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ANTELOPE AND SHEEP FENCES

Preliminary Report of a Study

by

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Introduction

In recent years sheepmen on Western range lands have become increasingly interested in management of better pasture for their flocks. This has been brought about, at least in part, by the difficulty of obtaining good herders. Experiments prove that lambs develop better when raised in fenced pastures. More effective predator control has reduced the hazard of sheep running loose in pastures without the constant protection of a herder. Fences enclosing such pastures have crossed antelope migration routes, enclosed range water supplies, and favored seasonal ranges of antelope. It has been reported that unregulated fencing of antelope ranges in New Mexico has resulted in the extirpation of a number of antelope herds and sportsmen and conservationists in the Northern Great Plains are fearful that increased fence construction on public lands will have similar results.

Late in 1951, the Bureau of Land Management requested a study be made of the effects of sheep-tight fences on antelope ranges in Montana and Wyoming to serve as a basis for future policy in permitting construction of such fences on public lands. Following a preliminary survey, three areas were selected as representative for the study. These were the Red Desert region near Rawlins, Wyoming; northern Converse County, Wyoming; and southern Carter County, Montana. The study was begun in January 1952, and continued intermittently to date. Following is a report of findings.

The Red Desert

The Red Desert region of south central Wyoming is an area of rather high elevation as it extends to either side of the Continental Divide. Much of this range lies between 6000 and 7000 feet above sea level. Scant precipitation supports a semi-desert type of vegetation characterized by sagebrush (Artemisia tridentata, A. cana, A. pedatifida) saltbush (Atriplex canescens), rabbitbrush (Chrysothamnus sp.), and greasewood (Sarcobatus vermiculatus). Grasses are mainly of the bunching habit and forbs are sparse. In consequence, the grazing capacity of these ranges is relatively low. Normally, the winter snowfall is not heavy and the nearly constant winds keep the ridges and higher slopes swept free of snow. This general region has been favored as a winter range for sheep for many years, the herders moving the bands to keep them from the areas of deeper snow.

This region is also a good yearlong antelope range. The antelope herds do not appear to have a definite pattern of seasonal movement, although moving over a wide area to satisfy requirements for forage, water, and shelter from storms. In the area of about 1,250,000 acres, from Riner to Table Rock and north to the Sweetwater County line, approximately 3200 antelope were counted by the Wyoming Game Commission in January 1952. Heavy losses were sustained by the antelope in this region during the severe winter of 1948-49 but at the present time recovery rate is very satisfactory.

There are now four sets of pastures in this area. These are the Rochelle Pastures, which include about a township in T. 21 N., R. 91 W.; the Seaverson Pastures in T. 20 N., R. 92 W. enclose about seven sections; the Hadsell Pastures in T. 21 N., Rs. 93 and 94 W., are about eleven sections in area, and the Larsen Pasture in T. 20 N., R. 97 W. encloses about thirty-two sections. The fences around all these pastures are constructed of woven wire. The Rochelle and Hadsell Pastures are used by sheep while the Seaverson and Larsen Pastures are mainly for cattle. These are all comparatively new enclosures, the oldest being the Seaverson Pasture which was permitted in 1945. The fences on the Larsen Pasture and the last part of the Rochelle Pastures were completed in 1952. The Rochelle Pastures are used spring, summer and fall by sheep. The Seaverson Pasture is used during the summer by cattle. The Hadsell Pasture is permitted as winter sheep pasture and the Larsen Pasture is permitted yearlong for cattle. All of these pastures are within the so-called checkerboard lands, or lands within the Union Pacific Railroad grant which gave the railroad ownership of the odd numbered sections within a distance of twenty miles on either side of the railroad right-of-way. The even numbered sections are largely Federal range. The Union Pacific Railroad has sold a considerable amount of this land to individuals for use as range or pasture as, due to the high elevation, short growing season and scarcity of water, it is not adapted to cultivation.

The existing pastures in this area occupy a relatively small part of the range used by antelope and in consequence have a relatively little influence on the antelope population as a whole. Should the fencing

program be expanded and include all of the checkerboard lands in this region, it could definitely influence available antelope range. This thought, apparently, has been back of much of the opposition emanating from this area to construction of fences on public lands.

About fifty miles north of Rawlins, on the north side of the Ferris Mountains and along the Sand Creek and Deweese Creek drainages, is the Buzzard Ranch owned by Mr. Leroy Moore. In enclosing pastures adjacent to the ranch, Mr. Moore has included some Federal range land, most of which inclusions were duly authorized. Most of the fences which Mr. Moore has reconstructed or newly constructed, are made with woven wire so as to hold sheep. There are about 1500 antelope that range yearlong in this area, spending the summer on the higher slopes and moving down along Sand Creek and adjacent to the Platte River as snow becomes deeper in the higher country. Many of the antelope spend the entire year along the lower part of Sand and Deweese Creeks, frequenting the hay meadows along these streams as well as the low hills and sand dunes adjacent to them. In addition to the woven-wire fences built by Mr. Moore, there are also some barbed-wire fences on this range to control the drift of cattle that are grazed here during the summer season. There has been criticism by local sportsmen and others of the fences built by Mr. Moore. These people feel that the fences are detrimental to antelope use of this area.

Converse County, Wyoming

Converse County in east central Wyoming has a high antelope population, much of the county being good antelope range and privately owned. Most of these private lands are fenced and are used as pastures for raising both sheep and cattle. Many of the fences are barbed wire but there are also many woven-wire fences, and generally the pastures are large, ranging from two to eight or ten sections in area.

Elevations here are somewhat lower than the Red Desert region, ranging from around 4800 feet to about 5500 feet above sea level. Precipitation is a bit more plentiful and supports a better growth of vegetation. It is predominantly a sagebrush country with Artemisia tridentata and A. cana as the most abundant species. Soapweed (Yucca glauca) and prickly pear are characteristic and the common grasses include blue grama, needlegrass, and western wheatgrass. Some of the better land is being farmed and hay meadows have been developed along a few of the larger stream bottoms but the greater part of the land retains its native cover.

Because most of the northern part of the county is privately owned and is fenced and at the same time supports one of the densest antelope populations in Wyoming, observations were made here in an effort to learn what effect, if any, the fences may have on the antelope.

