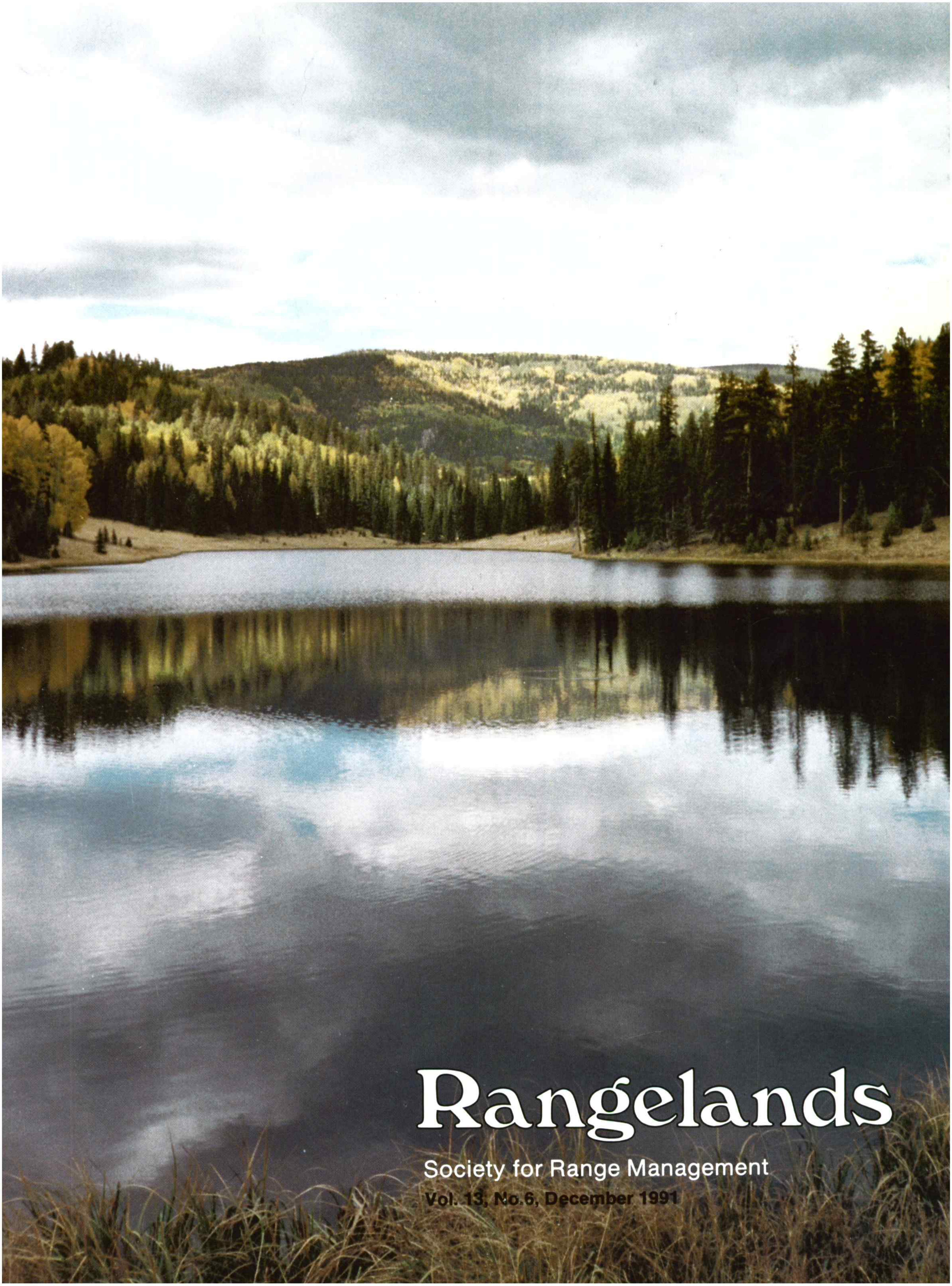

Rangelands

Society for Range Management

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Volume 13, No. 6
December 1991

Rangelands

FEATURE ARTICLES

DEPARTMENTS

COVER PHOTO

(FRONT): Hurricane Lake recreational area on the Fort Appache Indian Reservation near Spingerville, Arizona. (Photo by Sheri Mauti). BACK: A crestate saguaro in the New River Mountains of central Arizona. (Photo by Patti Fenner).

Coming!

Horse removal at Sleeping Giant

Water troughs and water quality

Building consensus for rangeland uses

Intercropping fodder trees

Old World bluestem

Economic multipliers

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

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The Trail Boss

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

The objectives for which the corporation is established are:

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

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

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

—to improve the effectiveness of range management 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.

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

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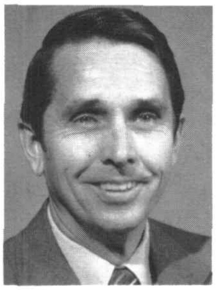
President's Notes



Range Condition is a simple concept, right? A ranch with private land and a federal land grazing permit should show consistency in condition ratings (good, fair, poor....), shouldn't it? Of course; but does it? Not necessarily. If the Soil Conservation Service (SCS) is rating range condition on the private land portion and the Bureau of Land Management (BLM) classifies the federal portion, similar areas could be rated differently, and probably will be. Confusing? It sure is. It's no wonder the rancher, the public, and the Congress become critical of such differences, not necessarily in actual condition, but in how condition is reported.

How could this happen? Doesn't the range management profession have its act together? The answer, I'm afraid, is "not really", at least not in this case and at this time. The agencies that have responsibility for such things as rating range condition have done their own thing. The SCS, BLM, Forest Service (FS), Bureau of Indian Affairs (BIA), Fish & Wildlife Service (FWS), various State land agencies, and others have been autonomous in their approaches to range condition ratings with little or no coordination with each other. Resulting differences make it easy for critics to attack the profession and overstate the problem.

After several unsuccessful attempts to resolve the differences, 1988 SRM President Bill Laycock chartered a "Unity in Concepts and Terms" task group, with representatives from the different agencies and other range professionals to work on the problem and develop recommendations for resolution. The Unity task group, chaired by Lamar Smith of the University of Arizona, worked hard and long to analyze not only what was wrong but how it could be fixed. Their report and recommendations to SRM's Board of Directors were approved and endorsed at the 1991 Summer meeting in Nebraska as a newly stated professional standard. SRM has suggested that the agencies, over time, adjust their programs to adopt these standards for uniformity and professional consistency.

The first three recommendations in the Unity report describe key changes needed: (1) Rangelands should be classified by *ecological sites* (ES) as a basis for rangeland inventories, assessments, and extrapolation of research and management experience. Ecological sites are "a kind of land with specific physical characteristics which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management". (2) Management objectives should be defined in terms of a *desired plant community* (DPC) for each ES and vegetation management status should be reported in terms of similarity to and trend toward or away from the selected DPC. DPC is defined as "of the several plant communities that may occupy a site, the one that has been identified through a management plan to best meet the plan's objectives for the site". (3) The effectiveness of present vegetation to protect the site against accelerated erosion by wind and/or water should be assessed independently of the actual or proposed use of the site. This assessment is called the "site conservation rating" (SCR). The SCR at which accelerated erosion begins is the "site conservation threshold" (SCT). Any site rated above the SCT is considered in *satisfactory* condition; those below the SCT are *unsatisfactory.* The *trend* in SCR will be interpreted to indicate whether present management is accomplishing the goal of attaining or maintaining the SCR above the SCT.

The Unity report has four other "housekeeping" recommendations to implement the new standards, assure understanding, and avoid recurrence of the old problem of inconsistency. The Board approved those too, and efforts are underway to review the SRM Glossary, to encourage agencies to establish a permanent interagency working group, to provide an educational program for these concepts, and to provide for research concerning site conservation threshold.

It should be noted that the National Research Council (NRC) of the National Academy of Science has established a similar committee, chaired by SRM past President Fee Busby. The NRC report and recommendations are not completed as of this writing, but it is hoped that the two efforts, that independently identified the same problem, will be compatible in their conclusions. In any case, SRM should be proud of the Unity task group for its hard work to help resolve a long-standing problem in the range profession.—**Stan Tixier,** President, SRM.

Executive Vice-President's Report

Who said Section meetings aren't important, educational, and very enjoyable? I have just completed a marathon trip to three Section annual meetings and the Grazing Lands Forum in a period of approximately two weeks, three in one stretch. Except for being completely exhausted and the proud owner of a very flat wallet, it was an experience. I have nothing but praise for the local organizers of all these meetings. The meetings were exceptional and should have been attended by every member of each Section, if for no other reason than the educational benefits that were there for everyone.

For example, at the Pacific Northwest Section meeting in Wanatchee, Washington, there was a series of papers addressing drought, its history of severity, and our total inability to predict its occurrence. That alone was worth the trip. It was explained to us that in **very recent** geologic times there have been droughts so severe that the large lakes of the West dried up completely—something we have never heard or realized could have happened. Perhaps this had a very special meaning to me for I grew up during the drought of the 1930's and saw so many wonderful, hardworking people give up and abandon their farms and ranches with tears in their eyes, totally destroyed. We surely need to always check with the past as we plan for the future if we expect to make any progress in the management of our rangelands.

In addition to the papers presented on drought, there were many more of equal importance. In other words, the meetings were more than qualified for college credits for continuing education for all who were present.

It has been said that a bachelor's degree has a half life of only seven years in these high speed times when we are absolutely covered over with an avalanche of new technology. I feel strongly that involvement in the scientific professional Society is perhaps one of the most practical and economical ways to keep our agency employees and all other members of the science and art of range management up to speed. To cut back or restrict their participation and involvement is actually an expensive step backward for both the institutions and the tax payers who invested vast sums of money to obtain the level of management the rangelands require.

At the Kansas and Oklahoma and Southern Section meetings, papers of equal quality were presented. In addition, tours were arranged at these meetings which gave hands-on educational experience. The management of rangelands is far different but equally important when the land is covered with water for several months each year. We toured Cyprus areas where the management for wildlife was equal to or greater than for livestock. The problem of absentee landowners and parasites add to the complexities of range management in the southern section of our Society.

Historic use of the rangelands of the Flint Hills of Kansas made that tour fascinating. Here for well over a hundred years cattle have been brought in and pastured on some of the finest ranges ever created. But they all have their problems that must be addressed. Like it was said, if it isn't palmetta and alligators in Florida and sagebrush and coyotes in Montana, it's bobcats and red cedar in Kansas. There is no use running from adversity—you might as well stay and face it. History has proven that over and over again.

The expression "how time flies" certainly is right. While in Kansas I joined a delegation of the K.O. Section in the first sight insepection tour for the 1996, believe it or not, Annual Meeting. It was their conclusion that Wichita, Kansas, met the requirements of hotels and meeting space. Now comes the hard part of negotiating the cost. But I have found that middle-sized cities like Wichita are much more appreciative of our business than the large cities, so I feel confident a fair price can be reached that will satisfy everyone.

The Grazing Lands Forum held their annual meeting again in Harpers Ferry, West Virginia. That area is so beautiful in the fall it's hard to concentrate on business. If you are a Civil War history buff, it is a must stop, for the town was taken and retaken by both armies six or seven times during those terrible times. This year's Forum developed situation statements on grazing of reclaimed lands and the use of chemicals on grazing lands, both subjects of high concern.

Any one desiring copies of the statements can obtain them here at the Denver SRM office in the near future. Next year's topic will be the process of developing rules and regulations, a subject that should be a great concern to anyone involved in range management. We are proud to have Dean Boe, one of our SRM Directors, as G.L.F. President in 1992.

Final points for this time. If their are some especially bright spots in our Society it is without question the great news that our new data base is in place. Congratulations are in order for a difficult job well done. There is still some sanding, painting, and polishing yet to do but I'm very proud. Also, our activities in the realm of International Range Management. Please keep your eye on that one. To say it will be exciting is the understatement of the day. Breathtaking is probably more accurate.—**Peter V. Jackson,** Executive Vice-President, SRM

Photo by Larry Workman

Food Habits of Roosevelt Elk

Kurt J. Jenkins and Edward E. Starkey

Knowledge of forage used by Roosevelt elk *(Cervus elaphus roosevelti)* is fundamental to understanding habitat relationships and planning habitat improvement programs in the Pacific Northwest. Foods available to Roosevelt elk in the Pacific Northwest are influenced largely by forest management practices that include clearcut logging and, in many cases, the subsequent seeding of clearcuts with grasses and legumes to improve big game and livestock forages and control shrubs (Ramsey and Krueger 1986). It is commonly assumed that Roosevelt elk, like Rocky Mountain elk *(C.e. nelsoni)*, are grazers primarily and that they benefit from management that favors grasses over shrubs (Kufeld 1973). Many early studies of food habits of Roosevelt elk, however, suggest that Roosevelt elk are primarily browsers (Skinner 1936). Following is a summary of results from several recent studies of food habits that identify important seasonal and geographical patterns of food habits of Roosevelt elk.

Methods

Food habits were reviewed for elk populations inhabiting the historic range of Roosevelt elk, including the western slope of the Cascade Mountains in Oregon and Washington, Vancouver Island, British Columbia, and northwestern California, as well as an introduced population inhabiting Afognak Island, Alaska (Fig. 1). Although native populations of Roosevelt elk have been supplemented with transplanted Rocky Mountain elk throughout Oregon and in the Cascade Range of Washington, we included several of these populations in our review. Studies were included in the review if they satisfied the following criteria: (1) percentages of all forage species or taxonomic groups in the diet were quantified (this excludes early qualitative studies of browsing pressure that may have overestimated importance of shrubs), (2) forage selection was determined seasonally, and (3) food habits were determined for free-ranging elk. Three methods of data collection were represented in the resulting sample of food habits studies, including analyses of stomach contents (2 studies), analyses of fecal samples (7 studies), and feeding observations of free-ranging elk (2 studies).

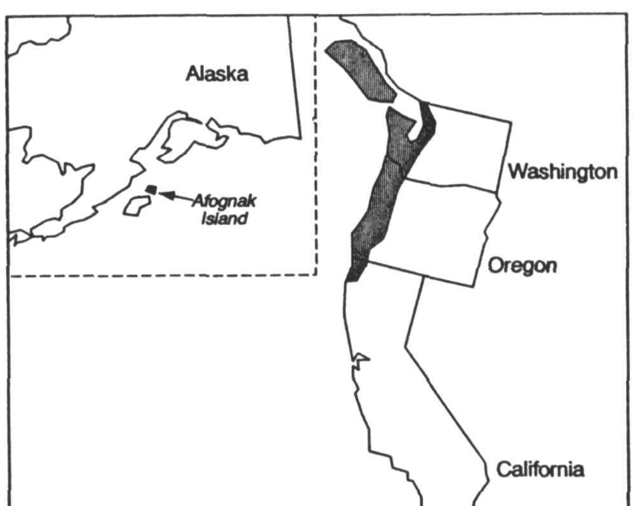


Fig. 1. *Historic range of Roosevelt elk and area covered in this review.*

Authors are wildlife research biologist, Wrangell-St. Elias National Park and Preserve, P.O. Box 29, Glennallen, Alaska 99588; and Terrestrial Ecology *program leader, Oregon Cooperative Parks Studies Unit, College of Forestry,* Oregon State University, Corvallis 97331. At the time of the research, the senior author was research associate, Oregon Cooperative Parks Studies Unit, Oregon State University, Corvallis 97331.

Authors would like to thank P.J. Happe, E.H. Merrill, and D.M. Leslie, Jr., for commenting on an earlier draft of this manuscript.

Previous reviews of food habits of elk assigned an importance value to each forage species based on the degree of use and qualitative considerations of forage abundance (Nelson and Leege 1982); species were assigned high importance values if they were rare and actively sought by elk or if they made up a large percentage of the diet. Such ratings failed to distinguish true forage preference from opportunism. In this summary, we report the mean percent contribution of each forage in the reported diets of elk. Means were determined from all studies in which a species was reportedly eaten. We leave interpretations of forage preference to those familiar with individual study areas, or those with specific estimates of forage availability.

Data were separated and analyzed by the following seasons of use: Winter (Dec.-Feb.), Spring (March-May), Summer (June-Aug.) and Fall (Sept.-Nov.). For studies that reported monthly food habits or that reported separate food habits for different herds within the same geographic area, data were averaged within seasons.

Foods of Elk

Roosevelt elk consumed a wide variety of forage species across their range, demonstrating a high degree of dietary plasticity and generalist foraging strategies. One hundred and eleven taxa were reported in the diets of Roosevelt elk (Table 1), but only 80 taxa made up greater than 1% of an average seasonal diet.

Table 1. Average percent contribution of major elk forages in diets of Roosevelt elk[1]. Sample size (i.e., number of studies in which forage species was reported in diet of elk) is included in parentheses.

	Mean percent of diets				
Forage species	Winter	Spring	Summer	Fall	References[2]
Forbs					
Anaphalis margaritacea		0.9(1)	2.3(2)	0.2(1)	2,5,7
Caltha biflora			2.2(1)		2
Dicentra formosa			1.8(1)	0.1(1)	7
Epilobium angustifolium	4.7(1)	1.7(1)	10.6(3)	11.7(4)	2,3,7,10
Epilobium spp.		1.0(3)	1.4(3)	0.1(2)	2,5,7,11,12
Fragaria spp.	0.4(2)	1.4(2)	0.3(1)	1.4(2)	6,11,12
Galium spp.		0.2(2)	0.6(2)	0.2(2)	11,12
Hypochaeris radicata	3.1(3)	3.0(4)	6.7(4)	4.6(4)	3,4,7,10,12
Lactuca muralis	0.5(2)		7.4(1)	5.4(1)	5,10
Lotus spp.	0.2(2)	1.1(2)	0.6(1)	0.5(3)	7,11,12
Lysichitum americanum	0.2(2)	0.6(4)	2.2(4)	1.2(2)	2,5,7,10
Mimulus guttatus			1.2(2)		2,7
Denanthe sarmentosa	0.8(2)	1.2(2)		1.1(2)	11,12
Oxalis oregana	0.1(1)	10.1(2)	9.5(3)	4.4(3)	4,6,7,9
Plantago spp.	0.2(1)	0.6(3)	2.8(2)	1.8(4)	4,7,11,12
Prunella vulgaris	0.2(3)	0.2(2)	2.0(1)	1.9(2)	4,11,12
Ranunculus spp.	0.6(1)	0.7(1)	0.8(2)	1.1(2)	4,7,12
Stachys cooleyae	0.2(2)	0.6(2)	1.6(2)	0.3(4)	2,6,7,11,12
Tiarella trifoliata	0.7(4)	0.4(2)	2.4(2)	2.6(2)	5,6,9,10,11
Trifolium spp.	0.5(2)	1.6(3)	1.5(2)	1.6(4)	4,7,11,12
Veretrum viride		1.0(1)	1.2(2)		5,10
Whipplea modesta	2.3(1)	1.2(1)	0.3(1)	7.0(1)	3
Unknown Forbs	2.5(5)	3.2(6)	20.6(4)	5.2(6)	1,2,3,5,7,8,10,11,12
FORBS SUBTOTAL	4.5(9)	9.8(8)	28.3(8)	14.0(11)	
Ferns					
Athyrium filix-femina	0.8(4)	1.0(3)	2.1(4)	1.0(5)	2,5,6,9,10,11,12
Blechnum spicant	5.5(6)	4.8(5)	0.3(4)	8.2(7)	2,5,6,7,9.10,11,12
Equisetum spp.	0.9(3)	0.7(2)	4.2(3)	2.6(3)	2,7,10,11,12
Polystichum munitum	7.6(7)	9.1(7)	4.4(5)	2.1(7)	3,4,5,6,7,9,10,11,12
Pteridium aquilinum	1.0(3)	2.5(1)	1.6(5)	1.0(4)	2,3,5,6,7,9,10
Unknown ferns	11.2(2)	12.7(2)	2.2(2)	5.0(2)	5,8,10
FERNS SUBTOTAL	12.9(9)	14.7(8)	6.3(8)	8.9(11)	
Grasses and Grass-like Plants					
Agrostis spp.	6.0(4)	3.6(4)	5.3(3)	5.0(5)	4,6,7,11,12
Anthoxanthum odoratum	7.2(1)	16.6(1)	11.3(1)	20.8(1)	4
Bromus marginatus			2.5(1)		4
Bromus mollis	3.5(1)	0.2(1)	2.0(1)	0.8(1)	4
Bromus spp.			0.1(1)	1.3(1)	7
Calamagrostis canadensis			7.1(1)		2
Carex spp.	10.3(7)	10.8(6)	5.1(7)	2.7(7)	2,4,5,6,7,8,9,10,11,12
Dactylis glomerata	4.9(3)	8.7(3)	7.7(2)	21.9(4)	4,7,11,12
Danthonia californica	17.5(1)	7.4(1)		3.1(1)	4
Elymus glaucus	0.7(2)	0.5(2)	1.1(1)	1.8(4)	6,7,11,12
Festuca arundinaceae	1.2(2)	1.4(2)	0.5(1)	3.0(3)	7,11,12
Festuca spp.	1.9(3)	1.3(2)		4.5(4)	4,7,11,12
Holcus lanatus	0.9(3)	0.6(2)	2.0(2)	2.0(4)	4,7,11,12
Juncus spp.	4.1(2)	7.2(2)	1.8(2)	2.5(3)	2,7,11,12

Table 1. (Continued)

