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# The Abundance, Migration and Management of Mule Deer in Dinosaur National Monument

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# THE ABUNDANCE, MIGRATION AND MANAGEMENT OF MULE DEER IN DINOSAUR NATIONAL MONUMENT

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

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in

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Robert W. Franzen

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ABSTRACT

The Abundance, Migration and Management of Mule Deer in

Dinosaur National Monument

by

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Dinosaur National Monument, in northwestern Colorado and northeastern Utah, is comprised of 206,409 acres and contains several deer winter ranges. A need for deer studies developed because of winter deer mortality and deteriorating range conditions on some parts of the Monument.

Approximately 500 deer winter on the Yampa Bench and approximately 300 deer winter on the Island Park winter range. These are the two main winter ranges within the Monument.

Deer on the Yampa Bench migrated an average of 7.3 air miles to the south and summered on the Blue Mountain Plateau during the summer of 1966. This Plateau is owned by the Bureau of Land Management and private individuals. Deer from the Island Park winter range migrated an average of 22.6 air miles to the northwest in 1967, onto the Diamond Mountain Plateau and the Ashley National Forest. Deer tagged on the Split Mountain winter range were found to travel to the south and west. These deer summered mainly upon private lands.

Deer remain on Harpers Corner approximately 10 months of the year until deep snows force them to lower elevations on Yampa Bench in early

February and from which they return in early April.

Vegetation composition and density data gave evidence that the deer and sheep which use the west end of the Yampa Bench are competing for forage. Carrying capacity data suggest that sheep use of this area be reduced.

Carrying capacity data for the Split Mountain range suggest that cattle use should be reduced. If grazing use was kept off this area until June, the grasses would have a better opportunity to put on good growth before utilization of them began.

Other winter ranges within the Monument are well within their carrying capacity limits. Thus, a safeguard exists on most winter ranges against deer winter mortality.

The physical condition of deer on the Monument's winter ranges was very good during the winters of 1966 and 1967. Consequently, deer winter mortality was found to be slight on the Monument's ranges during these two winters.

A few does remain on winter range areas within the Monument to summer. They generally use the river islands and the relatively inaccessible canyon slopes as fawning grounds.

Nearly all of the deer that winter within the Monument migrate to higher elevations off the Monument to summer. This makes them subject to reduction by hunting. Deer hunting pressure on the hunting units adjoining the Monument has in recent years been sufficient to keep deer numbers within their respective winter range carrying capacities.

(138 pages)

# INTRODUCTION

Dinosaur National Monument has been considered a mule deer problem area for many years. In 1947, Aldo Leopold cited the Monument as an over-populated deer range (Leopold, 1947). Adolph Murie visited the Monument in 1952 and stated that "bitterbrush and mountain mahogany have been so heavily browsed by deer and domestic sheep that they do not represent the food resource they would under lighter grazing" (Murie, 1952, p. 5).

High populations of deer were reported to have wintered within the Monument during the severe winters of 1944, 1949, 1950, 1952, and 1956. As a consequence of severe winters and an overabundance of deer on the winter ranges, there was a correspondingly high winter deer mortality reported for these winters (National Park Service, 1965).

Ranchers on private lands within the Monument have realized for many years that the Monument is used heavily by deer during the winter months, but that they migrated from the area in the spring. They have not known where these deer went to summer.

State Fish and Game Departments of Utah and Colorado believe that a better management program might be followed if hunting were permitted in the Monument. Various governmental agencies believe that a severe deer range problem may develop if hunting or some other form of deer reduction is not conducted within the Monument.

Overpopulation of deer, deterioration of the range, high winter mortality, and the lack of population control measures all led to the initiation of this study.

## Objectives

The objectives of this study were the following:

(1) To determine the distribution and estimate the numbers of deer that winter within the Monument on Island Park, Yampa Bench, Harpers Corner and other areas.

(2) To determine the migrational patterns of deer that winter within the Monument.

(3) To evaluate the condition of the vegetation on the Monument's deer winter ranges.

(4) To determine the condition of the deer on the winter ranges.

(5) To prepare management recommendations for the deer herds that winter on the Monument.

# REVIEW OF LITERATURE

Management studies have been made on many mule deer herds of the western United States. A few of the better known include studies by Taber and Dasmann (1958) and Leopold et al. (1951) in California, Swank (1958) in Arizona, Gruell and Papez (1963) in Nevada, and Robinette (1966) in Utah.

## Migration studies

Studies have shown that most mule deer herds make annual migrations. These migrations may differ in time and extent, depending upon the geographic area, the overall climatic conditions of that area, and the severity of any particular winter.

Fall migrations were found to be induced by severe weather which occurs first at higher elevations (Longhurst, 1952). Spring migrations to higher elevations were suggested by Leopold et al. (1951) to be induced by the lush, green vegetation found there. The urge to return to higher elevations also may be an urge to return to the place of birth, as suggested by Zalunardo (1965) and Gruell and Papez (1963).

The trapping, tagging, and release of deer has been a method widely used to ascertain where wintering deer herds migrate to summer and the routes they have taken. Tagged deer may be identified when and wherever seen or collected. Clover (1954) developed and successfully used a collapsible-type trap which had a rectangular steel frame with a cotton net covering. This "Clover" trap has been widely used and accepted throughout the western United States.

Bait used to entice deer into traps varies with accepted natural foods found locally and with a plant species palatability. Leopold et al. (1951) used alfalfa hay, apples, and salt with success in California, but found alfalfa to be the best all-around deer bait. Gruell and Papez (1963) in Nevada and Richens (1961) in Utah used alfalfa hay.

Methods of marking deer for later identification include the use of plastic streamers, bells, neck collars, metal ear tags, internal markers, and dyes. Richens (1961) used numbered aluminum ear tags with colored vinyl streamers attached to them.

Predation

Coyotes, bobcats, and mountain lions have been determined to be deer predators. Dill (1947), and Gashwiler, Robinette, and Morris (1960) found evidence that bobcats prey upon deer. Robinette, Gashwiler, and Morris (1959) found that in Utah the mountain lion preys heavily upon mule deer, particularly during the winter months. Taylor (1956) believes coyotes are important predators upon deer wherever they are found.

In order of importance, Richens (1961) found the following descending order of significance by predators upon deer in northeastern Utah: mountain lion, coyote, and bobcat.

Censuses

Aldous (1945) suggested the use of actual deer counts in very early spring when mule deer tend to concentrate in large groups on forage in the foothills and valley fringes.

The use of aircraft to obtain deer counts in Colorado has been assessed by Gilbert and Grieb (1957). They found that accurate assessments could be made if correction factors were applied to the aerial count.

These correction factors include weather conditions, ground snow conditions, vegetative cover, and the use of experienced counting crews exclusively. They suggested using aerial counts on broad areas as a trend count rather than a total count after applying correction factors.