Carter County, Montana

Southern Carter County in the extreme southeast corner of Montana was also included in the study. This is largely a range livestock area

with some cultivated and hay lands along the major drainages. The principal streams in this area are the Little Missouri River, Box Elder Creek, Little Powder River, and Powder River, all of which are roughly parallel and flow in a northeasterly direction. The relief is comparatively low. Most of the land along these streams is privately owned and fenced.

Some thirty years ago, antelope in this area were greatly reduced in numbers and it was largely through the local ranchers, who organized the Carter County Game Protective Association, that they were given sufficient protection from poaching to allow recovery to present numbers. The antelope population in this area at the present time is in the neighborhood of 3000 head, according to counts and estimates made by technicians of the Montana Game Commission, and the herds are increasing.

These antelope have a tendency to migrate between summer and winter ranges, with migrations largely influenced by weather conditions. During mild winters the movement is limited and many of the antelope will spend the winter along the Little Missouri and Box Elder Creek in areas that are also used as summer range. Severe storms or deep snow will cause the antelope to move westward to areas in the Powder River breaks along Cow Creek, Pilgrim Creek, and other small side drainages that empty into Powder River. In order to follow these ancestral migration routes, the antelope now have to pass many fences, both in getting to this winter range and again when they return to the summer areas. This they are apparently successful in doing and the manner in which they overcome these obstacles has an important bearing on the study. Observations have been made in a strip approximately twenty miles wide, north of and paralleling the highway from Alzada to Broadus, Montana.

THE STUDY

Rochelle Pastures

The Rochelle Pastures, located about twenty miles west of Rawlins, occupy practically all of T. 21 N., R. 91 W., and include seven individual enclosures. They are all enclosed by woven-wire fences but several types of constructions are represented. The exterior fence of Pasture 1 is of 32" woven wire set at ground level with 1 barbed wire 6 inches above the top of the woven wire and a second barbed wire 8 to 9 inches above the first barbed wire, making a total height of from 46 to 48 inches. Posts are one rod apart. This same fence extends northward forming the exterior fence of Pastures 2 and 3. The exterior fence of Pasture 5 is, in part, 26" woven wire, 6 inches between the first and second wires, and 7 inches between the second and top wires, making a total height of about 46 inches. The remainder of the exterior fence of Pasture 5 is of 26" woven wire placed with the bottom about 6 inches above the ground. A strand of barbed wire is strung about midway between the bottom of the woven wire and the ground. Two strands of barbed wire are placed above the woven wire, the first strand 5 inches above the woven wire and the top strand 8 inches above the first strand. This makes a fence approximately 45 to 46 inches in height. Posts are placed one rod apart. The division fence between Pastures 2 and 3 is 32" woven wire with one barbed wire 9 inches above the woven wire, making a total height of about 42 inches. The west side of Pasture 3 and one mile of the south side is 32" woven wire, placed about 7 inches above the ground. A strand of barbed wire is strung midway between the bottom of the woven wire and the ground. A strand of barbed wire is also strung 6 inches above the top of the woven wire, making a total height of 45 to 46 inches. The posts are alternate wood and steel, spaced one rod apart. These are all new fences, the first being completed in about June 1950, and the last being built during the summer of 1952. When these pastures were enclosed, a number of antelope was trapped within them. Mr. Rochelle and the local Bureau of Land Management officers and game warden agreed to keep the gates closed in Pasture 1. It was hoped by making periodic checks on these animals it could be learned if the pastures had any detrimental effects upon the animals and also if the antelope could get in and out of these pastures. Pasture 1 contains about 5 sections. The first count of antelope in it was made by Mr. Bridge and Mr. Rochelle in June 1950, shortly after the fence was completed and a total of 9 antelope was found. The following is a tabulation of the subsequent counts as obtained from the Bureau of Land Management files in Rawlins:

<u>Date</u>	<u>Observer</u>	<u>Count</u>
June 1950	Bridge and Rochelle	9 (Fence just completed)
July 24, 1950	Bridge and Rochelle	10
Aug. 24, 1950	Wilson and Rochelle	10
Oct. 20, 1950	Bridge and Rochelle	17
Nov. 1950	Wilson and Rochelle	0 (Apparently missed them)
Jan. 10, 1951	Bridge and Rochelle	17
Feb. 1951	Rochelle	17
Mar. 30, 1951	Bridge	2 (Poor day for observation)
Apr. 17, 1951	Kallas	4 (Not official count)
May 7, 1951	Wilson and Rochelle	2
June 6, 1951	Underwood and Scheffner	10 (West fence reported open)
June 20, 1951	Rochelle	20

<u>Date</u>	<u>Observer</u>	<u>Count</u>
July 2, 1951	Wilson and Bridge	10
Aug. 14, 1951	Underwood, Bridge, Rochelle	19
Sept. 20, 1951	Wilson and Kallas	18
Nov. 3, 1951	Rochelle, Underwood, Rakestraw	17
Dec. 6, 1951	Wilson and Colton	17
Jan. 25, 1952	Rochelle and Rouse	16
March 7, 1952	Wilson and Rouse	16
April 14, 1952	Rochelle and Rouse	1 doe

A dead antelope was found in this pasture on March 19, 1952. Examined by Wyoming Game Commission biologists, it was found to have died from a gunshot wound. Some time during March or early April, the gate in the southeast corner of Pasture 1 was found open. It appears that the main group of antelope left the pasture by this exit. Two horses that had been wintering in this pasture were observed in late March on Separation Flat, some three miles east of the pasture, leaving the pasture also through the open gate.

Another group of antelope was confined in Pasture 3, which contains about four sections. Counts were not made systematically in this pasture and I do not have a record of them prior to January 25, 1952. Mr. Rochelle stated that 65 antelope were counted in this pasture during the fall of 1951. One antelope was taken from it by Game Commission biologists for food habit studies early in the winter of 1951. In company with Mr. Rochelle, 60 antelope were counted on January 25, 1952 in this pasture. On February 14, 1952, Mr. Rochelle and I counted 55 antelope here. Heavy snow prevented access to the pasture again until April 14, when Mr. Rochelle and I found 5 antelope in the pasture. On April 15, I returned to the pasture and made a circuit of the fences and found 6 antelope. A heavy snowdrift had nearly covered the fence in a coulee on the northeast boundary of the pasture and it is believed that the antelope had gotten out by walking over the drift. No loss of antelope was found within the pasture and no evidence was found of the antelope getting out at any other point.

