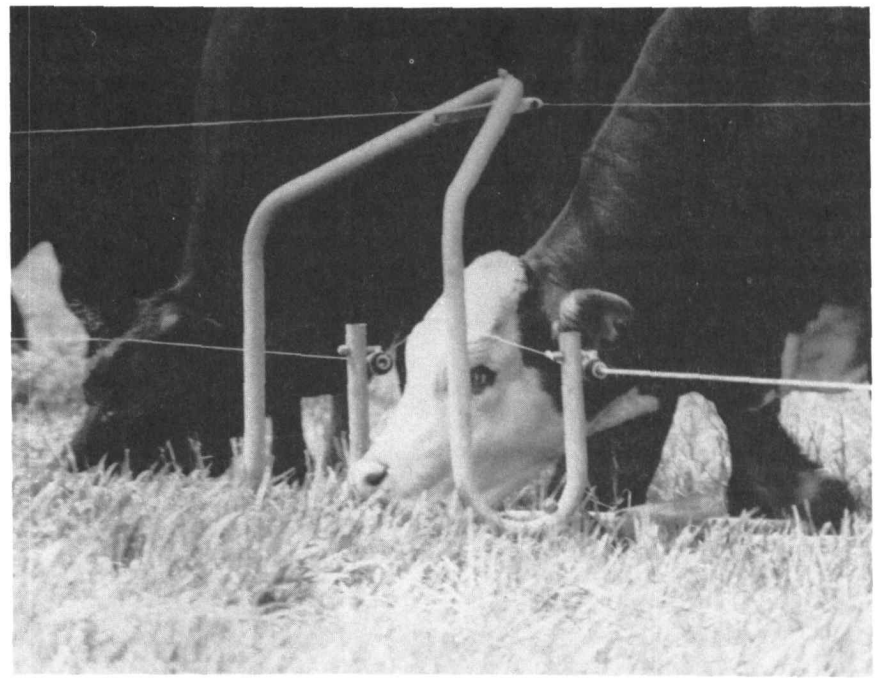

Fig. 5. *Steer beginning a pushing effort while grazing at one of the sleds.*

The initial allocation of 160 feet (depending on forage quantity) will last about 1 to 1.5 days. With the rapid depletion of forage, the cattle become interested in the frontal fence but the actual learning process requires human assistance. Sleds are manually pulled ahead about 1 or 2 feet to expose a strip of ungrazed forage which is readily consumed. This is repeated several times a day. After 3 to 4 days, the cattle are on their own and will readily push and move the frontal fence forward as they need. This learning process can be made less labor intensive by retaining several cattle with previous frontal grazing experience and mixing them in with a group of new cattle. If the cattle are familiar with a supplemental feed, placing a few small piles or a line of this feed in front of several of the sleds will encourage them to push it forward.

The key components for advancement of the frontal fence are the sleds. An animal using its forehead can lift and push on the push-cable and advance the sled forward (Fig. 5). Depending on the amount of force applied, advancement from such an effort may range from 0.5 to 1.5 feet. The frontal fence will also advance to a much lesser degree when enough force is applied to the push-cable at any point across the front. An important interaction occurs between ease and distance of advancement and frontal fence and lateral line tension. If tension is high, force applied to the push-cable is transferred to the pulley apparatus which in turn causes it to roll forward in order to relieve the tension and degree of curvature or arc of the frontal fence.

A hierarchy will typically from within the herd with several dominant animals preferring to graze at, and do the pushing of the sleds. These 'pushers' are commonly those animals which had the least fear of the frontal fence and were the first to push it during the learning period.

Forage utilization is directly reflected in the daily rate of advancement of the frontal fence. Rate of advancement is primarily related to quantity of available forage, frontal stocking, and forage intake of those cattle. Other important variables which affect rate of advancement include forage type and forage maturity or palatability. Management can influence rate of advancement, and thus forage utilization, by a combination of two adjustments. If there is a need to slow rate of advancement and increase utilization, the position of the electric

wire at each of the sleds can be adjusted outward so that it is closer to an animal's neck and shoulders (Fig. 5). Secondly, an increase in electric wire voltage from the typical 2,500 to 5,000 volts or greater may also be beneficial. These two measures increase the probability of an aggressive animal receiving a strong shock. There will be a 1 or 2 day lag time for these adjustments to take effect because the majority of the pushers or dominant animals within the herd will have to receive one or more shocks.

Livestock management is generally easier with frontal grazing. Herd sizes are relatively large, but the animals are more docile than those used in other types of grazing systems.

Frontal Grazing System Applications

As with all intensive grazing systems, management needs and inputs for frontal grazing are quite high. This is particularly true during the first several days of operation when the cattle are learning and adapting to the system. Subsequently, there should be thorough daily checks of the equipment and as needed, movement of the backfence and watering alley outlet pole. Periodic checks should also be made of the lateral line tension and wire voltage.

Frontal grazing has some similarities with regards to the basic principles and objectives of short-duration or rotation grazing systems that have a one-day occupation period in a subunit (paddock). Even more of an association can be drawn with grazing management that features a daily allocation or rationing of a strip of forage to livestock.

The basic requirement for the use of a frontal grazing system is a relatively flat and productive pasture which is free of trees and shrubs. Topography should not include abrupt drainageways or other obstacles which could impede the pace-governor, sleds, or the frontal fence itself. In Argentina, frontal grazing has been used on several introduced perennial grass pastures as well as some of the sorghum crops and alfalfa. The pastures themselves receive a fairly high level of management including fertilization, burning, and haying as necessary. Frontal grazing is probably not suitable for most native rangelands (especially semi-arid and arid) because of the intensity of defoliation and lower forage productivity.

Levels of animal nutrition under a frontal grazing system might also be manipulated through the arrangement and types of forage crops used. Strips of alfalfa or some other legume could be established at planned locations parallel to where the frontal fence would pass. Another approach might include the use of a cool-season and warm-season forage combination. If managed as independent pastures, the period for optimum use of a frontal grazing system could be extended. The two types could also be managed within the same pasture with an area of cool-season forage first followed by the warm-season. This might be useful with long frontally grazed pastures where there is a problem of either of the two forage types becoming excessively mature by the time the frontal fence advances to the far side.

Research on Frontal Grazing

Two 328-foot (100-meter) wide frontal grazing systems are being tested at the USDA-ARS Forage and Livestock Research Laboratory near El Reno, Oklahoma. They are being used during the summer on 'Caucasian' Old World bluestem and during the spring on no-till winter wheat pastures. Lengths are 2,500 and 1,500 ft. for the bluestem and wheat pastures, respectively. Animal performance and production, forage intake and composition, and forage disappearance before and after passage of the frontal fence are being measured. The frontal system is being compared against a conventional grazing approach for wheat pasture. Current plans for expansion of the wheat pasture study include the seeding of an additional forage crop to be frontally grazed after the wheat pasture is finished. On the bluestem pasture, frontal grazing is being compared against season-long (June–September) grazing at four different stocking rates.

