

Yellowstone's Northern Range Revisited

By Francis J. Singer

Management of elk and bison on the northern winter range of Yellowstone NP has remained a controversial subject through most of this century. Elk were artificially controlled particularly from 1935-68, and bison were fenced and cropped in the park. However, beginning in 1969 these reductions were terminated, and by 1971 a hypothesis of self- or natural-regulation of Yellowstone's ungulates was formulated by Glen Cole and Douglas Houston. Houston reported the experiment to be largely successful through 1979 in his book *The Northern Yellowstone Elk - Ecology and Management* (1982 Macmillan).

However, a series of events in the 1980s prompted renewed concern over the success of the experiment. Bison, elk, mule deer, and pronghorn antelope numbers increased dramatically. Elk counts rose from 10,500-12,000 in the 1970s to 16,000 by 1982 and then to 19,000 by 1988. Pronghorn antelope counts roughly tripled in the 1980s from 152 to 495, while the mule deer counts increased from 1,007 to 2,217. Elk largely reoccupied the portion of the northern range outside the park, effectively increasing the size of the winter range by about one-fifth. Seven of the first eight winters in the 1980s were less severe than normal. In August 1986, the NPS Washington office provided special funding through its Natural Resource Preservation Program to investigate the status of the northern range. In October 1987, Congress directed the NPS to "start a study on Yellowstone to see whether there is evidence of overgrazing."

A multidisciplinary approach was taken to studying the effects of elk grazing upon the northern winter range, and to date, 40 separate research projects involving 5 park scientists, 4 other agency scientists and 34 scientists from 18 different universities have been initiated. A series of five problem analyses has been conducted by outside scientists on key problem areas (elk population dynamics, grassland herbivory, riparian area concerns, willow ecology, and pronghorn conservation biology). Each panel has consisted of two to eight outside scientists, and their recommendations have helped shape the park's research programs.

The initial round of studies emphasized the grassland, meadow and sagebrush-bunchgrass communities, since elk derive most of their forages from them. Comparisons between ungrazed sites (within exclosures) and grazed sites were made for soil nutrients, soil compaction, soil infiltration rates, plant species abundance and production, and plant root biomass. Consumption rates by ungulates, grazing tolerances of key forage, and long-term grassland trends from LANDSAT imagery were investigated in separate university-based projects.

The paleoecological history of the northern range for the past several thousand years has been investigated through studies of pond sediment pollen histories, and for the past one thousand years cave deposits. Elk ecology studies have included radiotelemetry-assisted studies of migrations, habitat preferences, the ecological separation of mature bulls from cows and young bulls, and rate and causes of elk calf mortality.

The data suggest no statistically significant changes this century (the period of proposed elk overpopulation) in the nutrient inputs, sediment accumulation, or pollen profiles of eight northern range ponds when compared to pre-park levels. Winter range grasslands apparently are influenced very little by elk grazing.

RESEARCH ON YELLOWSTONE'S NORTHERN RANGE

Funded by the National Park Service

Project Title	Principal Investigator	Institution
Collect population statistics and monitor population size and mortality rates of elk, mule deer, and pronghorns. Document sources and rates of elk calf mortality.	F. Singer	NPS
The response of aspen to burning and ungulate browsing.	D. Despain	NPS
Range relations of five ungulate species.	F. Singer	NPS
An analysis of elk summer habitat.	F. Singer	NPS
Collect population statistics, and monitor population size and mortality rates of bighorn sheep.	M. Meagher	NPS
Bison ecology studies in Yellowstone National Park.	M. Meagher	NPS
Rehabilitate abandoned ranchlands dominated by exotic plants.	C. McClure, D. Despain	NPS
Evaluate condition and determine trends in elk winter range through exclosure comparisons.	F. Singer C. Montagne	NPS Mont. St. U.
Moose numbers, movements, habitat and forage use, and effects upon riparian areas.	F. Singer T. Puchlerz D. Tyers	NPS U.S.F.S. U.S.F.S.
Determining the sources of Yellowstone River sediment and turbidity.	Numerous individuals	Several Agencies
Comparative study of winter nutrition of Yellowstone elk using snow-urine analysis.	G. Del Giudice F. Singer	U. of Minn. NPS
Debris flow-dominated alluvial fans on Mt. Everts in northern Yellowstone National Park: depositional frequency and chronology of fan development.	C. Craig J. Schmitt	NPS Mont. St. U.
Food habits of the Yellowstone grizzly bear.	R. Knight	I.G.B.S.T.
A study of the range use and movements of elk in the upper Yellowstone area, in and out of Yellowstone Park.	J. Swenson	Mont. Fish, Wildl. Parks
	J. Vore, H. Picton	Mont. St. U.
A study of the relationships between prehistoric humans and wildlife in the northern range of Yellowstone Park.	E. Hadly L. Agenbroad	NPS N. Ariz. U.
Forage production and utilization patterns by elk and bison on all four seasonal ranges.	S. McNaughton, D. Frank	Syracuse U.
LANDSAT interpretation of grassland standing crops.	M. Boyce, E. Merrill, Marrs	U. of Wyom.
Ecology of mature bull elk.	J. Peek, D. Vales	U. of Idaho
Human disturbance of wintering elk.	E. Ables, F. Cassirer	U. of Idaho
Hunter and recreationist disturbances of elk near Gardiner, Montana.	H. Picton J. Vore	Mont. St. U. Mont. Fish, Wildl. Parks
Herbivory on the northern Yellowstone winter range.	M. Coughenour, J. Detling	Col. St. U.
The status of willows: distributions and browsing impacts on the northern range.	F. Singer	NPS
Behavioral and activity comparisons of Madison-Firehole, Lamar Valley, and Mammoth Hot Springs elk.	E. Ables	U. of Idaho
Riparian vegetation of the northern range, Yellowstone National Park: classification, succession, and environmental relationships.	R. Pfister, S. Cooper	U. of Mont.
The relationships of climate to sedimentation rates in lakes and ponds on the northern range in Yellowstone National Park.	H. Wright C. Barnowsky	U. of Minn. Carnegie Instit.
Factors that limit elk populations in the greater Yellowstone ecosystem.	C. Kay, F. Wagner	Utah St. U.
An intensive study of mountain lions in Yellowstone National Park and in the Yellowstone River drainage outside the park.	M. Hornocker	Wildl. Res. Instit.
Responses of major forage species to grazing by bison and elk.	L. Wallace	U. of Okla.