Pasture 3 is situated on a high open bench at nearly the same elevation as the Continental Divide in this area, where it is exposed to the wind and offers little shelter. The vegetation is dominated by short sage with a small amount of big sage. Sheep use during the preceding season had been rather close as most of the current growth in the sage and other browse had been cropped and the plants were beginning to have a hedged appearance. In February, the antelope were passing through about 8 inches of snow to forage on the short sage. In general, it was a very bleak and inhospitable area for the antelope to winter on but the animals appeared alert, active, and in good condition. It was only possible to observe them at a distance through binoculars but there appeared to be a good representation of past seasons fawns among them. Conditions did not permit an accurate breakdown of the group as to sex and ages.

The fluctuation in numbers, particularly in Pasture 1, indicates that the antelope were getting in and out of the pasture. The west fence, reported open on June 6, could have permitted antelope to enter the pasture and account for the increase noted on June 20, 1951. The small counts could easily be incomplete as this is a rather large pasture and there are

ridges and coulees in which antelope could be overlooked while making a count from the ground. The disappearance of all but one antelope between March 7 and April 14 was probably due to an open gate in the southeast corner of the pasture.

The antelope found in Pasture 1 on January 25, 1952 were 2 bucks, 8 does, and 6 fawns of the previous season. No data were available on the sex and age of the antelope previously found in the pasture. It is possible that the 10 animals observed on June 6, 1951, and again on July 2, 1951, were the adults and that the 20 observed by Mr. Rochelle on June 20, 1951, included 10 fawns.

During April and May of 1952, antelope were frequently observed along the Rochelle Pasture fences, beating back and forth along them as though they wished to get through. No antelope was observed to make an effort to jump these fences. One place was found along the interior fence between Pastures 5 and 6, where antelope had crawled under the fence, but no indication was found where antelope had been able to get past the exterior fences, other than the possible exit over the snowdrift in Pasture 3.

Seaverson Pastures

The Seaverson Pasture, located in T. 20 N., R. 92 W., contains about seven sections. This is the oldest of the pastures in this area, the fence permit having been issued in 1945. The fence is made of 26-inch woven wire with three strands of barbed wire above, spaced 5, 9, and 8 inches apart, making a total height of 48 to 50 inches. The posts are wood and are two rods apart with a light metal post or stay midway between. The pasture was originally used by sheep but in recent years has been used as a summer pasture for cattle. A cross fence subdivides the original pasture and there is a catchment basin or reservoir in each part to provide stock water. The stock water supply, according to local report, is not dependable. Forage for antelope is much better in this area than it is in the Rochelle Pastures. The sagebrush is more abundant and thrifty and does not show hedging. It is from this pasture that some of the newspaper accounts of antelope being trapped in sheep-tight pastures and dying of thirst and starvation, have originated. The following is quoted from a letter by Mr. Lemoine, President of the Carbon County Chapter of the Izaak Walton League, to Mr. James Munro, President of Wyoming Division of the Izaak Walton League, under the date of November 4, 1951. Mr. Munro furnished me with a copy of the letter.

"In regard to the dead antelope we found in one of the sheep-tight enclosures west of Rawlins last July. Five game wardens and myself tried to remove approximately 200 head of antelope from this sheep-tight enclosure where the water holes had gone dry. Many of them were so weak that tourists would walk within a few feet of them and take pictures and pick up antelope fawns and try to give them water.

"It was a tremendous task, and we were fortunate enough to remove at least 150 mature antelope. The fawns were so weak that they would run and hide in the tall sagebrush and the mothers would go away and leave them. We were in hopes that the

mothers would return and coax their young thru the sheep-tight fence, but it seems that after they reached the water, the never returned or maybe they did and were unable to get them thru the fence and many of them died and were found later. A sheep herder told me that he found many more later in another enclosure.

"On the drive mentioned, we used jeeps and pickup cars and many times had them cornered and tried to make them jump or go through the fence; many of them would run and hit the fence but not one ever tried to jump over.

"I received a phone call Friday from a U. P. Railroad worker that there are approximately 200 or 300 antelope in a sheep tight enclosure west of Rawlins along the right-of-way that are desperately in need of help. He said they have been rading the fence trying to find an opening for the past week and that some are practically unable to navigate. I have contacted the Game Warden and many sportsmen and we are going out to remove them."

This latter incident was published in the Cheyenne Eagle on November 13, the article stating that a railroad worker had reported seeing 300 antelope in a sheep-tight pasture west of Rawlins that were on the verge of starvation and could not get out of the pasture. Investigation by Mr. Kiel and Mr. Underwood, local game warden, failed to find the 300 antelope and there was no reason for them to starve as the pasture afforded good forage and there was ample new snow to provide water for them. On November 11 and 12, I had visited this pasture and had observed 24 antelope near the southeast corner of it on November 11, but they could not be found on November 12. At that time I was not aware of the report on the 300 antelope mentioned in the Cheyenne Eagle. Near the southeast corner of this pasture is a water gap where the bottom wire of the fence is 16 inches above the ground. Tracks and a quantity of antelope hair at this point indicated that it had been used by antelope going in and out of the pasture. Two other water gaps near this one were more shallow, the bottom of the fence being 11 and 15 inches, respectively, above the bottom of the ditch, and showed no evidence of use by antelope.

The sincerity of the reports quoted above is not doubted but the interpretation of the observations may be questionable.

Range Use by Antelope

Aerial counts of antelope made by the Wyoming Game Commission in 1948 in central Sweetwater County, north of the Union Pacific Railroad, gave a total of 12,296. A count of practically the same area in 1950 resulted in a total of 2553 antelope. In January 1952, 3198 antelope were found in this area. These counts reflect the severe loss suffered by the antelope in this region during the winter of 1948-49 and also indicate that a recovery in population numbers is progressing. Because of the reduced population at this time it is possible that their pattern of seasonal distribution may not be so evident as it would be if the range were more fully stocked.