Forage disappearance after passage of the frontal fence typically ranged from 65 to 75% on wheat pasture and 50 to 65% on bluestem pasture. Disappearance on the bluestem pasture tended to be on the low end of that range when forage began to mature. Two passes or runs of the frontal fence were made on the bluestem pasture with lengths of 30 and 20 days, respectively. Cattle were held on an adjacent pasture for 14 days after the first pass to allow more forage regrowth. This gave a nonuse period of 44 days for the starting area, but this decreased progressively down the pasture as the second run had a greater rate of daily advancement.

The few observations and data given reflect some of the different management approaches and decisions that have to be made as well as questions that need to be answered. Of major importance is the length of the frontally grazed pasture, which must be long enough to allow an adequate nonuse and regrowth period. With some forages, persistence may need to be considered. Reflected in length of nonuse period is quantity of regrowth for the second or possibly a third or fourth pass. One must keep in mind that forage quantity is the major factor influencing daily rate of front advancement. There are likely to be other interactions to varying degrees with forage type, growth pattern, starting date, and growing conditions.

Under frontal grazing, grazing efficiency is hypothesized to be higher due to very uniform utilization and less trampling of ungrazed forage. Because of the high stocking density under frontal grazing, manure is evenly distributed and trampled on the grazed area as the front fence progresses forward. This lends itself to some potentially interesting studies with regards to nutrient cycling, soil compaction, and intestinal parasite infestation. Parasite infestations may be lessened due to frontal grazing's similarity with rotational systems that provide pastures with nonuse periods long enough to break the life cycles of parasites. Animal travel may also be less, but this is highly dependent on the number and loca-

tions of the tanks in the watering alley. Forage intake may also be increased because of the competitive feeding nature of cattle; as observed in those fed in confinement.

The mechanical components needed for frontal grazing are quite advanced in terms of designs, function, and operation as a system. As with many inventions, however, minor details are undergoing continued refinement. A major aspect of frontal grazing that needs refinement and development is the management of it as a system, and how the system would fit into a livestock producing operation. Associated with this is a need to evaluate different forages and how they might interact with a frontal grazing system. Perhaps most importantly, frontal grazing will be a very useful tool for research in terms of studying numerous aspects of grazing, animal behavior, and plant responses.

Call for Papers

IVth INTERNATIONAL RANGELAND CONGRESS

22-26 April 1991
Montpellier, France

The IVth INTERNATIONAL RANGELAND CONGRESS will convene in MONTPELLIER (FRANCE), under the aegis of AGROPOLIS (International Complex for Research and Higher Education) and the ASSOCIATION FRANÇAISE de PASTORALISME (AFP-French Association for Range Management).

The official languages of the IVth IRC will be French and English; permanent simultaneous translation will be available, including during field trips.

The Scientific Committee wishes to emphasize issues related to the mediterranean and subtropical isoclimatic zones, but other subjects will be addressed. In particular, general issues of methodologies and management techniques and problems pertaining to other ecoclimatic zones are envisaged.

Registration fees are 2500 FF (approx. 400 US$) before Oct. 31, 1990 for full members and 1500 FF (approx. 250 US$) for associate members.

Deadlines for contributions are as follows:

* Title and 50-100 words synopsis : March 31, 1990
* 300-word summary and
* Full paper (4 pages of *Journal of Range Management,* i.e. approx 4000 words): July 31, 1990

For further information on the IVth IRC, please contact:

Dr. H.N. Le Houérou, Chairman
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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 parentheses for each citation).

An Analysis of the Range Forage Situation in the United States: 1989-2040; by Linda A. Joyce; 1989; USDA, For. Serv. Gen. Tech. Rep. RM-180; 136 p. (Rocky Mtn. For. & Range Expt. Sta., 240 West Prospect St., Fort Collins, Colo. 80521) As required every 10 years by the Resource Planning Act (RPA) of 1974, this report analyzes the U.S. range resource from a national perspective, includes public and private lands, and uses information collected by other public agencies as well as the U.S. Forest Service.

An Analysis of the Wildlife and Fish Situation in the United States; 1989-2040; by Curtis H. Flather and Thomas W. Hoekstra; 1989; USDA, For. Serv. Gen. Tech. Rep. RM-178; 146 p. (Rocky Mtn. For. & Range Expt. Sta., 240 West Prospect St., Fort Collins, Colo. 80521) As a companion to the preceding publication, this report assesses the current status and recent historical trends of wildlife and fish resources in the U.S., makes resource inventory and use projections, and evaluates implications and opportunities for resource management programs.

Assessment of Rangeland Condition and Trend of the United States, 1989; by Soc. Range Mgt., Public Affairs Comm.; 1989; Soc. Range Mgt., Denver, Colo.; 12 p. (Address: 1839 York St., Denver, Colo. 80206; $5) "Provides the best and most recent available data on the ecological status, condition, and trend of the U.S. rangelands."

An Automated, Objective Procedure for Selecting Representative Field Sample Sites; by Steven D. Warren, Mark O. Johnson, William D. Goran, and Victor E. Diersing; 1990; Photogr. Eng. & Remote Sensing 56(3):333-335. (U.S. Army Construction Eng. Res. Lab., Environmental Div., P.O. Box 4005, Champaign, Ill. 61824) Provides a procedure for selecting representative sample sites for land-condition analysis and ground truthing of digital satellite imagery.

Burning Upland, Mixed Prairie in Badlands National Park; by Steven G. Whisenant and Daniel W. Uresk; 1989; Prairie Nat. 21(4):221-227. (Dept. Range Sci., Texas A&M Univ., College Station Texas 77843) Compared prescribed burning in fall and spring and on less productive versus more productive sites; concluded recovery from fire on less productive sites required 1-3 years longer.

Comparison of Two Drills for Interseeding Rangeland; by Jerry D. Volesky, Pat O. Currie, and John R. Lacey; 1990; Mon. AgRes. 7(1):18-22. (Agric. Bul. Room, Mon. State Univ., Bozeman, Mon. 59717) Concluded from their study that a machine developed specifically for semi-arid western range conditions, the Range Improvement Machine, was more successful for interseeding western wheatgrass than a commercial drill designed to handle a variety of interseeding situations.

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

Draft Environmental Impact Statement: Vegetation Treatment on BLM Lands in Thirteen Western States; by USDI, Bur. Land Mgt., Washington, D.C.; 1989; var. paged. (Request copies from: Wyoming State Director, B.L.M., c/o Jim Melton, Team Leader, 1701 East "E" St., Casper, Wyo. 82601) Assesses the projected environmental impact of a wide array of vegetation treatment methods the BLM proposes to apply to BLM lands in 13 western states; an appendixes section is provided in a companion publication.

Economic Evaluation of Wyoming Big Sagebrush *(Artemisia tridentata)* Control Methods; by Myles J. Watts and Carl Wambolt; 1989; Weed Tech. 3(4):640-645. (Agric. Bul. Room, Mon. State Univ., Bozeman, Mon. 59717) Compared the profitability of four Wyoming big sagebrush control treatments.