The widely used pellet group count method for deriving a population estimate or index is based on the average number of times a deer defecates per day. Smith (1964) found varying rates of defecation depending upon a deer's age and diet in Utah. McCain (1948) derived an average daily defecation rate for mule deer to be 12.7 pellet groups, whereas Rogers, Julander, and Robinette (1958) derived the defecation rate to be 15.2 at the Little Hills Experiment Station in northwestern Colorado. The most widely used rate of defecation for mule deer is presently 13.0 pellet groups per day.

Diseases and parasites

Van Volkenberg and Nicholson (1943) found 11 species of parasites on deer suffering from malnutrition on the Edwards Plateau of Texas. Deer deaths, however, were caused primarily by malnutrition and parasitic infestations were secondary. They also found that weakened animals were more susceptible to parasitic infestations than were healthy animals. Doman and Rasmussen (1944) observed that losses on Utah winter ranges were primarily from malnutrition, but dead or dying deer generally were infested with various external and internal parasites. Non-infectious pneumonia also was frequently found to be an immediate cause of death.

Food habits

Taylor and Hahn (1947) noted that an overabundance of deer on the Edwards Plateau of Texas progressively destroyed one favored food plant species after another.

Lovaas (1958) used two methods to determine mule deer food habits in Montana: (1) volumetric and air dry weight percentages of the plant species found in the rumen, and (2) feeding site examination, expressed in instances of use on a species. Both methods compared closely in results. In summer, rumen contents were largely composed of forbs and secondarily of browse. In the fall, the rumens contained nearly equal amounts of forbs and browse. In winter, browse was foremost in rumen contents and forbs were second. In spring, browse was still most prevalent, but grass was second in amount. In California, Dixon (1934) found that forbs occupy the most prominent place in the summer diet of the mule deer and gradually give way to browse as fall approaches. Justin Smith (1952) found in Utah that grass makes up approximately 90 percent of a deer's spring diet.

Various range survey methods have been used on deer ranges to assess the vegetative composition, density, and use. Cole (1959) developed the closest-plant method of range sampling. Stewart and Hutchings (1936) developed the square-foot density method of determining vegetative composition and density. The Bureau of Land Management (1967) adopted and improved upon the "range trend plot frame" for evaluating range vegetation.

Vegetative utilization methods involve either estimation or measurement techniques. Cole (1963) developed a method of determining utilization based on estimation. Aldous (1945) determined the utilization of species of browse on deer winter ranges in Nevada by making November and May measurements of the current year's growth. He claimed a usage of more than 70 percent on current growth of bitterbrush is excessive and not conducive to continued vigor.

Winter mortality

Robinette, et al. (1952) noted a direct correlation of herd losses on three Utah winter ranges with the amount of forage on the areas at the onset of winter. Winter mortality has been noted on many winter ranges despite winter feeding programs.

Doman and Rasmussen (1944) reported an over-winter deer loss of 22 percent in 1942-43 on a depleted range in northern Utah where feeding was carried out. Smith (1950) found that if deer were on a steady diet composed entirely (or nearly so) of sage, the bacterial fauna of the stomach died and further digestion of material was hindered or completely prevented. Smith (1952) further found that deer did very well on a diet of alfalfa hay, most showing weight gains. On the other hand, all deer lost weight and several almost died on a diet of juniper.

Doman and Rasmussen (1944) observed in 1936 that 80 percent of 114 deer which died on a northern Utah winter range were fawns. Robinette et al. (1957) found winter losses of fawns were two to three times the winter loss of older deer, and the mortality of yearlings was approximately 1.6 times that of adult deer. These researchers also found the winter loss of female fawns was about 1.2 times that of males.

Doman and Rasmussen (1944) observed that mule deer will seldom survive during the winter if they lose more than 30 percent of their autumn weight. Harris (1945) found that the change from good to poor physical condition may take place within six weeks. Cheatum (1949) devised the bone marrow test based on the degree of marrow fat content as a criterion of winter condition.

In summary, Doman and Rasmussen (1944) claimed that the solution to preventing winter deer losses was to adjust deer populations to their

winter range carrying capacities and not to search for methods and diets for supplemental winter feeding.

A guiding principle in determining the necessity for removal of deer is Rasmussen's recommendation of one acre of "average" winter range per deer month if undue losses and range depletion are to be avoided (Aldous, 1945). In terms of forage requirements, Rasmussen (1939) suggested the factor of 0.15 to 0.20 as the forage-acre requirement per deer month.

Methods of alleviating overpopulated deer winter ranges have often involved the trapping and transplanting of deer. Dixon and Sumner (1939) removed deer from Zion National Park in this manner, as did Thomas and Allred (1943) on Wyoming ranges. However, the high cost per deer moved by this method is prohibitive.

Herd composition and fecundity

Hudson (1959) found that over 87 percent of the doe deer collected during the breeding season on the National Bison Range in Montana were pregnant with a fetus-doe ratio of 1.7:1. Sixty-four percent of the adult does had more than one fetus. In Utah, Robinette and Gashwiler (1950) noted that 85 percent of the does, excluding female fawns, were pregnant with a ratio of 1.58 fetuses per doe; and 57 percent had more than one fetus.

Robinette, et al. (1957) reported there were more males than females in both fetuses and newly born fawns in Utah. Morton and Cheatum (1946) found that undernourished animals do not reproduce to their full potential.

Costley (1948) estimated the crippling loss from deer hunting on Utah ranges to be 25 percent of the kill on "either sex" areas and 42

percent on "bucks only" units. Longhurst (1952) and Cottam (1954) claimed that 20-25 percent of the pre-season deer herd can safely be removed by hunting without depressing the future population.

# THE STUDY AREA

## History of the Monument

Earl Douglas, a paleontologist with the Carnegie Museum, discovered a large, high quality deposit of Dinosaurian and other Reptilian remains of the Jurassic-Triassic Periods in 1909 approximately seven miles north of the present village of Jensen, Utah. Because this deposit was unguarded and on private lands it was subject to vandalism by the local populace. In order to protect it, President Woodrow Wilson proclaimed it and 80 acres of surrounding land a national monument on October 4, 1915. The Monument was placed under the jurisdiction of the newly created National Park Service in 1916.

Due to increasing public interest in the scenic Green River and Yampa River canyon country to the north and northeast of the original 80-acre site, President Franklin D. Roosevelt proclaimed, on July 14, 1938, that 203,885 acres of land be included within the Monument. These 203,885 acres were then reserved from all forms of federal appropriation under the public land laws and added to the original 80-acre tract.

An acreage study conducted in April, 1945 established that the Monument actually consisted of 209,744 acres, 190,962 of which were federally owned and 18,782 acres privately owned. The private land belonged to ranchers and others that had established claim prior to the establishment of Dinosaur National Monument in 1915 (Orr, 1956).