During the winter of 1951-52 the greatest winter concentration of antelope appeared to be along the northern edge of the Great Divide Basin from near Lumen Lake to near Baroil. They were also found in this same general area during the winter in 1952-53 although due to light snow they were more scattered. More antelope were observed in this region in early December 1953, than in any other part of the basin.

This same area is used as winter range by several bands of sheep. Because of the necessity of moving the sheep to keep them on good forage and out of troublesome snow areas, it appears doubtful if there will be much immediate demand for fenced winter pastures in this region north of the checkerboard lands. As the studies to date have not revealed any definite pattern of seasonal movement of antelope in this area, no pertinent recommendations can be made as to where fences might be placed so as to cause the least hindrance to the antelope movement at such time as this herd approaches the 1948 population level.

The Buzzard Ranch

There are about 49 miles of woven-wire fence on the Buzzard Ranch, part of which is of 32-inch woven wire raised 8 inches above the ground and a single strand of barbed wire placed midway between the woven wire and the ground. A strand of barbed wire 8 inches above the woven wire makes a total height of fence 48 inches. Other fences are made of 26-inch woven wire raised 8 inches above the ground with a strand of barbed wire 4 inches below the woven wire. Two strands of barbed wire above the woven wire, spaced at 8-inch intervals, make a total height of 50 inches. In addition there are about 19 miles of barbed-wire fence, most of which is of four-strand construction.

In January 1952, Wyoming Game Commission technicians counted 1275 antelope that were wintering in this immediate area. There have been barbed-wire fences on this ranch for many years but it is only in recent years that Mr. Moore has erected the woven-wire fences. From observations and from information obtained from local residents, it appears that antelope use this area the year around. Some of them summer on the bench lands and slopes of the Ferris Mountains, but with winter snows they drift down into the lower hills along the Platte River breaks and Sand and Dewese Creeks. To reach these areas they must pass some of the woven-wire fences. In talking with Mr. Ty Moore on April 27, 1953, he stated that he had seen antelope jump fences at the ranch on two occasions. On April 28, 1953, a buck antelope was observed to go through a woven-wire fence on Sand Creek. The fence was 26-inch woven wire with one strand of barbed wire below the woven wire and two strands of barbed wire above, making a total height of about 50 inches. The antelope jumped over the woven wire and went between it and the barbed wires above it.

On December 3, 1953, a band of 14 antelope was observed to jump over a woven wire fence in the same general locality. The two top barbed wires were loose and sagging so the antelope had only to jump the woven wire fence, which was 34 inches high at this point. About one mile farther up the creek, a lone antelope jumped into the woven-wire fence.

The animal cleared the wire but hit the upper barbed wires and pulled the staples from the adjacent posts. The antelope was momentarily entangled in the loosened barbed wire but easily freed itself and proceeded on uninjured. There are places along this fence where the sand has blown out leaving spaces up to 18 inches high beneath the lower wire and the ground; antelope crawl under the fence at these points but it appears that they are also learned to jump these fences 28 to 34 inches high.

Converse County

Antelope populations in northeastern Wyoming have shown a very rapid increase in recent years. The 1948 census gave a population of 12,540 antelope in the entire northeastern unit. In 1950, 28,560 were counted, and in 1951 there were 42,072. The average annual hunter-kill in this area from 1946 to 1949 was 4656. In 1950, 13,424 antelope were harvested in this area. The 1951 count of the antelope in northern Converse County in the area between Highway 59 and the road from Douglas to Ross was 4458. This is about as heavy a concentration of antelope as is found in Wyoming. During August 1951, sample counts made by the Wyoming Game Commission, indicated a fawn crop of 59% over total adults. These data indicate that the antelope herds in this area are in thrifty condition, with a very high reproductive rate.

Generally, the greater part of the range land in northern Converse County is privately owned and is fenced into pastures. Fences of both barbed wire and woven wire are common as many sheep and cattle are raised here. These pastures as a rule are large, ranging from two to five or six sections in area, although there may be smaller pastures adjacent to the ranch headquarters or for special uses. Natural water sources are not abundant and frequently the stock water is provided by impoundments or reservoirs that retain runoff.

The layout of pastures of two ranches in this region is shown on the attached map of Converse County. These ranches are quite typical of this area. The Wm. Smith ranch on Sage Creek contains about 70 sections and produces both sheep and cattle, although most of the emphasis is on sheep. The Ogallala Ranch of Mr. Leroy Moore at Ross is a larger ranch containing about 87 sections under fence. This is also primarily sheep operation although some cattle are raised also.

In talking with Mr. Smith, he stated that for most of his sheep pastures he has found that a five-strand barbed-wire fence is adequate. The barbed wires are spaced at the following heights above the ground: 5, 11, 18, 26, and 38 inches. If the fence is near a watering place or other place where the sheep have a tendency to congregate, a section of 26-inch woven wire is used to prevent small lambs from getting through. Mr. Smith stated that the antelope on his ranch go from pasture to pasture as they wish, having little difficulty in going through the 12-inch space under the top wire. The 38-inch height of the fence is sufficient to hold his cattle and the four, more closely spaced lower wires, are sufficient to hold the sheep, except for the places noted above.

On November 13, 1951, Mr. Smith said that he had recently seen a buck antelope jump a fence. On April 3, 1952, both Mr. Smith and his son stated that they have seldom seen antelope going through their fences but that frequently they will observe a band of antelope in one pasture and a few days later see it in another. They also stated that antelope come into their ranch due to hunting pressure in surrounding territory and that in a few instances the antelope have been influenced by sheep movements. There does not appear to be any definite seasonal migration of antelope in this part of Wyoming.

A few hours were spent in watching antelope in the Smith pastures but no instance was observed of their trying to go from one pasture to another.

In 1950, the Wyoming Game Commission cooperated with the Bureau of Land Management in a study of the movement of antelope between the pastures of Mr. Moore's Ogallala Ranch at Ross, Wyoming. After obtaining a plot of the fences, the pastures were flown on February 2, April 5, and August 14, and the antelope counted in each pasture on each flight. There was a fluctuation in number of antelope in some of the pastures; however, it seems that adequate controls were not obtained on gates and the results are not too dependable. While most of these pastures are enclosed with woven-wire fences, there are some that are fenced with barbed wire.