Economics and Management of Fee Hunting for Deer and Elk in Utah; by Lucy A. Jordon and John P. Workman; 1989; Wildl. Soc. Bul. 17(4):482-487. (Range Sci. Dept., Utah State Univ., Logan, Utah 84322) Describes fee hunting in Utah and evaluates the advantages and limitations associated with fee hunting of deer and elk.

Improving Southwestern Riparian Areas through Watershed Management; by Leonard F. Debano and Larry J. Schmidt; 1989; USDA, For. Serv. Gen. Tech. Rep. RM-182; 34 p. (Rocky Mtn. For. & Range Expt. Sta., 240 West Prospect St., Fort Collins, Colo. 80521) A state-of-the-art report on opportunities and watershed restoration techniques available for rehabilitating and enhancing riparian ecosystems in southwestern environments.

Interagency Forage and Conservation Planting Guide for Utah; by Howard Horton (ed.); 1989; Utah Agric. Ext. Cir. 433; 67 p. (USU Ext. Bul. Room, Utah State Univ., Logan, Utah 84322; $1.50) Provides plant species and planting technique recommendations for seeding pastures, rangelands, wildlife habitat, mine lands, transportation and communications rights-of-ways, and other areas where permanent cover or erosion control is desired.

Livestock Grazing Successes on Public Range; by USDA, For. Serv., USDI, Bur. Land Mgt., and the Public Lands Council; 1989; USDA Prog. Aid 1439; 17 p. (Available from The Public Lands Council, 1301 Pennsylvania Avenue, NW, Suite 300, Washington, D.C. 20004 or national or local offices of the For. Serv. or BLM) Highlights the productive and environmental enhancement roles livestock grazing plays on public grazing lands under cooperative management; also highlights specific success stories.

Livestock/Wildlife Interactions: Behavioral and Territorial Relationships; by Valerius Geist; 1989; Amer. Soc. Anim. Sci., West. Sect. Proc. 40:496-499 (Faculty of Environmental Design, Univ. of Calgary, Calgary, Alta. T2N 1N4) Evaluates genetic "pollution," disease, and behavioral relationships of maintaining big game under game ranching conditions.

Natural Plant Toxicants in Milk: A Review; by K.E. Panter and L.F. James; 1990; J. Anim. Sci. 68(3):892-904. (USDA-ARS, Poisonous Plant Res. Lab., Logan, Utah 84321) A review of natural plant toxicants in milk, their effects on the ingesting animal, their transfer to milk and milk products, and their potential danger to humans and suckling animals.

Old World Bluestem: Planting, Stand Establishment, and Early Stand Production Management (With Considerations for Other Grasses); by R.L. Dalrymple; 1990; Noble Found., Ardmore, Okla.; 41 p. (Noble Found., Agric. Div., P.O. Box 2180, Ardmore, Okla. 73402; free) A state-of-the-art publication on utilizing warm-season grasses, with particular emphasis on Old World bluestems, summarized from practical experience, controlled demonstrations, and technical research.

Proceedings of Symposium "Seed and Seedbed Ecology of Rangeland Plants" (21-23 April 1987, Tucson, AZ); by Gary W. Frasier and Raymond A. Evans (Eds.); 1987; USDA, Agric. Res. Serv., Tucson, Ariz.; 311 p. (Limited copies available from USDA-ARS, 2000 E. Allen Road, Tucson, Ariz. 85719; available for purchase from Natl. Tech. Info. Serv., 5285 Port Royal Road, Springfield, Va. 22161). The proceedings of a symposium on "seeding revegetation species on rangelands where seeding is done with limited or *no seedbed preparation" under semiarid to arid conditions.*

The Role of Soil-Surface Morphology in the Function of Semiarid Rangelands; by R.E. Eckert, Jr., F.F. Peterson, M.K. Wood, W.H. Blackburn, and J.L. Stephens; 1989; Nev. Agric. Expt. Sta. Tech. Bul. 89-1; 81 p. (Agric. Bul. Room, Univ. Nev. Reno, Reno, Nev. 89557) *Summarizes the results of studies conducted on 27 study sites in northern and central Nevada to clarify the nature of soil surfaces in the function of semiarid rangelands.*

Seeding New Mexico Rangeland; by Chris Allison; 1988; N. Mex. Agric. Ext. Cir. 525; 15 p. (Agric. Bul. Room, N. Mex. State Univ., Las Cruces, N. Mex. 88003) State-of-the-art recommendations on seeding techniques and practices and plant species adaptations for New Mexico rangelands.

Sequential Analysis of Cattle Location: Day-to-Day Movement Patterns; by D.W. Bailey, J.W. Walker, and L.R. Rittenhouse; 1990; Applied Anim. Beh. Sci. 25(1-2):137-148. (Dept. Range Sci., Colo. State Univ., Fort Collins, Colo. 80523) A report of studies in Texas and Colorado *relative to movement patterns of grazing cattle;* concluded cattle tend to graze nearby areas each following morning rather than the same area or more distant areas.

Seven Popular Myths about Livestock Grazing on Public Lands; by Jeffrey C. Mosley, E. Lamar Smith, and Phil R. Ogden; 1990; Idaho For., Wildl., & Range Expt. Sta., Moscow, Ida.; 18 p. (Editor, Idaho For., Wildl. & Range Expt. Sta., Univ. Idaho, Moscow, Idaho 83843; $2 each or $1.50 for five or more copies) The authors have distilled the basic "myths" behind the belief that current livestock grazing is economically and ecologically unsound public land activity, rebutting each with facts and figures drawn from many sources; suggested reading for all range scientists and practitioners and *environmentalists generally!*

Sheep Production in Coastal Oregon Douglas-fir Plantations; by Wayne C. Leininger, Steven H. Sharrow, and Bruce D. Rhodes; 1989; Northwest Sci. 63(5):195-200. (Dept. Range Sci., Colo. State Univ., Fort Collins, Colo. 80523) *This study provides information on seasonal forage quality and sheep production for use in assessing the profitability of grazing cutover forests in the Pacific Northwest, a potential silvicultural tool for reducing vegetation competition in conifer regeneration.*

Sierra Foothills Range Field Station—Thirty Years of Research: An Overview; by Charles A. Raguse, Gary A. Beall, John L. Hull, Douglas McCreary, and Charles B. Wilson, 1990; Calif. Agric. 44(2):4-7. (ANR Pub., Univ. Calif. 6701 San Pablo, Oakland, Calif., 94608) Provides an overview of past and current research at this field station; this lead article is followed by six specific research reports on short-duration grazing, bovine pinkeye, supplementing *range calves, drought effects on blue oaks, selective oak removal,* and wildlife diversity; requesting the entire issue is suggested.