Forage species	Mean percent of diets				References[2]
	Winter	Spring	Summer	Fall	
Lolium spp.	0.7(3)	0.6(3)	6.3(2)	2.9(4)	4,7,11,12
Luzula spp.	0.2(2)	0.4(2)	1.6(2)	0.4(3)	2,7,11,12
Phleum pratense	1.8(2)	1.0(3)	0.3(1)	3.0(3)	6,7,11,12
Poa spp.	1.8(4)	2.6(3)	0.8(4)	2.2(5)	2,4,6,7,11,12
Scirpus microcarpus			1.9(1)		2
Typha latifolia			1.0(1)		7
Unknown grasses	6.3(8)	13.8(7)	11.4(7)	8.2(10)	1,3,5,6,7,8,9,10,11,12
GRASSES SUBTOTAL	24.2(9)	32.0(8)	23.1(8)	23.6(11)	
Conifers					
Abies amabilis	4.0(2)	3.8(2)	1.6(1)	11.6(2)	5,10
Picea sitchensis	7.3(1)	0.2(7)		1.0(1)	4,9
Pseudotsuga menziesii	2.0(7)	2.0(5)	0.4(3)	0.5(5)	2,3,5,7,8,9,10,11,12
Taxus brevifolia	3.9(5)	3.8(3)	2.0(2)	5.2(3)	2,5,8,10,11,12
Thuja plicata	7.6(8)	3.8(6)	2.5(3)	4.6(7)	2,3,5,6,8,9,10,11,12
Tsuga heterophylla	14.1(8)	3.6(7)	2.4(6)	5.2(8)	2,3,5,6,7,8,9,10,11,12
Unknown conifers	2.3(3)	1.0(3)	1.1(1)	2.5(2)	5,11,12
CONIFERS SUBTOTAL	25.2(9)	9.6(8)	3.3(8)	11.0(11)	
Shrubs					
Acer circinatum	5.2(5)	3.1(6)	4.1(5)	2.2(7)	2,3,5,6,7,8,9,11,12
Alnus rubra	2.0(4)	2.1(5)	2.6(5)	6.0(8)	2,4,5,6,7,9,10,11,11,12
Amelanchier alnifolia	4.7(1)	10.7(1)	3.5(1)	4.6(1)	8
Arctostaphylos uva-ursi	0.4(3)	0.2(2)		1.5(2)	10,11,12
Berberis nervosa	3.3(7)	1.6(3)	0.6(1)	1.1(5)	3,5,7,8,9,10,11,12
Chimophila umbellata	0.7(2)	0.2(2)		1.1(2)	11,12
Cornus canadensis	0.5(2)	1.4(4)	5.4(2)	3.9(3)	5,6,10,11,12
Gaultheria shallon	5.6(6)	1.8(5)	1.8(3)	3.2(7)	3,5,7,9,10,11,12
Ledum spp.			2.2(1)		5
Linnaea borealis	9.7(4)	4.7(4)	0.5(1)	2.5(3)	2,5,9,11,12
Lonicera involucrata		0.7(1)	1.1(1)	0.9(1)	5,10
Menziesia ferruginea			1.5(1)		2
Myrica gale	0.1(1)		5.0(1)	0.4(1)	5,10
Oplopanax horridum	1.0(3)	1.9(1)	3.4(2)	2.1(3)	2,5,11,12
Physocarpus malvaceus	3.2(1)	2.4(2)	5.3(1)		5,10
Populus trichocarpa	2.9(4)	1.0(3)	3.4(2)	6.4(5)	5,7,9,11,12
Ribes spp.	0.2(2)	0.8(1)	1.6(2)	1.0(1)	5,10
Rosa spp.	2.6(4)	0.8(5)	3.6(3)	1.5(4)	4,7,8,11,12
Rubus spectabilis	1.9(6)	5.8(8)	10.6(8)	3.5(10)	2,3,4,5,6,7,8,9,10,11,12
Rubus spp.	2.0(3)	9.5(3)	5.0(4)	1.6(6)	3,4,5,7,9,11,12
Rubus ursinus	7.0(4)	5.6(5)	7.1(3)	4.4(6)	3,4,6,7,11,12
Salix spp.	2.1(7)	1.7(7)	4.8(7)	6.7(8)	1,2,3,5,6,7,8,10,11,12
Sambucus racemosa	2.0(2)	1.1(5)	3.8(5)	16.0(3)	1,2,3,5,7,10
Sorbus sitchensis			2.2(1)		2
Spiraea spp.	0.4(2)	1.1(3)		2.0(1)	5,11,12
Vaccinium spp.	3.7(7)	3.8(6)	2.8(8)	2.7(8)	1-12
Viburnum edule		0.6(1)	2.1(1)	5.0(1)	1,5
Unknown shrubs	4.6(5)	4.0(5)	8.9(3)	6.5(5)	5,7,8,10,11,12
SHRUBS SUBTOTAL	28.9(9)	31.7(8)	37.1(8)	36.7(11)	
MOSSES SUBTOTAL	0.0(4)	1.6(2)	0.7(2)	0.5(2)	6,8,9,10
FUNGI SUBTOTAL		0.2(1)		0.1(1)	4
UNKNOWN SUBTOTAL	4.3(3)	0.8(1)	1.0(2)	4.8(1)	6,9,10
GRAND TOTAL	100.0	100.4	99.8	100.1	

[1]Major species were defined as those making up >1% of a mean seasonal diet. Minor species, not reported here included: *Achillea millefolium, Achlys triphylla, Circium* spp., *Clintonia uniflora, Habenaria saccata, Hieracium albiflorum, Hydrophyllum fendleri, Lupinus* spp., *Maianthemum dilatatum, Montia* spp., *Rumex acetosella, Senecio triangularis, Smilacina stellata, Streptopus* spp., *Taraxacum officinale, Tolmiea menziesii, Veronica* spp., *Gymnocarpium dryopteris, Lycopodium sitchense, Deschampsia elongata, Abies grandis, Sequoia sempervirens, Acer macrophyllum, Baccharis pilularis, Cornus stolonifera, Corylus cornuta, Holodiscus discolor, Malus* spp., *Rhamnus purshiana, Ribes bracteosum, Symphoricarpos* spp.

[2]References and Geographic locations:

1. Batchelor (1965): Afognak Island, Alaska
2. Hanley (1980): Cascade Mountains, Washington
3. Harper (1985): Coast Range, Southwestern Oregon
4. Harper et al. (1967): Northwestern California
5. Janz (1983): Vancouver Island, British Columbia
6. Leslie et al. (1984): Olympic Peninsula, Washington
7. Merrill (1987): Cascade Mountains, Washington (Mount Saint Helens)
8. Schoen (1977): Cascade Mountains, Washington
9. Schwartz and Mitchell (1945); Olympic Peninsula, Washington
10. Brunt et al. (1989): Vancouver Island, British Columbia
11. Jenkins and Starkey (1990); Cascade Mountains (Mount Rainier National Park)
12. Jenkins and Starkey (1990): Cascade Mountains (managed forests adjacent to Mount Rainier National Park)

Although 39 species of forbs have been reported in diets, only a few dominated seasonal diets, particularly during summer and fall (Table 1). Fireweeds (*Epilobium* spp.) and wooly catsear *(Hypochaeris radicata)* were abundant in summer and fall diets of elk on silviculturally managed ranges (Hanley 1980, Harper et al. 1985, Merrill 1987, Brunt et al. 1989), whereas wood sorrell *(Oxalis oregana)* and foamflower trefoil *Tiarella trifoliata)* were abundantly eaten in unmanaged old-growth forests of the Olympic Peninsula (Schwartz and Mitchell 1945, Leslie et al. 1984).

Sedges contributed large proportions to the winter and spring diets of Roosevelt elk throughout their range (Table 1). A variety of other graminoids, notably bentgrass (*Agrostis* spp.), sweet vernal grass (*Anthoxanthum* spp.), and orchard grass *(Dactylis glomerata)* were also locally important.

Several shrubs dominated seasonal diets of elk (Table 1). Salal *(Gaultheria shallon)*, huckleberry (*Vaccinium* spp.), and trailing blackberry *(Rubus ursinus)* were especially abundant in winter diets. Salmonberry *(Rubus spectabilis)* and huckleberry were abundant in summer diets, whereas alder *(Alnus rubra)*, cottonwood *(Populus trichocarpa)* and a variety of other shrubs were abundant during autumn (Table 1). Western hemlock *(Tsuga heterophylla)*, western red cedar *(Thuja plicata)* and the ferns swordfern *(Polystichum munitum)* and deer fern *(Blechnum spicant)* were consumed abundantly during winter.

Seasonal differences in diet selection of Roosevelt elk reflected seasonal differences in forage availability and phenology. Averaged across the geographical range, shrubs made up the greatest proportion of the annual diet of Roosevelt elk (Fig. 1). Consumption of shrubs peaked during summer when leaves and succulent shoots were most available. Grasses comprised the second largest part of the annual diet, especially during spring when grass is most productive and nutritious. Forbs made up a very small percentage of the mid-winter diets of elk, but together with shrubs and grasses they were important summer forages. Conifers were winter staples of Roosevelt elk, but proportions of conifers in the diets diminished appreciably during spring and summer. Ferns were eaten abundantly by Roosevelt elk during winter and spring.

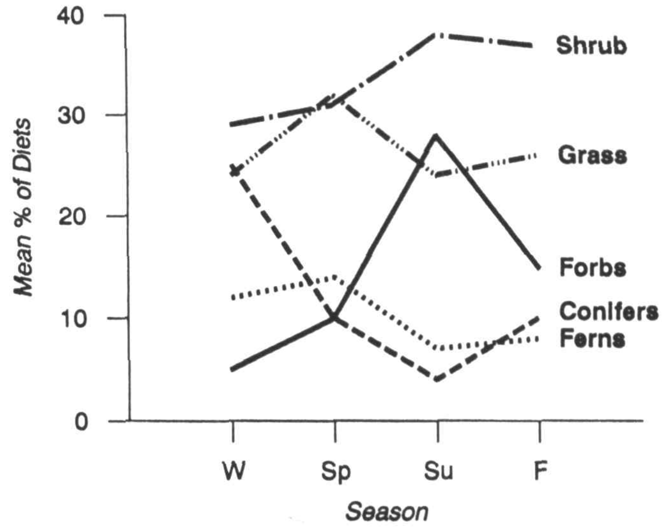


Fig. 2. *Mean percentages of major forage classes in the diets of Roosevelt elk as determined from 12 studies of food habits from throughout the range of Roosevelt elk (Table 1).*

Geographical differences in diets of Roosevelt elk reflected broad differences in forage availability as influenced by prevailing land-uses and vegetation. In northern California, for example, Roosevelt elk fed extensively in coastal prairies where grasses made up the majority of the annual diet, and conifers and ferns were eaten only rarely (Table 2). In contrast, in forested regions of the Olympic Peninsula and Vancouver Island, conifers and ferns made up the bulk of the winter diet, and grasses,

Table 2. Geographic variation in forage-class composition of Roosevelt elk diets.

			% of Diet				
Geographic region	Reference	Seasons[1]	Forbs	Ferns	Grass	Conifers	Shrubs
Afognak Island, Alaska	Batchelor (1965)	F	43	0	3	0	54
Vancouver Island, British Columbia	Janz (1983)	Y	4	20	19	22	35
Olympia Peninsula, Washington	Schwartz and Mitchell (1945)	F,W	4	11	7	16	25
	Leslie et al. (1984)	Y	16	20	16	17	21
Cascade Mountains, Washington	Jenkins and Starkey[2] (1990)	F,W,Sp	9	1	11	35	43
	Jenkins and Starkey (1990)[3]	F,W,Sp	16	5	30	13	36
	Hanley (1980)	Su	31	6	27	14	23
	Merrill (1987)	Su,F	35	7	30	T	27
	Schoen (1977)	Y	13	11	33	9	33
Coast Range, Oregon	Harper (1985)	Y	17	6	15	6	56
Northwestern California	Harper et al. (1967)	Y	10	T	63	T	26

[1]Seasons of study include Fall (F), Winter (W), Spring (S), Summer (Su), and Year-long (Y).
[2]Diets from old-growth forest ecosystems in Mountain Rainier National Park.
[3]Diets from cutover, regenerating forests adjacent to Mount Rainier.

Photo by Patricia Happe

being comparatively rare, made up a relatively small part of the annual diet. Graminoids and forbs were seasonally important to elk in coniferous forests of the Olympic Peninsula and Vancouver Island, but never to the extent that they were in managed forests of the western Cascades or in prairie habitats of northwestern California. Deciduous shrubs were key forages of Roosevelt elk across their range (Table 2).

Discussion and Conclusions

Mean percentages of forages reported in the diets of Roosevelt elk are subject to bias and must be interpreted with caution. Ten of the twelve diets of elk reported in this study were determined from stomach and fecal analyses, which can misrepresent actual consumption of some forages (Gill et al. 1983). Conifers and evergreen shrubs, for example, often are overrepresented in fecal or stomach samples (Leslie et al. 1983); whereas forbs and stems of deciduous shrubs may be underrepresented (Gill et al. 1983, Holechek and Valdez 1985). Only Leslie et al. (1984) attempted to correct for such biases. We suggest, therefore, that forbs and deciduous shrubs may actually be more important during some seasons than is suggested by this review; conifers and evergreen shrubs may be less important than reported.

Secondly, one must be cautious not to equate relative abundance of forages in the diet with forage preference. Dietary percentages are influenced by availability of forages as well as by forage preference. Few of the studies reviewed obtained reliable estimates of forage availability for use in determining forage preference. Studies that compared forage selection to forage availability, however, ranked forbs and grasses as the most preferred forages, and evergreen or coniferous browse at the least preferred forages (Merrill 1987, Jenkins and Starkey 1990). Even non-preferred forages, however, such as evergreen browse, may be functionally important to elk during periods of seasonal food shortage.

Our results confirmed the dietary plasticity of Roosevelt elk, and the importance of maintaining a variety of forages on elk ranges in the Pacific Northwest. Current management efforts to seed cutover forests with grasses and forbs are laudable; however, habitat managers should not underestimate the importance of deciduous browse for Roosevelt elk especially during summer and winter when many herbaceous forages are unpalatable or unavailable due to deep snow. Recent studies of nutrient qualities of browse in clearcuts and old-growth forests revealed that high concentrations of astringent tannins often eliminated the protein available to browsers in open-grown shrubs (Happe et al. 1990). Consequently, we believe that optimum management of forage resources for Roosevelt elk in commercial forests would include seeding grasses and legumes in clearcuts and retaining old-growth patches that contain abundant shrubs.

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The Preferred Grazing System

Marion E. Everhart

The Past 75 Years

Articles on Range Management, Ecology, Wetlands and Riparian, Grazing Systems, and Planning were reviewed extending back to 1915. The purpose was to (a) chart the progress that had been made in range management, (b) determine what problems had been identified that had not been solved, and (c) to plan action for the future.

Range bulletins and USDA publications, later followed by *The Rangelands Journal, Rangeman's News,* and *Rangelands* were studied for articles which were then categorized under the headings shown above.

The following is a synopsis of these articles starting from the earliest date and proceeding to the date of this analysis. A total of eighty one (81) articles were reviewed, followed by a condensation for brevity purposes and to provide a format for future thinking. Since all facets of range management should be considered in range plans, each of the subject headings should be analyzed for an acceptable grazing system for the future.

Range Management

In 1915 Jardine wrote in the 1915 yearbook of agriculture about overgrazing by livestock of choice plants and the evils of loose stock. Sampson in 1918 wrote about erosion and stream flow. These were the earliest writings found.

In 1957, Tomanek, Martin, and Albertson wrote about the grazing preference comparisons of Six Grasses in the Mixed Prairie. They developed a chart of the preference of various grasses over others. They stated that there were site as well as species preference. In the same year Tomanek and Albertson made studies showing plants' reaction to grazing. Moldenhauer and Everhart in 1958 developed the minimum vegetation required to keep erosion below 0.25 ton per acre in ARS bulletin 41-20. In 1960 the Rocky Mountain Forest and Range Experiment Station completed research of Upland and Bottomland rangeland with regard to site preference.

Paulsen and Ares in 1961 stated that sustained grazing capacity does not exist on arid southwestern rangeland.

"The Wildlife Management Institute" in 1973 published the *New North American Wildlife Policy.* Fragile ecosystems in wilderness and national parks were commented upon and the problem of grazing of arid lands led to substantial deterioration of the range. The role of wildlife on rangelands was covered in their policy statements. SRM contends that multiple use management is essential. In 1974 Management was stated as the key to wildlife variety and abundance. *Outdoor* Editor Bob Thomas in seven issues reported overstocking of rangelands throughout Arizona's arid rangelands.

Flexibility by following a conservation plan where range sites and condition classes along with climax plants was discussed by Fields in 1977. A range condition procedure was discussed. Cosby in 1978 stated that range management benefited wildlife. The range ecosystem and range condition were recommended as guides to range analysis.

Everhart in his book "Land Classification For Uses, Management, and Valuation" published in 1981 presented tables of (a) site preference, (b) species preference, (c) map of primary non-rangeland based on the "The Western Range", U.S. Government Printing Office, (d) generalized precipitation map of the United States, and (e) relationship of soil quality and vegetation quality. Also presented classification groupings for wildlife and forest lands.

Managing rangelands for Mule Deer was discussed by Holechek in 1982 with preferred species, deferred grazing and need for protective brush for wildlife emphasized. Whetsell in 1982 stated that livestock selected vegetation by species preference and his system placed more cattle on smaller areas for a short time period. "Pen Points" in 1984 indicated that fencing should separate range types and conditions. "Viewpoints" in 1984 presented USLE on rangelands (an erosion formula). Similar to the above, Renard et al. in 1984 discussed the "Universal Soil Loss Equation". Rangeland vegetative succession and wildlife was emphasized by Kindschy wherein the classification of seres with the use of habitat groups was covered. Hann in 1986 discussed "Habitat Groups".

Ecology

In 1916 Clements in his book wrote about plant succession and indicators on rangeland. Sampson in 1917 wrote concerning Succession as a Factor in Range Management, then in 1919 Plant Succession in relation to Range Management. This was followed by Dyksterhuis in 1949 writing "Condition and Management of Rangeland Based on Quantitative Ecology". "Benchmarks" in 1971 provided a statement of Principles and Positions. The statements quoted and defined *"non-productive land",* also land use capability classification. In 1974 "Ecology—The Foundation of Wildlife Management" discussed ecology and wildlife. McKay in 1975 in writing "Producing from

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Rangelands" discussed acres of rangeland in excellent, good, and fair condition. In 1985, Dyksterhuis re-examined range sites and condition classes in a "follow up" as based on quantitative ecology.

Bottomlands, Overflow Lands, Wetlands, and Riparian Lands

In 1977 Winegar in his article, "Camp Creek Channel Fencing—Plant, Wildlife, Soil, and Water Response", discussed meadows and wildlife habitat. Kramer in 1978 discussed livestock ponds and fences and the location of fences along geologic land forms. In 1978, Meehan et al. wrote about livestock grazing and the aquatic environment reporting the over use of desirable species and the concentration of livestock in favored areas. Fish habitat should be protected. Peek et al. in 1981 reported on a study of riparian areas in Idaho, and stated that riparian use is a serious issue—that spawning areas should be protected and Fisheries Biologists should be used. In an article on the biological importance of streambank stability the need for stability of banks was emphasized by Bohn. Thomas in 1986 wrote about riparian protection and enhancement in Idaho and stated that fencing was used and that fish preferred the ungrazed areas. Elmore, et al. in 1987 discussed riparian area management in watershed management. A riparian research program was discussed in the 1987 article by Prouty, who stated that the Forest Service had a variety of disciplines focused on this problem. Tixler et al. in 1988 stated that riparian areas were trampled.

Grazing Systems

Preferred grazing was discussed in 1977 by Sipe along with wildlife. Penfield in 1982 discussed topography, marshlands, wetlands, need for planning, burning, etc... More grass means more cattle was presented in 1982 by Whetsell.

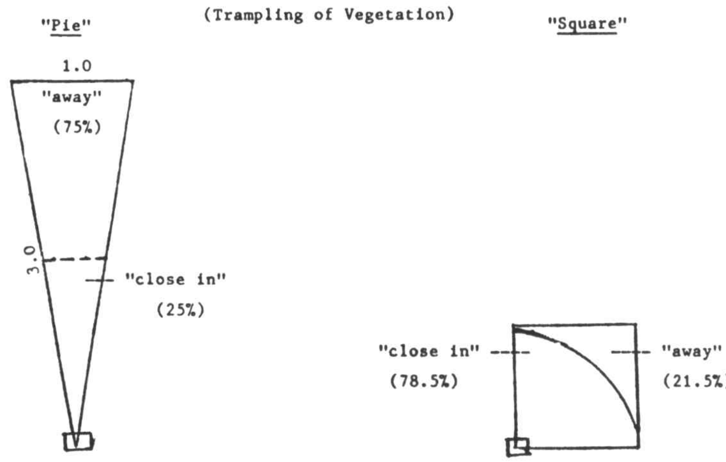
The Savory Grazing Method was discussed in 1982 by Steger. Ranges should be divided by range types and grazing should be done when nutrition is highest, says Holechek and Herbel in 1982. In 1982, Kelton states a grazing system does not improve range condition, also cattle should be moved one time per week.

Blackburn in 1983 presents livestock grazing impacts on watersheds. Creeks should be fenced out, also all water sources (springs, reservoirs, etc.), says Anseth in 1983. It slows erosion, he says.

Holechek in 1983 discussed all systems, also seasonally suitable, fenced riparian areas, and discussed preferred areas and preferred species. Evaluation, selection, and different types on ranges need different times of grazing, says Platou in 1985. He states that high intensity is not adapted to Shrub Steppe. In 1985, Penfield discusses a workable grazing program. He states that marshlands need to be treated differently from dry sites. Quigley in 1987 wrote about Short Duration grazing from an economic perspective. A grazing system is not adapted to steep slopes, also not adapted to many areas (terrain, season of use, type of land, etc.). Trampling is a big problem, says Pieper in 1988 in his article, "Is Short Dura-

SHAPE OF PASTURES

(Trampling of Vegetation)



one pasture - 960 acres

area within 1.5 miles to water ("close in")
1/2 distance out = 25% of pasture area.

area away is 3.48 times as large as square shape

one pasture = 640 acres

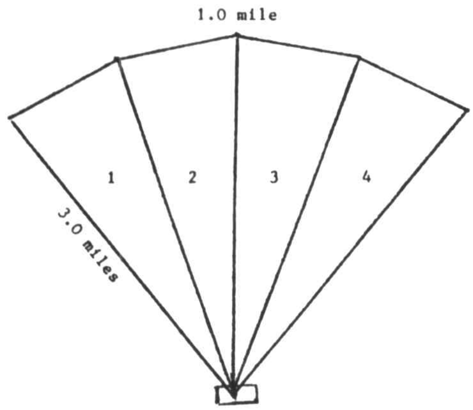
area within 1.0 miles to water ("close in") is 78.5 percent of whole

area close in is 3.14 times as large as pie shape.

Comment: 75 percent of the time (last 3/4 of grazing period) must be spent trampling already fully utilized range in the pie pasture, therefore 25 percent is sacrificed for the remmaining 75 percent.

FIGURE 1

FENCING ANALYSIS



Parts of 12 sections - 50% fenced

12 miles of fence - 3,820 acres

1 mile of fence per 202 acres

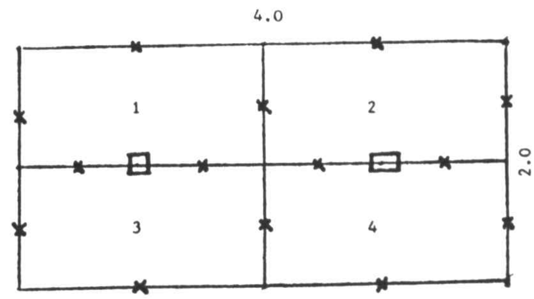
Difference: Square = 320 acres per mile of fence
Pie = 202 acres per mile of fence
118 acres per mile of fence

- -

50 percent of 7,680 acres fenced (see figure 2), therefore a loss of 50 percent due to not being in the system.

Loss:

Improper fencing	- 56	percent
Not fenced into the system	- 50.0	percent
Total	106	percent



8 sections - 100% fenced

16 miles of fence - 5,120 acres

202 divided by 320 = 63 percent loss

- -

100 percent of 5,120 acres fenced.

No loss of fenced areas.

Loss:

Insufficient fencing	- None
Not fenced	- None
Total	None

FIGURE 2

tion Grazing the Answer". Minimum ground is needed and only certain amounts of vegetation can be safely harvested.