Further changes since 1945 include the relocation of boundaries, deletion of acreage to other governmental agencies, and purchase of

private lands outside the Monument for access roads and a headquarters area near Dinosaur, Colorado. In October 1967, the Monument included a total of 206,409 acres which was composed of the following breakdown:

| State | Federal (acres) | State or Private (acres) | Total (acres) |
|---|---|---|---|
| Colorado | 149,047.61 | 3,951.11 | 152,998.72 |
| Utah | 48,065.97 | 5,344.60 | 53,410.57 |
| Totals: | 197,113.58 | 9,295.71 | 206,409.29 |

Fauna

The fauna of the Monument has undoubtedly changed considerably since the time of William Ashley's exploration through the Monument area in 1825. This is particularly true of several species of large mammals such as the buffalo (Bison bison), grizzly bear (Ursus horribilis), and gray wolf (Canis lupus) which have been extirpated. Other species such as the black bear (Ursus americana) and mountain lion (Felis concolor) have been greatly reduced in number and their continued existence is precarious (Appendix Table 1).

The mule deer (Odocoileus h. hemionus) is perhaps the only mammal within the Monument that has gained appreciably in numbers. The Monument is, and probably always has been, primarily a winter range area for this species. According to local ranchers deer were very scarce around 1900, but increased considerably in numbers since about 1915 and were considered to be too abundant by 1945 (Lombard, 1946).

It appears that the mule deer is an adaptable animal. Many predators of deer have been removed, but present day deer hunting outside the Monument consistently removes large numbers of deer. Probably the most important factor accounting for higher deer populations is the change in vegetative composition caused by domestic livestock overgrazing the range. This overgrazing altered the composition of the range from grass to browse. A more detailed history of the deer will be presented under "History of the Monument Deer Herd".

Several species of game birds inhabit the Monument. Included are sage grouse (Centrocercus urophasianus), blue grouse (Dendrogapus obscurus), chuckar partridge (Alectoris graeca), Canada goose (Branta canadensis), mallard duck (Anas platrhynchos), and other species of waterfowl.

Nine broods of Canada geese were observed in June of 1967 in the Island Park area. Many Canada geese winter in the canyon areas of the Monument. Mallards and other ducks also nest and winter here.

Sage grouse and blue grouse can be found in the vicinity of Canyon Overlook and lower Pot Creek. Blue grouse also have been seen in Zenobia Basin. Chukar partridge can be found on much of the Harpers Corner area.

Twomey's (1942) list of "The Birds of the Uintah Basin in Utah" is applicable to much of Dinosaur National Monument.

A checklist of the Monument fauna was compiled by Beidleman (1957). Woodbury (1960) edited a checklist of the fauna and flora of the nearby Flaming Gorge Reservoir Basin which would apply to the canyon areas of the Monument. Pearson's (1967) study of the aquatic ecology of the Green River includes the ecology of the Monument's fishes.

Flora

Much of the vegetation of the Monument is typical of that found in a semi-arid desert with 7 to 14 inches of annual rainfall. The Monument's vegetation varies from xeric to mesic types of plant communities, depending mainly upon the elevation of the particular sites.

The higher elevations of Harpers Corner, Zenobia Basin, lower Pot Creek, and Wild Mountain are typified by big sage (Artemisia tridentata), serviceberry (Amelanchier alnifolia), bitterbrush (Purshia tridentata), and, in the latter three locations, ponderosa pine (Pinus ponderosa). Because of increased precipitation at the higher elevations near Round Top, the north rim of Blue Mountain, and Zenobia Peak there are scattered stands of Douglas-fir (Pseudotsuga menziersii var. glauca), and quaking aspen (Populus tremuloides) on the slopes.

Lower elevation areas, such as Island Park and the Yampa Bench, are typified by two types of vegetation: big sage-shadscale areas and pinyon-juniper areas. Big sage, shadscale (Atriplex confertifolia) and associated grasses such as the Agropyron spp., Poa spp., and Stipa comata are found on the flat, open areas. Large areas of Utah juniper (Juniperus osteosperma) and pinyon (Pinus edulis) are also common, particularly in highly dissected areas of water drainage where the soil is shallow and rocky. Juniper and pinyon can also be found on shallow and rocky soils at higher elevations.

There are bare rock areas at lower elevations where only single junipers can exist in crevices that have captured and held a bit of soil. Such areas are common on the north side of the Yampa River near its confluence with the Green River.

The most common plant in the Monument is big sage, although junipers run a very close second. The higher elevation mountain plateaus which adjoin the Monument, such as Blue Mountain and Diamond Mountain consist of a large acreage of rolling slopes of big sage with scattered serviceberry. These areas are the main summer ranges for the deer that winter on the Monument.

Arthur H. Holmgren, Curator of the Intermountain Herbarium at Utah State University, prepared a check list of the plants of the Monument in 1962. He collected and identified a total of 553 species from this area.

Climate

The Monument has a semi-arid climate with dry, hot summers and dry, cold winters. Summer temperatures decrease with increased elevation. There is increased precipitation during the winter with increased elevation. These statements are generally true for the entire year, but not with the same consistency as during the particular season mentioned. Lower elevations on the Monument (less than 6,000 feet) receive approximately 7 to 9 inches of annual rainfall. Higher elevations (approximately 6,000 to 9,000 feet) receive between 11 to 14 inches.

Daily and seasonal temperatures vary widely, as is typical for inland areas. Daily maximum and minimum temperatures during the summer range between 45 or 50° F to 100° F. Minimum temperatures during the winter months occasionally fall below a minus 10° F at night. This is particularly true for the month of January, the coldest month of the year. Daytime temperatures during January seldom exceed 32° F (Table 1).

Table 1. Climatological data from the weather stations in Dinosaur National Monument.