Tetracan, Russian Wild Ryegrass; by T. Lawrence, A.E. Slinkard, C.D. Ratzlaff, N.W. Holt, and P.G. Jefferson; 1990; Can. J. Plant Sci. 70(1):311-313. (Research Sta., Agric., Can., Swift Current, Sask. S9H 3X2) *This comprises the official release notice about* Tetracan, a tetraploid cultivar of Russian wildrye with enhanced establishment vigor.

Vegetative Rehabilitation & Equipment Workshop, 43rd Annual Report, Billings, Montana, February 19 & 20, 1989; by Gerald A. Henke (Workshop Chm.); 1990. USDA, For. Serv., Missoula, Mon.; 28 p. (USDA, Equip. Dev. Center, Missoula, Mon. 59801) Proceedings of the annual workshop, with *continuing emphasis on improving* rangelands and furthering range equipment technology.

Yield and Quality Response of Subirrigated Meadow Vegetation to Nitrogen, Phosphorus, and Sulfur Fertilizer; by James T. Nichols, Patrick E. Reece, Gary W. Herget, and Lowell E. Moser; 1990; Agron. J. 82(1):47-52. (West Central Res. Ext. Cent., Rte. 4, Box 46A, North Platte, Neb 69101) Results of a hay yield and quality study conducted at the U. of N. Gudmundson Sandhills Lab. near Whitman, Neb.

Frasier's Philosophy

It is with great pride that I accept the responsibility of being Editor of the *Journal of Range Management* in addition to my duties as Editor of *Rangelands.* It will be a big task to maintain the excellent standards which Pat Smith has developed over the past 10 years. The *Journal of Range Management* continues to attract the top scientific reports in the field of range management. No other publication has the diversity of scientific information related to the areas of plant physiology and ecology, animal physiology and ecology, plant-animal interaction, grazing management, soils/hydrology/reclamation/improvements, measurement and sampling techniques, and economics, all concerned with developing a better understanding of the proper way to manage the vast rangelands of the world.

My goal is to keep both *Rangelands* and the *Journal of Range Management* as foremost publications addressing and documenting our achievements in the field of rangeland management. *Rangelands* will continue to present informative articles in a light reading format that is easily interpreted and assimilated. The *Journal of Range Management* will continue to be the formal documentation of scientific information.

Six years ago when I took over the reins of *Rangelands* from Danny Freeman I stated, "If it isn't broken, don't fix it." During the last few years, the philosophy has been strictly maintained. We have made changes in *Rangelands,* but only after careful consideration of the needs and benefits. The same philosophy will be our guide with the *Journal of Range Management.*

There is no medicine like hope, no incentive so great, and no tonics so powerful as expectation of something better tomorrow.
Orison Swett Marden

Capital Corral

Ray Housley
Washington Representative

Judy Nelson, BLM District Manager at Lakeview, OR, won the Public Lands Foundation's first Outstanding Public Lands Professional Award. She was nominated by the Oregon Chapter of the National Wildlife Federation for her management actions on the Warner Valley Wetlands Area in Southeastern Oregon. Judy is an active member of SRM of long standing.

Sen. Pete V. Domenici (R-NM) has introduced a bill to create a National Forest Foundation dedicated to the preservation and enhancement of the National Forest System. "The bill would establish a charitable non-profit corporation to raise and direct money and other valuable resources . . . to complement ongoing Federal efforts," the Senator said. The Foundation would be provided $500,000 per year for the first two years for start-up costs, and the Secretary of Agriculture would be authorized to provide up to $ 1 million per year for the first five years to match private contributions. The bill would create a fifteen-member Board of Directors consisting of trained, experienced professionals appointed by the Secretary of Agriculture. The proposed foundation would parallel the Fish and Wildlife Foundation created a few years ago. A National Park Foundation has been functioning for several decades.

BLM's report, "The Range of Our Vision" got mixed reviews from some environmentalists, but most were pleased that the agency has set attainable goals and that Director Cy Jamison is committed to reaching them. The report, released in Washington in March, shows slow but steady improvement in public lands range condition in the past half-century. Good and excellent condition range has doubled from less than 16 percent to 33 percent since 1936 while poor condition declined from 36 percent to 16 percent. (Incidentally, BLM has joined the FS in adopting "ecological status" terminology for describing range condition. That will help avoid some of the subjective bias inherent in the old qualitative terms).

BLM's goals are to restore 75 percent of riparian areas by 1997, increase range in late seral stages from 33 percent to 40 percent by 2009, and reduce range in early seral stages from 16 to 10 percent by 2009. BLM considers the latter to be sort of an irreducible minimum due to wildfires, drouth and other natural impacts.

USDA waived some import restrictions to enable temporary importation of cattle from sections of Mexico where severe drouth has shriveled rangelands and pastures, threatening livestock with starvation. Brucellosis testing is waived if the herds have previously been tested within three months before the date of entry. Cattle will not be sold to U.S. buyers, and will return directly to Mexico from U.S. feeding sites; they will be segregated from U.S. cattle.

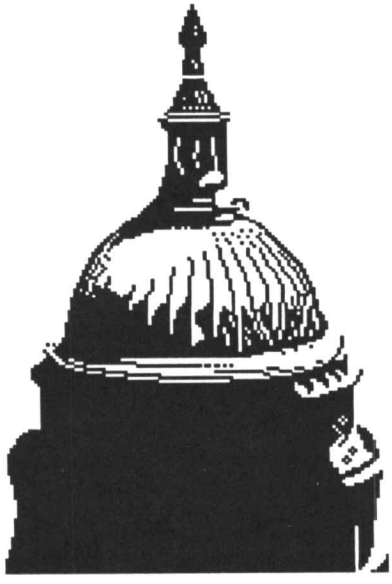
Seven Popular Myths about Livestock Grazing on Public Lands is a new booklet out of the experiment stations at the Universities of Idaho and Arizona. Authors are Jeff Mosley, E. Lamar Smith and Phil Ogden, distinguished SRM members all. The publication succinctly deals with some key economic and environmental issues relating to livestock use on lands managed by BLM and FS. Its facts and figures provide a helpful basis for rational discussion of public rangeland management. Copies are available from the Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID 83843 at $2 a copy ($1.50 for orders of 5 or more).

Personnel Needs of Land Management Agencies was the focus of a joint hearing April 5 of the House Subcommittees on Civil Service and National Parks and Public Lands. Issues identified by thirteen witnesses (including SRM) were recruitment, retention and compensation, professionalism, workforce diversity, demographics and "personal" issues such as dual career couples, child care, stress, housing and relocation. There was frank testimony about the professional-political interface and political interference from International Association of Fish and Wildlife Agencies' Executive VP Max Peterson. SRM testimony centered on professionalism and workforce diversity while spelling out the professional staffing needs of FS and BLM to meet range management goals. We suggested that one way to begin to deal with workforce diversity needs would be to fund a pilot project to embody both long and short range strategies. The pilot effort would include the land managing agencies, Office of Personnel Management, key professional societies and representative universities with natural resource programs. The project would test means for attracting minorities and women to natural resource careers, with efforts beginning at the secondary school level, including cooperative education and scholarships. Agencies would increase efforts to enhance professional qualifications of employees already on board, and universities and professional societies would examine curricula and accreditation standards to help improve recruitment performance; relationships of established natural resource schools with traditional minority institutions would be explored.

