Exclosures in Big Game Management in Utah[1]

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An "exclosure" is defined by Daubenmire (1940) as an experimental area which is protected from the activities of a particular class of animals by a barrier such as a fence or screen, thereby controlling a single factor of environment, namely, the animal influence. Several different types of exclosures are employed by the land management agencies in Utah. One of these is the "big game" exclosure.

Typically, big game exclosures in Utah are fixed installations consisting of three parts. The first part is fenced to exclude both big game and livestock and is referred to as the "total-protected"area. The second part is fenced to exclude only livestock and is referred to as the "game-only" area. The third part is unfenced (often designated by stakes) and subject to use by all classes of range animals. It is referred to as the "open-range" area. The game-only area is omitted where there are no livestock, thus making an exclosure of only two parts.

Big game exclosures came into use in Utah when deer populations conflicted with livestock interests in central and southern Utah during the early 1930's. As a result of the increases in deer numbers, two groups were opposing certain policies of the land management agencies. On one hand, stockmen, threatened with grazing allotment cuts, believed that overabundant deer, and not livestock, were mainly responsible for deteriorating range conditions. On the other hand, sportsmen were not convinced of overpopulations and refused to harvest sufficient numbers of the deer. Big game exclosures were built to show the actual circumstances.

Three small exclosures were first built in Utah in 1932 by the Utah State Department of Fish and Game and the U. S. Forest Service on Beaver Mountain of the Fishlake National Forest. The first of these was in Baker's Canyon on deer winter range, the second near Merchant Valley on deer intermediate range, and a third south of Big Flat on summer range. Additional exclosures were added in 1933 on the summer range of Beaver Mountain.

These pioneer exclosures demonstrated that the chief effect of overstocking by deer was the deterioration of browse and that livestock were responsible for overgrazing the grasses.

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The objectives of the present study were (1) to describe the existing big game exclosures in Utah, (2) to investigate the possibility that deer use of game-only areas and the surrounding open-range may often be unequal, and (3) to evaluate the role of big game exclosures in range management in Utah, and to indicate the direction of future endeavors.

From historic records and the examination of isolated tracts that escaped overgrazing, Utah's foothill ranges are thought to have once grown abundant native forbs and grasses (Julander, 1954). With the arrival of settlers, and as their cattle and sheep herds prospered, much of this cover was destroyed. In its place grew big sagebrush, juniper, and other shrubby species that were better able to withstand use by livestock. Simultaneously, as large areas in the foothills and mountains of the state grew to browse, the deer herds began to respond to protection from hunters and predators. The combination of abundant feed and protection produced the most favorable condition for deer increase since settlement (Rasmussen and Gaufin, 1949) and lasted until about 1942, when deer numbers outgrew the forage producing capacity of important parts of the range (Julander, 1954).

In 1890, the range lands of Utah supported unregulated use by approximately 360,000 beef cattle and 2,000,000 sheep (Rasmussen and Gaufin, 1949). Heaviest livestock pressure on the ranges occurred from 1915 to 1920, as a consequence of the demands for meat created by World War I. Following that war, livestock reductions were effected, but concurrent with these reductions deer numbers were growing, so that total animal pressure was probably not much relieved (Julander, et al., 1950). By 1954, Utah's cattle numbers were increasing, while sheep numbers were decreasing. Shorter seasons on the range, decrease in grazing permits, and increased use of feedlots, however, have lessened over-all cattle pressure on the range.

FIGURE 1. Gardner Creek exclosure, with the total-protected area (left) and the open-range area (right). Deer were responsible for the difference in browse. Photo taken in 1954.

Status of Exclosures

Thirty-six big game exclosures were known to be located in Utah in 1954. The U. S. Forest Service sponsored and carried the big game exclosure building program in Utah until 1946. The Utah State Department of Fish and Game later became interested and built 7 exclosures on a cooperative basis with the U. S. Forest Service. Thirty-four exclosures were located within national forest boundaries, one on Utah State Department of Fish and Game land, and one on U. S. Bureau of Land Management land. Sixteen exclosures were built prior to 1942, and 20 more were completed after the end of World War II. Six exclosures had only a total-protected area; 30 were designed with total-protected and game-only areas, two of which had rabbit-proof areas also. Twenty-seven exclosures were fenced with wiring, and nine were of log and block walls. Twenty-five exclosures could be reached by road, ten were less than one mile from a road and one was about five miles from a road. The trend was from small exclosures (10 were less than ½ acre), designed primarily for demonstration purposes, to larger exclosures (10 were ½-1 acre and 16 were 1-4 acres) better suited for investigating the effects of grazing and browsing animals on the range.