Planning

Nothing can be done without systematic planning. Colbert in 1977 discusses land use planning following land use classification and ecosystem analysis. Anderson in 1977 states planning is needed in the management of renewable resources.

The Preferred Grazing System

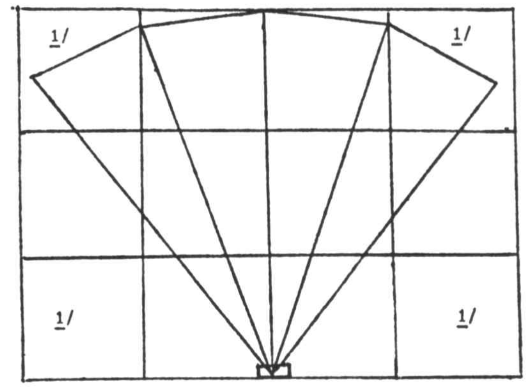
Since 1915 when Jardine wrote about range erosion, 75 years have passed and a summary and analysis is in order. These articles have been separated into various subjects for further study. This writer who has spent much of his life—45 years (1946-1991)—in range management first as a ranch planner then as a range specialist, then as a Certified Range Management Consultant—will attempt to present a Preferred Grazing System.

1. Range surveys must be the first item that is to be accomplished. Range sites and condition classes should be mapped to serve as a basis for all grazing of livestock, grazing systems, trend analysis, and planning. Along with this the soils map, vegetative survey resources inventory, and geologic map analysis for slopes must be done. The next step is to develop a habitat group map for wildlife management as wildlife is a part of every good management plan. Determine what range improvements are needed such as water facilities, fencing, brush control, erosion prevention, etc.. Fencing and water needs can not be determined at this point as other decisions will impact these items. The growing season as to total days and dates must be itemized. Annual precipitation and time of year (season) must be determined, also the frequency of drought (duration and extent) obtained. Climatic zones such as wet, humid, subhumid, dry subhumid, semi-arid, and arid must be obtained and placed with the inventory and classification of resources. A research of vegetative cover that is needed by the various range sites that must be left to prevent erosion and to provide protection for the soil microorganisms and plant roots for the next season of use must be then made.
2. The next item is to analyze all of the plant inventories: site and condition survey, habitat groups, wildlife inventory including stream analysis (spawning beds, fish and mollusks, etc.), need for wildlife brush and tree cover, and recreation improvements such as camp sites along streams, etc..

   Analyze possible classes of livestock, age, and season of use with consideration of the amount and season of precipitation, evaporation, and transpiration, and the *needs of the land* as to vegetation left at the end of the season of use. Study the carrying capacity of the range including the amount needed by the wildlife for *food and cover.*

Analyze vegetation cover as to what range improvement can be realized such as (a) can the poor condition sites be realistically improved if sufficient land cover is left for soil protection and (b) can the fair condition sites be improved to good condition and, if so, what grasses need to be protected during the grazing season.

3. Tentatively map the range types that are not compatible to be grazed in the same pastures with other range types. Then map out bottomland sites, overflow sites, wetland sites, and riparian areas that must be separately fenced. This may call for a range consultant to assist in this difficult assignment. Assign preclimax, climax, and postclimax to all range sites for grazing system analysis. Put the requirements of each site in the proper prospective.
4. If the grazing unit (the ranch) is a mixture of types, greater care must be taken and help may be necessary as sacrifice areas must be held to a minimum. The fencing and water facilities must be placed properly as these are costly items. More about this when the system is selected.
5. Fencing analysis for proper grazing systems must be studied with great care. The location of the fence must separate range types with varying site and species preferences. Bottomland sites, overflow lands, wetland (potholes or marshes) and riparian lands (along creeks, streams, rivers, etc.) must be fenced out if not determined to be sacrifice areas.
   Figure 1 shows efficiencies of rectangular fencing.
   Figure 2 shows the loss due to improper fencing and also areas not fenced into the system.
   Figure 3 shows the trampling effect of improper fencing.
   Figure 4 shows a proper fenced ranching unit.
6. High density, short duration grazing systems are proper for ranges with site and species preference problems *in an environment of proper precipitation for adequate regrowth.* Rotation grazing is proper in an area of below precipitation for adequate regrowth.
7. The grazing rotation should provide for a minimum of four pastures and a maximum of eight. The livestock should be placed in one pasture and left for a minimum of 10 days if there are eight pastures, and 15 days if there are 4 pastures. Each pasture can be regrazed as many as 2 more times (a total of 3) during the season then placed in all pastures if desired and if allowed in the computed carrying capacity. Do not use pie shaped pastures because of (a) trampling and erosion and (b) cost of inefficient fencing.



1/ Not in the system Figure 3

FENCING SCHEMATIC

Riparian and Bottomland Range Sites

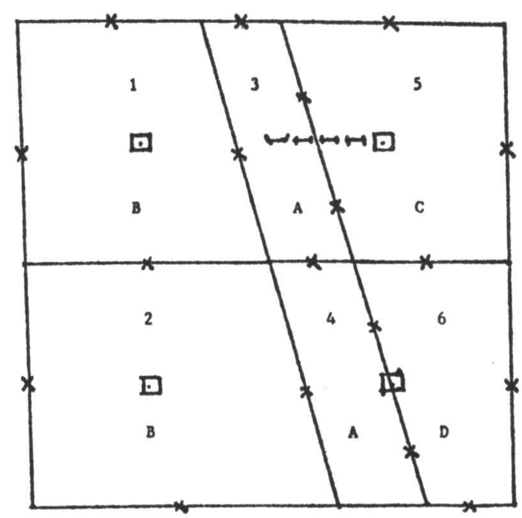


Figure 4

Pasture 1, 2, 3, 4, 5, 6

A = Riparian and Bottomland site

B = Climax sites (too steep to graze 10%)

C = Climax and preclimax intermingled (70% climax)

D = Preclimax and climax intermingled (30% climax)

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Environmental Effects on Picloram Translocation in Leafy Spurge

Rodney G. Lym and Calvin G. Messersmith

Variable herbicide absorption due to changes in the environment or plant growth stage can result in inconsistent weed control, especially with perennial rangeland weeds such as leafy spurge. Leafy spurge grows on a wide variety of terrain from flood plains to river banks, grasslands, ridges, and mountain slopes (Bakke 1936). Leafy spurge is primarily found in untilled non-cropland habitats such as abandoned cropland, pasture, rangeland, woodland, roadsides, and waste areas. Leafy spurge causes economic losses from both reduced forage production and avoidance of weed-infested areas, by cattle. Leafy spurge can reduce carrying capacity from 50 to 75% (Alley et al. 1984, Reilly and Kaufman 1979).

Leafy spurge is difficult to eradicate, but topgrowth control and gradual reduction in the underground root system are possible. Picloram (Tordon)[R] is the most effective herbicide for leafy spurge control (Lym and Messersmith 1985). Generally, herbicides are most effective when applied during the true-flower growth stage in mid-June or during regrowth in the fall from late August until a killing frost occurs in October. However, results can be inconsistent. Picloram has given from 100% to less than 5% control 2 months after application even when properly applied at the maximum labelled use rate.

Occasional poor leafy spurge control by picloram may be due to poor herbicide absorption and translocation caused by unfavorable weather conditions or by limited carbohydrate movement within the plant. High relative humidity and an increase in air temperature of 2° F or more 24 hours before treatment can result in more picloram absorption and translocation in leafy spurge (Lym and Messersmith 1990). Since both picloram and carbohydrate movement in leafy spurge are weather dependent and roots must be killed for long-term control, the effect of leafy spurge growth stage and weather conditions for picloram movement to roots was investigated.

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Methods

Radiolabeled picloram (^{14}C-picloram) was applied weekly from mid-May until mid-October for 2 years to leafy spurge plants grown in pots in the field. Plants were harvested 72 hours after treatment and were sectioned into treated leaf, remaining stem and leaves, and roots. The amount of picloram absorbed and translocated was determined for two growing seasons at two depths and the relationship between root carbohydrate and picloram content estimated.

Results and Discussion

Picloram absorption was similar throughout most of the growing season and averaged 36% of applied picloram (Fig. 1). The poorest absorption occurred during summer dormancy. In growth chamber experiments, picloram absorption increased as the relative humidity increased during treatment but was not affected by the air temperature before or after treatment. To maximize picloram absorption in leafy spurge, plants should be treated when growing rapidly and during periods of high humidity such as early morning or late evening.

Picloram concentration in the leafy spurge topgrowth was greatest when the herbicide was applied during the vegetative growth stage in the spring but declined rapidly when the plant began to flower (Fig. 2). There was a small increase in picloram concentration around early Sep-

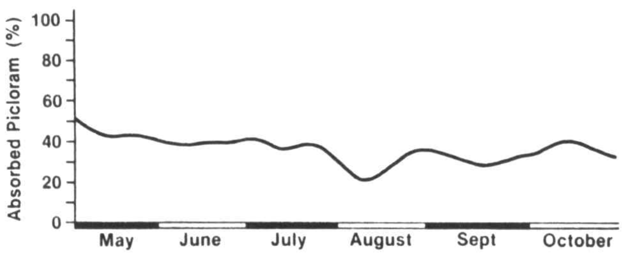

Fig. 1. *Picloram absorption by leafy spurge averaged over two growing seasons.*

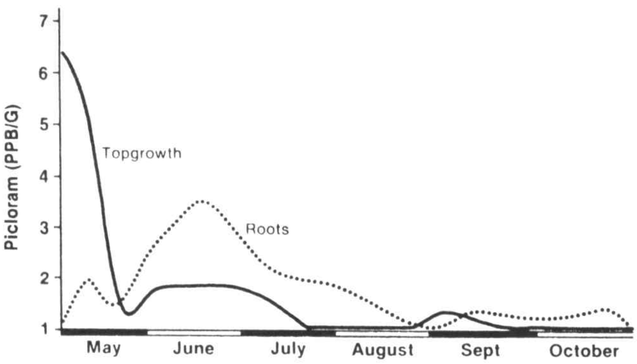

Fig. 2. *Picloram translocation to leafy spurge topgrowth and roots averaged over two growing seasons.*

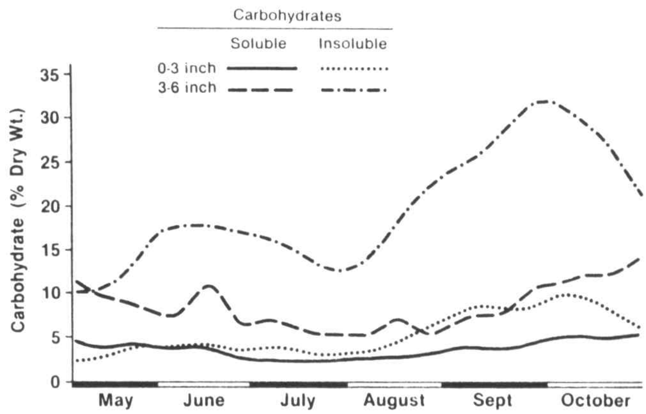

Fig. 3. *Water-soluble (mostly sucrose) and -insoluble (starch) concentration in leafy spurge roots at two depths averaged over two growing seasons.*

tember when young fall regrowth appeared. Since leafy spurge topgrowth is easily killed by relatively economic herbicide treatments such as 2,4-D, picloram concentration in the topgrowth is only important if it leads to more picloram in the roots.

Picloram concentration in leafy spurge roots was influenced more by leafy spurge growth than by any other factor. Picloram movement to the roots correlated directly with the percent control achieved in the field during the growing season. Maximum translocation occurred during the late-flowering and seed-set growth stages in June and early July (Fig. 2), the "traditional" leafy spurge treatment season. Picloram concentration in the root declined steadily during summer dormancy but then increased slightly during fall regrowth. Although about one-third of the picloram applied to leafy spurge was absorbed throughout the growing season, the maximum translocated to the roots occurred during flower development. The increased translocation was hypothesized to be due to increased flow of carbohydrates to the roots during the late-flowering growth stage.

Leafy spurge roots contain two predominate types of carbohydrates, water-soluble (mostly sucrose) and water-insoluble (starches). The carbohydrate concentration varied over the growing season and by root depth (Fig. 3). Water-soluble and -insoluble carbohydrates were present in similar amounts (by depth) in the early spring during vegetative regrowth, but insoluble carbohydrates predominated after flowering, especially for the 3- to 6-inch depth. Water-soluble carbohydrates were highest during the true-flower growth stage and in the fall, which is also the time herbicides are traditionally applied.

Picloram translocation evaluated over the entire growing season did not correlate with either the water-soluble or -insoluble carbohydrate concentration (Table 1). Auxin herbicides such as picloram often are considered to flow with plant sugars from the leaves to the roots, especially in perennial weeds (Crafts and Robbins 1962). This hypothesis apparently is not valid with leafy spurge over the growing season, but picloram translocation may be aided by carbohydrate flowing during the peak movement of picloram to the root system during flowering.

Picloram and carbohydrate content within the true-flower and fall regrowth stages were analyzed separately (Table 1). Picloram content and the water-soluble fraction both increased during the true-flower growth stage with a correlation of 78 and 95% at the 0- to 3-inch and 3-to 6-inch depths, respectively.

Table 1. Correlation of concentrations of water-soluble and water-insoluble carbohydrates and picloram in leafy spurge roots 72 hours after treatment.

Growth stage and root depth	Carbohydrate type	
	Water-soluble	Water-insoluble
	------ (Correlation %) ------	
All season		
0 to 3 inches	0	0
3 to 6 inches	0	0
True-flower		
0 to 3 inches	78	60
3 to 6 inches	95	56
Fall-regrowth		
0 to 3 inches	0	0
3 to 6 inches	0	0

Despite a large increase in carbohydrate movement to the roots in the fall, picloram translocation did not increase (Fig. 2 and 3, Table 1). This was unexpected since the hypothesis was that herbicides move with sugars when sugars are stored for overwintering. This was not true with picloram in leafy spurge and may not be true for other auxin herbicides or perennial weeds. Although some herbicides such as glyphosate (Roundup)[R] follow patterns similar to sucrose in plants, phenoxy herbicides such as 2,4-D and picloram differ from sucrose in both rate and pattern of movement (Martin and Edington 1981).

Optimum timing of picloram application for maximum translocation to the roots is during the true-flower growth stage and to a lesser degree during fall regrowth. Within these growth stages picloram should be applied during periods of high humidity. Air temperature is less important than relative humidity in determining picloram translocation to the roots. Research has shown that application during cool weather immediately following several days of hot weather may increase picloram translocation to the roots and thus increase control slightly (Lym and Messersmith 1990).

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Wildlife Depredation Policy Development

N.R. Rimbey, R.L. Gardner, and P.E. Patterson

Historical Setting

In most areas of the western United States, big game animals migrate between winter and summer use areas. Snowfall at higher elevations and the relative availability of forage, water and shelter at lower elevations lead to herd concentrations in specific areas during the winter. Prime winter wildlife habitat may be a traditional "wild" range setting or privately owned cropland, pasture, or haystacks.

In many western states, public lands are often intermingled with private lands, creating a "checkerboard" pattern of ownership. Frequently, there are no definitive boundaries, such as fences or differences in vegetation patterns, to distinguish the lands. Wildlife do not recognize these boundaries in their migration routes.

The Idaho National Engineering Laboratory (INEL) is a large tract of land (570,000 acres) in southeastern Idaho controlled by the United States Department of Energy for nuclear research. Except for corridors along several state highways, it is essentially closed to public access with no hunting. Antelope, the primary big game species in the area, have access to this refuge or "safe area". As a result, attempts to control herd numbers by public hunting in the surrounding area by the Idaho Department of Fish and Game (IF&G) have been largely unsuccessful.

Irrigation development in arid southern Idaho began in the early 1900's and resulted in over 3.4 million acres of rangeland and marginal dry cropland being converted to irrigated agricultural production. These developments removed "native" big game habitat and replaced them with newly preferred foods of hay, grain, irrigated pasture, and other crops. New wildlife migration patterns developed to access these abundant forage sources.

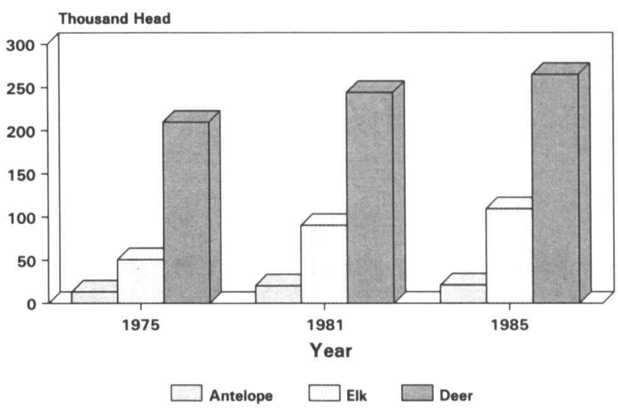

Fig. 1. *Idaho big game population estimates, 1975–1985.*

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Big game population trends in the area have shown steady increases over the last 15 years (Fig. 1). Along with the increases in big game populations, harvest by sportsmen has fluctuated over time but shown steady increases over the past 15 years (Figures 2 and 3). Idaho Fish and Game policies on enforcement and hunting regulations are largely responsible for these increases. The wildlife resource is publicly owned, with IF&G the trustee. In contrast to land management agencies like BLM and the Forest Service, IF&G manages game and not habitat.

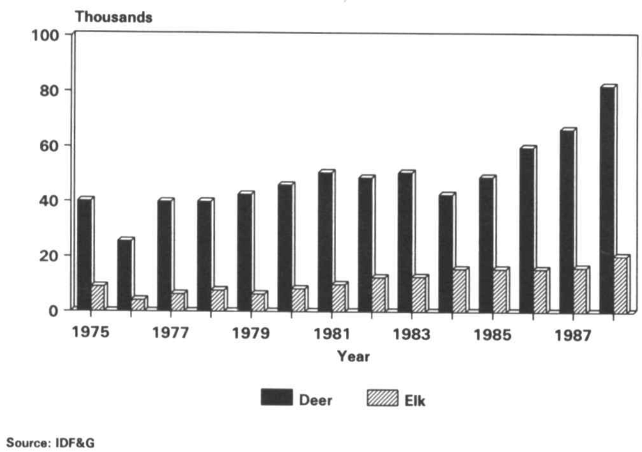

Fig. 2. *Big game harvest estimates—deer, 1975–1988.*

Weather has played a key role in recent wildlife management decisions. Severe winters hit the state during the early 1980's. Emergency wildlife feeding programs were implemented. Hay stacks were fenced to restrict wildlife use and special hunts were conducted to reduce herds. In 1984, IF&G was authorized to use $1.50 from each deer, elk, and antelope tag sold to help pay for winter feeding programs to maintain big game numbers. Over $1 million was spent for winter feeding programs that year (Conley 1990). Because of winter feeding programs and heavy snows, antelope crossed fences, interstate highways and other barriers to "new" ranges. The massive die-off of wildlife that normally takes place during hard winters did not occur. In addition, the public appears to have accepted supplemental feeding as a viable winter range alternative to maintain wildlife numbers.

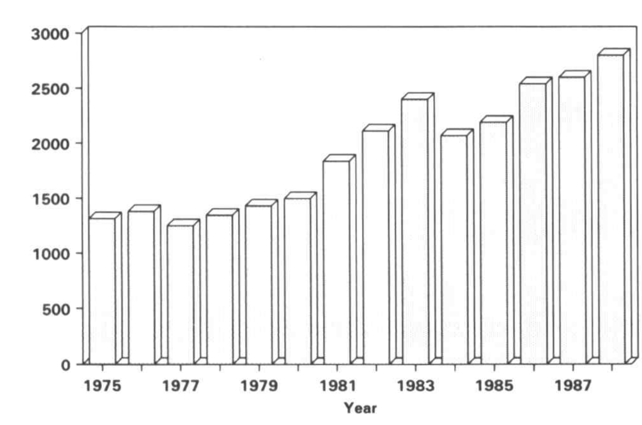

Fig. 3. *Idaho big game harvest estimates — Antelope 1975–1988.*

Drought conditions struck Idaho during 1987 and 1988, reducing available water and habitat for both wildlife and livestock. Big game use shifted from traditional range settings to the "oases" created by irrigated agriculture. Elk, deer, and antelope began extensively consuming and damaging growing crops during the summer of 1988. One of the areas with the heaviest influx of game was in agricultural areas near INEL. IF&G received a total of 1,957 depredation complaints from landowners between 1985 and 1989. Also, 43 Utah operators reported an annual loss of $250,000 (Nielsen and McBride 1989), during the same time period. One can conclude that the issue was not just centered in Idaho.

Agricultural producers began expressing concern about wildlife numbers and the resulting damage to crops. Financial stress during the mid-1980's was an additional motivator for many producers (Gardner et al. 1986). Farmers and ranchers also expressed concerns that IF&G personnel appeared insensitive to the economic hardship imposed by wildlife on agricultural landowners. In contrast wildlife supporters countered that overgrazing on public lands was causing the migrations to private lands, and that agriculture had no "conservation ethic" and generally favored the demise of wildlife.

Short-Term Solution

In the 1989 session of the Idaho Legislature, a bill (HB288) which would have mandated the use of license fees to compensate farmers for wildlife depredation was vetoed by Governor Cecil Andrus. A second bill (HB416) was approved which mandated a one-time appropriation of $500,000 from IF&G license funds to pay for damages to crops during the period spanning from July 1, 1988 through June 30, 1989. This appropriation provided for review of farmer claims by an impartial party and a further audit by the Board of Examiners prior to payment. The appropriation also stated that damages were limited to "growing crops, stored commodities, and fixed assets." In addition, House Concurrent Resolution 31 provided for a negotiation committee, with legislative oversight and a professional mediator to look for long-term solutions to wildlife depredation on private lands.

The State Board of Examiners developed claim forms and placed the program under IF&G jurisdiction. The number of claims submitted by landowners surpassed most expectations. One hundred eleven claims for a total of $1.3 million were filed for 1988 damages, with an additional 93 claims totaling $450,000 for 1989 damages. However, minimal guidelines accompanied the claim forms, so that damage estimates followed no consistent methodology and varied widely. Maximum yields, peak prices for most commodities damaged, and damages to items not covered in the legislation (shrubbery, dog food, machinery, etc.) were included in many of the claims. Little or no evidence to substantiate validity was included with the claims.

Analysis of Claims

The claims, greatly exceeding the $500,000 appropriation, were initially forwarded to IF&G, who hired an independent crop insurance adjuster to analyze them. The adjuster reviewed approximately 60 percent of the claims and recommended using a **forage consumption method** developed in Utah for calculating wildlife damages. The remaining claims were reviewed by local IF&G personnel, using the same Utah approach. Under this method, estimates of numbers of big game animals using a farm or ranch were multiplied by daily forage requirements (lbs. per head per day) and the period of time that wildlife were using the private forage sources to derive forage losses. Assuming accurate counts are made daily, this method could provide a reasonable lower-bound estimate of damages.