The obvious keen interest of these two key subcommittee chairmen, and their clear recognition that adequate staffing of qualified professionals is the basis of sound land and resource management is some of the best news heard on Capitol Hill this year. And Chairman Bruce Vento (D-MN) and Gerry Sikorski (D-MN) pledged that the hearing was only the first step toward positive, concrete action.

SCS has published a riparian policy statement to provide a definition and guidance to field offices for use when providing management options which affect riparian areas. The bulletin includes helpful criteria to identify riparian areas, management considerations, and guidelines for grazing management options.

Start making your plans today!
for the 1991 Annual Meeting of the



Society for Range Management

Washington, D.C.
January 11–17, 1991

It is never too early to begin preparations for your visit to our Nation's Capitol. Our annual meeting convention headquarters will be the Gateway Marriott Hotel in Crystal City, Virginia — located just across the Potomac River from the District of Columbia.

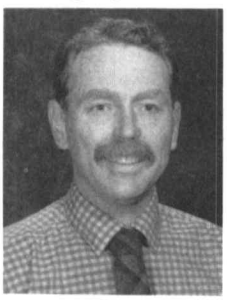
You are literally minutes away from the city's excitement via the clean and convenient METRORAIL subway system.

While you're at the meeting attending the fabulous array of informative sessions your hosts have planned, don't forget to spend time visiting the many National monuments and museums!

Results from the 1990 Graduate Student Papers Competition

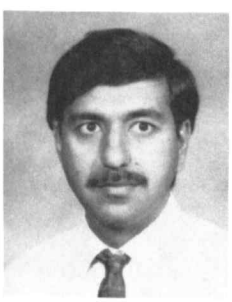
Twenty-one students participated in the Graduate Student Paper Contest during the 43rd Annual Meeting of the SRM at Reno last February. Twelve students competed in the Ph.D. category and nine competed at the M.S. level. Each presentation was evaluated by a panel of three judges who were selected at random from a pool of twenty judges. The final score for each student was determined by a summation of the three scoresheets (total points possible: 210). All students and their advisors are to be congratulated for their fine efforts.

Ph.D. Category



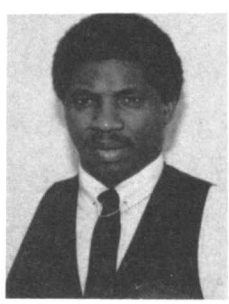
1st Place (183 points)—W. Eric Limbach—Utah State University. Eric was raised in Massillon, Ohio. He obtained a B.S. in biology from the University of Akron (Ohio). He has a M.S. in botany from the University of Wyoming and a second M.S. in range management from the University of California at Berkeley.

Title of Paper: "Seed Mass and Planting Depth Effects on Seedling Development and Survival of Two Cultivars of Russian Wildrye" by W.E. Limbach and C.A. Call.



2nd Place (182 points)—Sarwat N. Mirza—Utah State University. Sarwat was raised in Rawalpindi, Pakistan. He obtained a B.S. in biology from the University of Baluchistan, Quetta, and his M.S. in biological sciences from Quaid-e-Azam University, Islamabad.

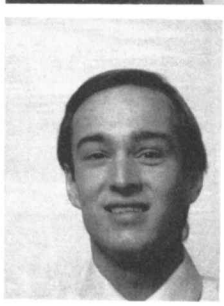
Title of Paper: "Interactions with the Mother Modify Dietary Preferences and Aversions of Lambs Differing in Age" by S.N. Mirza and F.D. Provenza.



M.S. Category

1st Place (161 points)—Vincent M. Kituku—University of Wyoming. Vincent was raised in the Kangundo area, Masaku District, Kenya. He received a B.S. in range management at the University of Nairobi, Kenya.

Title of Paper: "Effect of Range Manipulation on the Nutritive Value of Bitterbush *(Purshia tridentata)* in South Central Wyoming" by V.M. Kituku and J. Powell.



2nd Place (159 points)—Steven J. Popovich—Colorado State University. Steve was raised near Boulder, Colorado, and received a B.S. in range ecology from Colorado State University.

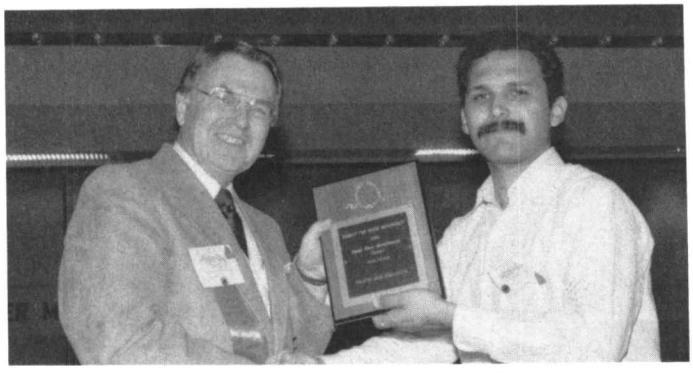
Title of Paper: "Competition Between Individual Ponderosa Pines and Their Underlying Vegetation" by S.J. Popovich, J.E. Mitchell, and E.T. Bartlett.

Honorable Mention

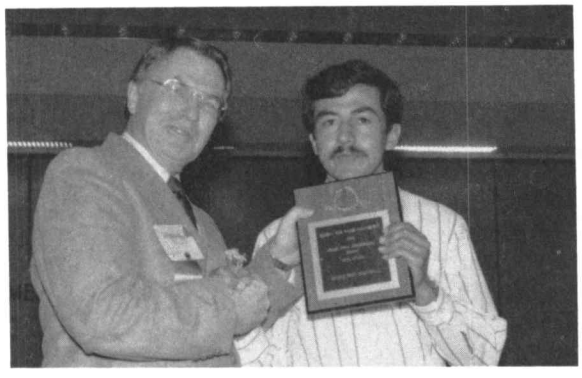
Sergio Soltero Texas Tech University (Ph.D. 161 points)
Anjana Desai Texas A&M University (Ph.D. 159 points)
Ken Spaeth Texas Tech University (Ph.D. 159 points)

1990 Winners

Individual winners in competitions get their congratulations from 1989 President Tom Bedell at the Annual Meeting in Reno.



Omar Angeles, Antonio Narro, 1st Place Plant I.D.



Humberto Flores, Antonio Narro, 2nd Place Plant I.D.

Greg Millhollin, Montana State, 3rd Place Plant I.D.