In talking to Mr. William Moore of the 7 UP Ranch, he informed me that he had observed antelope jump fences on a few occasions. His ranch foreman stated that antelope commonly jumped the fence in getting in and out of meadows. Antelope observed in the Moore pastures have gone through gates and under barbed-wire fences but none were seen to attempt to get by a woven-wire fence.

Carter County, Montana

The history of the development of fences and the reactions of the antelope to them in Carter County, Montana, appear to have gone through the stages that are now being demonstrated in the more newly fenced areas in Wyoming. Older residents of southern Carter County, including the late Roy Williams, told me that when the fences were first put in along the Little Missouri and Box Elder Creek, the antelope had much difficulty in getting by them. In the course of time they learned to jump the fences if they could not crawl under or through them. Mr. Manly Moore stated that he had tried opening his fences at corners in order to let the antelope through them, but this was not very successful if the corner happened to be on lower ground. He then opened gaps on the ridges, leaving them open when the pastures were not in use.

On April 22, 1952, a doe antelope was observed to jump three fences near Albion, Montana. One of these fences was five-strand barbed-wire with a height of 34 inches. One fence was five-strand barbed-wire 38 inches high, and the third fence was five-strand barbed-wire 37 inches high. The animal was not being molested and jumped the fences with little apparent effort. On March 21, 1953, a doe antelope was observed to jump

a 42-inch fence between the Arbuckle and Ratcliff ranches, west of the Little Missouri on Butte Creek. This was a woven-wire fence topped with barbed wire. The doe left six other antelope, walked over to the fence and jumped it to join another group of 25. During the evening of September 17, 1953, five antelope were observed to jump over the fence into James Oliver's hay field. Five other antelope either entered or left the field during this period but their manner of getting by the fence was obscured by haystacks so it was not certain whether they also jumped over. The following morning, a buck and two does were observed to jump the same fence. Due to flood irrigation it was not possible to reach the fence at this time to obtain measurements of the fence. On December 1, 1953, a group of 25 antelope was observed to jump this fence and it was possible to reach it for measurement. This fence is 26-inch woven-wire topped with two strands of barbed wire for a total height of from 38 to 42 inches. It is an old fence and the wire is not very tight. This group of 25 antelope included some fawns of last spring but none of the animals displayed any difficulty in jumping the fence. Mr. Watson Beed, in making antelope observations in this area during October and November 1953, reported as follows:

"On October 16, 1953, I saw a band of eight antelope lying down near a four-strand, 42-inch high cattle fence. I stopped and watched them through glasses at a distance of about one-half mile. When I stopped the car, the antelope all got to their feet and five adults and one fawn of the year jumped the fence. Two fawns remained on this side of the fence and wandered back and forth for almost an hour looking for a place to get through the fence. I finally walked slowly toward them and one fawn jumped through the fence under the top wire. It was an awkward jump and I believe the animal was scratched by the second wire. The last fawn reached the fence corner and when I was about 100 yards from it, the animal made a neat clean jump. As near as I could ascertain, it cleared the fence by at least ten inches.

"On October 29, 1953, I saw 15 out of a band of 17 antelope jump a woven wire fence with two barbs on top. The fence was 42 inches high and the space between the top and the second barb was eleven inches. Two fawns of the year finally jumped this fence between the top and second barb wires. I did not press or frighten the animals but merely stopped the car and watched them with binoculars.

"On October 29, 1953, I saw an adult doe antelope in a fairly small alfalfa field. The field was fenced with woven wire with three barb wires above. The height was 45 inches. I walked slowly toward this doe and she trotted up to the fence, stopped and jumped it neatly with plenty of room to spare. This doe did not run off so I went on down the road and when I returned about two hours later, the animal was again in the alfalfa field. Again I walked toward her and again she jumped the fence but did not run off.

"Randy Burch, a rancher near Hammond, reported that a band of about 40 antelope feed during the entire summer in his alfalfa field. He said that they jumped in in the morning, fed all day, jumped out in the evening to go for water and repeated the performance daily. When the adult antelope jumped into the field in the morning, according to Burch, the fawns lay down outside the fence. These fawns did not learn to jump the fence before late September, and to the best of his knowledge, some of them never learned to jump.

"I found one rancher that said he had no antelope trouble with his alfalfa. His fields were fenced with 36-inch woven wire with three strands of barb wires spaced six inches apart on top."

During the course of this study, no antelope were found entangled in a fence. Mr. Kleber Hadsell told me of finding the remains of a buck antelope caught in his pasture fence west of Rawlins about three years ago. Mr. Kuning, in a report dated January 4, 1954, stated that one of the Williams boys remarked that he has seen more antelope tangled in a two-barbed-wire than any other type of fence. The Williams are chiefly cow men. Mr. Ben Brownfield of Ridgeway, Montana, stated that antelope are more apt to get tangled in a loose wire than in a tight wire fence. Mr. Watson Beed furnished a photograph of the remains of an antelope fawn that had died after being caught in the wire while trying to crawl under a woven-wire fence. Three photographs of antelope carcasses on fences have been seen, but antelope lose their lives from being caught in fences less frequently than do mule deer.

Practically all of the ranchers in this part of Carter County say that the antelope are increasing and while most of them do not begrudge them the forage consumed, the number of ranchers who are complaining of antelope damage is increasing. Hunting pressure is comparatively light in this area and the harvest does not approach the annual increment.

Migration

Data on seasonal movements of antelope in Carter County were obtained largely from local residents and from reports by the Montana Game Commission. Weather during the winter of 1952-53 was mild and very little movement occurred. According to the local residents, there are several areas along the Little Missouri and Box Elder Creek where a number of antelope normally spends the winter. Heavy snow and cold weather would cause many of them to move westward into the breaks along Powder River and more sheltered country along Crow Creek, as well as some of the other side drainages. During the winter of 1948-49 most of the local antelope moved to this winter range ahead of the severe storms. Antelope drifting westward from South Dakota ranges moved into the areas along the Little Missouri. General opinion is that the heaviest loss of antelope in this section occurred among these antelope from South Dakota, as these were in a weakened condition upon arrival in Montana and the continued cold, coupled with the deep snow covering the forage was more than could be withstood.