However, the **forage consumption method** ignores damages from trampling (especially of small grains), defecation, and broken hay bales and relies upon some degree of subjectivity on herd numbers and period of depredation. Using this procedure IF&G recommended paying less than 10 cents on the dollar ($113,000) of the claimed amount, on a statewide basis. At this point the issue received a great deal of media attention and became highly emotional and political. There were allegations of intentional fraud and calls for criminal charges against some of the farmers who filed claims (Steubner 1989).

An Idaho court decision provided a precedent that crop damages be computed based upon the difference between expected yield and actual yield, with deductions made for costs not incurred (reduced harvest, irrigation, and labor). The Board of Examiners felt that IF&G's analysis did not adhere to this recommendation. The Board requested personnel at the University of Idaho to review several of the claims, make recommendations on an evaluation process, and provide commodity prices, cost adjustments, and other factors relative to the process.

The University of Idaho study recommended a **yield decrement** approach to estimate the change in net farm income from wildlife depredation, and that ASCS proven yields or historic crop sales records from individual claimants be used to compare with actual yields or sales from 1988 to develop estimates of yield decrements. Average crop year prices for most commodities were developed from USDA data and regional commodity markets. These prices were recommended for use in valuing yield decrement losses and were significantly lower than the drought and seasonally induced peak prices used by many claimants. Custom rates for agricultural operations (Withers and Sadeghi 1987) were used to estimate costs not incurred if harvest was reduced or not undertaken. Drought impacts were separated from wildlife impacts by arbitrarily assigning half of the yield decrement to drought. The Board was advised to derive similar "drought" factors on a county basis, through consultation with ASCS offices. Using these procedures, four "hardship" claims were reduced from $330,000 to $100,000 but were still well above the IF&G recommendations of $13,657 (Rimbey and Rimbey and Patterson 1989).

The State Auditor was charged with analyzing individual claims and relied on the yield decrement approach. His analysis resulted in all of the $500,000 appropriation being recommended for payment for the 1988 damages (Williams 1989).

Long-Term Solution

A twelve-member negotiating committee was established by the Idaho Legislature (HCR31) to devise a program to handle wildlife depredation problems in the future. The directors of the departments of IF&G and Agriculture each selected six members to provide equal representation of opposing interests. A professional mediator was hired to help the committee seek a consensus on critical issues relating to depredation. Twelve public hearings were held in various sections of the state, with numerous meetings by the committee to work toward resolution of the problem.

After 16 days of meetings, a consensus was reached on several critical factors relating to wildlife depredation (Gaffney 1989). First, the committee came to the conclusion that depredation had the potential to be a long-term problem/issue for the state. The threshold question then became "at what point does the impact of the publicly owned wildlife resource exceed a reasonable amount for a landowner to bear and thus deserve compensation?" Second, there was agreement that prevention, both in terms of habitat improvement and depredation damage, was preferable to compensation for damages. There was no consensus on controlling animal numbers to match habitat availability. This is not to imply that IF&G was doing nothing about depredation. Paneling of stored crops, increased hunting seasons, permits and harvest, habitat improvements, and harassment of animals were all used by the department to minimize damages during 1989. Expenditures for the winter feeding program and mitigation measures amounted to $850,000 during FY 1989 (IF&G 1989).

The committee recommended that funding for the damage payment program would be derived from two sources. The IF&G operating budget would be the source of a maximum of $200,000 per year that would go into a fund known as the Idaho Fish and Game Wildlife Depredation Account. This fund would be used to cover damage claims for amounts less than $10,000. Landowners with damages that fit into this category would carry a $1,000 "deductible" for claims filed. In other words, a landowner retained the liability for damages less than $1,000. A second fund was called the Wildlife Depredation Trust Fund Account. Only the interest from this account would be used to pay for damages exceeding $10,000 per claim. The fund would be created from a one-time appropriation of $1 million from the State's General Account, with the addition of $250,000 annually for five years from the interest earned on IF&G's dedicated funds. When the trust fund reaches $3 million, additional earnings will be available for "wildlife habitat enhancement projects or the planting of diversion crops to minimize depredation." Thus, the state would limit depredation payments in any year to $200,000 plus the interest ($180,000 to $300,000) from the trust fund.

The committee's final report detailed other key points concerning the agreement and continually stated that the pact was forged through a consensus process. In announcing the agreement, committee members stressed that the proposed program was very "fragile" and if the legislature attempted changes, it was null and void from the committee's perspective.

Public Perceptions of Depredation

During the development of the proposal, statewide public testimony was heard by the committee and revealed several common threads that have a bearing on the problem. First, wildlife enthusiasts did not realize the extent that game used private land resources, the amount of loss experienced by agriculture during "normal" years, or the pride or conservation ethic expressed by many farmers and ranchers toward game. Many sportsmen assumed that the public had a right of access to private land, confusing public ownership of wildlife with the landowner's right to control access. In contrast, it sometimes appeared that agricultural interests felt public lands were under their control, and access by the public was discouraged by grazing permit holders. Both viewpoints are accentuated in "checkerboard" land ownership states such as Idaho.

Second, agriculture's perception was that IF&G had been insensitive in administering wildlife programs in the state. It appeared to some agricultural interests that IF&G had pursued the single objective of increasing wildlife populations without regard for private land impacts. These people also asserted that production of crops, grazing carrying capacities on public and private lands, and other factors had been overlooked by the department in their attempts to maximize game numbers. In the extreme, this resentment toward IF&G appeared to surface as a desire to punish the department through adverse publicity, re-directing resources, and limiting their authority.

Conclusions

Wildlife depredation is an extremely complex issue. At the root of the issue are property rights disputes relating to the publicly owned wildlife resource and public and private land resources. Resolution of the issue rests with determining the appropriate mix of multiple uses and users of these various resources. Conflicts and tensions will likely increase with the trend toward urbanization coupled with the amenity and recreational values that society is placing on these resources. To that extent, wildlife depredation is similar to other public concern about agricultural production and resource use (water quality, chemical usage, food safety, and a few others).

Idaho needs to determine "optimum" big game numbers within the state. Hopefully, these decisions will be based upon physical, biological, and financial constraints. It appears the state can no longer afford to allow IF&G to maximize game populations without regard to constraints such as carrying capacity of winter ranges and financial burdens on private landowners.

Analysis of the situation may show that from an efficiency perspective, optimal game numbers may be higher than current levels. However, many of the distributional impacts will come to bear on landowners. Provisions should also be made to mitigate landowner impacts.

The wildlife depredation story in Idaho is not complete. Annual cycles of increasing wildlife numbers, drought, and other factors may lead again to depredation damages to agriculture. Costs will vary cyclically with the development of these specific situations. The 1990 Idaho Legislature acted upon the recommendations of the negotiating committee providing the mechanism for developing a depredation program (SB1515). A funding mechanism (SCR135) to fully implement the program failed to pass during the 1990 session. The 1991 session appropriated monies to establish both funds recommended by the negotiating committee (SB1231). With this action, the Idaho Wildlife Depredation program is established and appears ready to handle wildlife damages in the future. Finally, the recommendations and solutions proposed by the negotiating committee and adopted by the legislation, appear to be a positive first step in the process. However, specification of filing procedures, information that claimants need to provide to validate claims and responsibilities of landowners prior to filing claims still need to be refined.

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Influence of the Animal Rights Movement on Range Management Activities-Productive Directions

Robert H. Schmidt

A democracy allows for freedom of expression and the opportunity for nonconventional viewpoints. This has certainly encouraged the formation and growth of the animal rights movement. The philosophical strength behind the animal rights paradigm lies in the belief that all animals, human and nonhuman alike, have a moral equality that should defy separation. One leader of the animal rights movement has summed it up as an "equal consideration of interests." Simply stated, the animal rights philosophy dictates that the use of nonhuman animals in biomedical research, food and fiber production, recreational uses such as hunting and trapping, zoological displays, and controlling wildlife damage, among others, is totally inappropriate unless it is ethically and morally proper to subject humans to the same or equivalent treatment.

This philosophy clearly does not sanction a number of activities currently associated with the management of rangelands. These activities include the production of livestock such as cattle, sheep, and goats; invasive research manipulations of range animals; the control of free-roaming horses and burros; rangeland rodent population reduction; most predator management systems; rangeland hunting operations; and the production and harvest of forage materials to maintain the livestock industry.

However, the ***animal rights*** philosophy is not to be confused with the ***animal welfare*** philosophy. Proponents of animal welfare do not promote equal rights for nonhuman and human animals (Schmidt 1991). Rather, adherents to this philosophy desire to reduce pain and suffering in animals. Livestock production, predator management, and other rangeland-related activites are not opposed *per se*; however, the concern here is that these activities are performed and accomplished in a manner that reduces, minimizes, or eliminates animal suffering.

Because the animal rights movement is philosophically opposed to many activities currently performed on rangelands, little compromise is anticipated over the next decade and beyond. The relatively small yet vocal minority of "animal rightists" have neither political power nor the heart of the social majority. They do stimulate the public into thinking about the role and use of animals in our society, however. This heightens the public's sensitivity to animal welfare-related issues.

Animal welfare concerns are currently affecting the *status quo* of rangeland management with concerns about native species of wildlife versus domestic livestock; biodiversity and endangered species; predation management systems such as trapping, aerial gunning, and the use of toxicants; and free-roaming horse management being influenced at the political level through legislation, initiatives, and judicial and executive interpretation. Researchers involved with the use of animals already must receive approval from institutional animal use and care committees prior to initiating a project.

It will be realistic and productive to focus animal welfare concerns on rangeland management systems. The range management profession needs to demonstrate that it is a caring, progressive, professional, and socially responsible profession. The Society for Range Management can clarify this role through position statements, activities, and testimony. This clarification must not focus simply on defending current activities. It must, in order to maintain its leadership into the future, focus on upgrading management technologies to make them socially acceptable, progressive, and a role-model for other professional natural resource management organizations and agencies.

Livestock producers on rangeland are looking to SRM for leadership in how to address the animal rights issue. Assisting these producers in reducing their fears as to the influence of animal rights believers and focusing their industry in progressively tackling animal welfare considerations should aid in softening future conflicts and giving them positive direction. This effort may involve the development of new techniques, the creation of alternative management paradigms, and a revision of standards of conduct for managers and scientists. The effort must not involve fooling the public with no concern about being caught. The time is past to educate the public. We must allow the public to educate us, the resource management professionals.

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Beavers and Riparian Ecosystems

Charlie Clements

The role of beavers in riparian ecosystems of western North America is a two-edged sword. Meadows created by beaver dams and ponds, with all their associated biological diversity, bring the impressions of nature at its best. Over-utilization of woody vegetation, bank erosion, and catastrophic floods from bursting beaver dams form a contrasting view.

This review of the role of beavers in past and present riparian ecosystems is offered to encourage land managers to be aware of the importance of these animals. My review concentrates on the western Great Basin, but the principles discussed apply to western North America.

Taxonomy

The North American beaver *(Castor canadensis)* is one of two species belonging to the rodent family Castoridae (Hill 1982, Burch 1985). The other species *(Castor fiber),* resembles the North American beaver in size and appearance but is found in Europe and Asia.

The earliest beaver fossils date from the mid-Tertiary of North America. Fossil beavers include giant forms. The modern day North American beaver dates from the Pleistocene (Kowalski 1976).

Historical Relations

Much of the earliest exploration of far western North America can be attributed to the search for beavers by trappers. During the early 19th century beaver pelts, as a source of felt for hats, along with demands for fur for garments, brought trappers to the wilderness. Finan MacDonald and Michael Bourden led the 4th expedition of the Hudson Bay Company in 1823 that reached the extreme northern part of the Great Basin. Bourden was killed by Indians and MacDonald wrote, "when that country will see me again, the beaver will have gold skin" (Phillips 1977).

Peter Skene Ogden then led the next six brigades for the Hudson Bay Company, and first reached the Great Basin in 1826 at the present location of Malheur Lake, in east-central Oregon. On that trip he wrote, "I may say without exaggeration, man in this country is deprived of every comfort that can tend to make existence desirable. If I can escape this year I trust I shall not be doomed to endure another" (Phillips 1977). But Ogden did return and from 1828–1830 explored parts of the Great Basin which lie in present day Idaho, Nevada, and Oregon.

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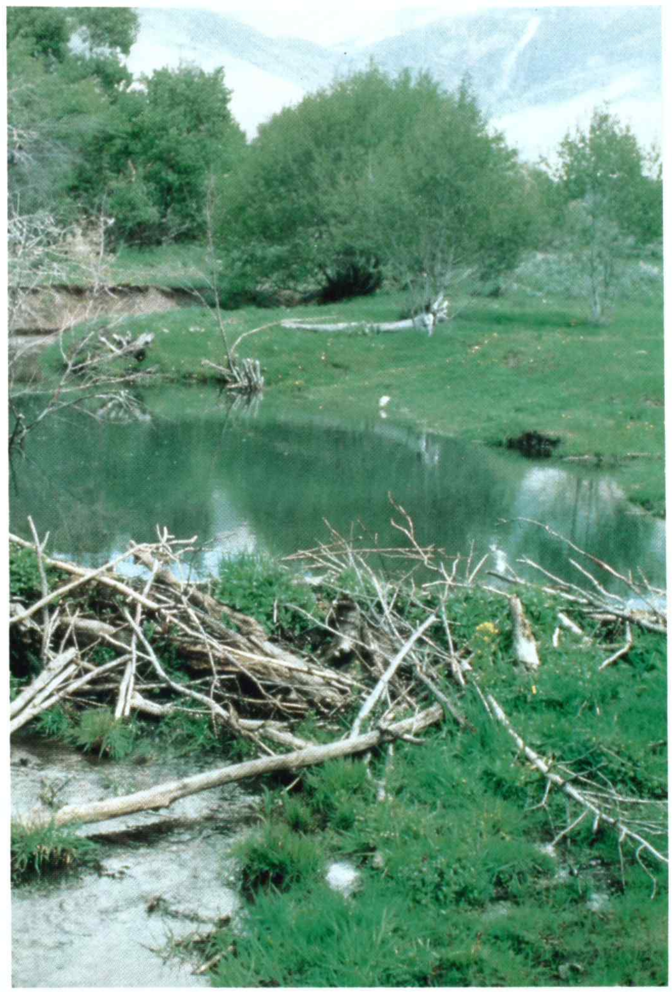

Fig. 1. *Degraded meadow improved by beaver activity. (Photo courtesy of Wayne Burkhardt)*

The wanderings of fur trappers created tensions among the Spanish, French, English, Russians, and Americans, all of whom were attempting to establish and maintain their claims over what eventually became the western United States. These pressures led the Hudson Bay Company to develop a policy of deliberately over-trapping the eastern and southern borders of their Pacific Northwest territories. This destruction of the beaver resources was designed to discourage American trappers from encroaching on what was claimed as British territory (Bryce 1904).

Trappers continually pushed on to new trapping areas because the existing beaver populations were largely destroyed by excessive trapping that failed to leave viable colonies to repopulate the areas trapped. By late in the 19th century much of the North American beaver population was over exploited.

Near the end of the 19th century many states adopted protective laws concerning wildlife resources which included bans on trapping beavers. Game management agencies on the stage and federal level began reintroducing beavers to areas where they had been completely removed by trapping and to areas where they did not previously occur. Currently beavers probably exist over a broader range in North America than they did at contact time with European man.

When Peter Skene Ogden explored Nevada from 1828 to 1830 he recorded that the Humboldt River had five forks, three of which contained beavers, and that beavers were quite numerous in those forks. He also recorded beavers to be present in other systems of Nevada, such as the Colorado and Owyhee Rivers, but stated that the Carson, Truckee, and Walker Rivers were free of beaver signs (Cline 1988).

All of these mentioned systems currently contain beavers, along with many other systems which were recorded by early explorers to be free of beaver signs. Reintroduction programs probably can be credited with the present occurrence of beavers in many areas.

Were beavers native to those systems that were recorded to have no beavers? Considering that the main purpose of these early explorers was to find areas occupied by beavers, and they had qualified trappers along, their records of certain systems being free of beavers at the time of their passage should be very reliable. Could beavers have been native to systems like the Carson, Truckee, and Walker Rivers before early explorers passed through, and, if so, what brought about the extinction of beavers in these systems? Perhaps disease, overtrapping by native Americans, or predation caused their disappearance, or maybe they were not native for some unknown reason.

Life History

Beavers may be exceeded only by man in their abilities to alter the environment. Through their construction of dams, beavers can change degraded meadows into a pond environment with a dependent diversity of animal and plant species (Fig. 1). For example, the density and species diversity of birds has been found to increase due to beaver activities (Medin and Clary 1990). In contrast to such desirable effects of beavers, they also can cause flooding of agricultural areas and highways and create havoc with irrigation systems. Beavers can also overutilize preferred woody species along streams, such as aspen and cottonwoods, and in so doing cause a temporary decrease in tree species diversity (Yeager and Rutherford 1957), and eat themselves out of house and home (Fig. 2).

A beaver colony is made up of one or more families consisting of a pair of adults, yearlings, and kits. Beavers are known to be monogamous, colonial, and territorial. If a beaver's mate dies, a new mate is selected from dispersing two-year-olds or other unmatched adults (Buech 1985). Beavers breed once each winter and have a gestation period of about 107 days (Wilsson 1971). Litters consist of from one to nine kits. The litter size corresponds with the quality of the environment the colony occupies and the severity of the winter (Gunson 1970, Payne 1975).

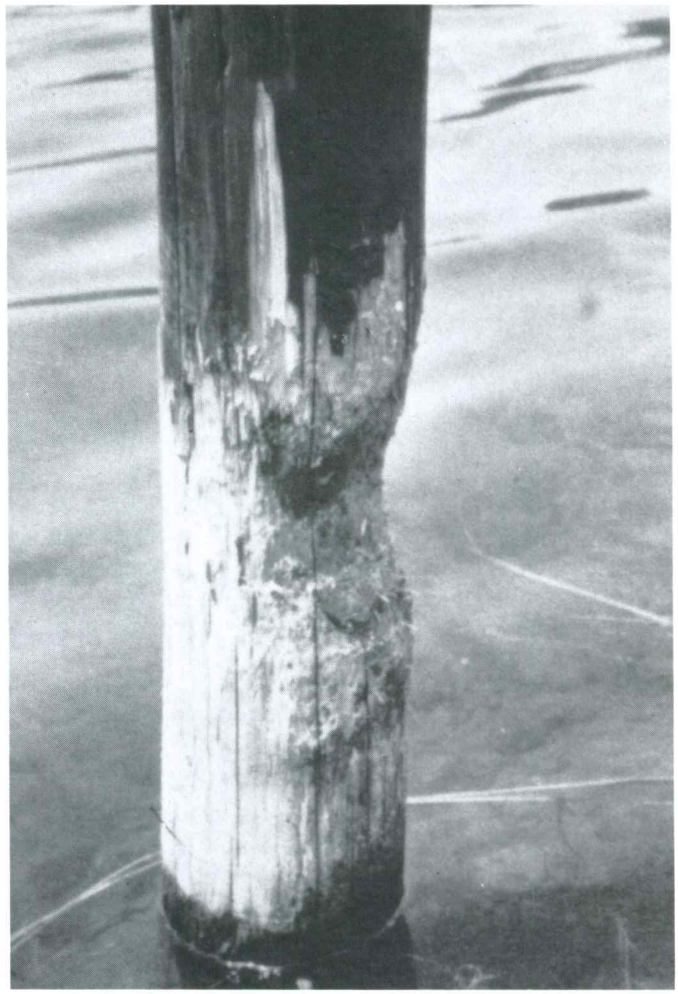

Fig. 2. *Beaver cutting of a creosote soaked telephone pole. (Photo courtesy of R.J. James)*

The young are born with open eyes and fur and weigh about a pound. Newborn kits can move about within the lodge. At about two months of age they are weaned and must forage outside the lodge. As yearlings, beavers learn to become accomplished builders. They leave their home lodge in search of mates and establish new lodges (Buech 1985).

They may use old dams, and/or lodge structures that already exist by refurbishing them or they may build their own structures. They start building a dam, which usually takes place from August through October, by placing branches at a chosen site and adding mud and other debris from the bottom near the dam. Once the height of the dam is near the preferred level, the construction of the lodge begins (Buech 1985).

The building of the lodge starts with the beavers gathering and piling sticks on shore close to the water. The beavers then start piling sticks in a chosen area and keep adding until a substantial pile starts to accumulate. Mud is then added to the bottom of the pile. The chosen site may be surrounded by water, which they prefer, or they may build it along the edge of an impoundment or on shore (Buech 1985).

Beavers are vegetarians and feed during fall and winter on the tender bark of willows, aspen, cottonwood, and alder. During spring and summer they prefer to feed on sedges, grasses, and forbs, and other aquatic and riparian plants (Jeffress 1975).

Population Dynamics

Because their ponds and lodges serve as a safety refuge, beavers populations are not preyed upon intensely by native carnivores. Bobcats, coyotes, wolves, mountain lion, bears, wolverines, and lynx have been known to take beavers. Where wolves still exist, beavers may be an important component of their summer diet and predation upon beavers can be quite high (Smith and Peterson 1988, Fuller and Keith 1980, Peterson 1985, Voigt and Kolenosky and Pimlott 1976). Diseases such as Tularemia and rabies may also affect beaver populations.

With natural enemies not being a major factor in population control for beavers in most areas, man and his activities have a large influence on population dynamics. Harvest rates tend to reflect prices being paid for beaver pelts. For example in 1975–76 pelt prices in the United States averaged $6.00 each and 188,300 were harvested. In 1976–77 the price rose to $16.00 and 232,700 were trapped for commerce (Hill and Novakowski 1984).

Management

Management plans for riparian areas should include an active plan for beaver management. A beaver colony will selectively exploit the woody vegetation of a riparian area. In western Nevada, along the eastern base of the Sierra Nevada, beavers will virtually eliminate black cottonwood from the riparian zone, but leave mountain alder. This changes the tree density, tree height, availability of tree cavities, and many other aspects of the riparian habitat. Conversely, unlimited trapping can eliminate the beaver population from riparian areas, which can decrease the diversity of a riparian area. A study done in Idaho suggests that beaver pond ecosystems can provide important habitats for nongame breeding birds in the Western United States (Medin and Clary 1990).

Habitat changes resulting from beaver activities can have extreme influences on the quality of a riparian system and can be either negative and positive. Each individual area is different and therefore management plans may need to be specific for each area.

The most practical way of controlling beaver population is through systematic harvesting of surplus animals. This can prevent damage to the riparian habitat while maintaining the beaver population.

In this age of awareness of animal welfare it is necessary to involve the general public in the design of management plans for beaver management. Unlimited beaver populations can be bad for riparian habitats and ultimately for beavers themselves. On the other side of the coin, to remove beavers completely from an area would eliminate the natural part of the environment that is important to many species of animals and plants. These are very emotional and difficult issues for land managers to work with, but they are important aspects of natural resource management.