There were no differences in 12 soil nutrients or in runoff or sediment yield (as determined by a rainfall simulator), between grazed and ungrazed areas. However, there were higher surface bulk densities and lower soil infiltration rates in grazed areas. Several grasses that can increase when grazed, including junegrass, bluegrasses, and thickspiked wheatgrass, were more abundant in grazed areas. However, annual production of grazing-sensitive grasses – bluebunch wheatgrass and Idaho fescue – were not influenced by grazing, as were 19 other grasses, 87 forbs, and 22 shrub species found on the study sites. Root biomass and total plant cover were uninfluenced by grazing, although there was less dead litter and more bare ground on grazed sites.

The studies indicate only subtle differences between grazed sites on winter ranges and sites protected within exclosures for 27-31 years. None of the differences suggest departures from natural conditions. The park recognizes that total protection from grazing as in exclosures does not represent natural conditions. The 27-31 year old exclosures only serve to emphasize how little elk grazing affected the drier, winter range sites. This evidence further supports D. Houston's contention (1982) that precipitation patterns influenced the grasslands more than elk grazing. From 1958 to 1981, total plant cover more than doubled on grazed and ungrazed study sites apparently due to a pattern of wetter summers, at the same time elk numbers more than quadrupled following termination of the artificial reductions.

Few conclusions may be made about the effects of elk and bison grazing upon the summer range, because most of those studies are still in progress. Perhaps a greater influence from grazing summer range may be documented because ungulates graze the plants on summer range while they are growing, in contrast to grazing cured, dormant forages on winter range after these plants have transported their nutrients to their root systems in the fall. The frozen ground and protective snow cover further minimize grazing effects on winter range plants. One study, however, suggests that summer range grassland standing crops, as determined from LANDSAT imagery, are significantly correlated to optimal winter snowpack and not to elk numbers. Summer range grassland production, however, was directly correlated to elk calf crops.

Another study has found fewer plant species inside exclosures on summer ranges. Short-statured plants were less abundant inside exclosures, probably because grazing did not trim taller plants. Research on willows and aspen has just been initiated, and will include studies of grazing intensities, annual production, and the effects of drought and fire upon ungulate preferences of plants and the production of plant secondary defense compounds.

The severe drought and the fires of 1988 may help to answer several questions about the northern range. A large number of willow and aspen stands burned in 1988, for the first time this century. The opportunity has been presented to document fire responses of these species. Park biologists are predicting enhanced growth, new seedling establishment, and greater abundance of willow and aspen. Although palatability may also be enhanced by the burning, many aspen and willow stands may escape to above the height of ungulate browsing after the fires.

As a combined result of the drought, burning of winter ranges, and a severe winter in 1988-89, mule deer numbers declined 19 percent, pronghorns 27 percent, and elk 38-43 percent (of which 14-15 percent was harvest and 24-27 percent was winterkill). The

opportunity now exists to document the ungulate recovery from the winterkill and response to large scale burns of both winter and summer ranges. Currently, one group of biologists is predicting fire-related enhancement of elk carrying capacity due to greater nutrient content and greater forage production in burned areas. Another group of scientists is predicting only moderately enhanced carrying capacity and only minor or no increase in elk numbers as a result of the fires. This group maintains that fire-related enhancement of forage quality is often minor (only a few percentage points) and the effects may be short-lived, lasting perhaps only 1-3 years. Additionally, elk are so efficient at selecting a consistently high level of nutritious forages, especially on summer ranges, that even though fires enhance forages, the net benefit to elk is relatively minor. The fires of 1988 have provided a unique opportunity to investigate these conflicting hypotheses on a large scale.

Abstracts from the First and Second Annual Meetings of Research and Monitoring on Yellowstone's Northern Range (January 28-29, 1988 and March 22-23, 1989) are available from J. Varley, Chief of Research, Box 168, Yellowstone NP, WY 82190. Also available from the same address is a Summary of Significant Findings dated July 15, 1989, and copies of final reports on the winter range exclosure studies (soil, grasslands) and the pond sediment studies.

Singer is a Research Biologist at Yellowstone NP.