Personal observations of the movement of antelope in this area have not been made and the manner in which the animals overcome the obstacle of the numerous fences during migration has not been determined.

What Is A Sheep-Tight Fence?

How much fence does it take to hold sheep? This question was asked of many sheepmen and other livestock raisers and a wide variety of answers was obtained. There are several factors to consider in determining the kind of fence needed to hold sheep. If sheep are accustomed to being herded and then released in a pasture to roam at will, it will take them considerable time to become adjusted to the change. They are apt to trail along fences and go through them if possible until they become used to the pasture. Sheep that have been raised in pastures without being herded seldom bother the fence. The breed of sheep is also a factor, as sheep raisers have told me that the black-faced, medium wool sheep are more difficult to hold in pastures than are the fine wool breeds. Topography of the pasture, quantity, quality, and distribution of water, quality and amount of available shelter, the size of the pasture, are all factors which contribute to the contentment of a flock and determines whether the sheep will be satisfied to remain in the pasture or try to leave it.

Mr. Rochelle, at Rawlins, favors a woven-wire fence, preferably 32 or 34 inches high with barbed-wire above to make a total height of 46 to 48 inches. Mr. Wm. Smith of Douglas, stated that a five-wire barbed-wire fence 38 inches high in which the lower four wires are spaced to a height of 26 inches, is sufficient to hold sheep except where they are apt to congregate, as near a water hole; there a 26-inch woven-wire is needed to prevent the small lambs from being crowded through the fence. Most of Mr. Moore's fences on the Buzzard ranch are either 26 or 32-inch woven wire topped with barbed wire to a height of 46 to 48 inches. On most of these fences the woven wire is placed 5 to 8 inches above the ground and a strand of barbed wire placed beneath the woven wire. Some of the Rochelle fences are arranged in this manner. Mr. James Oliver, Mr. Ben Brownfield, Mr. R. O. Burch, and Mr. Ormisher, all of southern Carter County, Montana, agreed that a 26-inch woven-wire fence topped with two strands of barbed-wire to a total height of 40 to 38 inches was sufficient to hold sheep as well as other livestock. Mr. Oliver stated, however, that he preferred 32 or 34-inch woven-wire topped with two strands of barbed wire for a total height of 44 inches. Mr. Arbuckle, of Albion, Montana, has much of his pasture fenced with 32-inch woven-wire topped with two strands of barbed wire for a total height of 43 inches. Some of his fences have only one strand of barbed wire above for a total height of 40 inches.

From a summary of these interviews, it appears that the minimum requirement of a fence to hold a sheep is about that recommended by Mr. Smith of Douglas. This is a barbed-wire fence of five strands, spaced 5, 11, 18, 26, and 38 inches above the ground. The alternative would be 26-inch woven wire with one strand of barbed wire placed 12 inches above the top of the woven wire for a total height of 38 inches. Some of the ranchers

stated that it did not require a very high fence to keep their sheep in but that a higher, tighter fence was desired to keep other livestock out.

Size of Pasture

The minimum area of an enclosure that can be tolerated by antelope has not been determined. The minimum area which is practicable to enclose as a sheep pasture is primarily an economic problem. The cost of fencing and developing the pasture, balanced against the value of the forage, the cheaper cost of caring for the sheep, and the other advantages of the pasture must be to the operator's profit. Some sheepmen prefer to pasture a small number of sheep in a smaller enclosure while others like a larger number in a larger pasture. On an average in the Red Desert region in Wyoming a pasture of about 4 to $4\frac{1}{2}$ sections is needed to carry 300 sheep for six months, or a band of 1500 would require a pasture from 20 to $22\frac{1}{2}$ sections for the same period. Ordinarily, ewes with lambs seem to do better in smaller groups of from 300 to 600 head, while most operators run their sheep without lambs in larger groups. Thus, the minimum area of a pasture is largely determined by the operator's methods of management and the local conditions affecting them. It would appear that the smallest practicable pasture in the Red Desert region and areas of similar forage conditions would be about 4 sections; however, as a problem in sheep management, this point requires a much deeper study into the economics of the operation than has been possible in this study.

Management of Pastures

One of the greatest dangers to antelope that has been observed in the pastures of the Red Desert area is overuse of the pastures. This results from stocking too heavily for too long a period. The sheep can be moved to other pastures or sources of feed when the forage of a pasture is exhausted. Antelope confined in these same pastures by insurmountable fences are faced with the problem of survival on an exhausted range. In overusing forage in this area, the sheep eat the same plant species that are required by antelope. This problem is recognized in other parts of the country. The following is quoted from the publication "Life History, Ecology and Range Use of the Pronghorn Antelope in Trans-Pecos Texas," by Helmut K. Buechner, reprinted from The American Midland Naturalist, Vol. 43, March 1950, pages 257 to 354:

Page 261: "The intense competition between sheep and antelope was probably first referred to in literature by Taylor (1936) who stated that antelope do not do well on sheep ranges but seem to thrive on cattle ranges. In a report on the antelope herds of northern Arizona, Knipe (1944) mentions that competition for forage is keen between sheep and antelope, as they both have the same food preferences. Throckmorton (1945) also refers to the undue competition between antelope and sheep, with the former giving ground. Discussing restocking projects in Texas, Etheridge (1946) states that failure of antelope transplants is closely related to heavily stocked sheep ranges and that transplants are usually

successful on ranges lightly stocked with sheep or stocked with cattle. Reporting on competition, Uzzell (1946) points out that all cases of failure of antelope transplants in Texas, with one exception, were on ranges stocked with sheep or a combination of sheep and cattle."

Page 265: "In recent years considerable losses of antelope have occurred on sheep ranches as well as on ranches stocked with both sheep and cattle. During this period from 1935 to 1940, sheep increased in the Highland Soil Conservation District, which includes Presidio County and part of Jeff Davis County, from 1,105 to 27,820 head, and during the next five years to 122,979 head. Antelope are unable to withstand the severe competition from sheep and therefore die."