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The Geomorphic Process: Effects Of Base Level Lowering on Riparian Management

Linda S. Masters, J. Wayne Burkhardt and Robin Tausch

Recent emphasis in range management has centered on the maintenance and rehabilitation of riparian areas and associated meadows. These sites provide high forage values, critical wildlife and fisheries habitat, and important hydrological benefits. Many stream systems are downcutting or laterally eroding, causing concern over the stability of the riparian areas. This instability is believed by many land managers, biologists, and environmentalists to be the result of poor land uses. However, stream channel conditions are often the result of interactions between man's use of the land—such as urban development or range use—and natural, ongoing geomorphic processes. Common remedies attempting to arrest erosion include installing stream structures or altering domestic livestock grazing. Too often, these remedies are applied without first understanding the dynamics of the entire drainage system or the driving geomorphic processes. Streams are dynamic systems, constantly adjusting to changing conditions, and it is the natural state of streams to downcut and laterally erode. Whether a stream is downcutting or aggrading at any point along its channel depends on both upstream and downstream conditions.

This paper focuses on some of the physical and geomorphic processes of the Great Basin watersheds. The discussion is directed to the current impacts to stream channel morphology from the drying-up of the once massive ice age (Pleistocene) lakes.

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Stream Dynamics

Tectonic forces and climatic fluctuations in the last 25,000 years (Cronquist, et al. 1972) have not allowed steady state conditions to become established on most of the large watersheds in the Great Basin. Present day climatic conditions are conducive to occasional extreme precipitation events which produce high stream flows causing dramatic changes in stream channel morphology. Fol-low-ing these events, the streams once again undergo gradual changes leading toward a more balanced state. This process may take several hundred years depending on stream characteristics (e.g., steepness, channel material and confinement).

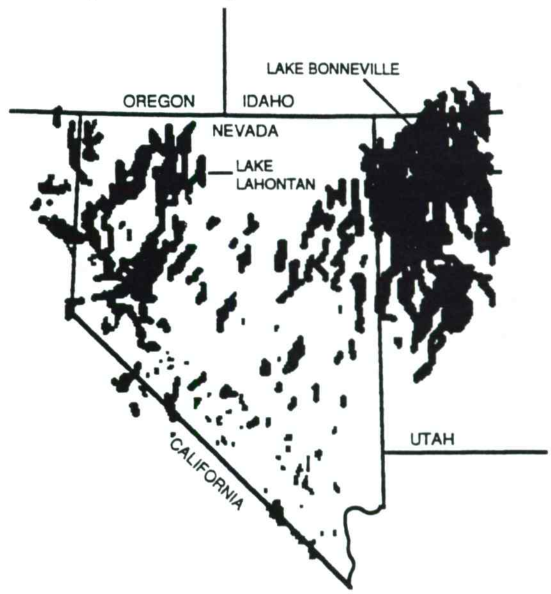

Fig. 1. *Pleistocene Lakes of the Great Basin.*

An important, but often overlooked physical process which always initiates readjustment in stream morphology is a change in base-level. The base-level of a stream is defined as the lowest level to which the stream can erode its channel or as the elevation of the stream's mouth where it enters the ocean, a lake, reservoir, or another stream (Hamblin 1982). A change in base-level always leads to some kind of readjustment in the stream bed gradient, width, depth and sinuosity (Lowe and Walker 1984).

Lowering of base-level creates a steepened gradient that induces accelerated flow and causes the formation of a headcut. The headcut migrates upstream with a corresponding downstream deposition of eroded material. This process continues throughout the watershed or until the advancing headcut encounters resistant bedrock. Other adjustments such as increase in channel width and decrease of bank angles will occur until a new steady state cross-section geometry is established. (Richards 1982).

Pleistocene Lake History

During the Pleistocene ice-age, Lake Lahontan (Fig. 1) covered an area of about 45,000 square miles in northern and western Nevada, with small areas in the adjoining states of California and Oregon (Jones et al. 1925). One-hundred other valleys in the Great Basin also contained perennial lakes during that time (Williams 1983). These "pluvial" lakes were formed during a climatic regime in which there was greater net moisture available than is available in the same area today (Flint 1971). Lake Bonneville in Utah and Lake Lahontan in Nevada were the largest of these pluvial lakes. Base levels of the streams leading to the lakes have fluctuated as lake levels changed dramatically over time. This has created changing

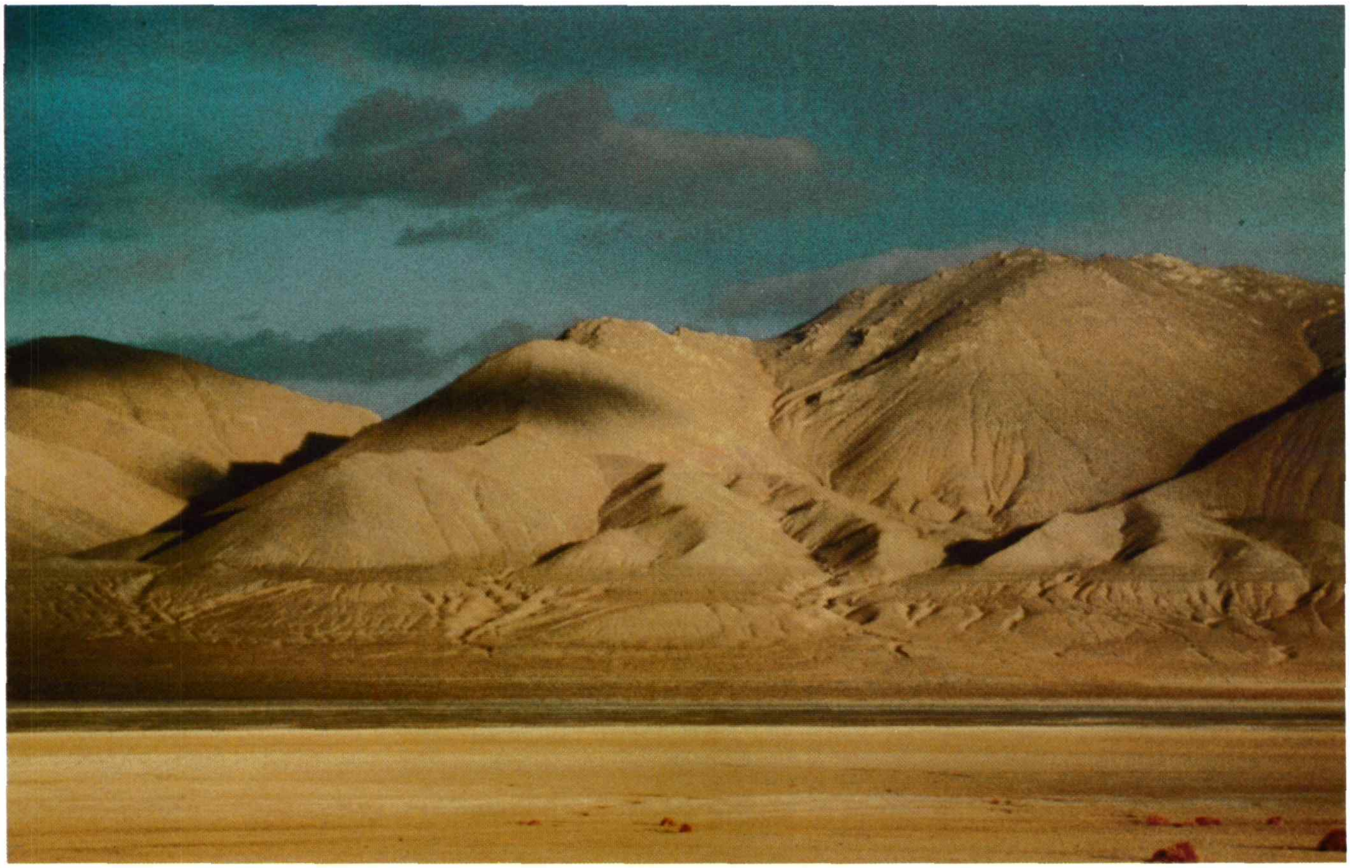

Fig. 2. *Channel entrenchment initiated by base-level lowering in small drainage basin adjacent to a remnant Pleistocene Lake (Winnemuca Lake).*

control points for erosional and depositional processes. Currently in Nevada, the dry playas and lakes within the closed basins represent the base-level for the surrounding drainage systems.

It is generally agreed that there were one or more peaks in lake level from 25,000 to 15,000 years before the present (B.P.) and one or more very brief high lake levels in some basins about 12,000 years B.P. (Mifflin and Wheat 1979). During the last major pluvial stage, Lake Lahontan raised in elevation from 3,800 feet to 4,200 feet (Hawley 1968) and had a maximum depth of about 700 feet at Pyramid Lake and about 500 feet at Carson Sink (Morrison 1965). As the Pleistocene ended, Lake Lahontan was full and surrounding streams had aggraded (Davis and Elston 1972). Drainages formed during this time terminated at the upper shoreline of the lake and stream energy dynamics were controlled by high lake levels.

About 10,000 years before the present, the Great Basin climate shifted toward warmer and dryer conditions (Harper and Alder 1972) and recent studies suggest that lakes dropped rapidly to low levels by 9,000 years B.P. (Lajoie 1983). From about 3,500 to 1,400 years B.P., the climate was again cool and moist enough for episodic lakes to form in such basins as the Black Rock Desert, a playa remnant of Lake Lahontan (Davis and Elston 1972). Since that period minor cyclic climatic changes have occurred. Within the last few hundred years, drying and warming trends have again caused the evaporation of Pleistocene lake remnants and most lake basins in Nevada are now dry playas. However, exceptional snowfall during the early 1980's produced a twenty-five foot rise in Pyramid Lake and historic lake level rises in other basins such as Salt Lake and Malhuer. Cycles of stream channel entrenchment and deposition caused by these numerous lake fluctuations have created a series of headcuts which continue to successively sweep through the drainage networks in an upstream direction (Schumm and Hadley 1957).

Drainage Response and Management Concerns

As Lake Lahontan receded, the base level for all rivers entering the basin was lowered and cutting of the present river channels was initiated (Davis and Elston 1972). The lowering of the base level increased the erosional energy of the rivers. As a result, expanded drainage systems are currently forming through the readjustment processes of downcutting, headward erosion, slope retreat and extension of drainages downslope. In small, steep drainages adjacent to remnants of Pleistocene lakes the effects of these processes are clearly demonstrated (Fig. 2). Downcutting and slope retreat occurs in all segments of the streams; headward erosion is extending the drainage network upslope in the moun-

Fig. 3. *Channel entrenchment in a large drainage basin (Long Valley Creek) initiated by base-level lowering at Honey Lake.*

tains above the old shoreline and downcutting is extending the drainage system downslope into old lake sediments.

In larger drainage systems, the effects of these processes are not as easily perceived. They are, however, still occurring. In the Long Valley drainage which empties into the Honey Lake basin northwest of Reno, downcutting through old Pleistocene lake deposits is apparent between Herlong and Doyle (Fig. 3). In this case, readjustment results in a different geomorphological expression of the downcutting processes than that seen in small steep drainages. Here the entrenchment is much broader and flatter, reflecting the surrounding basin characteristics. In this watershed, headward erosion has, so far, extended 50 miles up the drainage to a point just west of Bordertown on the California and Nevada border. The existing headcut in this portion of Long Valley marks the upstream extension of the erosion processes initiated several thousand years ago by the drying up of the Honey Lake arm of pluvial Lake Lahontan (Fig. 4). The headcuts are still slowly moving upstream degrading conditions in the remaining meadows irrespective of current, past, or future land use in the valley.

The downcutting of the main channel of Long Valley Creek has also affected tributaries entering the stream. As the headcut in the mainstream moves past a tributary, the local base-level of that drainage is drastically lowered, thereby initiating erosional adjustments in the tributary (Fig. 5). Erosion in tributaries can mean the loss of valuable meadows and riparian areas as headcuts move up through valley bottoms. In addition, reduction of base-level not only lowers the drainage outlet of all tributaries, but it also profoundly affects the ground water levels in the basin. Lowering of a water table can result in encroachment of woody shrubs into a previously productive meadow. It is important to recognize the underlying physical processes taking place in this area so that management or rehabilitation programs are aimed at the appropriate target. Man induced perturbations to the Long Valley watershed have obviously affectd this drainage, but the dominant cause of channel erosion and water table lowering is base-level lowering and the subsequent headward progression of the stream channel readjustments.

The extent to which resource managers need to be concerned with these large scale processes becomes apparent when a watershed the size of the Humboldt drainage is considered (Fig. 6). The present day Humboldt river is about 400 miles long and flows in a westerly direction

Fig. 4. *The current location of the Long Valley headcut, which was initiated by the drying-up of Honey Lake several thousand years ago.*

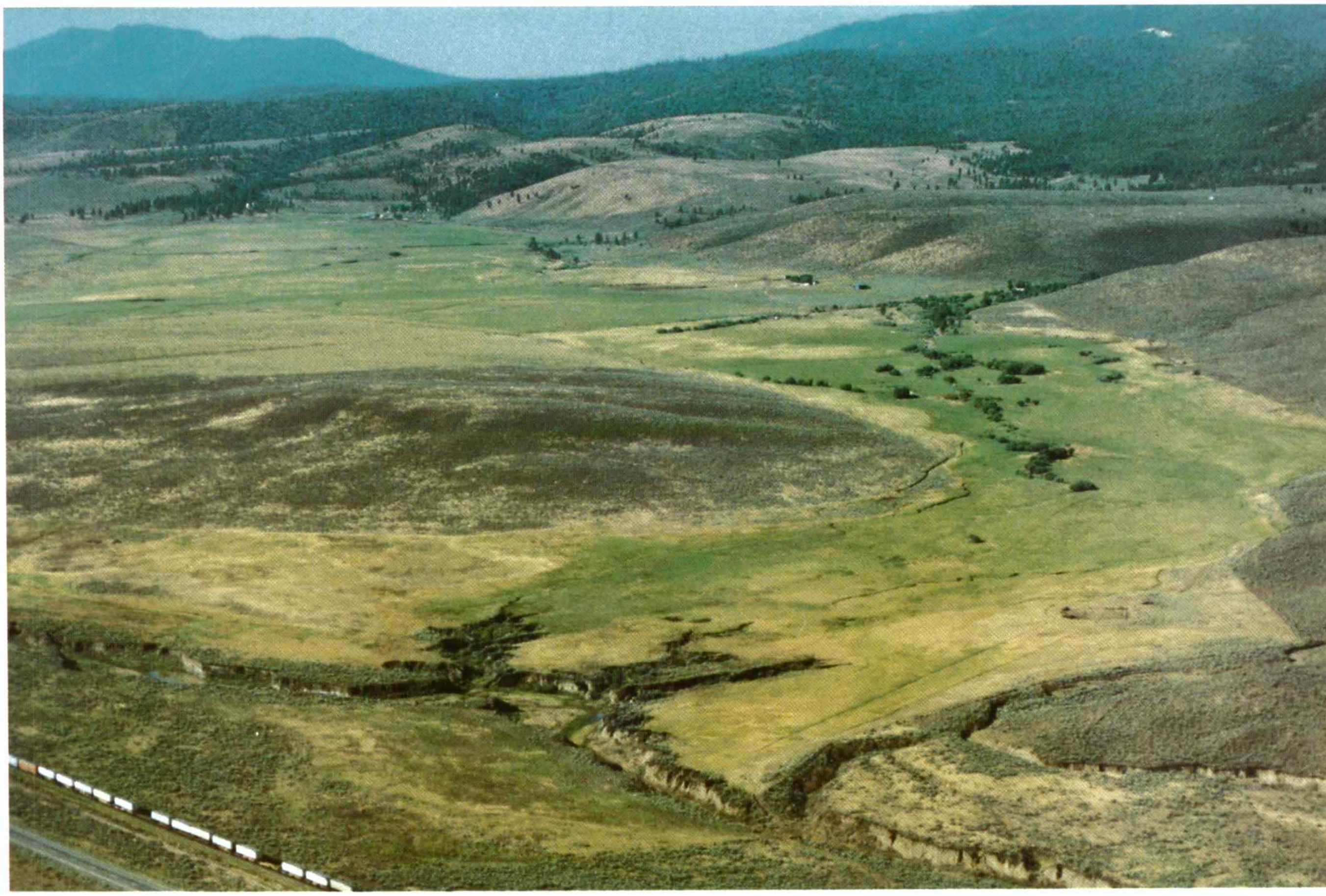

Fig. 5. *Initiation of erosional adjustments in a tributary subsequent to main channel entrenchment of Long Valley Creek.*

from headwaters in the Ruby Mountains (south fork) and the Independence Range (north fork) terminating in Humboldt Lake in west central Nevada. During the period of maximum depth of Lake Lahontan, the Humboldt River emptied into the lake northeast of Winnemucca. Today the terminus of the river at Humboldt sinks, south of Lovelock, has standing water only in wet years. The 500′ drop in base level this represents is still dramatically affecting the entire drainage system across northern Nevada.

Major drainages into the Humboldt River include: Grass Valley and Paradise Valley (Little Humboldt River) in the Winnemucca area, the Reese River Valley near Battle Mountain, Pine Creek and Susie Creek valleys near Carlin, and the South Fork and the North Fork of the Humboldt River near Elko (Fig. 6). All of these tributaries show various stages of downcutting, headward erosion, lateral erosion and aggradation in response to changes in the base level of the main fork of the Humboldt River. It must also be recognized that smaller drainages emptying into the above-mentioned tributaries are also being affected as headward erosion continues to proceed throughout the entire network of streams in the system. This natural process is on-going irrespective of past, present, or future land use.

Conclusions and Discussion

The drying of the Pleistocene Lakes has resulted in widespread downcutting and headward erosion that is continuing throughout watersheds in the Great Basin. However, this knowledge has largely been ignored or overlooked by many biologists, land managers, and environmentalists.

It is very easy to recognize the effects of lowered base-levels resulting from the drying-up of the Pleistocene lake systems on a small scale such as those visible at the Winnemucca Lake playa (Fig. 2). It is much more difficult for a resource manager to visualize these same impacts on a large scale when the closest playa is a hundred miles or more away.

It is important to recognize and understand these relationships so that responsible management decisions can be made. Removing or reducing domestic livestock from a meadow will not prevent the loss of that valuable land if the more dominant erosion processes associated with base-level adjustments are driving current stream channel changes.

Channel erosion and deposition in response to base level changes is a natural geomorphic process. Climatically driven Pleistocene Lake level changes, crustal tectonics such as the Stillwater Mountains faulting, or man-made channel alterations such as road crossings or reservoir con-

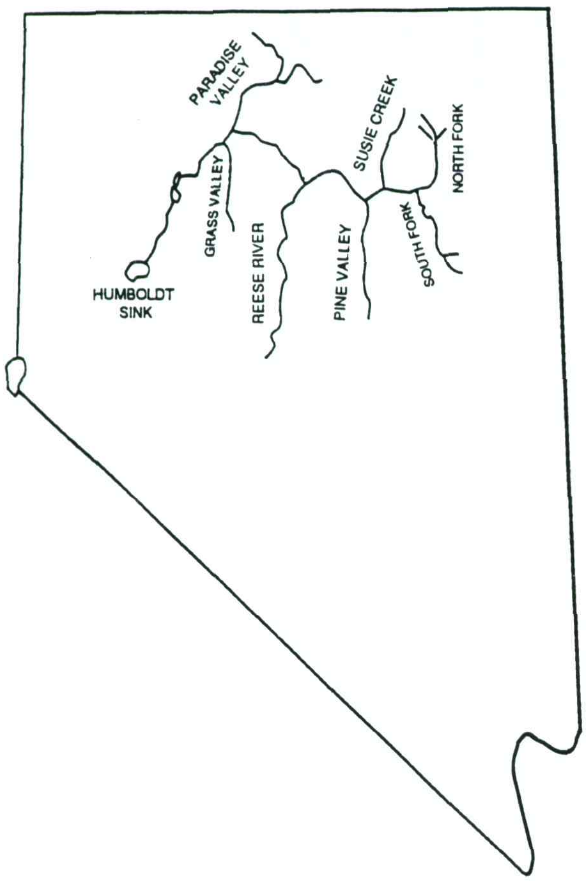

Fig. 6. *Humboldt River drainage and major tributaries.*

struction all produce similar results. Road construction, bridge and culvert installation, reservoirs and water diversions, channelizing, and revetment projects can all affect local stream base levels and initiate subsequent upstream and downstream channel adjustments.

The land manager, when confronted by current stream entrenchment and active head cuts should look well beyond just land use in the immediate locale. The entire stream drainage should be evaluated. Physical and geomorphic processes, more so than biotic impacts, are often the driving forces behind ongoing stream dynamics. Proper management and rehabilitation recommendations for stream systems require an evaluation of these processes as well as land use.

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Buffalo, Early Range Users

Heather Smith Thomas

Long before the American pioneers laid eyes on the mountains and plains of North America, there were "cattle" on our western ranges. Bison roamed the hills, migrating from winter to summer grazing areas, making seasonal use of these lands much as our domestic livestock do today. The bison and the domestic cow belong to the same family (Bovidae) and are genetically similar (they can interbreed and produce fertile offspring). They are also very similar in their grazing habits and preferences.

Ancient bison were larger than the modern "buffalo" and co-existed with other giants of their day like the woolly mammoth. We're not sure when woolly mammoth became extinct or when the ancient bison changed to smaller form. In 1971 archaeologists discovered the remains of a prehistoric man's meal at a site 18 miles west of Idaho Falls, Idaho, which consisted of bones from a woolly mammoth and a bison. Carbon dating showed that the elephant leg bone was 12,250 years old. The bison bones are presumed to be the same age.

This discovery gave a clearer idea about the evolutionary progress of modern bison and supported the theory that bison continually lived (and were hunted by prehistoric men) in the upper Snake River country of Idaho for many thousands of years. Earlier discoveries had already unearthed 8,000-year old buffalo bones at other sites in Idaho. But the 12,250-year-old bones gave even stronger evidence that the ancient giant buffalo did not become extinct, but merely fluctuated in herd numbers and body size (due to climate changes and food availability) and gradually changed into our modern, smaller type of buffalo.

One archaeologist's theory, after studying the bones of other animals that competed with the bison for food, was that bison may have become smaller in body size and in numbers at a time when North America was hotter and drier, after the Ice Age, when there wasn't much grass. Many large herbivores died off. The bison herds dwindled, and evolution created a smaller animal—better able to survive with less feed. Starvation and natural selection worked together to produce a smaller buffalo. The giants died off more readily or their nutritional state made it more difficult for them to reproduce, and eventually the body size of the whole species was reduced as Mother Nature ruthlessly culled the herds. When the climate became more like the present, bison populations increased again, but the animals are still genetically smaller in size than their early giant ancestors.

One type of buffalo that roamed the Northwest until the 1800's has become extinct. The buffalo west of the Continental Divide were called mountain buffalo *(Bison bison athabasca)*. These were smaller, more active, more timid, with lighter and silkier hair than the bison of the plains *(Bison bison bison)* The plains buffalo were more numerous and had a much wider range.

Mountain buffalo lived in an area which is now Idaho, Oregon, and Washington, and migrated north and south somewhat with the seasons. In southwestern Idaho there were also some plains buffalo, but most of the buffalo in the Pacific Northwest were the smaller variety, the mountain buffalo.