Quarry, Utah
elevation: 4,866 feet

3-years monthly averages (1965-1967)

| Climatic characteristic | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperatures (°F) | | | | | | | | | | | | | |
| maximum: | 26.5 | 34.0 | 50.9 | 64.8 | 73.9 | 82.5 | 93.9 | 91.3 | 80.6 | 66.8 | 52.6 | 25.9 | |
| minimum: | 2.0 | 6.1 | 23.2 | 32.6 | 40.5 | 47.5 | 56.4 | 52.9 | 42.1 | 32.3 | 26.0 | 7.1 | |
| Precipitation (inches) | 0.40 | 0.24 | 0.39 | 0.50 | 0.98 | 1.36 | 1.08 | 0.53 | 0.92 | 0.68 | 0.67 | 1.32 | 9.07 yearly $\bar{X}$ |

Dinosaur, Colorado
elevation: 6,000 feet

4-years monthly averages (1964-1967)

| Climatic characteristic | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperatures (°F) | | | | | | | | | | | | | |
| maximum: | 31.7 | 35.7 | 45.8 | 58.0 | 69.5 | 77.0 | 87.1 | 85.2 | 73.2 | 65.4 | 47.8 | 28.5 | |
| minimum: | 8.2 | 10.7 | 19.6 | 30.6 | 37.7 | 43.4 | 52.7 | 51.6 | 40.9 | 33.2 | 24.2 | 9.4 | |
| Precipitation (inches) | 0.34 | 0.41 | 0.79 | 0.92 | 1.50 | 1.65 | 0.89 | 0.82 | 1.05 | 0.58 | 0.97 | 1.48 | 11.40 yearly $\bar{X}$ |

# HISTORY OF THE MONUMENT DEER HERD

## Winter ranges

The five deer winter ranges within the boundaries of the Monument are situated on the lower elevation flats and benches along the Green and Yampa Rivers (Figure 1).

### Yampa Bench:

Yampa Bench is the largest bench area on the Monument and consequently the largest deer wintering area. This bench extends along the south side of the Yampa River from Thanksgiving Gorge in the east to Echo Park in the west where the Yampa River joins with the Green River. The elevation of the Bench varies from approximately 5,250 feet on the western end to approximately 6,400 feet at West Cactus Flat near the eastern end. The west end from Pool Creek Canyon to Castle Park road is the widest portion and is comprised largely of wide flats of big sage. In winter much higher densities of deer are found on the western end than on the eastern end.

### Island Park:

The Monument's second largest deer winter range is the Island Park area. Its name comes from the islands formed eleven miles downstream from Echo Park where the Green River divides in several places forming seven major islands. The largest of these is approximately 40 acres.

There is a two-square-mile flat on the west side of the Green River in Island Park. Many small intermittent streams enter the river in this vicinity and have formed numerous small valleys. The hilly terrain

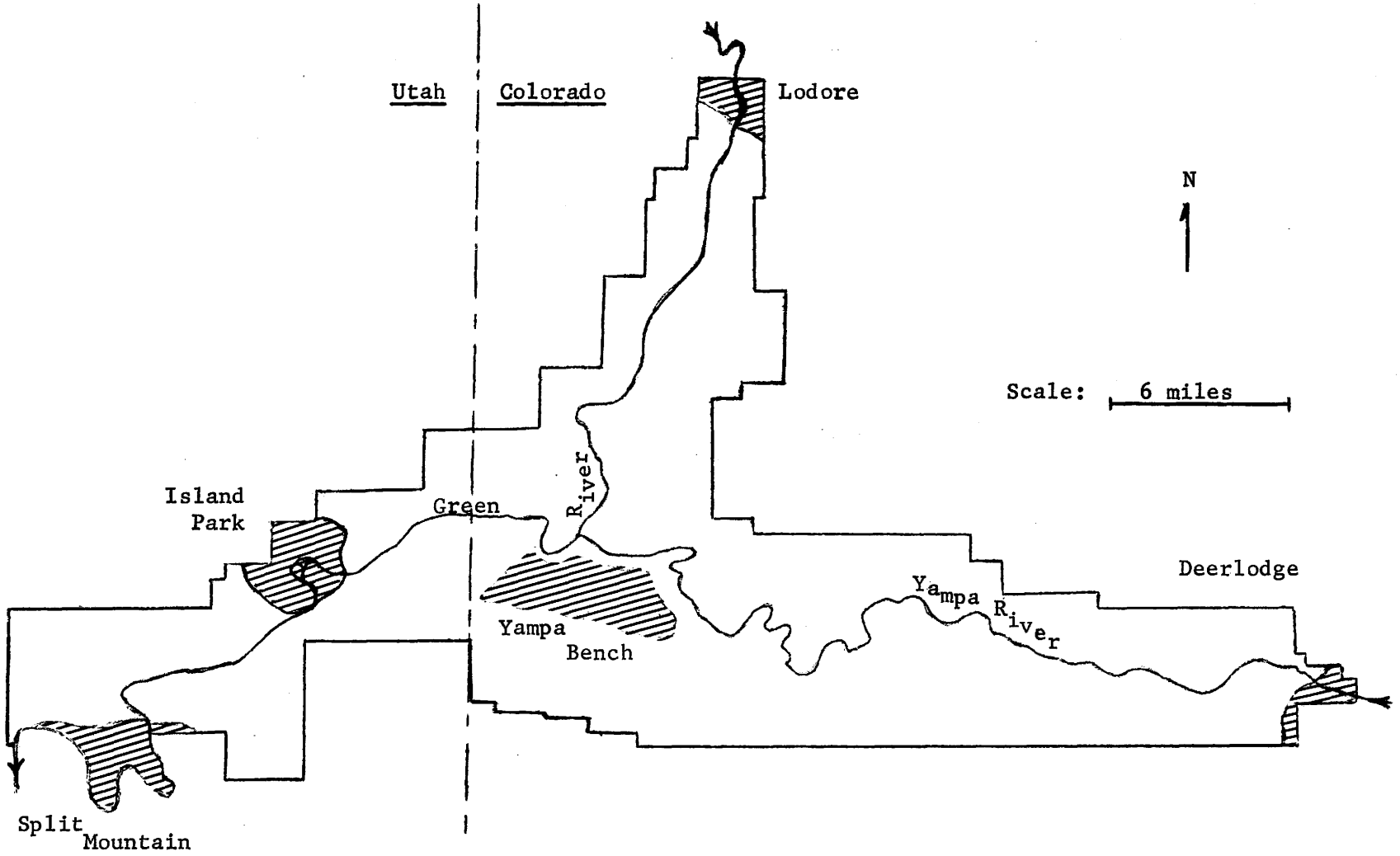


Figure 1. Location of deer winter ranges within Dinosaur National Monument.

between these small valleys are covered with scattered junipers, which provide protective cover for deer during the daylight hours. The broad, flat areas of Island Park and adjoining Rainbow Park also are used by deer but not as heavily as the surrounding hills, valleys, and small benches. The elevation limits of the Island Park area normally used by deer during an average winter vary from 4,961 feet (river bank) to approximately 5,400 feet. The flats around the old Ruple Ranch of Island Park support stands of greasewood and shadscale, whereas the hills and benches are composed mainly of big sage, junipers, forbs, and Indian ricegrass (Oryzopsis hymenoides).

Split Mountain:

The Split Mountain deer range is located where the Green River opens into the huge, flat Uintah Basin region after leaving the steep-walled Split Mountain Canyon. This area is composed largely of big sage flats with scattered junipers. There are also several rock "breaks" in this area where mountain mahogany (Cercocarpus montanus) is fairly common. The area most used by deer is comprised of approximately three square miles of Monument property and three square miles of private property. The elevation of this winter range extends from 4,796 feet to approximately 5,200 feet.