Topographically, the locations of the big game exclosures were classified into five natural divisions. Five were in bottomlands, 8 on ridgetops, 5 on mesa or plateau tops, 8 on hillsides, and 10 on relatively level foothill areas. Exclosures were grouped into 10 vegetation types based on the most conspicuous or dominant vegetation present (Table 1). The exclosure locations ranged in elevation from 5,000 feet to 10,100 feet. Twenty-eight (78 percent) had a southerly exposure; the remaining 8 (22 percent) faced a northerly direc-

Table 1. Big game exclosures by vegetation types, Utah, 1954.

Vegetation type	Exclosure	
	Number	Percent
Sagebrush and mountain brush	9	25.0
Mountain brush	7	19.0
Sagebrush	6	16.5
Aspen	5	14.0
Sagebrush and aspen	2	5.5
Mountain brush and juniper	2	5.5
Reseeding	2	5.5
Sagebrush and juniper	1	3.0
Sagebrush and reseeding	1	3.0
Aspen and reseeding	1	3.0
Total	36	100.0

tion. The exclosures were located on ranges important to either big game or big game and livestock. The majority received moderate to heavy use by deer and cattle, and some by deer alone (Table 2). Sixteen exclosures (44 percent) were located on deer winter ranges, 14 (39 percent) were on summer deer ranges, and 6 (17 percent) on intermediate (spring and fall) deer ranges. Livestock use was restricted to spring, summer, and fall on ranges having exclosures.

Effects of Animal Use of the Range

Big game exclosures can be useful in studying the effects of big game and livestock on plant composition, density, and growth forms, as well as on litter and soil.

Ground-cover

Five-foot square plots were read on tracts having similar slope, exposure, and vegetativc type and growth densities, for the total-protected, game-only and open-range areas. A visual estimate was made of the percent of the plots covered by soil-pavement-rock, litter, and herbaceous species. Forbs and grasses were rated as "desir,-ables", "intermediates", or "least desirables", as classified by the Intermountain Region of the Forest Service (Varner, 1954). The results apply only to exclosures used by deer and cattle, since too few exclosures were used by sheep and elk for reliable observations.

Differences in ground cover were negligible between the total-protected and game-only plots, while significantly more soil-pavement-rock, less litter, less grasses, and less desirable forb species were found on the open-range plots, showing that cattle and deer combined, more than deer alone, adversely influenced herbaceous ground-cover.

Browse

The effects of animal use on browse plants were clearly shown at the big game exclosures. When deer use was excessive, the browse on the areas accessible to deer was hedged and highlined, and often spindly. The only surviving age classes of browse were large shrubs that had reached a mature size at the time deer numbers became excessive, which permitted hedging or highlining instead of complete destruction. Frequently, palatable shrubs on total-protected areas were plentiful, while the same species had surrendered their places to less palatable shrubs on the game-only and open-range areas accessible to deer.

Ten browse species, important to range animals because of their palatability or abundance, were prominent at the exclosures (Table 3). Of these, bitterbrush *(Purshia tridentata)*, service berry *(Amelanchier* spp.), curlleaf mahogany *(Cerocarpus ledifolius)*, birchleaf mahogany *(C. montanus)*, cliffrose *(Cowania stansburiana)*, and aspen *(Populus tremuloides)* appeared most sought after by range animals, and most abused. Where the above 6 species were abundantly available, big sagebrush *(Artemesia tridentata)*, juniper *(Juniperus osteosperma)*, Gambel oak *(Quercus gambelii)*, and snowberry *(Symphoricarpos* spp.) appeared lightly utilized Only when the more palatable shrubs were unavailable were the latter 4 species closely used. The former 6 species (excepting aspen) were characterized by thin stands, while the latter 4 species usually grew abundantly.

Generally, the low-growing, bushy species like bitterbrush and snowberry grew to withstand continued over use by forming an impenetrable hedge-like growth, while the more chararcteristically treelike species succumbed more readily unless they were tall enough to be partially out of the reach of deer. Bitterbrush in particular was able to survive by forming a hedge in this manner. Where protected, it had an open bushy growth that stood more than 3 feet high. With abuse, however, it was often reduced to a matted

Table 2. Big game exclosure having moderate to heavy use by big game and livestock, Utah, 1954.

Class of use	Exclosure	
	Number	Percent
Deer and cattle	22	61
Deer only	9	24
Deer, cattle, and elk	2	6
Deer and sheep	1	3
Deer, sheep and elk	1	3
Deer and elk	1	3
Total	36	100

Table 3. Important browse species occurring at the 36 big game exclosures, Utah, 1954.