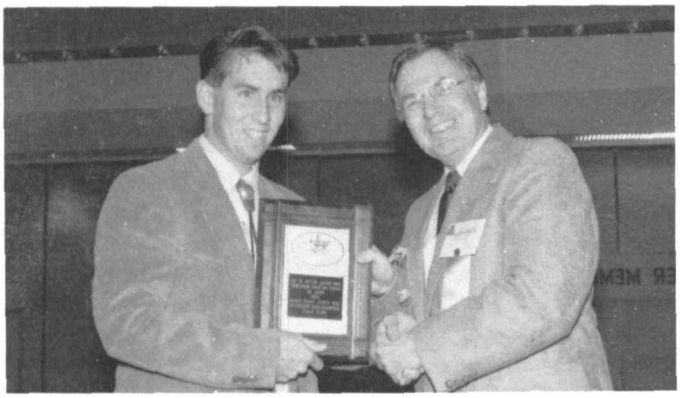
Daniel Ibarra, Antonio Narro, 4th Place Plant I.D.

Abel Lezama, Antonio Narro, 5th Place Plant I.D.

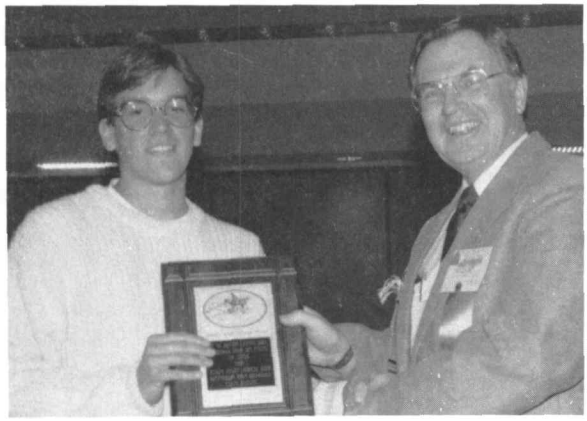
Steve Wetts, Utah State University, 1st Place Individual URME

Boyd Bradford, Utah State University 2nd Place Individual URME

Justin Derner, University of Nebraska 3rd Place Individual URME



Scott Barber, 1st Place High School Youth Forum, California Section



Zeb Hogan, 2nd Place, High School Youth Forum, Arizona Section

Judy Lloyd, 3rd Place, High School Youth Forum, Texas Section

Team winners in Reno.

Universidad Autonoma Agraria "Antonio Narro", 1st Place Winners in the Plant Identification contest: (l. to r. front row) Abel Lezama, Martha Guerra, Eustaquo Mora, Raciel Saldana, and Daniel Garcia; (back row) Omar Angeles, Humberto Flores, Daniel Ibarra, Lucio Rodriquez (coach), and Gerardo Rodriquez.

Montana State University, 2nd Place Winners in the Plant Identification Contest: (l. to r. front row) Toni Strauss, Greg Millhollin, Vicki Hillius, and Barb Terland; (back row) Dr. Carl Wambolt (coach), Tom Mott, and Rod Duty.

Universidad Autonoma Chapingo, 3rd Place Winners in the Plant Identification Contest: (l. to r. front row) Antonia Gonzales E., Jose Gonzalez M., Berta Rodriquez C., and Oscar Dominguez S.; (back row) Jorge Castrellon, Jamie Herrera T., Jose Garcia V., and Luis Rincon N.

Utah State University, 1st Place Team in the Undergraduate Range Management Exam: (l. to r. front row) Gus Warr, Boyd Bradford, and Jim Dobrowolski (coach); (back row) Greg Sorenson, Steve Watts, Ron Torgerson, and Kerry Schwartz.

University of Alberta, 2nd Place Team in the Undergraduate Range Management Exam: (l. to r. front row) Bonnie Stelfox, Julie Priddle, and Chris Nykoluk; (Row 2) Rob Brown, Andrea Sissons, and Clara Qualizza; (back row) Brian Olson, Terry Osko, and Barry Irving (coach).

Montana State University, 3rd Place Team in the Undergraduate Range Management Exam: (l. to r. front row) Judy Buer-Benson, and Rusty Terland, co coach; (row 2) Greg Millhollin, Rod Duty, and Dave Mousel; (back row) Bret Olson, co-coach, and Tom Mott.

Range Plant Identification Contest 1990

They did it again—in fact it's been again and again. The University Autonoma Agraria-"Antonio Narro" of Saltillo, Mexico, won the ID contest in great style with record-setting scores for the third time at Reno.

Congratulations are definitely in order for their coach, Lucio E. Rodriquez, for developing such a winning team.

Second place was won by Montana State University of Bozeman, Montana, and third place went to the University Autonoma Chapingo, followed by South Dakota State, Utah State University, and University Autonoma de Nuevo. Leon Omar Angeles G. was high point person of the contest, scoring a near perfect 992 points out of a possible score of 1,000. Second place winner Humberto Flores (a teammate) was close behind scoring 972, with Greg Millhollin hot on his heels with a score of 971. The 1990 contest at Reno was the largest ever, drawing a total of 25 teams. This is certainly an indicator of the growing popularity and stiff competition of this prestigious contest.

Undergraduate Range Management Examination

Ninety-one students from fifteen colleges and universities competed in the 1990 Undergraduate Range Management Examination held at the Annual Meeting in Reno. The URME consisted of 123 multiple choice questions and three problems in the areas of Range Ecology, Grazing Management, Range Improvements, Range Regions, Range Inventory and Analysis, and Multiple Use Relationships.

Utah State University won the contest for the second year in a row. The **University of Alberta** came in second followed by **Montana State University, Colorado State University,** and **South Dakota State University.**

The winning individual was **Steve Watts** from Utah State University. Steve has set a new individual standard for the exam by scoring 10 percentage points higher than anyone in the history of the exam. **Boyd Bradford** (last year's winner) from Utah State University came in second followed by **Justin Derner** of the University of Nebraska. Placing fourth and fifth were **Travis Moseley** and **Jeff Williams,** both of Colorado State University.

Universidad Autonoma Agraria "Antonio Narro" competed in the URME for the first time. They are also the first team from Mexico to compete. Congratulations to all participants and coaches for a job well done. See you in Washington, D.C. next year.—**John Tanaka**

1990 Combined URME and Plant

The second Combined Award was announced at the Reno meeting. The combined winner is determined from those students who place in the top 25% of both contests. There were nine students who qualified this year. The Soil Conservation Service and SRM presented this year's winner with a plaque. In addition, the winner receives a trip to Washington, D.C., to visit the national SCS office. This year's winner is **Greg Millhollin from Montana State University.** Greg placed third in the Plant Identification contest and sixteenth in the URME. Congratulations to Greg and to all who did double duty by competing in both contests.

Minutes Highlights

Meeting of the SRM Board of Directors February 1990, Reno, Nevada

Efforts to include more color in *Rangelands* are being continued with the February, 1990, August, 1990, and February, 1991, issues being scheduled to contain 16-page color inserts. There is a four-month lead time needed for preparation, and interested individuals should contact Jerry Schwien or Gary Frasier.

A Speakers Brochure has been drafted by the Information and Education Committee and will be available soon with suggestions on how to present papers at the Annual Meetings.