Photo by Michael Thomas

Buffalo horn shells.

Many old buffalo bones, skulls, horn shells, etc., have been found in the Northwest, especially in areas where the Indians killed large numbers. In southwestern Idaho between the Snake and Owyhee rivers there are two sites where the Indians herded the animals off rocky cliffs to their deaths. Other "buffalo jumps" have been found in Lemhi County and Custer County in Idaho and in other locations in the Northwest.

Buffalo jumps usually consist of rimrock terrain with steep cliffs, where the cornered bison were forced to leap from high ledges and were killed or injured on the rocks below. At one site in Owyhee County, stone fences were built at the outer edges of the ridge to keep the stampeding buffalo from escaping, directing them to the cliff's edge. When the leaders got to the edge they could not stop, forced on over by the stampeding herd behind them. Carbon dating of weapons used during the hunts showed the arrows and spear points to be 4,000 years old.

A buffalo jump near Challis, Idaho, was confirmed by archaeologists as having been used by Indians between 1,500 A.D. and 1,750. Buffalo jumps were not used after the Indians acquired horses. Western tribes obtained horses from the Spaniards in the Southwest, beginning about 1680. Raiding and trading from tribe to tribe resulted in spread of horses northward until most of the Indians were mounted by the time the American explorers entered the West in the early 1800's. After becoming mounted, the Indians hunted buffalo from horseback and there was no need to use the jumps. The use of horses in hunting these animals made the hunting much easier, and contributed to near extinction of the buffalo.

The numbers of buffalo fluctuated, possibly due to climate, feed, and hunting pressures. When Lewis and Clark came through Idaho in August of 1805, they saw no buffalo and the local Shoshoni Indians were starving for lack of game, living on berries, roots, and what salmon they could catch along the river. At that time the Indians in the Lemhi Valley obtained buffalo meat for their winter food supply by making an annual fall hunt in eastern Montana where the plains buffalo were plentiful.

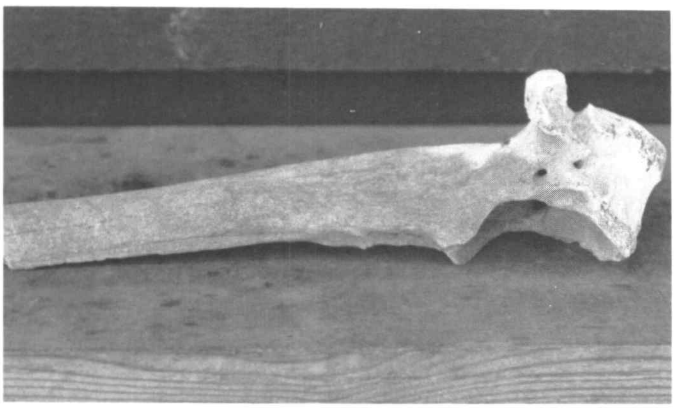

Photo by Michael Thomas

Buffalo "hump" vertebra. The vertebrae in the hump area have long spines.

A few years later, however, explorers and fur trappers found mountain buffalo in what is now eastern Idaho. In 1824 Alexander Ross led a party of fur trappers through the Big Hole basin in Montana, over Lemhi Pass into Idaho, going down the Lemhi River and up the Salmon. They reported seeing many buffalo along the way. One valley, possibly the Pahsimeroi Valley or Round Valley near Challis, had an estimated 10,000 buffalo in one herd.

In 1825 Peter Skene Ogden led the Hudson Bay Company expedition across Bannock Pass into Idaho in February and found buffalo by the hundreds. The buffalo were possibly wintering in the Lemhi Valley or may have been trapped there, unable to go to more southern ranges. Ogden reported very deep snow in the passes to the south. Ogden wanted to go south into better beaver country and in late March sent six men on horseback to explore one of the passes to find a way through. Over the last 12 miles, they drove about 600 head of buffalo in front of them to break trail through the deep snow.

There are few reports of mountain buffalo in the Northwest after the 1840's and 50's. It is believed that severe winters or disease (or both) and hunting pressure by Indians and early trappers caused their decline and disappearance.

The buffalo were gone. These large herbivores had grazed the western rangelands for thousands of years. The ecology of these areas and the native vegetation and grasses had evolved under grazing by buffalo. These ponderous bovines had travelled all over the mountains, grazing the higher elevations and more northerly ranges in summer, migrating to lower valleys or going farther south for winter where deep snows did not cover the grass. In some places the deep trails made by migrating buffalo can still be seen. Even today a cowboy or hiker can occasionally run across a buffalo skull or a horn shell, evidence of mountain buffalo that roamed these hills.

The buffalo thrived, most years, eating the native grasses that had adapted to being continuously harvested by grazing animals. The buffalo grazed in herds, often covering an area in even greater numbers than our domestic livestock do today. But the buffalo didn't stay long in one place. They grazed out an area and then moved on. The way buffalo used the land was similar to one type of present-day range management method called short duration, high intensity grazing—using an area very thoroughly and then moving to another, giving the grazed portion time to regrow before grazing it again. This is often more healthy for the range than leaving a smaller number of animals in one area for too long a time.

The grazing animal has a unique relationship with the grass. He depends on it for food, and it depends on him for cultivation, better seed planting, and harvest. Grass can survive without being grazed, but it is never as healthy or vigorous as when periodically used by large herbivores. Grazing stimulates plants to greater growth and higher rate of reproduction and spreads the seeds over wide areas (some of the seeds that go through the bovine digestive tract remain viable). Grazing is the natural condition; this is the way the grasses have developed over the last several million years.

Under natural conditions, the rangelands historically grew a wide variety of plants (grasses, forbs, shrubs) that support a variety of animals, both browsers and grazers. With a variety of animals using the vegetation, no one species or type of plant is overused or killed out. Without grazers, the grass crowds out the shrubs; without browsers the shrubs crowd out the grass. The mountain buffalo had an important ecological niche and was crucial to the health of the range. This niche needed to be filled, after we lost the buffalo. Today it has been filled by his close relative. With well-managed grazing by livestock, we can assure healthy rangelands for years to come, supporting the same native grasses or other plants that have thrived since prehistoric times, and supporting an important large herbivore that fits into the ecological picture very well, harvesting an annually renewable resource and converting it into human food.

We still have the native browsers—deer and antelope. The elk and bighorn sheep use some grass, but not to the extent the mountain buffalo did. We lost a very important part of western ecosystem when we lost the buffalo. This would have put thousands of acres of rangeland into a stagnant and very unnatural situation except for one saving grace: we substituted domestic livestock for the buffalo.

Today our ranges are in better shape than they have been for a long time. Once again we are establishing a balance between the grass and the grazer. Making seasonal use of the range (and rotating pastures, not staying overlong in any one area), with a reasonable number of livestock, we are simulating an earlier era when these lands were seasonally and rotationally grazed by the wandering herds of mountain buffalo.

Impact of Elk in Catron County, New Mexico

James M. Jackson

In 1909 the last Merriam's elk, native to the Gila Forest was reported killed by a commercial hunter, and that species of elk became extinct. In 1936 the first 25 head of exotic Rocky Mountain elk were introduced on the Gila National Forest (Marston, 1990). Since 1936 the elk herd has increased to levels that are now creating conflict over the concept of multiple use and could threaten the habitat. How many livestock and elk can the Gila National Forest and the adjoining BLM and private lands sustain?

A BLM news release states that "the improving trend in rangeland condition is reflected by the large increases in wildlife populations since 1960. Elk, for example, have increased almost 800 percent, from 18,278 in 1960 to 142,870 in 1988." (Zilicar, 1990). Estimates of the increase in the elk herd in the West, are from less than 100,000 in 1930 to about 600,000 in 1987 on all the Federal Lands (Thomas, 1990). The New Mexico Department of Game & Fish has increased elk hunting licenses on public lands by 47% from 9,500 to 14,000 over the past five years. "Given a chance, elk have done well..." (NM Dept. of Game & Fish, 1989).

The utilization of the forage by livestock and elk may differ, but they often eat the same grasses and browse. As a result, both have to be managed to protect the natural resources. A few years ago on the Yellowstone Park, it has been estimated that 25% or 3,125 elk starved to death (winter kill) out of about 12,500 animals (Lemke & Singer, 1989). Before those animals died, what negative impact did they have on their habitat and how long will it take the range to recover with the continued pressure of the remaining animals?

A study by the Colorado Division of Wildlife on the impact of elk winter grazing on livestock production over the past three years showed that "elk grazing during the winter influenced the performance of cattle during spring" in direct relationship to various elk densities. "The birth weights of the calves of the cattle tended to decline relative to elk density," as well as effecting the conception rates of the cows (Hobbs & Baker, 1989). There can be no question that the density of elk impacts livestock.

Catron County consists of almost 4.5 million acres with about 2,800 people. Fifty percent of the land is controlled by the U.S. Forest Service; 13% by the BLM; 12% by the State of New Mexico; and only 25% private, much of that surrounded by Federal agencies. Because so much of the County is controlled by Federal agencies, the policies and management of the Federal lands has a tremendous effect on the economy and quality of life of the people. A Western New Mexico University study states that "much of the rural economy is dependent upon commodity production with a heavy dependence upon public resources....Elk hunting is very popular in Catron County; however recreation hunting is a nonbase industry with most of the economic benefits accruing outside the County. The total hunting impact on Catron County was approximately $600,000 while statewide the impact was $1.6 million for the 1988 Catron County elk hunt. The reason for the difference is that hunters and outdoor recreationists in general, purchase most of their supplies and equipment outside the County, mainly in the urban centers of New Mexico. The local impact in Catron County of cattle from public land ranches for 1988 was $18.8 million" (Thal 1990).

Background and Procedure

For the past few years the ranchers of Catron County have noted an increase in elk numbers. There has been a noticeable increase in depredation by elk on improved and irrigated pastures on deeded acres. There have also been observations of much greater utilization of the public lands by elk, as well as expansion of their range. The intent of the survey was to create a data base from the livestock industry, that in conjunction with the elk herd

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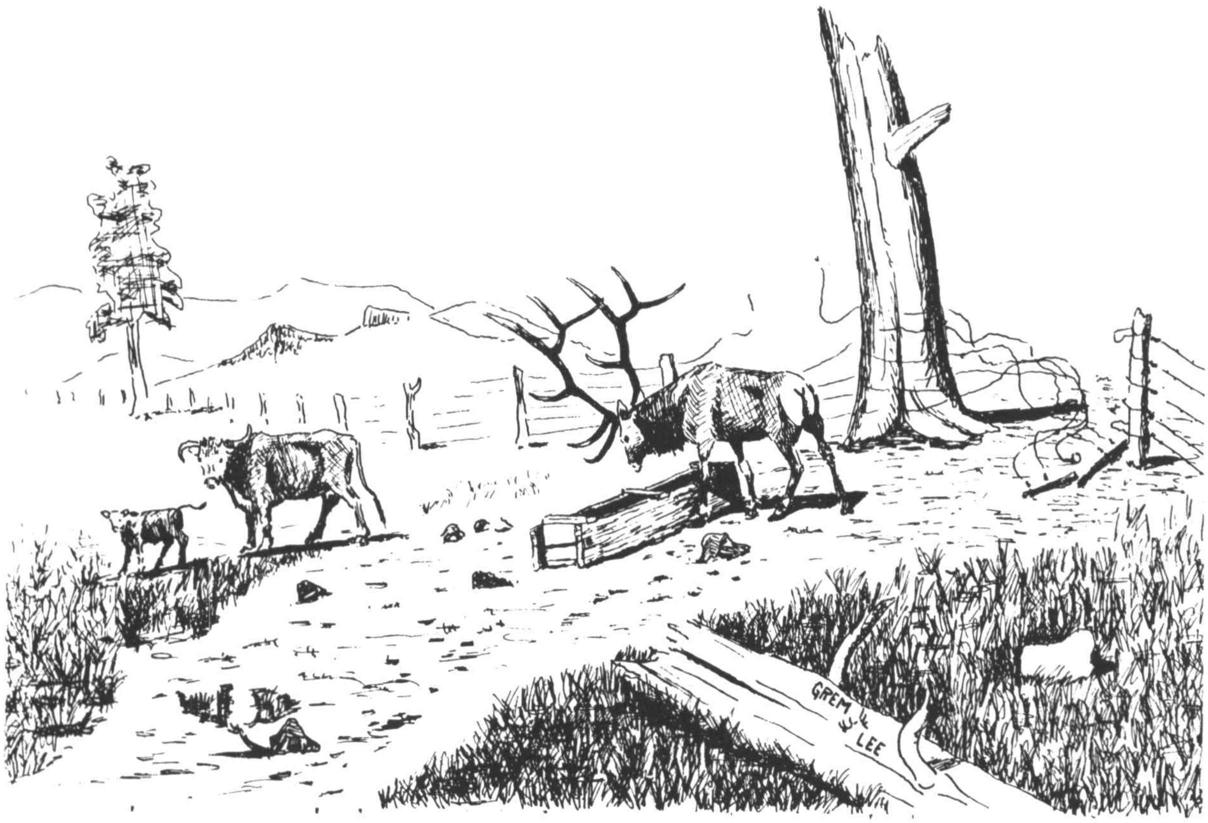

Drawing by Grem Lee of Apache Creek

estimates of the Forest Service and New Mexico Game & Fish, would give a better approximation of the size of the herd.

A questionnaire was sent to the permittees on the various allotments by the Catron County Farm and Livestock Bureau. After the due date, a telephone call was made to those Forest permittees that failed to respond. The numbers of elk are based on actual counts; estimates; and tied to telephone conversations or comments in the survey, estimates with a strong potential of accuracy.

On community allotments in which more than one permittee answered, the numbers were averaged for that area. Because some of the responses had low-high estimates for the Forest Districts, the low elk numbers were added up, and then the high numbers. The low and high numbers were then added and averaged to represent the high elk estimates for the District. The possibility of movement between allotments and of an individual elk being counted twice was taken into account by taking the final high estimate and dividing that figure by a factor of 2 to represent the final low estimate of each Forest District. Table 1 shows the results broken down by the Forest Districts for which there was a response. It is important to understand that the data do not represent the total elk numbers on the Gila Forest because 5 Ranger Districts were not surveyed in depth: the Black Range, Silver City, Beaverhead, Wilderness, and Mimbres. The elk on the BLM, State, and private lands were also not surveyed.

Summary

It is evident to me, based on the survey of the four Forest districts out of the nine on the Gila, that the

Table 1. Elk census results.

Period	Forest Districts				Totals of four districts
	Quemado	Luna	Reserve	Glenwood	
	Low - High	Low - High	Low - High	Low - High	Low - High
Winter— Nov. 1 to Feb 28	1,030 - 2,060	600 - 1,200	1720 - 3,440	420 - 830	3,770 - 7,530
Spring— March 1 to April 30	1,020 - 2,030	750 - 1,510	3,380 - 6,760	430 - 860	5,580 - 11,160
Early Summer— May 1 to June 30	1,030 - 2,050	680 - 1,350	3,500 - 6,990	360 - 710	5,570 - 11,100
Late Summer— July 1 to Oct 30	1,040 - 2,080	740 - 1,490	3,630 - 7,250	250 - 510	5,660 - 11,330

number of elk has reached or exceeded the amount called for in the Forest plan of 7,523 animals (EIS Gila NF Plan, 1985). There is a high probability that the other Districts combined would have a minimum of 2,000 extra elk, which, added to the low total figure of 5,660 animals from the surveyed areas, would represent the total elk allotted by the Forest Plan for 1996.

The Quemado Ranger District has made an effort over the last three years by aerial surveys in cooperation with New Mexico Game & Fish, and by various other means to estimate elk hunters. The Forest personnel independently estimate the elk numbers on the Quemado District to be from 975 to 1,200 animals. I find the proximity of their estimates to the low numbers in the allottees' survey as encouraging in relation to accuracy. I also believe that further evidence of the downward bias of the allottees' survey is from the Arizona Game and Fish Dept. operational plan, which states that the Escudilla herd of 300–450 adult animals in Arizona has most of its winter range in New Mexico (Arizona Game and Fish 1990). The low numbers in the survey from the Luna District do not show this fact, which leads me to believe that actual elk numbers must be, at least, between the low-high figures.

RECOMMENDATIONS by Order of Priority

1) It is time to stabilize the elk herd on the Gila Forest by means of antlerless hunts. "Since bull elk do not reach their maximum antler development until they are 7–10 years of age (Wolfe 1982), the relatively high harvest rates on public lands greatly reduce the percentage of trophy bulls in most herds...." (Wolfe 1985). By stabilizing the herd and even decreasing the density of elk, it will lower juvenile mortality, increase conception rates, reduce the effects of disease, and improve overall herd health. Cow hunts will partially be compensated for by increased survival rates as well as reducing pressure on bulls and allowing more trophy animals to develop. The number of elk is a concern because it is directly related to the concept of density-dependent population regulation (Wolfe 1985) as well as carrying capacity.

2) Accurate population estimates are almost impossible to get on elk at a reasonable cost. For example, the Arizona Pinetop Region gives population numbers that vary from the low of 6,820 animals to the high of 10,230 (Arizona Game & Fish Dept. 1990). In a study done on the 480,000 acres of Vermejo Park, after 213 hours of actual counting time over 10 years, the low-high varies by 35% or in 1985 5,700 plus or minus 3,100 animals (Wolfe 1985). There will never be a clear cut figure that shows the Forest Service that elk numbers have reached the planned amount. Instead, those numbers will probably vary from 5,040 to 10,006. Those advocacy groups favoring elk will pick the low number, and those that want to see elk controlled or reduced will pick the high number.

The main reason there is concern about the elk population is related to the capacity of the habitat. The most reasonable method for coming up with the impact of elk is by utilization studies. The Gila National Forest has already recognized this and started a program. Some ranchers have started programs either by themselves, by independent consultants, or with the help of the New Mexico Range Improvement Task Force. The Bureau of Land Management, New Mexico Game and Fish, or some other group may also do some studies. It is important to have a consensus of method so that all data collected can be relevant to each other.

3) Identify those public lands and private lands that are suffering depredation by elk to an amount that drastic economic hardship is created. An attempt should be made by all involved groups to seek this information.

4) Start a program to collar some cow elk in such a manner that they can be identified. In Arizona they have been able to determine various herds in different territories with radio collars over a two-year period. This program would give needed information on elk movements, allowing the New Mexico Game & Fish to better manage hunts and to control those herds creating the greatest conflicts. When the animals are captured, blood tests should be taken to check for disease within the elk herd such as brucellosis that can be spread to livestock.

5) More aerial elk surveys should be done to help in the collar program of pinpointing the various elk herds and their movements. This work would help in creating a better handle on the herd dynamics by means of bull:cow:-calf:yearling ratios as well as giving another method of estimating elk numbers.

6) Increase the elk cow hunts to stabilize, or if necessary to reduce, the elk herd in those areas suffering heavy impacts based on the information collected with the earlier recommendations. The increase of revenue to the New Mexico Game and Fish should allow a reduction in elk bulk licenses in order to manage in the direction of quality trophy hunts on the Gila.

7) The New Mexico Game and Fish should consider a permanent program of giving hunting licenses to individuals holding grazing Forest or BLM Allotments. This could serve as a source for range improvements that benefit both livestock and wildlife. The fees received by the rancher must be used for habitat improvement and would also serve as compensation for maintaining, and in some cases ownership, of such range improvements as water facilities and fences. This system would also decrease the conflicts between wildlife and livestock by creating a sense of self interest by the livestock industry in the health of the elk herd. It would also help the outfitters in the area by increasing the available source of elk licenses.

8) Habitat and water improvements must be planned in the true sense of multiple use. The timber industry in cutting various areas, can create early, mid, and late seral sites tht benefit elk and livestock, and create the variability of habitats that all animals require. The Sikes Act monies must be integrated in the multiple use concept. The idea of developing water or creating range improvements and then fencing them solely for wildlife only exacerbates the polarity of interest groups. As an example, should water that is created by range funds, or water that

is privately owned, be fenced to keep out wildlife?

9) All water developments funded by the Sikes Act on the Gila watershed in the Gila Forest must be cleared by the New Mexico Engineer. The Supreme Court decision in Arizona vs. California (1964) as well as the Colorado River Basin Project Act of 1968 requires that the New Mexico State Engineer be involved. The Gila National Forest must also be in full compliance with the Supreme Court decision United States vs. New Mexico, 438 U.S. 696,57 L. Ed. 2d 1052 (La. 1978) in how any water is allocated.

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Grazing Private and Public Land to Improve the Fleecer Elk Winter Range

Michael R. Frisina and Forest G. Morin

Competition for forage between elk and domestic livestock has generated controversy on both public and private lands. As a result, numerous studies documenting relationships between cattle and elk were conducted in Montana and other western states. In Montana, dietary comparisons and intraspecific competition on seasonal ranges have been evaluated by numerous studies. Range relationships between elk and cattle within "rotational" grazing systems were described by Campbell and Knowles (1978), Komberec (1975), Frisina (1986), and Gniadek (1987). Lyon et al. (1985) reported that elk generally avoid cattle-occupied areas, and Mackie (1978) described impacts of livestock grazing on wild ungulates.

Historically, most intense conflicts occur where domestic livestock and elk are competing for forage on elk winter ranges. Anderson and Scherzinger (1975) described a program of coordinated elk and cattle use on the Bridge Creek elk winter range in Oregon. However, practical solutions for resolving these conflicts on elk winter ranges are lacking. To address this issue, the Montana Department of Fish, Wildlife and Parks, United States Forest Service, and Smith 6 Bar S Livestock Company (6 Bar S) initiated a program in 1987 to combine existing research with sound range management principles to design a grazing system with the following six objectives:

1). Maintain soils, vegetation, and riparian zones in good or better condition on public and private lands.

2). Increase elk to potential on all land ownerships.

3). Increase cattle grazing potential.

4). Minimize impact of winter and spring use by elk on private land by providing adequate habitat on public lands.

5). Manage the entire elk winter range in the Fleecer area as one unit, regardless of land ownership.

6). Maintain optimum level of livestock production on 6 Bar S lands.

Description of Area

The Fleecer Coordinated Grazing Program is located on the southeast face of Mt. Fleecer, approximately 25 miles southwest of Butte, Montana. The area ranges in elevation from 5,500 feet to approximately 7,000 feet, and is mostly nonforested. Bluebunch wheatgrass and Idaho fescue grasslands are the predominant vegetation with some Douglas-fir occurring along ridgetops and southerly aspects. Some rough fescue is also present. Aspen and willow stands are common along stream banks and in wet areas. Average annual precipitation varies from 14 to 18 inches. Soils were classified as Ochrepts, Boralfs, and Borolls by the Forest Service.

The area in the grazing program is a combination of public and private lands. Approximately 9,920 acres are Forest Service, 4,160 acres are Montana Department of Fish, Wildlife and Parks, with 2,490 acres in private ownership by Smith 6 Bar S Livestock.