Deerlodge Park:

Deerlodge Park is a flat area along the Yampa River located at the most eastern portion of the Monument. Many cottonwood trees (Populus angustifolia) grow along the river banks, and big sage predominates a short distance from the river bank. A number of resident deer are found in the vicinity of Deerlodge Park, and during the winter additional deer move into the area to over-winter. The area used by wintering deer is

approximately three square miles in size. The elevation of this wintering area ranges from 5,500 feet to approximately 5,900 feet.

Gates of Lodore:

Two miles downstream from the Monument's northernmost boundary, the Green River enters a huge canyon called the Lodore Canyon. The entrance to this canyon is bounded by steep canyon walls which rise nearly 2,000 feet above the river. This area is called the Gates of Lodore. Between Lodore and the Monument boundary approximately two square miles of big sage and juniper country along the Green River are used by a small resident group of deer as well as an increment of deer during the winter months. The elevation of the Lodore wintering area ranges from 5,356 to 5,800 feet.

Past and present numbers

Few records of deer numbers were recorded during the early exploration of the Monument region. John Wesley Powell (1875) observed "many" deer on his trip down the Green River in 1869. Rial Chew (1967), long-time resident of the Yampa Bench, stated that deer were rarely seen in this area from 1915 to 1920. Mr. Chew claimed that perhaps a total of 50 deer were seen on the Bench in the winter of those years. Today the Bench is a major deer wintering area. Mr. Chew also claimed that after about 1920 the deer population began to increase and that by 1945 deer numbers were very high on the Bench during the winter. During the severe winter of 1948-49 he estimated the number of deer wintering on the Bench to be about 2,500 head. The deer were so numerous that they would follow closely behind the hay sled, eating from it, whenever he took hay out to feed his cattle. Also, the snow was so deep and crusted on the Bench that winter that the deer stayed on the Bench road and used the trails made by the hay wagons and sleds.

Mrs. Billie Ruple Untermann (1967) gave a most authentic and first-hand account of the Island Park deer wintering area. The Ruples, relatives of Mrs. Untermann, were the original settlers of the Island Park area. In Mrs. Untermann's "History of the Island Park Area" (1967), she reported that about the year 1885 deer were hunted quite frequently by whites and Indians alike in the Diamond and Jones Creek areas north and east of Island Park. Mrs. Untermann claimed that the highest winter deer density she ever saw in Island Park was during the severe winter of 1937.

The Ruple Ranch was sold about 1945 to Clark Feltch of Vernal, Utah. Mr. Feltch (1967) stated that the highest densities of wintering deer he had observed since 1945 were during the winters of 1948-49 and 1952-53 when he estimated that there were probably 1,000 deer in the Island Park area. He also noted a heavy deer winter kill during these winters of heavy snowfall and cold weather. Mr. Feltch further claimed that the number of deer wintering in Island Park during winters of average severity was between 300 and 400 head. The Utah Division of Fish and Game purchased the Ruple Ranch on April 4, 1958.

Agencies concerned with the Monument's deer herd or range conditions have at various times during the past 20 years conducted deer censuses both within and in the vicinity of the Monument. These censuses were accomplished by three methods: (1) aerial counts, (2) road counts, and (3) counts made on horseback (Table 2).

These counts are highly erratic, but one inference can be made from them: the more severe a winter, the greater the number of deer that use the winter ranges within the Monument.

Table 2. Past winter deer counts made on Dinosaur National Monument, 1947 to 1967.

| Date | Count | Agency | Method |
|---|---|---|---|
| Island Park winter range: | | | |
| 1947 | 476 | Utah Division of Fish and Game | aerial |
| 1948 | 547 | " " | " |
| 1949 | 83 | " " | " |
| 1950 | 51 | " " | " |
| 1951 | no count | | |
| 1952 | 28 | " " | " |
| 1953 | no count | | |
| 1954 | 14 | " " | " |
| 1955 | 11 | " " | " |
| 1956 | 152 | National Park Service - John Tyers | horseback |
| 1957 | 160 | Bureau of Land Management & Utah Division of Fish and Game | " |
| 1958 | 348 | " " | " |
| 1959 | 315 | " " | " |
| 1960 | 455 | " " | " |
| 1961 | 110 | " " | " |
| 1/15/1962 | 127 | National Park Service - Goick | road |
| 1/25/1962 | 314 | " " - Goick | " |
| 1/15/1963 | 85 | " " - Todd | " |
| 11/17/1963 | 84 | " " - Goick | " |
| 11/23/1964 | 51 | " " - Steele | " |
| 12/06/1964 | 29 | " " - Steele | " |
| 2/10/1965 | 65 | " " - Welch | " |
| 12/16/1965 | 64 | " " - Welch | " |
| 12/18/1965 | 75 | " " - Franzen | " |
| 2/15/1967 | 68 | 1967 deer trapping operation | " |
| Yampa Bench winter range: | | | |
| 3/05/1966 | 160 | 1966 deer trapping operation | " |
| 2/09/1967 | 214 | National Park Service - Hanneman & Franzen | " |
| 3/06/1967 | 150 | Colorado Game, Fish and Parks Dept., approx. 25% coverage | aerial |

The few deer that remain on winter ranges to summer are generally does which use the protective canyons and river islands as fawning grounds. The predominance of does in these lower areas has been noted by local ranchers and by Cole (1953).

Winter mortality

Chew (1967) reported that there was "a lot of" winter deer mortality on the Yampa Bench during the winters of 1949, 1952, and 1964. Clark Feltch (1967) owner of Island Park from 1945 to 1958 likewise stated that he observed deer winter mortality during the winters of 1949 and 1952.

Monument deer records indicate, although few numbers were provided, that deer mortality occurred during the following winters (National Park Service, 1965):

| Year | Comments from the records |
|---|---|
| 1944 | "great" numbers of deer died in the Island Park area |
| 1949 | a "heavy" deer winter mortality occurred in the general area |
| 1950 | the deer suffered "high" winter mortality on winter ranges |
| 1952 | there was a "heavy" die-off of immature deer last winter (Cole, 1953) |
| 1956 | "above average" winter kill on winter ranges |
| 1958 | only one "winter kill" deer was found in Island Park this year (Clemons, 1958) |
| 1964 | Yampa Bench ranchers estimate that one out of five fawns died. |

Deer-bighorn sheep relationships

The bighorn sheep within the Monument appear to be limited strictly to the Lodore Canyon. This situation prevailed during Barmore's (1962) study period. No evidence of an extension of the bighorn's range has been noted in the nearby Yampa or Whirlpool Canyons. During 1966 and 1967 bighorns were not observed on the canyon rims or nearby sage flats and upland areas that constitute deer summer range. Few deer inhabit the

Lodore Canyon area during the summer period. In 1959, Barmore (1962) observed only two deer in the canyon during the entire summer. During December, 1959, Barmore saw 11 deer in approximately half the length of the canyon. Apparently some deer winter along the river bottoms of Lodore Canyon but migrate to surrounding upland areas to summer.