SRM will be printing and distributing **a brochure on "Horse Sense"** prepared by the Small Tract Range and Pasture Task Group. The brochure will be made available to the general public through Extension offices, horse associations, and SRM Sections.

Highlights of the **membership program for the year** will include: Promote and track the Presidential Challenge to all Officers, Committee Chairs, and Committee members, at both the national and Section levels, to solicit at least one new member; maintain the Phone-A-Thon program; work with the Professional Affairs Committee on developing a demographics program on membership; continue the existing membership recruitment programs, including the $5.00 rebate program; and work with the Task Group assigned to develop a program to explore how more extensive out-reach, education, and fund-raising initiatives can be implemented.

SRM will prepare and distribute **a letter of support** for reauthorization of the Rangeland Research Grants within the Farm Bill.

Special guests attending the Board of Directors Meeting were Tom McDonnell of the American Sheep Industries Association; James Magagna, President of the Public Lands Council; Mike Penfold, Assistant Secretary of Lands and Renewable Resources in the Department of Interior; and Ed Spang, State Director of the Bureau of Land Management for Nevada.

The *Journal of Range Management* **Editorial Board** has implemented some informational programs that include a Manual for Associate Editors and Reviewers, revising the *JRM* Style Manual and Handbook, and an "Author Comment" sheet being sent to solicit the opinions of authors on the review process for the *JRM*. Authors who have an article rejected in this process have the following options available to them, if they desire to use them: 1. Call and speak to the Associate Editor handling their manuscript; 2. Re-submit the article in an edited version; and, 3. They can file for an appeal. In an appeal, the article is reassigned, as an appeal, with all relevant correspondence being sent to a new Associate Editor and forwarded on to a new Reviewer.

The Board adopted the International Affairs Committee **International Liaision Program Procedures Guide** and agreed to send a letter from the SRM President to the U.S. Secretary of Agriculture, encouraging the Secretary to add range to the Memorandum of Understanding (MOU) to establish scientific cooperation between Mexico and the United States on natural resource issues. A letter will also be sent to the Sociedad Mexicana de Manejo de Pastizales (SOMMAP) requesting they contact the Mexican Secretary of Agriculture and Water Resources in support of adding range to the MOU.

The Board accepted the recommendation of the Accreditation Panel to **accredit the University of Wyoming.** The Panel was also encouraged to incorporate the concept of regional programs within the current accreditation program.

The Outstanding **Achievement Award criteria will be changed** to consider groups for the award and the number of awards to be presented in any one year will be increased to 2/10's of one percent of the total Society membership.

A SRM Enhancement Task Group will be chartered to pursue the potential of financial enhancement to the Society.

The **Public Affairs Committee recommended actions** on or correspondence to be distributed on ten items of old business and eleven items of new business. Those items of discussion by the Committee were: RPA Rangeland Assessment and Program, National Academy of Sciences/National Research Council, Ranch Apprenticeship Program, Undesirable Plant Legislation, Farm Bill, Washington DC Representative Testimony, EPA Endangered Species, California Desert Conservation Act, typing facilities for Annual Meetings, Wildlife Enhancement Permits, Forest Service Land Management Planning Critique, NBC Today Show, Niobrara River Wild and Scenic Designation, Desert Tortoise, Water Quality 2000—Phase II, Open Range Laws, Quick Response Mechanisms, and Joint Policy Statements with other conservation groups. A Position Statement on "Wildlife Management Incentives for Private Land Owners" was adopted after revision and will be subject to further modifications if necessary. (See copy in this issue.)

It was suggested that each agency to be contacted about the possibility of including the SRM **Annual Meetings into the training programs** for personnel.

The theme for the 1992 Annual Meeting will be "Range Management: A Public Benefit".

The headquarters facility for the 1993 Annual Meeting in Albuquerque, NM will be the Doubletree, with secondary facilities at the Hyatt Regency, La Posada, El Centro, and the Hilton.

The Excellence in Range Management Committee conducted **an "Effectiveness in Range Management" survey** during the meeting, with the results to be prepared for submission as an article in *Rangelands* and the Committee determining further actions needed.

Recommendations from the Finance Committee were accepted by the Board as: The current location of funds

and management will continue in 1990; the Employee Tax Sheltered Savings Plan will be kept available for participation; no refunds will be made for single item purchases; the Executive Vice-President is authorized to refinance the loan on the headquarters office at 1839 York Street in Denver at the most opportune time to take advantage of the current low interest rates; notification will be given to new chairmen as to policies and procedures on obligating funds; the Finance Committee Chairman and Endowment Fund Board of Governors Chairman will serve as ex-officio members of each other's committees; and the SRM Denver Office Staff is to be commended for another year of outstanding financial management of SRM funds. In addition, an Annual (Winter) Meeting Refund Policy was established as:

Refunds of Annual Meeting Pre-Registration Payments after the cutoff date will be made according to the following guidelines—

—100% refund of registration and special events payments upon request, if cause of non-attendance was due to death or hospitalization.

—No refunds (to include special events) after the cutoff date for any other reasons.

The SRM President was authorized to send **a letter written by the Endowment Fund Board of Governors** that solicits funds from select members and requesting their input as to what might be the most desirable uses for interest from the fund.

A proposed "Code of Ethics" as revised by the Professional Affairs Committee will be acted on at the 1990 Summer Meeting.

The Executive Committee of the Board will be meeting in May, 1990. At that time, they will review draft proposals from the Board and the Planning Committee on the **current committee structure** within the Society. This review will include possible mechanisms for streamlining committee work and communications.

The 1990 Projected Budget was approved.

Detailed copies of the SRM Board of Directors Minutes, or correspondence accepted and mailed as a result of the Board Meeting, may be obtained at a minimum cost by contacting the Society office at: Society for Range Management, 1839 York Street, Denver, CO 80206.

Position Statement
Wildlife Management Incentives
For Private Land Owners

The Society for Range Management recognizes that private lands commonly supply important wildlife habitat and recreational opportunities. Habitat quality and quantity may be critical factors limiting wildlife populations. Without appropriate incentives, land owners may not devote the necessary resources toward enhancing wildlife habitat and increasing recreational access. Monetary compensation may provide incentives for land owners to incorporate wildlife management as an integral part of their total land management strategy. Further, state, provincial, and federal agencies should be encouraged to provide private land owners with educational programs, technical support, and financial incentives to enhance and sustain productive natural resources on private lands.

Accepted by the SRM Board of Directors, February 15, 1990, at the 1990 Annual Meeting.