The area is historically important for providing livestock grazing, habitat for wintering elk, and hunting oriented recreation. Forest Service range surveys conducted in 1953 indicated range deterioration due to past heavy livestock use on a season-long basis (unpublished FS data 1970). These same records also indicate range condition has improved steadily since the 1953 survey. Livestock numbers were increased during the 1980's to a current level of 714 cattle or 1,342 animal months (AM's) (Figure 1). Recent history of the Fleecer elk herd began in

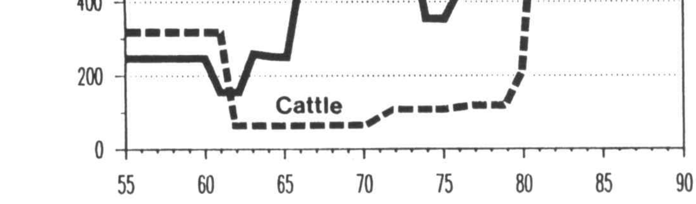

Fig. 1. *Elk and cattle number trends for the Fleecer area.*

1910 when 25 elk from Yellowstone Park were transplanted to augment a native remnant herd. The Fleecer Wildlife Management Area was purchased by Montana Department of Fish, Wildlife and Parks in 1962 to expand winter elk habitat provided by the Forest Service lands. Restrictive hunting seasons, improvements in habitat,

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and additional use of 6 Bar S lands has enabled the elk herd to increase to its present wintering population of 1,100 with about 800 wintering in the Fleecer Coordinated Grazing Program (Figure 1). The Fleecer's are one of the most heavily hunted areas in Montana because of the large elk population, the large proportion of public land, and proximity to Butte (Frisina 1982).

Grazing Program

The Fleecer Coordinated Grazing Program was fully operational in 1988. It follows rest-rotation grazing principles described by Hormay (1970), and includes 9,730 acres of suitable livestock range. The program was implemented gradually from 1981 to the present as planning, range improvements, and necessary agreements were completed. With the exception of fall grazing on Montana Department of Fish, Wildlife and Parks lands, it was completed in 1987.

	LIVESTOCK ROTATION BY YEAR			SEASONAL RANGE USE	
PASTURES	1988	1989	1990	ELK	CATTLE
1-MFWP	REST	SPRING	LATE FALL	WINTER	SPRING & FALL (LATE)
2-MFWP	LATE FALL	REST	SPRING	WINTER	SPRING & FALL (LATE)
3-MFWP	SPRING	LATE FALL	REST	WINTER	SPRING & FALL (LATE)
4-6 BAR S	SUMMER	FALL	REST	WINTER	SUMMER & FALL
5-6 BAR S	REST	SUMMER	FALL	WINTER	SUMMER & FALL
6-6 BAR S	FALL	REST	SUMMER	WINTER	SUMMER & FALL
7-FS	EARLY SUMMER	REST	REST	WINTER	SUMMER (EARLY)
8-FS	REST	EARLY SUMMER	REST	WINTER	SUMMER (EARLY)
9-FS	REST	REST	EARLY SUMMER	WINTER	SUMMER (EARLY)
10-FS	FALL	REST	SUMMER	SUMMER	SUMMER & FALL
11-FS	SUMMER	FALL	REST	SUMMER	SUMMER & FALL
12-FS	REST	SUMMER	FALL	SUMMER	SUMMER & FALL

LEGEND: *Rest* - Non use by livestock; *Early Summer* - June 1 to Mid July; *Fall* - Mid August to October 1; *Spring* - Mid April to late May; *Summer* - Mid July to Mid August; *Late Fall* - October 1 to Mid October

Note: AFTER THREE YEARS THE LIVESTOCK ROTATION IS REPEATED.

ON 6 BAR S LANDS SUMMER CATTLE USE CONSISTS OF EARLY SUMMER AND SUMMER COMBINED. FALL CATTLE USE EQUALS FALL AND LATE FALL COMBINED.

Fig. 2. *Livestock grazing formula by year and pasture showing seasonal elk and cattle use within the Fleecer Coordinated Grazing Program.*

The grazing program consists of 12 pastures with the rotation of livestock, pasture ownership, and seasonal use by cattle and elk (Figures 2 and 3). There are nine pastures providing winter habitat for elk: three each of Montana Department of Fish, Wildlife and Parks; 6 Bar S; and Forest Service lands. The remaining three pastures on Forest Service land are used by elk during summer and fall. Each year, seven of the 12 pastures are used by cattle

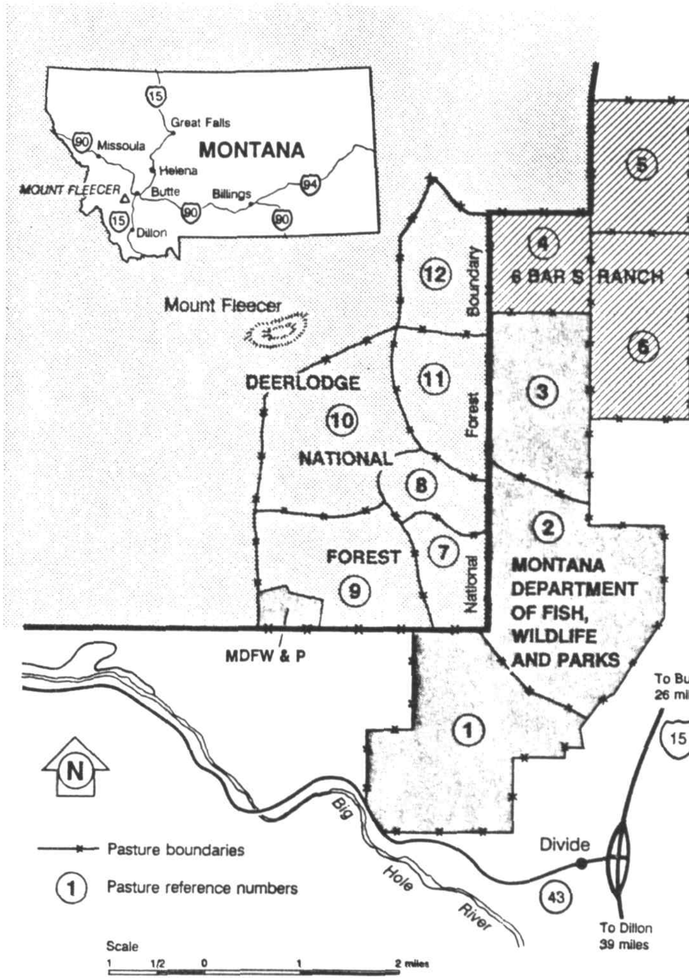

Fig. 3. *Schematic showing pasture location and ownership within the Fleecer Coordinated Grazing Program. Pasture numbers correspond to those on Figure 2.*

during summer and fall, and the other five pastures are rested from livestock use. One of three Montana Department of Fish, Wildlife and Parks pastures provides spring use (April to May) for livestock each year.

At the start of the cattle grazing season (mid April), 500 head of livestock owned by 6 Bar S are placed in one of the three Montana Department of Fish, Wildlife and Parks pastures (Figures 2 and 3). They remain in this pasture until rapid growth of vegetation occurs (late May). Cattle are then removed, thereby allowing maximum regrowth to occur. On June 1, 187 cattle owned by Forest Service permittees are moved to one of the three Forest Service elk winter range pastures. They remain there until mid July, then they are moved to one of the three Forest Service elk summer range pastures. The remaining two Forest Service elk winter range pastures are rested from livestock use all year (Figures 2 and 3). Cattle remain in one of the Forest Service elk summer pastures until seed ripe time (mid August), then are moved to a second Forest Service elk summer pasture where they remain until September 30.

The third Forest Service elk summer pasture is rested from livestock use all year. On October 1, the livestock are moved to one of the Montana Department of Fish, Wildlife and Parks elk winter pastures for 15 days. On October 15, cattle are removed from the grazing program area for the winter.

The three pastures owned by 6 Bar S provide summer-fall grazing for 200 livestock, and are all elk winter range pastures. One of these pastures is rested from livestock use annually to provide forage for wintering elk. Forage from these elk winter pastures is payment to Montana Department of Fish, Wildlife and Parks for providing 6 Bar S with 500 AM's of spring livestock grazing. After three years the cattle rotation is repeated.

Discussion

The Fleecer Coordinated Grazing Program meets the stated objectives of coordinated livestock and elk management as follows:

Objective 1. Our application of rest-rotation grazing principles described by Hormay (1970) is designed to maintain an upward trend in vegetation and soil conditions. Forest Service monitoring data indicate rangeland and soil conditions are improving (unpublished FS data 1988).

Objective 2. Elk trend count data in Figure 1 demonstrates elk numbers are increasing. This is a result of habitat provided on lands in the grazing program. General observation of elk density on the winter range and amount of forage utilized indicates the elk population is at or near habitat potential.

Two of the three elk winter range pastures on Forest Service lands are rested from livestock use each year to provide forage for elk. Prior to this arrangement, two of the pastures were grazed under a deferred system. The third was reserved for wildlife and received no cattle use for over 20 years. By incorporating the non-use pasture into the system, more rest to improve plant vigor is provided for the formerly deferred pastures. In the formerly non-use pasture, accumulated old growth is periodically removed by cattle to improve the quality of forage for wintering elk (Anderson & Scherzinger 1975 and Jourdonnais 1985). After each of these Forest Service elk winter range pastures is grazed by cattle, it is rested from livestock use for two consecutive years, thus providing substantial forage for elk.

All three pastures on Montana Department of Fish, Wildlife and Parks lands provide winter habitat for elk. Each year one pasture is rested from livestock use and provides a full growing season of plant growth for winter elk forage.

All three pastures on Montana Department of Fish, Wildlife and Parks lands provide winter habitat for elk. Each year one pasture is rested from livestock use and provides a full growing season of plant growth for winter elk forage.

A second pasture is grazed during early spring, and cattle are removed during late May to allow a maximum amount of plant regrowth to occur. The second pasture provides almost as much forage as the one rested from livestock grazing. The third pasture is deferred from use until late fall, when about 100 AM's of cattle grazing are permitted. This light use leaves a substantial amount of forage in the pasture for wintering elk.

The arrangement between Montana Department of Fish, Wildlife and Parks and 6 Bar S through the grazing program provided an increase in the total amount of available winter habitat for elk. Prior to this program, 6 Bar S was receiving winter elk use at an increasing rate and notified the Montana Department of Fish, Wildlife and Parks that the elk population should be controlled, as it was negatively affecting their livestock operation. Incorporating 6 Bar S lands into the grazing program eliminated this conflict. All pastures are available for wintering elk use, including one pasture which is rested from livestock use. The additional winter habitat has allowed for an increase of about 300 elk beyond the previous potential.

In addition to elk winter habitat, the Forest Service elk and cattle summer range pastures are managed according to a three pasture rest-rotation grazing formula with benefits similar to those reported by Frisina (1986).

Objective 3. The number of cattle and AM's provided has gradually increased towards potential during the 1980's (Figure 1).

Objective 4. Recent research by Frisina (1986) and Grover and Thompson (1986) indicate elk prefer to forage during late winter or early spring in pastures grazed the previous growing season by domestic livestock. Abundant green growth is readily available in these pastures during spring.

Also, periodic grazing by cattle on the elk winter range pastures improves the nutritional value of forage plants by removing accumulated old growth and improves forage quality (Anderson & Scherzinger 1975 and Jourdonnais 1985). Management of the Fleecer Coordinated Grazing Program incorporates these facts to make public lands as attractive as possible to elk.

Objective 5. Incorporating 6 Bar S lands into the grazing program has allowed management of the entire elk winter range as a single unit.

Objective 6. The optimum level of livestock production is maintained on 6 Bar S lands. The exchange of use agreement with Montana Department of Fish, Wildlife and Parks has allowed 6 Bar S to provide more rest from livestock grazing on lands used for cattle production, thus helping maintain maximum plant vigor and forage production.

Management Implications

The Fleecer Coordinated Grazing Program is a practical solution to resolving elk and cattle conflicts on elk winter ranges in the West. Cattle are used to actually enhance forage quality and quantity by applying early spring cattle grazing, rest-rotation grazing principles, and integrated management of various land ownerships. Coordinated management resulted in substantially increased cattle and elk numbers, while resolving a landowner tolerance problem.

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Mackie, R.J. 1978. Impacts of livestock grazing on wild ungulates. Transactions of the 43rd North American Wildlife and Natural Resources Conference. pp. 462–476.

U.S. Forest Service. 1970. Unpublished data in Butte Ranger District files. U.S. Department of Agriculture, Forest Service, Deerlodge National Forest, Butte Ranger District, Butte, Montana.

Note: A video presentation of this grazing system was shown at the 1989 National SRM meeting in Billings, Montana. It is available upon request from: U.S. Forest Service, Butte Ranger District, Butte, Montana 59701. Telephone: (406) 494–2147.

Run, Antelope! Run!

Run, Antelope! Run! Run! Run!
Save your life from the hunter's gun.

Hunter's in a jeep, wheels driving fast,
Fifty yards behind you; can your slim legs last?

Sage brush and prairie lie ahead,
Outrun the jeep or you'll be dead!

Run, Antelope! Run! Run! Run!
Lose that man with the jeep and gun.

We cheer and pray for your strength and speed,
But the jeep is cutting down your lead.

Run, Antelope! Run! Run! Run!
You've a right to live in the prairie sun.

Ahead lies a gully, wide and deep—
You clear that chasm in one full leap!

The jeep driver brakes and drives away.
Antelope, you outran death today!

Vernette L. Palmer

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).

Alfalfa Menu Includes Many New Varieties; by Hay and Forage (Grower Staff; 1990; Hay & Forage Grower 5(8):6–7, 9–10. (Webb. Div., Intertec Pub. Corp., 7900 Intern. Dr., Minneapolis, Minn. 55425) Over 200 commercial varieties are listed, including 44 new varieties for 1991; data provided in tabular form includes company producing seed, fall dormancy, and pest resistence ratings.

Beef Research in Big Sky County (Fort Keogh); by Dennis Senft; 1991; Agric. Res. 39(1):4–9. (USDA-ARS, Fort Keogh Livestock & Range Res. Lab., Rte. 1, Box 2021, Miles City, Mon. 59301) Provides an illustrated summary of the history, organization, and major research contributions from one of the largest research ranches in the world, the Fort Keogh Livestock & Range Research Laboratory.

The Benefits of 2,4-D; An Economic Assessment; by M. Stemeroff, J. Groenewegen, and R. Krystynak; 1991; Can. Farm Econ. 23(1):3–19. (Deloitee Haskins & Sells, Guelph, Ontario) Provides in-depth information on the benefits of 2,4-D in Canadian agriculture and outlines the additional benefits of 2,4-D use in forestry, rights-of-way, parks, and home lawns.

Bonding of Spanish Kid Goats to Cattle and Sheep; by C.V. Hulet, D.M. Anderson, J.N. Smith, W.L. Shupe, and L.W. Murray; 1991; Appl. Anim. Beh. Sci. 30(1–2):97–103. (USDA-ARS, Jornada Expt. Range, Box 30003, N. Mex. State Univ., Las Cruces, N. Mex. 88003–0003) Spanish kid goats bonded to heifers and stayed with them under free-ranging conditions; the bond with lambs to heifers became stronger as the time of close association was extended beyond 30 days.

Conditioned Taste Aversions: How Sick Must a Ruminant Get Before It Learns about Toxicity in Foods?; by T.J. du Toit, F.D. Provenza, and A. Nastis; 1991; Appl. Anim. Beh. Sci. 30(1–5):35–46. (Address: Dept. Range Sci., Utah State Univ., Logan, Utah 84322) Concluded that the food-avoidance learning abilities of ruminants are better developed than previously assumed, and that aversion behavior is probably an important means by which large herbivores reduce the risk of being poisoned while foraging.

The Conservation Reserve—Yesterday, Today, and Tomorrow: Symposium Proceedings, January 14, 1991; by Linda A. Joyce, John E. Mitchell, and Melvin D. Skold (Eds.); 1991; USDA, For. Serv. Gen. Tech. Rep. RM-203; 65 p. (USDA, Rocky Mtn. For. & Range Expt. Sta., 240 W. Prospect Road, Fort Collins, Colo. 80526) While providing background on the objectives, implementation, and present status of the Conservation Reserve Program, the main emphasis of this symposium, including 11 papers, was in addressing what will happen to CRP lands when the 10-year contracts expire in the mid-1990s.

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

Do Pellet Counts Index White-tailed Deer Numbers and Population Change?; by Todd K. Fuller; 1991; J. Wildl. Mgt. 55(3):393–396. (Dept. For. & Wildl. Mgt., Univ. Mass., Amherst, Mass. 01003) This study in northcentral Minnesota found neither abundance of pellet groups nor extrapolated deer density significantly correlated with annual population estimates derived from aerial surveys; concluded that the use of pellet groups to index deer numbers or population change is limited.

Ecological Relationships of Curlleaf Mountain-Mahogany (*Cercocarpus ledifolius* Nutt.) Communities in Utah and Implications for Management; by James N. Davis and Jack D. Brotherson; 1991; Great Basin Nat. 51(2):153–166. (Utah Div. Wildl. Resources, Shrub Sci. Lab., 735 N. 500 E., Provo, Utah 84606) Reports on field studies in Utah and consolidates findings with those of other authors on the synecology of curlleaf mountain-mahogany communities and their utility for big game.

Effect of Glyphosate on Introduced and Native Grasses; by Rodney G. Lym and Donald R. Kirby; 1991; Weed Tech. 5(2):421–425. (Crop and Weed Sci. Dpet., N. Dak. State Univ., Fargo, N. Dak. 58105–5051) Evaluated the effect of glyphosate alone and with 2,4-D on various introduced pasture and range grass species; the diploid varieties of crested wheatgrass were found especially resistant to glyphosate.

Fifty Years of Research Progress: A Historical Document on the Starkey Experimental Forest and Range; by Jon M. Skovlin; 1991; USDA, For. Serv. Gen. Tech. Rep. PNW-GTR-266. (USDA, Pacific Northwest Res. Sta., 319 S.W. Pine St., P.O. Box 3890, Portland, Ore. 97208) Summarizes the history of the region and the station, recounts the comings and goings of research personnel, analyzes the succession of events that have brought about ecological changes, and includes a list of publications resulting from research at the station.

Fire and Grazing in the Tallgrass Prairie: Contingent Effects on Nitrogen Budgets; by N. Thompson Hobbs, David S. Schimel, Clenton E. Owensby, and Dennis S. Ojima; 1991; Ecology 72(4):1374–1382. (Colo. Div. Wildl., 317 W. Prospect Road, Fort Collins, Colo. 80526) Concluded from this study in the Kansas Flint Hills that fire and grazing acted together to influence the N budget of the tallgrass prairie; the effects of grazing on grassland spatial pattern were relatively weak in the presence of fire but strong when fire was absent.

Goat Herbivory and Plant Phenology in a Mediterranean Shrubland of Northern Baja California; by Didier Genin and Antoine Badan-Dangon; 1991; J. Arid Environ. 21(1):113–121. (Centro de Investigacion Cientifica y Educacion Superior de Ensenada, Apdo postal 2732, Ensenada, Mexico) Since phenological stage of development played a major role in which plants the foraging goats in the study selected, the authors hypothesized that the timing of consumption plays an important role in the vulnerability of plants in range ecosystems to herbivory and in their growth capacity and competitive ability.

Grazing and Brush Management on Texas Rangelands: An Analysis of Management Decisions; by C. Wayne Hanselka, Allan McGinty, Barron S. Rector, R.C. Rowan, and Larry D. White; 1990; Texas Agric. Ext. Serv., College Station, Texas; 22 p. (Address: Dept. Rangeland Ecology & Management, 225 Animal Industries Bldg., College Station, Texas 77843–2126) An analysis of the results of a survey of Texas ranchers was used by the authors to provide knowledge concerning ranch characteristics, criteria used for making grazing and brush management decisions, and the types of decisions and technologies applied.

Lifetime Production of Beef Heifers Calving First at Two Vs Three Years of Age; by R. Nunez-Dominguez, L.V. Cundiff, G.E. Dickerson, K.E. Gregory, and R.M. Koch; 1991; J. Anim. Sci. 69(9):3467-3479. (USDA-ARS, U.S. Meat Anim. Res. Center, Clay Center, Neb. 68933) The research results reported for this study led to the conclusion that economic efficiency can be improved by managing heifers to calve first as 2-year olds under either mild or intense culling of open cows.

Management of Rocky Mountain Bighorn Sheep Herds in Colorado; by James A. Bailey; 1990; Colo. Div. Wildl. Spec. Rep. 66; 24 p. (Colo. Div. Wildl., 317 W. Prospect Road, Fort Collins, Colo. 80526; $2) Utilized CDW population estimates and records of herd management during 1946-88 to evaluate the management of Rocky Mountain bighorn sheep herds in Colorado in relation to future research and management needs.

New Concepts in International Rangeland Development: Theories and Applications; by Richard P. Cincotta, Charles W. Gay, and Gregory K. Perrier (Eds.); 1991; Dept. Range Sci., Utah State Univ., Logan, Utah; 115 p. (Address: 1991 IRDS Proceedings, Greg Perrier, Range Sci. Dept., Utah State Univ., Logan, Utah 84322-5230; US$12 postpaid) A collection of 9 articles presented at the SRM national meetings, Washington, D.C., Jan. 4, 1991; articles concern issues facing rangeland conservation, utilization, and technical education in the Third World.

Nodulation and Nitrogen Accretion Response of *Cercocarpus betuloides* Seedlings to Phosphorus Supplementation and Water Availability; by B.J. Wienhold and J.O. Klemmedson; 1991; Plant & Soil 131(2):187-197. (School Renewable Natural Resources, Univ. Ariz., Tucson, Ariz. 85721) Based on greenhouse experiments, phosphorus supplementation and moderate soil moisture levels (compared to either higher or lower soil water potentials) increased nodulation, nitrogen fixation, and growth in *C. betuloides* seedlings.

Public Land Policy and the Value of Grazing Permits; by L. Allen Torell and John P. Doll; 1991; West J. Agric. Econ. 16(1):174-184. (Dept. Agric. Econ. & Agric. Bus., N. Mex. State Univ., Las Cruces, N. Mex. 88003) Results suggest that the cost advantage of grazing on public lands has been capitalized into substantial permit values but that the market value of public land grazing permits has and will continue to diminish with increase in grazing fees and the current environmental emphasis of public land management.

Range, Plus Complementary Forages for Beef Cattle Production; by James T. Nichols; 1989; Forage & Grassland Conf. 1989:196-203. (West Central Res. & Ext. Center, Univ. Neb., North Platte, Neb 69101) Uses Nebraska examples in emphasizing how complementary forages used in conjunction with range can increase production per unit of land, improve animal performance through improved nutrition, and reduce production costs.