Since bighorn sheep do not use upland areas surrounding Lodore Canyon and few deer use the steep and rugged canyon, there is little forage competition within or near the Monument between these two species.

## HISTORY OF LIVESTOCK GRAZING

The grazing history of Dinosaur National Monument is sketchy for some areas and complete for others. Few written records pertain to numbers of ranchers and livestock, dates of livestock use, range conditions, and other factors.

Many western ranges were originally described as composed of broad, dense stands of stirrup-high grass. This same description apparently applied to much of the area near or within the present day Monument. In 1869, the Blue Mountain area south of the Monument was reported to be a "broad grassy table" (Powell, 1875). As recent as 1918 the Zenobia Basin portion of the Monument was composed primarily of grasses (Chew, 1967). Both of these areas, like most of this region, presently is composed almost completely of big sagebrush. Murie (1952) suggested that big sage may be a natural climax species in some areas of the Monument, but in other areas it is an invader encouraged by overgrazing.

The first history of livestock grazing in the vicinity of the present day Monument pertains to Browns Hole. Browns Park, as it later became known, is a wide, relatively flat valley along the Green River immediately north of the Monument boundary. While exploring the Green River in 1867 Major John Wesley Powell and his party found two Texas cattlemen wintering 2,000 head of tough Texas and Mexican longhorns in the Browns Park area (Burroughs, 1962). Soon after 1867, Browns Park became a hotbed of contention between large and small cattle outfits and between people already in the cattle business and a growing number of those who wished to get into it. All desired Browns Park as a winter range for their livestock.

Cattle ranching had spread out from Browns Park by 1880 and ranches had developed at what is today Jensen, Utah and Dinosaur, Colorado. Cattle grazed over much of Blue Mountain and the southern portion of the Monument. It has been estimated that at the peak of grazing between 1910 and 1920 there were between 4,000 and 6,000 horses and 10,000 cattle in this area (Orr, 1956). Sheep were not introduced until about 1920.

Heavy infestations of Mormon crickets (Anabrus simplex) between 1915 and 1936 further deteriorated range conditions. Joint efforts of county, state, and federal governments finally controlled these insects in 1936 (Orr, 1956).

Most of this area was patented and fenced by 1920 and stockmen who had taken up their lands under the various land laws developed their herds and grazed them on the surrounding unappropriated public domain (Orr, 1956).

The Taylor Grazing Act, which established the Grazing Service, was passed in 1934. Grazing permits, which allowed grazing on public domain, were thereby issued in accordance with good grazing management practices.

Public hearings as to the enlargement of the Monument were held in 1936. The following quote is an excerpt from the Park Service policy statement read at the hearings:

> The grazing of livestock shall be permitted within these Monument areas, under the administration of the National Park Service, as it has been in various other national parks and monuments, subject to the condition of the range and in sympathy with the economic requirements of the communities concerned. Such grazing permits, issued by the National Park Service and in cooperation with the Division of Grazing, shall not be construed as granting an interest in the national monument lands and shall not be renewable after the removal or death of the original holders. By this method, the transition from the present limited use of these areas for grazing to their use and development as national monuments will be a gradual

> process, with due regard and consideration for existing economic requirements... (Orr, 1956, p.3).

The Monument was enlarged by 203,885 acres in 1938, and a cooperative grazing management program was entered into with the Grazing Service in April, 1940. This "Memorandum of Agreement" provided for the issuance of grazing permits by the Grazing Service, subject to approval by the National Park Service. The Park Service has administered grazing on the Monument lands since 1961.

The number of grazing permits has remained nearly constant since the enlargement of the Monument in 1938. Twenty-seven permittees held 29 grazing permits on the Monument in 1938. In 1966, 24 permittees held 29 permits. Permits are issued on an annual basis. Approximately half of the permittees own base lands within the Monument and are dependent upon Monument lands for their livelihood (Orr, 1956).

The Bureau of Land Management established a maximum allowable animal unit months (AUM) of 7,354 for the Monument in 1960. By agreement, range surveys are to be conducted periodically to assess range conditions and to make adjustments as to carrying capacities (Hartzog, 1966). Wildlife is to be considered when establishing carrying capacities.

The National Park Service purchases private lands within the Monument whenever the opportunity occurs. Grazing on acquired lands was summarized by Hartzog (1956, p.2) as follows:

> When the Government purchases the base lands within the monument, the grazing privileges attached to these lands are terminated. If these permittees also own base lands outside the monument, they would still be entitled to graze on the monument, using those preferences attached to base lands outside for a period of 25 years after September 8, 1960, and thereafter for the lifetime of the original permittee and his heirs.

> If title to base lands lying outside the Monument is conveyed, or such base lands are leased to someone other than a member of the immediate family of the permittee as of September 8, 1960, the grazing preference shall be recognized only until September 8, 1985.

The Park Service also is observant to possible adjustments with the Bureau of Land Management and adjacent permittees to transfer preferences from Monument lands to lands outside the Monument. Appendix Table 3 summarizes Monument grazing use.

## METHODS AND PROCEDURES

### Pellet group transects

Pellet group transects were used to obtain an index to deer density and information on seasons of deer use or non-use. A total of 21 transects were established on deer winter ranges in the Monument at the following locations: nine on Yampa Bench, three on Island Park, three on Split Mountain, four on Harpers Corner, one at Deerlodge, and one at Lodore. Each transect was assumed to receive average use by deer and domestic livestock.

The transect lines were established as follows: Two steel posts 10 feet apart delineated the transect direction. A numbered tag denoted the sighting post and the number of the transect. Ten steel stakes were installed 50 feet apart along each transect line. Each stake constituted the center of a plot. A 11-foot 9-inch chain was used to circumscribe a 1/100-acre plot at each of the 10 stakes. Each transect was read twice a year, in May and November. Pellet groups per plot were recorded and the plots were then cleared of all pellets to prevent their being included in future counts.

Pellet groups for the 10 plots in each transect were totaled and converted to deer-days use per acre. The 10 1/100-acre plots equaled 1/10 of an acre when added for each transect line. By multiplying the total number of pellet groups from the 10 plots in a transect by 10 the product then represents the density per acre. To convert total pellet groups per acre to deer-days use per acre the total number of pellet

groups per acre was divided by the mean daily defecation rate per deer. The formula used to estimate deer-days use per acre (Rogers, Julander, and Robinette, 1958) is:

$$\text{deer-days' use per acre} = \frac{\text{projected total number of pellet groups per acre}}{\text{average daily defecation rate per deer}}$$

Nearly all figures obtained on the average daily defecation rate per deer have approximated the figure of 13.0. Because of this and the ease of using a single whole number for computations, 13.0 pellet groups per deer per day was considered the average daily defecation rate during this study.