Advisory Council Highlights

The Advisory Council convened February 11–14, 1990. Items of interest to Sections included:

New Regional Alignment for Annual Meeting Rotation

The newly adopted regional alignment for Annual Meeting rotation was explained. Sections will now fall into three regions through which the rotation process will occur. Implementation of the new system will begin with Region III for the 1995 Annual Meeting. Regional division is as follows:

Region I	Region II	Region III
Texas	Pacific Northwest	California
Kansas-Oklahoma	Idaho	Nevada
Nebraska	International	Arizona
Southern	Mountain	Utah
Florida	Wyoming	Colorado
National Capital	South Dakota	New Mexico
	Northern Grt Plains	Mexico
	North Central	

Rangelands

Gary Frasier distributed samples of the color insert which was featured in the February, 1990 issue of *Rangelands*. It is hoped such an insert will eventually appear in every issue, increasing SRM visibility. Distribution of reprints, accompanied by a membership application, may also satisfy membership solicitation needs. Mr. Frasier requested Section support both in terms of encouraging interested parties to submit such material and in distribution of reprints.

In an effort to diversify and expand the content of *Rangelands*, Sections were also encouraged to sponsor one *Rangelands* article per year. Such articles should be of general interest, eight pages in length, double spaced, and include tables and/or photos.

Rangeland Reference Areas

Section assistance is requested in helping to identify rangeland reference areas, as well as establishing an estimated time frame for their evaluation. (For further information, contact Charles Johnson, Route 1, Box 27A, Baker, OR 97814 or Barbara Allen, 241 Iverness Court, Oakland, CA 94605).

Section Administrative Handbook

Through the work of an Advisory Council ad hoc committee chaired by Jim Clawson, Sections have been provided with administrative information in an attempt to create a smoother transition during the period when officers change and to help acquaint new officers with standard SRM procedures and requirements. Sections with additional information or suggestions are asked to contact Mr. Clawson (University of California, 916-752-3455) or Rene Crane (Denver office).

Other topics of discussion during the meeting included the use of video in SRM activities, length and structure of SRM Summer Meetings, Coordinated Resource Management, and review of the seven Advisory Council Recommendations presented to the Board during the

1989 Summer Meeting.

Further discussion resulted in eight Recommendations being adopted by the Advisory Council for presentation to the Board during the Annual Meeting (see Joint Meeting Notes).

Mr. Joel Frandsen, President of the Utah Section, was elected Chair-elect of the Advisory Council.

Joint Meeting of the Board of Directors and the Advisory Council

The Board of Directors and Advisory Council met jointly February 14, 1990. Presentations on Parliamentary Procedures and effective procedures for approaching Congressional delegates during the 1991 Annual Meeting preceded the business meeting.

Eight Recommendations were presented to the Board of Directors by the Advisory Council.

Recommendation 1. The 1993 Summer Meeting be held in Missouri.

Accepted by the Board of Directors February 14, 1990.

Recommendation 2. The 1995 Annual Meeting be held in Arizona, the specific city to be determined.

Accepted by the Board of Directors February 14, 1990.

Recommendation 3. The Advisory Council accepts the report of the ad hoc committee on SRM Symposia and recommends the recommendations of the committee be brought into action.

Referred to the Executive Committee for further analysis and recommendation at the 1990 Summer Meeting.

Recommendation 4. The Board of Directors accept the Arizona Section Resolution [regarding the NBC Today Show] as written.

After the report of the Public Affairs Committee, the Board of Directors accepted a recommendation to send appropriate correspondence on this issue in lieu of accepting the Recommendation. Advisory Council members shall receive copies of the relevant correspondence.

Recommendation 5. The SRM Board of Directors sponsor the "Alternative Futures for the Great Plains" Symposium.

The Executive Vice-President will obtain more indepth information prior to acceptance of sponsorship or co-sponsorship.

Recommendation 6. The Advisory Council accepts and recommends the Board of Directors support the Nevada Section Desert Tortoise and Livestock Grazing Resolution.

After the report of the Public Affairs Committee, the Board of Directors accepted a recommendation to send appropriate correspondence to the Fish & Wildlife Service in lieu of accepting the Advisory Council Recommendation. Advisory Council members shall receive copies of the relevant correspondence.

Recommendation 7. The Advisory Council recommends to the SRM Board of Directors that the Board develop a quick response mechanism to public issues requiring immediate attention. This shall include, but not be limited to, a key team who can immediately draft a response that can be approved by the three SRM officers and disseminated as rapidly as the situation warrants to be effective. In the event the three officers are not available, one or more Board members may be consulted. Any such action shall be later ratified by the full Board.

Be it further recommended that the Board requires the Denver office to develop direct contacts with new wire services, agricultural and other press, national media and others to disseminate the quick response positions on range issues.

The above recommendations refer to those situations where public information is given by persons or organizations in the area of rangeland issues that is false or misleading from the scientific point of view.

It was the direction of the Board that the Executive Vice-President develop a proposal on a specific process to be used in these cases. This will be reviewed by the Executive Committee at the May meeting.

Recommendation 8. The Advisory Council strongly recommends the SRM Board of Directors adopt a joint policy statement or resolution with other conservation groups which:

1. Identifies judicious and proper grazing as a practice compatible with conservation of rangeland ecosystems.
2. Supports judicious and proper livestock grazing as an integral component of sustainable agriculture on rangelands.

Policy statements shall be developed with one or several conservation groups. These groups should include but are not limited to: Sierra Club, National Wildlife Federation, Nature Conservancy, Izaak Walton League, Audubon Society, Ducks Unlimited, Trout Unlimited and Rocky Mountain Elk Foundation.

Be it further recommended that the SRM seek other common areas of agreement where policy statements or resolutions can be issued jointly concerning natural resource management and conservation.

The Board adopted the second part of Recommendation 8. to the effect that SRM will pro-actively seek common areas to develop and build on with other organizations.

Life Members (continued)

Don J. Neff
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*Donald W. Nelson, Jr.
Joe B. Norris
Kay V. Norris
Paul E. Nyren
Thomas M. O'Connor
*Joseph F. O'Rourke
Kyle Owen
C.E. Owensby
Karl G. Parker
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Gene F. Payne
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C. Kenneth Pearse
Dorothy Pearson
Henry A. Pearson
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Mike L. Pellant
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Beatrice C. Pickens
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Jeff Powell
Scotty G. Prescott
*J. Boyd Price
L. Glen Quigley
Charles M. Quimby
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Klaus Radkte
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*Laurence E. Riordan
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Larry R. Rittenhouse
Joseph H. Robertson
Winthrop P. Rockefeller
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Elno D. Roundy
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Faith E. Ryan
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Gail E. Sharp
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M. Silia
Chester L. Skilbred
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Arthur D. Smith
Michael A. Smith
Sydney E. Smith
Terry J. Smith
Floyd L. Snell
Carol A. Sparks
Thomas L. Sparks
Steven M. Spencer
Bill Stark
Stan Starling
Warren J. Stevens
Robert L. Storch
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Faisal K. Taha
Charles E. Taylor
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Nora Taylor
Wayne F. Taylor
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Courtney A. Tidwell
*David P. Tidwell
*J. Stanley Tixier
Lynn D. Todd
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*George T. Turner
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Albert L. van Ryswyk
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*Clinton H. Wasser
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Noel H. Wellborn
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*Warren C. Whitman
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*Robert E. Williams
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