Rangeland Technology Equipment Council: 1990 Annual Report; by Rangeland Tech. Equip. Council; 1991; USDA, For. Serv. Tech. & Dev. Center, Missoula, Mon.; 83 p. (USDA, For. Serv. Tech. & Dev. Cen., Bldg. 1, Fort Missoula, Missoula, Mon. 59801) Comprises a selection of papers from the 1990 annual meeting at Reno, Nevada, and a synopsis of articles at Vegetative Rehabilitation & Equipment Workshops for 1980 through 1989. (Note: when VREW was changed to RTEC in 1990, a broader charter for the group permitted incorporating all federal, state, and private range land managers.)

Salinity Resistance Water Relations, and Salt Content of Crested and Tall Wheatgrass Accessions; by Richard C. Johnson; 1991; Crop Sci. 31(3):730-734. (USDA-ARS, Plant Germplasm & Testing Unit, 59 Johnson Hall, Wash. State Univ., Pullman, Wash. 99164-6402) Provides results of a study to identify crested wheatgrass accessions that may be useful in breeding salt-resistant populations and to determine potential mechanisms of salinity resistance in crested wheatgrass and tall wheatgrass.

Sod-Seeding Forages into Colorado Meadows without Herbicides; by Eugene G. Siemer and BerthaAnn Gery; 1989; Forage & Grassland Conf. 1989:191-195. (Colo. State Univ., Mountain Meadow Res. Cen., Gunnison, Colo. 81230) Provides criteria for successfully establishing improved legumes and grasses in old, native, high altitude mountain meadows in the Intermountain by sod-seeding.

Successional Trajectories of a Grazed Salt Desert Shrubland; by S.G. Whisenant and F.J. Wagstaff; 1991; Vegetatio 94(2):133-140. (Dept. Range Sci., Texas A&M Univ., College Station, Texas 77843-2126) Re-evaluated long-term data on grazing seasons and intensities from studies at the Desert Experimental Range in western Utah using successional trajectories through the statistical space of ordination; concluded that grazing season had a more pronounced influence on floristic trajectories than did grazing intensity, with March-April grazing being an important cause of retrogression in the salt desert shrub ecosystem.

Vegetation Management in the Cross Timbers: Response of Woody Species to Herbicides and Burning; by Jimmy F. Stritzke, David M. Engle, and F. Ted McCollum; 1991; Weed Tech. 5(2):400-405. (Dept. Agron., Okla. State Univ., Stillwater, Okla. 74078) Results of a study in the Cross Timbers near Stillwater in which tebuthiuron and triclopyr were applied alone and in combination with burning; a companion article (Weed Tech. 5(2):406-410) deals with the response of understory vegetation to the same treatments.

A Whole-Farm Economic Analysis of Season-Long and Intensive-Early Grazing Systems; by Jeane Webb-Redmond, Orian H. Buller, Gerry L. Posler, Clenton E. Owensby, and Robert C. Cochran; 1991; J. Amer. Soc. Farm Mgrs. and Rural Appr. 55(1):83-90. (Dept. Agric. Econ., Kansas State Univ., Manhattan, Kans. 66506) This study compares SLS (more grassland intensive) and IES (more capital intensive) in a whole-farm framework; it was concluded both systems fit into some farm situations depending upon the amount of pasture available relative to capital.

Capital Corral

Ray Housley
Washington Representative

Always do the right thing.
It will gratify some folks
and astonish the rest.
Mark Twain

The Office of Government Ethics stepped on a yellowjackets' nest with its proposed regulation limiting federal employees' participation as professional society officers on official time (*Rangelands,* October 1991). More than 1,100 responses—overwhelmingly protesting the restrictive rule—poured in before the comment deadline. SRM, several of its Sections and most of the other natural resources professional societies responded. The furor prompted a hearing before the House Post Office and Civil Service Subcommittee on Human Resources, which heard testimony that the proposed reg would discourage federal workers from participating in professional society affairs. OGE witnesses at the hearing admitted the proposed rule was "ambiguous" and promised to revise it before it becomes final early next year. The Committee—and several members of both the House and Senate—have written OGE to urge modification of the proposal.

"Corn, Porn and Politics" was the *Washington Post's* description of the deal that struck down a House-passed increase in grazing fees for BLM and FS in exchange for rejecting Sen. Jesse Helms' (R-NC) proposed language restricting "obscenity" in projects to be funded by the National Endowment for the Arts. Rep. Sidney Yates (D-IL), who chairs the Interior Subcommittee on Appropriations, is a noted supporter of the arts, was persuasive in the conference committee. A House vote on a motion to recommit the matter to the conferees failed by a narrow 15-vote margin. Grazing fee increase advocates say they'll be back again next year. Sen. Malcolm Wallop (R-WY), noting that "there are obviously two sides to the grazing issue", has indicated his intent to hold hearings on the grazing program early in 1992. And the appropriations bill carries Report language instructing the agencies to update specific portions of the grazing fee study made in the mid-80's.

The United Nations Environmental Program (UNEP) has in press a report, "Desertification Costs: Land Damage and Rehabilitation" by H.E. Dregne of the International Center for Arid and Semiarid Land Studies, Texas Tech University. In the draft available for review, the author admits to a poor data base for his assessments, and states, "A large amount of personal opinion colors the evaluation." He acknowledges that at least one table's numbers on a rate of desertification are "impossible to interpret meaningfully." The paper may strain credibility among range professionals when they read that rangeland in excellent or good condition is classified as "slight desertification" with up to 25% loss of carrying capacity. The report is likely to generate some discussion which could result in clarification and interpretation, but the data as presented are perhaps subject to misinterpretation or misuse by those with a narrow agenda.

The Soil Conservation Service "Head Shed" underwent some changes this summer. After Galen Bridge was elevated to Associate Chief, Gary Margheim took over as Deputy Chief for Programs. Manly Wilder got a title change to Deputy Chief for Strategic Planning and Budget Analysis. Barbara Osgood, who was State Conservationist in New Jersey, has moved over to serve as USDA's liaison to EPA. And the SCS Earth Team signed up two volunteers: Evelyn Madigan, wife of Secretary of Agriculture Edward Madigan, joined Grace Richards, wife of SCS Chief Bill Richards, in signing up for personal appearances at special events to promote conservation.

After completing a 30-year career in FS range research that would have left most content to rest on some considerable laurels, Henry A. Pearson has begun another career with the Agricultural Research Service. Pearson leaves Louisiana for Arkansas, where his clientele will be working with an accomplished scientist long dedicated to helping managers apply research results in the real world.

More range management decisions will be coming from the courtrooms than the range if present trends continue; about a dozen actions are now pending against BLM and FS. Both agencies have been sued by the Federal Lands

Legal Foundation in U.S. District Court in New Mexico. The suit has to do with rulemaking requirements in connection with implementing Section 8 of the Public Rangelands Improvement Act (PRIA) dealing with allotment management plans.

Also in New Mexico, FS has been sued by a permittee alleging improper taking in connection with a permit reduction related to range condition.

In Nevada, Wayne Hage has brought suit following trespass action by the FS. That suit asks $28 million in damages.

And in Wyoming, BLM is engaged in litigation for allegedly failing to adequately consider in its EIS on allotment management plans the impact of methane production by domestic livestock.

Readers Write

The Whitehorse Butte Controversy Continues

The article "Whitehorse Butte Allotment—Controversy to Compromise" by Michael Holbert (*Rangelands* June 1991) which appeared in the June 1991 issue of *Rangelands* provided a good overview of how the BLM came to its decision regarding livestock management of the Whitehorse Butte Allotment. But Mr. Holbert failed to answer several of the issues I originally raised in an earlier article which appeared in the December, 1990 issue of *Rangelands.*

Central to my argument was the failure of the agency to consider the total economic and environmental costs associated with livestock grazing in the Whitehorse Butte Allotment which I believe is fairly representative of public lands allotments throughout the West. Mr. Holbert never really answers how the BLM justifies spending $400,000 dollars of taxpayer money to mitigate the ecological impacts created by the commercial use of public resources by a private individual when termination of grazing privilege would seem to provide for more overall resource and public benefits in the long run at far less cost.

Mr. Holbert defends the BLM's decision to continue livestock grazing by suggesting an earlier document—the Southern Malheur Rangeland Program Summary—had determined that livestock grazing was an appropriate use of these lands. How could it be appropriate when it clearly was, by the BLM's own admission, causing significant degradation to other resources? However, we are told by Mr. Holbert, merely due to "improper grazing". Why would the agency permit "improper grazing" in the first place? And why should the public pay hundreds of thousands of dollars to "improve livestock management?" Is the public really getting its money's worth? You can grow cows on the moon if you want to spend enough money. But that is the point. Given the low productivity and suitability for livestock grazing without a significant capital investment in a host of range developments—which have their own negative impacts upon the land—grazing livestock here is a poor public policy.

Furthermore, the assumption that the proposed mitigation measures will result in no impacts is absolutely ludicrous. There are no empty niches. Livestock—even well-managed livestock—are using forage, space and water that could and would support native species. If we are going to trade away native plants and animals to support non-native, alien privately owned animals, we must be ready and able to show that the overall public benefits derived exceed these "costs". In their original analysis of the Whitehorse Butte Allotment, the BLM never considered these trade-offs, nor did Mr. Holbert provide any further discussion in his piece.

If spending public funds to mitigate the impacts created by private commercial livestock operations is considered an appropriate use of public money, then why shouldn't the BLM also spend public funds to construct settling ponds for mining operations to mitigate and protect rivers from mineral wastes? No doubt the mining industry would support such a notion, but I would maintain this is an inappropriate use of public funding. And that is the issue I raised in my original article and an issue Mr. Holbert did not address. To suggest that the public should shoulder even a portion of the costs of mitigating the impacts from privately owned livestock using public resources because such mitigation will improve the quality of other public resources begs the meaning of the word *benefit*, especially when most, if not all costs, could be avoided by elimination of livestock grazing. The cost of protecting public resources from the degradation or abuse of private commercial enterprises at the very least should be a cost entirely borne by the private individual—in this case the rancher using the public lands.

Merely suggesting that red meat production justifies these expenditures fails to consider that a similar investment in a more favorable climate would produce a far better return. In short, neither Mr. Holbert nor the BLM has demonstrated any clear reason why grazing should continue on the Whitehorse Butte Allotment other than grazing has always occurred here and that, given changing public values, is no longer reason enough.

George Wuerthner, Box 273, Livingston, Montana 59047

Editor's Note:

With this letter we are closing discussion on the Whitehorse Butte controversy.

The Balance of Nature, Chaos, and Range Management

Recently I was watching TV where two elderly ladies were being interviewed about the effects of a recent oil spill and they were commenting about how it damaged the delicate balance of nature. Their remarks brought to mind some research out of Berkeley, California, on oil spills during WW II which stated there was never any permanent damage caused by an oil spill.

This is not to say that the balance of nature is not delicate. Lies are always delicate. I'm not calling the concept a lie just because it is credited to Henry Thoreau, although his pacifist philosophy prevented him from seeing the real truth. I'm calling it a lie because of the grossly distorted reasoning emanating from the concept in regard to agriculture which includes subjects such as wolves, chemicals, grazing on public lands, and cattle.

Nonlinear physics also questions equilibrium. One of the principles of Chaos is that a biological system must be robust to withstand volcanoes, tornadoes, earthquakes, buffalo, and H-bombs, and if you lock a biological system into one mode, you enslave it preventing it from adapting to change.

A good example of this can be found in range management. Mode locking in range management is continual grazing, continual rest, and take half-leave half. Enslaved range is susceptable to drought, noxious weeds, grasshoppers, fire, and grassbugs.

The easiest way to avoid enslavement in range is to hit the two extremes which are severe grazing followed by an extended rest (never longer than two years in the Northern Great Plains) allowing the biomass to recover. The Bible says "There is a time to build, a time to destroy." While this practice may not agree with the concept of the balance of nature, it gives stability to the range.

While Chaos questions equilibrium, it says there is stability in a nonlinear system such as nature and that stability lies in beginnings. Beginnings, in range, are seeds, roots, and rhizomes. To have a stable range site you must have seedlings and those seedlings must be able to survive.

While not believing in the balance of nature for the above reasons, I believe in a different concept which states that in a biological system you must be competitive or you will be replaced by an ameoba, a noxious weed, a black grassbug, or a wolf. Abusing a resource is not being competitive, but enhancing a resource allows one to survive.

Ray Banister

Reference: James Gleick 1978. Chaos, Making a New Science.

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I certify that the statements made by me above are correct and complete.—*Peter V. Jackson,* Managing Editor.

Meeting Highlights from the SRM Board of Directors Summer Meeting, July 1991, North Platte, Nebraska

President Tixier announced the **decision of Peter V. Jackson to retire** as Executive Vice-President of the Society. The Executive Committee of the Board will act as a "search and screening" committee, with a review of candidates beginning around November 1 and a recommendation being ready around January 1st for Board review and acceptance. An anticipated announcement of the replacement would be made at the 1992 Annual Meeting and responsibility actually being transferred sometime between March 1 and May 15. The Board of Directors recognized the faithful and outstanding service Peter V. Jackson has given SRM and recognized his request to retire at the end of the year, or as soon as suitable candidate can be found.

The International Affairs Committee was assigned the responsibility of developing an organizational structure for SRM to work as an **"international clearing house of information"** for worldwide rangeland and grassland organizations.

SRM member **R. Dennis Child was elected Chair** of the International Rangelands Congress (IRC) Continuing Committee, with other SRM members William A. Laycock and Martin Gonzalez serving on the Committee as well.

At the IV International Rangeland Congress held in France last April, the IRC Continuing Committee awarded the **1995 Congress to SRM to host** the Congress in North America. The SRM Board appointed an "Organizing Committee" consisting of Paul Tueller, John Malechek, Pat Aguilar, Phil Sims, and A.J. Dye, with Phil Sims appointed as the Chair and taking the lead in organizing this committee. The **Organizing Committee will be responsible** for completing the membership of the committee to include representation from Mexico and Canada, outlining the meeting organization and defining a "Steering Committee" structure, financing requirements, potential tours, program theme and ideas, and meeting facilities information, to include information on the local arrangements status of members to help. The Board informed the Advisory Council members as to the opportunity for SRM to host the upcoming Congress and asked for Sections to discuss their willingness to help sponsor this event.

The Conservation Reserve Program and Leadership Skills Select Committees were reviewed and rechartered for another five years.

A color photo contest has been suggested to gather pictures for *Rangelands* covers. This might be implemented at the 1992 Annual Meeting, and would provide a backlog of photographs for use in *Rangelands*.

The Board of Directors formally endorsed **affiliation with the Coalition on Funding Agricultural Research Missions (COFARM)** and will contact the Ecological Society of America expressing SRM's support for the "Sustainable BioSphere Initiative" report.

The Board of Directors accepted the recommendation of the Professional Affairs Committee to **modify item 1. of the Code of Ethics** to read: "foster an environment where all people are encouraged to participate in the Society and the management and enjoyment of rangelands".

The Employment Affairs Committee filed a **Report to the Office of Personnel Management (OPM)** on the Range Conservationist Series GS-454 and is monitoring further action by OPM on this matter.

SRM adopted the Recommendations from the **Task Group on Unity in Concepts and Terminology** as outlined in their Report (See September, 1991 *Trail Boss News* "SRM Recommends New Range Terminology"). The Task Group will remain intact until the 1992 Annual Meeting to decide on further follow up actions needed.

Leaders of the American Forage and Grasslands Council **(AFGC) met with the SRM Board of Directors** to discuss potential joint programs for the two organizations. Ken Smith, President; Dana Tucker, Executive Secretary; and Vivian Allen, President-Elect, reviewed AFGC's structure and program with the Board of Directors. Ideas for joint efforts between the two organizations began with an exchange of publications and information for both organizations, the concept of joining together at meetings at the international and local levels, and the possibilities of co-sponsoring symposia together. SRM commends the American Forage and Grasslands Council for their work on the development of a "Grazing Lands Glossary".

The Board took the following **actions recommended by the Public Affairs Committee:**

1. Approval was given for a revised Policy Statement on Research Needs, Funding and Implementation as submitted by the Public Affairs Committee.
2. A Draft Biological Diversity Statement was accepted, in concept as a discussion statement, with the Committee to come back to the 1992 Annual Meeting with a recommended Policy Statement.
3. The Committee's recommendation of making no comment on animal rights was accepted.

The recommendations from the Awards Committee for presentation of the 1992 Annual Meeting Awards were approved by the Board. The Board also approved established of a "Sustained Lifetime Achievement Award" category, along with Committee's recommendation to present the first of these awards at the 1992 Annual Meeting and the recommendation of a recipient.

At the 1991 Annual Meeting, **First Vice-President Jack Artz was assigned the responsibility of developing a Plan of Action** for developing an overall "Strategic Plan" for the Society. The objectives of the Strategic Plan are to review the current structure and programs in SRM; to identify future objectives and priorities; and, to develop a five- to ten-year Plan of Action to guide the Society in reaching those objectives and priorities. The plan will include information obtained from previous Plans of Work, survey results from the Technology Transfer and Excellence in Range Management Committees, financial reports, and input from Board, Committees, Sections, Washington DC Representative, and SRM members. A draft of the Stategic Plan should be ready for presentation at the 1992 Annual Meeting.

Meeting Highlights from the Advisory Council, North Platte, Nebraska

The Advisory Council met on July 13 & 14, 1991, during the Society for Range Management Meeting in North Platte, Nebraska, hosted by the Nebraska Section. Sixteen Sections were represented by their Officers or designated proxies. Discussion and action items were:

Past Advisory Council Recommendations: Past recommendations and action by the Board on these recommendations were reviewed. This is a result of a previous recommendation by the A.C. so members can be better informed on past topics of discussions and the disposition of these items.

Presidential Report: President Tixier addressed the A.C. with a number items of interest. One of these is the 1995 Vth International Rangeland Congress, which SRM will host. Members of the A.C. were asked to consider, within their respective Sections, the opportunity to assist with this congress.

Tixier then expressed desire to acknowledge and recognize SRM's Veterans of the Gulf War. He asked anyone knowing of individuals who served in Desert Storm to please contact the SRM Office for possible acknowledgement at the 1992 Annual Meeting in Spokane, *Trail Boss News* publication, or both.

Executive Vice-President's Report: Peter Jackson informed the A.C. of SRM's intent to build a library of videos-tapes, films and catalogues of rangeland videos, with a proposed completion date of two years. He asked that any films/video-tapes relating to range be sent to the SRM Office, or individuals with knowledge of these to contact the SRM Office.

1995 Summer Meeting: The A.C. discussed the next summer meeting open for bid, which will be held in 1995. Sections in Region 3 were asked to consider bidding to host this meeting. A decision will be made at the 1992 Annual Meeting in Spokane as to which Section will take the bid.

Section Reports: A majority of the Sections represented reported holding successful range/youth camps with good attendance at all.

From their individual Endowment Funds, some Sections reported donation of one or more scholarships. South Dakota noted donating a $500.00 scholarship to South Dakota State University, Texas donated two scholarships at $500.00 each, and Utah awarded a $1,000.00 scholarship to a student at Brigham Young University.

Rangelands: Gary Frasier to spoke to the A.C. on the success of the recent color inserts in *Rangelands*, and noted that individual Sections might want to sponsor a color insert depicting range management in their Section. After his report was complete, the A.C. commended Frasier for the good image and approach of *Rangelands.*

Endowment Fund: John Hunter reported to the A.C. on the growth of the Endowment Fund, aided by the successful sales of lapel pins. The sales from the pins at the 1991 Annual Meeting in Washington, DC, were successful, but he noted a need for more sales at the Section level. As each Section now has individual endowment funds, all profits made from the sale of lapel pins at the Section level will be split between the Parent Society and the Sections on a 50/50 basis.

Leadership Development Committee: The A.C. will coordinate with the Leadership Development Committee to host some leadership training at the Annual Meeting in Spokane for Advisory Council members. This will be directed mainly to current Presidents and President Elects, to obtain training on SRM Constitution and By Laws, parliamentary procedures, along with the already scheduled speaking workshops.

Joint Meeting of the Board of Directors and Advisory Council

The Joint Meeting of the Board of Directors and Advisory Council was held July 14, 1991, with President Stan Tixier and Chair Joel Frandsen presiding. Joel Frandsen presented the recommendations of the Advisory Council to the Board of Directors and the Board took the subsequent actions on each of these recommendations:

The Advisory Council Recommended to the Board of Directors:

Recommendation 1: The revised and updated Advisory Council Procedures be accepted and reprinted. Some minor changes were made in wording to recognize changes in terminology like "Chair" in lieu of "Chairman", along with minor changes in duties and responsibilities such as recognizing the secretarial duties of the SRM staff instead of the Chair-Elect, and the opportunity for the Advisory Council Chair to serve on the Executive Committee of the Board. *The Board accepted the new procedures and guidelines as submitted.*

Recommendation 2: Oppose the proposal of the Society serving as a contractor for rangeland inventory, monitoring and management. It was the feeling of the Advisory Council that SRM serving as a paid contractor could place the Society at odds with agencies or private range consultants. *The Board accepted Recommendation #2* of the Advisory Council and wished to inform the Advisory Council that the Board is not currently considering any proposals of this kind.

Recommendation 3: That SRM investigate the feasibility of establishing a fellowship program in Washington, D.C. This was viewed as an excellent opportunity for a select person(s) to shadow the Washington, DC, Representative in making contacts with other organizations, agencies, and key people. *The Board acknowledges*

Recommendation #3 from the Advisory Council and asked the Washington, DC, Representative to investigate the possibilities of the proposal in terms of existing fellowship programs in the nation's capitol.

Recommendation 4: The SRM accept the Colorado position to not support the Affiliate Membership Proposal. This was a reversal of the Advisory Council's position from the Annual Meeting. It was the majority feeling, after further consideration, that the Affiliate idea may result in a loss of revenue and membership instead of its planned objective to gain membership and spread the word in *Rangelands. The Board accepted Recommendation #4* from the Advisory Council which is to discard the SRM Affiliate Proposal. The Board then accepted a proposal to work with interested Sections to develop an outreach proposal that would embody the concepts and feasibility of the SRM Affiliate Proposal but would not involve a membership category.

Recommendation 5: Support the recommendations of the Task Group on Unity in Concepts and Terminology. After presentation of the report and tabling it overnight for study and consultation, the Advisory Council felt it was very timely and needed to unify the profession and the agencies depending on the professionalism of SRM. *The Board accepted the report of the Task Group on Unity on Concepts and Terminology during the report of the Task Group.*

Advisory Council Informational Items for the Board of Directors:

1. there was review, and consideration of, the potential for a split in the profits or losses of the Summer Meetings. The Advisory Council decided they prefer the present situation as a section-sponsored activity. *This item will be referred to the Finance Committee for review as to cost and revenue sharing, and the Board will act after their input is received.*

2. *the Advisory Council passed a resolution to ask the Public Affairs Committee to review the Environmental Protection Agency's "Proposed Guidance Specifying Management Measurements for Sources of Non-Point Pollution and Coastal Waters".*

In addition to these Advisory Council recommendations and informational items, the Board noted the SRM Policy and Position Statements, as currently accepted through this meeting, will be published in the Trail Boss News as soon as possible for the membership. This action was in response to a request they received from the Advisory Council at the 1991 Annual Meeting.

Index, Volume 13
1991


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