Vegetative utilization methods

Two methods were used to ascertain what percentage of the browse plants was being removed. These were: (1) actual measurement, and (2) the Cole method of estimating browse utilization.

Measurement: This method of determining browse utilization was described and assessed by Smith and Urness (1962). A measurement was made during the last week of November and the first week of December of the current year's growth on one branch per plant of many plants along a transect line. These same branches were re-measured during the first week in April and the percentage utilization was determined.

Branches to be measured were tagged with a numbered aluminum tag. Current year's growth (growth above the last leaf bud scar) on the branch (above the tag) was measured with a centimeter scale. Measurements were then totaled for the entire branch and recorded on a field data form. All of the branch totals were totaled for all plants measured in November and again in April. The percentage of the yearly growth that had been utilized could then be determined from these two totals by the following

formula:

$$\text{Percentage use} = \frac{\text{total November twig length - total remaining April length}}{\text{total November twig length}}$$

In a year of low forage production, the utilization percentage would be higher compared with a year of medium growth even though the same amount of forage was taken. Smith and Urness (1962) suggested the use of a growth or "production index" in order to assess browse utilization properly. The production index is the average of several year's average twig length. Once determined this can serve as a base with which to compare a year's production.

Deer population changes can be indicated if both the growth index and utilization percentage are known entities. Smith and Urness (1962) further suggest the use of a "use index", which is obtained by multiplying the average twig length (growth index) for the year by the utilization percent figure for that year. This use index would conceivably vary with highs and lows in numbers of wintering deer. The use index would provide a criterion for determining population fluctuations. However, much depends on the severity of the winter, as it affects the distribution of deer on the winter range.

Cole Method: This method, devised by Cole (1963), involves making condition and utilization estimates on browse species upon key range areas. Condition evaluations from different years can be compared to reflect range trends. This method was used at each of 20 pellet group transect locations on the Monument.

The first 50 browse plants along the transect line were evaluated as to form class, age class, and leader utilization. Three age classes and eight form classes based on availability and the degree of hedging

were used. Utilization of browse plants was estimated on the basis of the percent of total available leaders showing use (see Appendix Form 1). To facilitate estimation of utilization, this method divided the leader use estimates into five percentage ranges. The utilization percentage recorded for each plant was considered as the mid-point of the particular range within which it fell (see Appendix Form 1).

The mean percentage utilization for the 50 plant samples was considered the average utilization for the transect area. This evaluation was made each spring, about April 1, before leader growth began.

Exclosures

Exclosures have been constructed on three "key" areas. A key area was considered as a problem area used by livestock and deer in the past and still used by them. These were problem areas because they received such a concentration of animals. The purpose of these exclosures was to help provide answers to the following questions:

(1) If protected, does the range in the general area have the ability to rehabilitate itself? (Rehabilitation will be expressed in increased growth of present vegetation and an increase of perennial grasses along with a decrease of annual grasses and invader species.)

(2) What percentage of utilization on the vegetation is a result of livestock and what is a result of deer?

The locations of the three completed National Park Service exclosures are: Island Park, Harpers Corner, and the Yampa Bench. They were completed in October of 1965, July of 1967, and August of 1967, respectively. Each consists of a five-acre exclosure with a seven-foot high chain link fence to exclude both livestock and deer and another five-acre

exclosure with a 32-inch high fence designed to exclude only domestic livestock. Deer can readily jump into and out of these exclosures. Between the two types of exclosures an open area of at least five acres was left in which both livestock and deer could feed.

The total exclosures (those surrounded by seven-foot high fences) provide the "control" for all vegetative measurements taken in that vicinity.

It was essential that a comprehensive evaluation of the exclosures be made at the time of their installation in the summer of 1967. Such data will serve as the basis for future comparisons. According to the Vernal, Utah, Office of the Bureau of Land Management, the most accurate and consistent type of vegetation analysis used at this time was the "Range Trend Plot Frame Method" adopted and used by them since the spring of 1967 (Bureau of Land Management, 1967).

Fifteen permanent vegetative trend evaluation plots were established and evaluated by me at each of the three exclosure sites during August of 1967. This initial survey is on file at the Monument headquarters building in Dinosaur, Colorado.

Vegetative composition and density

An evaluation was made of the deer winter range in order to assess them properly in terms of their carrying capacity. To do this, a composition and density analysis was made of the vegetation at each of 20 pellet group transect locations on deer winter range areas within the Monument. Data were evaluated in terms of carrying capacity for deer, sheep, or cattle, whichever applied to a particular winter range area. Pellet group transects were used for this analysis because they were

established in areas that represented the vegetative composition of that particular wintering area and were areas of average use by deer and domestic livestock. The "Square Foot Density" method developed by Stewart and Hutchings (1936) was used for this analysis. Five random stations were established along each transect. A chain, 5.64 feet long, was used to circumscribe a 100 square foot circular plot at each station. The plot was then divided into four quadrants and the density for each plant species was estimated to the nearest 0.25 square foot in each and then totaled for the four quadrants. This total was the density percentage which each species comprised of the total plot. Each species density within the five plots were then added together and divided by five to obtain the average species density percentage for the transect.

Trapping and tagging

The deer counts taken at various times of the year indicated that much of the Monument is comprised of deer winter range. Some of these wintering deer were trapped and marked so that they could be identified on their summer and fall ranges to determine their migration patterns.

The Utah Division of Fish and Game supplied the tagging materials which consisted of aluminum ear tags and colored vinyl-nylon ear streamers. A numbered ear tag was affixed through the cartilage of both of the deer's ears with pliers. In addition to a number, each tag had the following message on it: "Important-Save Skull-Notify Utah F. & G. Dept., S.L.C., Save Tag". One and one-half x 10-inch vinyl streamers were attached to the aluminum tags so that they moved freely and were readily observed from a distance. Different colored streamers were used on each of the three deer trapping areas.

Two types of traps were used to catch deer. A wooden box trap was used for several days in January of 1966. Deer did not go into the wooden trap as readily as the "Clover" trap (Clover, 1954), and it was much more difficult to move and set because of its greater weight and bulkiness.

The Clover traps used were made of a steel pipe frame covered with a cotton netting. All eight corners of the trap hinged horizontally, so that the trap could be fully collapsed. Traps were held in place by tie down ropes tied to steel stakes on the two long sides of the trap. Traps were placed singly or in groups in areas where deer tracks were plentiful in the snow. Leafy alfalfa hay was used as bait.