Browse species	Occurrence	Percent of Occurrence
Big sagebrush	29	80.6
Bitterbrush	22	61.1
Serviceberry	17	47.2
Juniper	17	47.2
Snowberry	16	44.4
Birchleaf Mahogany	13	36.1
Gambels oak	11	30.6
Aspen	11	30.6
Curlleaf mahogany	8	22.2
Cliffrose	5	13.9

growth only a few inches high. Big sagebrush survived on most grazed plots because it was usually only lightly browsed. However, on many deer winter ranges big sagebrush suffered severely from overuse.

The recuperative powers of the different browse species varied considerably. Bitterbush, birchleaf mahogany, and snowberry were noticeably quick to recover; after only 2 or 3 years of protection in newly built exclosures they were no longer hedged and once again open-growing. The treelike species, however, were slow to regain foliage below the highline; highlines were often visible after years of protection.

The majority of the exclosures had serious shortcomings for purposes of studying the effects of livestock or big game use. In the first place, most were too small to enclose representative portions of range, even though they were located on representative parts of the range. Many were poorly built or maintenance had been neglected, with the result that animals entered the areas from which they were intended to be excluded.

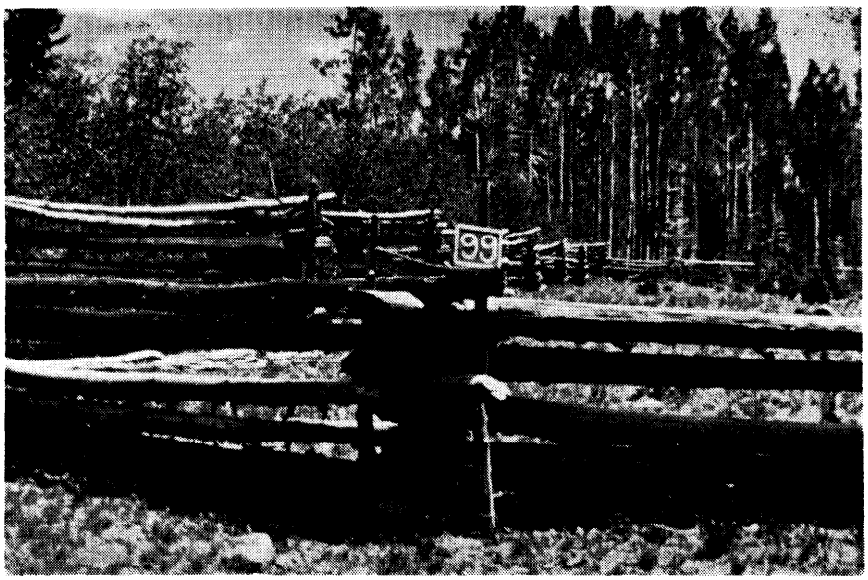

FIGURE 2. Big Flat exclosure, Utah, 1954, showing the fence line that divides the total-protected and game-only areas that were clear-cut of aspen in 1932. Notice the total-protected area (left) filled with young aspen, while the game-only area (right) remains bare of aspen because of heavy deer use.

Deer Use of Game-Only Exclosures

A comparison of deer use inside game-only areas with that of the surrounding open-range was made by pellet-group counts at 26 big game exclosures having game-only areas. Areas within the game-only fencing were matched with open-range areas having equivalent slope, exposure, and vegetation. On each area studied 3 or 4 belt transects of from 100 to 200 feet were run. As shown by the pellet group counts, deer use on the game-only areas was approximately equal to the open-range use at 9 exclosures, but at 9 others it was considerably greater and at 8 others considerably less. The abundance of browse on the range that surrounded an exclosure probably influenced this use. When browse was abundant outside, deer were less inclined to cross the fencing. When scarce, and the game-only browse was abundant, as at the Grass Valley exclosure, deer were attracted inside the exclosure. Deer appeared less inclined to enter game-only areas one-quarter acre or less in size than larger areas, while a size larger than one acre appeared to deter deer the least (Table 4). The age of an exclosure seemed not to affect deer use, as judged by pellet-group counts. A factor which can influence deer use is fence height. It should be 3-3½ feet high to effectively exclude livestock, but not higher, so as to be no barrier to the different size and age classes of deer.

Table 4 Deer use at 26 big game exclosures, related to the size of the game-only areas, Utah, 1954.

Game-only area size (acres)	No. of exclosures having more "game-only" than open-range" deer use	No. of exclosures having equal "game-only" and "open-range" deer use	No. of exclosures having less "game-only" than "open-range" deer use
00 to 0.24	0	0	5
0.25 to 0.49	1	1	0
0.50 to 0.74	1	1	1
0.75 to 0.99	2	1	1
1.00 and larger	5	6	1
Total	9	9	8

Discussion and Recommendations

The many small "show me" exclosures built on deer problem areas of the State demonstrated that livestock and not deer were mainly responsible for the depleted range grasses. The exclosures helped to educate sportsmen to the effects of too many deer on browse, showing that deer numbers were limited in the long run to the available browse on a range. For the specific purposes that they were intended these exclosures were effective devices in bringing about a better understanding of the effects of livestock and deer on the range.