Page 296: "When antelope have been released on sheep ranges, they have either died out completely, decreased, or held about the same population over a period of 5 or 6 years. This is a direct result of the intense competition between antelope transplants on sheep range, depending on the number of sheep and the condition of the range. A release (1941) of 29 head on the R. K. Merrill Ranch 8 miles northwest of Fort Davis, for example, decreased to about 24 by 1946; yet part of the herd escaped across a fence to a cattle ranch, the U Up and Down, and increased to 75 head over the same time. Though the Merrill Ranch is not seriously overgrazed, none the less the sheep keep the antelope food plants grazed out to the extent that only a small portion of the game can survive. It is apparent that under conditions of inadequate food supply, as on sheep ranches or during severe drought, the antelope fail to breed or perhaps suffer a high mortality of newborn young, thus cutting down the population to the carrying capacity of the range."

Page 318: "The most important limiting factor to antelope increase and distribution at the present time is the intense food competition from domestic sheep. Recent increases in the number of sheep in the region have caused hundreds of antelope to die when confined to these ranches by sheep-proof fences. Moreover, occupation by sheep has eliminated several millions of acres of formerly suitable antelope range. Were it not for the sheep industry with its recent expansion, the antelope population could be greatly increased. There, of course, is still much room for their expansion on cattle ranches. On sheep ranches not heavily overstocked, the available food supply limits the antelope population level. This is evident on a few sheep ranges where antelope hold their own but do not appreciably increase or decrease."

Page 351: "Competition between cattle and antelope is about 19%, the cattle being mostly grass consumers and antelope forb-and-browse consumers. Antelope prosper well on cattle ranges. Ranch men should have little fear of competition from the

game at a population density of about 10 pronghorns per square mile. Probably even more antelope could be easily maintained without undue competition.

"Sheep-antelope competition on properly grazed ranges will probably be about 25 per cent. Under present conditions of heavy overgrazing, competition is near 100 per cent, with the antelope giving way to the domestic animals. A study of clip quadrats on three ranches showed that little antelope food remains on overstocked sheep ranges. Food competition seems to be the cause for the incompatibility between sheep and antelope."

Effects of Fences

The following excerpts relative to the effects of fences on antelope are quoted from the same publication:

Page 265: "According to Game warden A. R. Williams, Bill Jones (now deceased) an old-time ranchman in the vicinity of Marfa, saw antelope shipped out of Marfa in refrigerator cars to be sold on the market. The destruction of the antelope herds was facilitated by pasture fences when these came into general use. Sheep-proof fences made the antelope especially vulnerable, since the antelope refused to jump the fences. In the Texas Panhandle, Lewis (1938) describes how in 1881 about 1,500 pronghorns were slaughtered by hunters in one day when the animals drifted into the pocket of a drift fence during an unseasonal blizzard. Use of the automobile added another hazard to the antelope, especially in fenced pastures.

"Blizzards and droughts brought down populations periodically in various areas. In the southern part of the Panhandle, J. R. Strayhorn reported that 150 antelope froze to death during a blizzard in Garza County near Post, Texas. Fences prevented the antelope from migrating to protected areas as they did when they roamed freely over the range. During the severe drought from 1933 to 1935, hundreds of antelope as well as livestock perished from starvation."

Page 309: "Sheep-proof fences are effective barriers to antelope. In desperation bucks may force a hole in a net fence with their horns, working the hole until it is large enough to crawl through, according to George Knight, foreman of the Worth Evans Ranch, 18 miles west of Marfa. Fences on cattle ranches are of either 4 or 5 strands of barb wire. Antelope pass under such fences readily or rarely between the wires. Experience must be gained before an antelope can pass adeptly under barb wire. A yearling buck, 2 does and 6 fawns ran to a fence when disturbed by the presence of the writer; the does selected a spot in a 5 wire fence and quickly crawled under. The yearling buck and the fawns attempted to follow, but refused to go under the wire. Finally the buck led the fawns off and the two does crawled back under the wire to join the herd as it ran away. During

a daily activity study on May 19, one doe was seen going under a 4-strand barb wire fence, followed after a moment's hesitation by her two little fawns. Later another doe was observed to crawl under the fence at the same place. The two offspring of this doe stopoed at the fence, then walked along it for a place to crawl under. Finally they walked away from the mother and the doe crawled back under the fence and into the pasture with them."

Page 305: "On rare occasions antelooe display remarkable jumping power. On several occasions during trapping operation, Fisher (1941) observed antelope jumping a five foot corral net fence from a stand-still position. One old buck that had been in the trap for the third time cleared a six-foot net from a standing position. During the past eleven years, Henry Fletcher, whose ranch is located 20 miles south of Marfa, has annually found an average of one antelope dead with its hind feet caught in the top strand of a barbed wire fence. Antelope were frequently seen jumping low net fences by Wesley Roberts near his home on the Gage Estate, 8 miles west of Alpine.

"Most antelope seem to be unaware of their ability to jump, for they often die of starvation on severely overgrazed sheep ranges rather than jump the sheep-proof fences."

In a report on Pittman-Robertson projects by the Montana Game Commission dated July 15, 1948, the following was reported on the Carter County Antelope Study - Summer 1947, by Gerald Salinas:

"Woven wire and sheep-proof fences impede the natural migration pattern, which has been to drift ahead of severe storms to protected areas. These fences, which are increasing in number, often delay the antelope along their route to the winter range. By restricting movement, they cause antelope to be caught in areas which offer little protection and food during storms. Some of the antelope become weakened and eventually winter kill."

Ranchers in Converse County have described to me the very unsporting practice of some present-day hunters driving antelope into fence corners with motor vehicles to facilitate shooting.

Mr. Paul Russell, Director of Wildlife Restoration, New Mexico Department of Game and Fish, in his paper "Crises of Antelope Management," describes the decimation of antelope herds in New Mexico by woven-wire fences. Mr. Russell also offers some suggestions for averting extirpation of antelope on other ranges. The following is quoted from Mr. Russell's paper:

"The impending disaster may be avoided only by gaining the full cooperation of all agencies administering public lands, and cultivating the cooperation of the livestock industry towards bringing about and maintaining a policy governing all fences on public lands and also to govern fences constructed with

government aid on private lands; so these fences will not deprive antelope of their legal, rightful home on public lands and will have a strong influence on the management of privately owned lands.