To more fully realize the potential value of big game exclosures for scientific study as well as for demonstrating the long-range effects of animal use on the range, it is recommended that the land management agencies cooperatively plan future construction guided by the following points:

(1) That big game exclosures be located on representative parts of range, physiographically as well as vegetatively, and that they enclose ecological units of range that can develop naturally and independently of the surrounding range. The more heterogenous the conditions, the larger the exclosures would necessarily be. That total-protected, game-only, and open-range areas be carefully selected to have equivalent conditions, thereby allowing for accurate comparisons. Experienced range ecologists should be delegated the responsibility of location and design.

(2) That big game exclosures be permanent installations, with no more being built than can be properly maintained by the agency which built them. Once their upkeep is neglected and animals enter, much of the accrued development is destroyed.

(3) That big game exclosures be distributed on the important vegetation types to sample use by the different kinds of range animals. Some important vegetation types that should be sampled are: (a) foothill sagebrush, (b) pinyon-juniper, (c) mountain brush (d) aspen.

(4) That the fencing for exclosures should be of the most open design practical to minimize its effects on the range environment. However, log and block fencing, because of its durability, would possibly be necessary where deep snows prevail. Fencing which excludes deer should stand at least 8 feet high. Fencing excluding livestock, while allowing deer to enter freely, should stand 3 or 3½ feet high, and be railed.

(5) That where rabbits are abundant, part of the total-protected area should be made rabbit-proof. This can be done with 1-inch by 1-inch mesh welded wire, supported against sagging, the lower edge of which should be buried 6 inches and pegged securely into the ground. Fitch and Bentley (1949) describe construction that will exclude gophers and other rodents.

(6) That a sign giving the name, date built, building agency, and purpose would identify the structures, and discourage their use as corrals. Stiles or ladders should permit access to the total-protected areas, since gates or doors may be left open.

(7) Included in the compiled records should be permanently located photo-hubs, and aspect and fence line photographs. Also recorded should be climate and animal use, including classes, seasons, and intensities. In addition, carefully designed studies sampling the different components of the range, groundcover and browse, should be established on the exclosures and surrounding range. These studies, standardized and regularly repeated, would chronicle the long range effects of differential animal use on the range.

LITERATURE CITED

FITCH, H. S. AND J. R. BENTLEY. 1949. Use of California annual forage by range rodents. Ecology 30: 306-321.

JULANDER, ODELL. 1954. Ecology of deer-livestock foothill ranges in Utah. Rept. An. Conf. Western Assoc. State Game and Fish Commissioners. pp. 186-194.

———, W. L. ROBINETTE, A. D. SMITH AND D. M. GAUFIN. 1950. A review of Utah's big game, livestock, and range relationship problems. Intermountain For. and Range Exp. Sta. Res. Paper 24. 53 pp.

RASMUSSEN, D. I. AND D. M. GAUFIN. 1949. Managing Utah's big game crop. Trees, Yearbook of Agriculture. House Doc. 29. U. S. Govt. Prtg. Off. pp. 573-580.

SHORT, L. R. 1939. Enclosures and temporarily fenced plots. Proc. Range Res. Seminar, Great Basin Res. Center, Ephraim, Utah. U. S. Forest Service Rept. pp. 211-219.

VARNER, I. M., R. E. LATIMORE, D. M. GAUFIN, E. R. DOMAN AND D. I. RASMUSSEN. 1954. Big game range analysis. Rept., Intermountain Region, U. S. Forest Service. 54 pp.

Cure for Sore Head in Sheep

Filarial dermatosis of sheep, also known as elaeophoriasis, or "sore head", can be cured. Two compounds, ET-57 and piperazine, gave complete cure of even the most advanced cases of the disease in USDA tests.

This rare skin malady affects sheep grazing above the 6,000-foot level on summer ranges in the western United States and Canada. Although it now infects less than 1 percent of domestic sheep, there are indications that the disease is spreading.

Filarial dermatosis is caused by a worm parasite related to the nematodes responsible for elephantiasis in humans. The microscopic larvae live in the skin, causing raw, bleeding lesions of the head, feet and abdomen, which result in lameness and blindness.

A single injection of ET-57 directly into the rumen of an affected animal can cure it. Adding piperazine to the sheep's drinking water for 3 days or administering it as a single drench proved equally effective. USDA scientists believe that both drugs can be adapted for treatment of sheep under field or range conditions.