"Such a policy would, in all fairness to the livestock industry, have to be, at least in part, rather flexible; however, the following outline is offered as a guide to formulating a workable policy:

- "1. Ranches covering a part of an existing or potential antelope range should not be enclosed by antelope-proof fences.
- "2. Interior antelope-proof fences should be permitted only as a protection to crops and for small holding or buck pastures. These pastures should not be located so the travel of antelope from one section to another of the habitat unit will be blocked.
- "3. Boundary fences and interior fences, with the exceptions heretofore mentioned, should not be of woven wire, but of barb wire so spaced if necessary to control sheep, but still permit the passage of antelope. Such fences are in existence; they do at times retard antelope but do not have the fatal characteristics of woven wire.
- "4. Gates and other short, so-called 'Antelope Gaps' are in most cases inadequate, such passage ways have their merits and should be encouraged in existing fences; however, woven wire fences with such provision well located are still a definite hazard.

"In conclusion it is well to say that we must not be confused by the forces which may wish to endow the antelope with fence jumping characteristics and the ability to find obscure passage ways in time of dire need."

Conclusions

From the information obtained, the following conclusions are drawn:

1. Fences are obstacles to the movement of antelope. Antelope have a certain amount of adaptability and learn to crawl under, or go through, or jump over, fences if the type of construction permits. Ordinary barbed-wire fences used to control cattle will usually permit antelope to crawl under, as the bottom wire is frequently raised about 15 inches above the ground. Woven-wire fences are more difficult for an antelope to cross. Antelope that are unfamiliar with fences are more restrained than animals used to them. It takes considerable time for antelope to learn to cope with fences. Antelope have the native ability to jump, but in their natural habitat are seldom required to jump over high obstacles. It takes some time for them to learn to jump over low fences.

2. Many of the antelope in southern Carter County, Montana, have learned to jump over fences up to 45 inches in height. The antelope in the Buzzard Ranch area in Wyoming are learning to jump the fences there.

3. Where fences cross regularly established routes of travel, drop gaps or other suitable openings should be provided and left down when not required to hold livestock. Such openings should be on ridges and not in low places.

4. A 40 to 42-inch fence is ordinarily high enough to hold sheep as well as other classes of livestock. Tight fencing for the first 26 inches in height is usually necessary to restrain sheep. Higher than this, a wider spacing of wires is usually sufficient for other classes of livestock. A 5-wire barbed-wire fence with the wires spaced 5, 11, 18, 26 and 38 inches above the ground is reported sufficient to hold sheep as well as other livestock and yet allow antelope to get through it. Such a fence is not considered adequate if near a place where sheep are apt to congregate as there is danger of small lambs being crowded through it. At such places 26-inch woven-wire fences are recommended. Some sheepmen state that the minimum requirement of a sheep fence is 26-inch woven wire topped with two strands of barbed wire for a total height of 40 to 42 inches. The space between the top barbed wire and the second wire should be about 12 inches.

5. The minimum area of an enclosure that can be tolerated by antelope has not been established.

6. The minimum area practicable for sheep pastures is variable, depending upon local conditions. Under range conditions similar to those of the Red Desert region of Wyoming, the minimum area would appear to be about 4 sections. Such pastures have not been in existence long enough to determine their effect upon antelope.

7. In areas as closely fenced as southern Carter County, Montana, and central to northern Converse County, Wyoming, the present antelope herds are thriving.

8. If fences are so constructed and so located as to prevent antelope from reaching needed water, seasonal forage or shelter, the fences are definitely detrimental to their welfare.

9. There is a tendency for some sheepmen to graze pastures too closely. This practice is detrimental to both sheep and antelope. Antelope cannot compete with sheep for forage and cannot thrive on areas overused by sheep because of the similarity in their forage preferences. Due to the greater divergence in forage preferences, antelope do better on ranges used by cattle. In the management of sheep pastures on public lands, also used by antelope, the operator should be required to leave sufficient forage on the area to provide for the antelope needs.

10. If the proper spirit of cooperation is fostered between the governmental land management agencies, private land owners, conservationists, and hunters, it should be possible to maintain antelope in reasonable numbers throughout most of their range without inflicting undue hardship on any of the land users.

11. It would appear logical, where Government aid is given toward construction of fences on private as well as public land within antelope ranges, to require a type of construction that would cause least interference to the movement of the antelope.

Recommendations

1. Fences on public lands used by antelope should be kept to the minimum compatible with the proper management of those lands. When enclosing of pastures for sheep is necessary, consideration should be given to the location of fences so as to cause the least influence with antelope movements. Local conditions will influence the minimum size of the pastures, but for other than buck pastures or other small special pastures the areas should be large enough to care for the stock without frequent movement. In the Red Desert region of Wyoming and similar range areas, a 4-section minimum is suggested. Pastures fenced with barbed wire which will permit antelope to pass through them might be smaller.

2. A maximum total height of 42 inches for fences on public lands used by antelope is recommended. When woven wire is required, a height of 26 inches is recommended. This may be topped with not more than two strands of barbed wire, one strand not more than 4 inches above the woven wire and the top strand not more or less than 12 inches above the lower. The practice of raising the woven wire and placing a strand of barbed wire below it is not recommended. The use of 5-strand barbed wire fences for sheep pastures, with spacing 5, 11, 18, 26 and 38 inches high is recommended.

3. The opening of gaps, at least 3 rods wide, in woven wire fences during periods when the pastures are not being used by livestock, is recommended with the gaps placed where fences cross regularly used routes of travel for antelope, and along ridge tops. On long straight fences in flat terrain, gaps should be spaced not more than $1\frac{1}{2}$ miles apart. The location of such gaps should be selected with knowledge of local conditions and for the purpose of facilitating the movement of antelope across the area, rather than for merely satisfying a regulation.

4. Pastures on public lands, whether used by either sheep or cattle, should be managed in a manner so as to leave sufficient forage and water to sustain the population of antelope and other game animals using the area.