Trapped deer were quickly approached, the tie rope was unsnapped from the steel stake, and the trap was collapsed upon the deer forcing it to the ground. The deer's ears were then pulled through the cotton mesh, tagged with an aluminum tag and vinyl streamer, and then pushed back through the mesh. Tag numbers, age (fawn, yearling, adult), sex, and general physical condition were recorded, and external parasites were collected. The trap was then uprighted and the deer released.

Tagged deer observations

Migration data were obtained during the spring, summer, and fall from sightings and kill locations of deer trapped and eag tagged on their winter ranges. Several methods were used to locate tagged deer. These were:

(1) A coverage of the surrounding areas by vehicle and horseback by the project leader.

(2) Notification of all people engaged in activities in the surrounding areas that a deer migration study was in progress and that their recording and reporting of any tagged deer would be very much

appreciated. A form was distributed with a self-addressed envelope to such people (Appendix, Form 2).

(3) The State and Federal agencies in the area were asked to cooperate by recording and reporting tagged deer sightings. This request was made through the Monument's Cooperative Deer Research Committee.

(4) Articles were placed in the local newspaper explaining that a deer migration study was being conducted and that notification of any sightings of tagged deer in the area would be helpful. The Utah Division of Fish and Game placed these articles, one in June of 1967 and the other during the 1967 deer hunting season.

(5) Personal contact was made with hunting camps during the Colorado and Utah deer hunting seasons.

Deer checking stations

The Colorado Game, Fish, and Parks Department established a checking station at the Utah-Colorado state line along U.S. Highway # 40 during the 1966 Colorado deer hunting season. While working at this checking station, the project leader contacted several hunters that had either killed or seen tagged deer on Blue Mountain. Kill totals for Colorado hunting units that adjoined the Monument were obtained at this time along with a general evaluation of deer physical condition.

The project leader established a temporary check station at the Diamond Mountain road intersection near Diamond Mountain Gulch during the 1967 Utah deer hunting season. At this station 11 tagged deer sightings were reported by hunters.

Deer herd composition and condition

Sex ratios and composition. Sex ratios and age composition of deer on summer range were observed through 7 x 50 binoculars from the last

week in August to the first week in October. Specific routes on deer summer range areas were traversed during both years of the study. Only deer that could be definitely classified by sex and age class were included in the data. Sex and age data from trapped deer were of little value because does were trapped more readily than bucks and fawns.

Physical condition. Data concerning the physical condition of deer were collected visually and by palpation during the trapping operation and on deer which were taken through deer checking stations during the hunting season.

Trapped deer were examined for external parasites, papillomas, mange, and any other evidence of physical impairments or deformities. External parasites were collected and preserved in 70% alcohol. The amount of fat on the body was assessed by feeling the back bone, ribs, and hip bones. If these bones were prominent, the deer was generally recorded as being underweight and in poor condition.

Deer brought into checking stations during the hunting season also were examined for external parasites and general body weight. The jaws were examined for the occurrence of "lumpy jaw".

The bone marrow from either the humerus or femur bones was examined from deer which died as a consequence of trapping or were found dead on winter ranges. If the bone marrow was bloody and gelatinous, it was indicative that the deer's fat supply was low and the body had used up its stored fat reserves and was using the fat stored in the bone marrow. Such deer are in poor physical condition. If the marrow was white and fatty, this indicated that the deer still had sufficient fat reserves in the tissues and was not in physical hardship (Cheatum, 1949).

## TRAPPING PROBLEMS

### Trampled fawns

Three fawns died from trampling during the two-winter period as a consequence of an adult doe and one or more fawns being simultaneously trapped. Does often trampled the fawns in their attempts to escape from the trap. In addition to the three fawns which died, five others were undoubtedly hurt by trampling; but they managed to leave the trapping area upon release.

This type of trapping loss perhaps could be reduced or even eliminated by using traps with a narrower entrance. Two of the 29 traps used had an entrance width of approximately 30 inches instead of the recommended 44 inches. The narrow traps worked equally as well as the wide traps; however, no more than one deer at a time was ever captured in the narrower traps.

### Broken necks

Of 75 deer tagged in 1966 only one, a doe fawn, died of a broken neck. Three deer out of a total of 116 trapped in 1967 died from broken necks. The broken necks generally resulted when the trapped deer lunged into the corner or top steel pipe framing of the trap.

### Installation and checking of traps

It was best to locate traps in such a manner that they were not in view of each other. When one deer observed another being tagged in another trap, it frequently became so excited that it injured or even killed itself attempting to escape.

Deer were found to move greater distances in their feeding during nights of a full or nearly full moon and little or no overcast. This was expressed in increased numbers of deer trapped during such nights. Virtually all deer were trapped during the night. In the daylight hours, deer normally could be found bedded down in juniper cover along rocky breaks. It was important to check traps early in the day so that deer did not remain in the traps any longer than necessary. When a deer was found in a trap, the trap was collapsed upon the deer as quickly as possible to prevent its movement and possible injury.

Traps were positioned so that the entrance was toward the direction from which the trapper approached. This prevents the escape of a second deer from the trap that would otherwise occur from one deer leaping into the entrance gate and causing it to slide open.

Recaptures

Alfalfa bait apparently was a powerful attractant, and a deer was often recaptured on the next night after initial capture. A total of 44, or 59 percent of 75 deer tagged during the winter of 1966, were recaptured. And, 195 recaptures were recorded for the 110 deer tagged during the winter of 1967. Deer were almost invariably recaptured either in the same trap of initial capture or in a trap less than 300 yards away.

After the recapture rate became high in an area, the traps were moved to another area. A distance of only 400 yards was usually sufficient to trap untagged deer.

Livestock

The west end of the Yampa Bench was both a deer and livestock winter range. The Chew livestock ranchers wintered 950 sheep, 10 horses, and

approximately 45 head of cattle in this area. The livestock found that the deer traps were a ready source of forage. When a horse entered a trap, it invariably broke the tie rope snaps and ran 50 to 200 feet before it threw the trap off. Trap frames usually had to be repaired when this occurred. Cattle, on the other hand, usually remained calmly in the trap until released. However, on four occasions, a cow or steer dragged the trap a short distance before shaking it off.

Sheep always remained calmly in the trap awaiting release. More than one sheep usually was caught at a time. On one occasion, six sheep were captured simultaneously in a single trap.

A total of 3 horses, 16 cows, and 34 sheep were trapped on the Yampa Bench during the winter of 1966. In Island Park in 1967 only six cows were trapped while trapping deer. Finally, the cattle were removed from Island Park on February 3 when the owner's grazing permit expired.

## SEASONAL MOVEMENTS

Seasonal movements of deer from the Yampa Bench, Island Park, and Split Mountain winter ranges in Dinosaur National Monument are independently discussed since movement of deer from one winter range to another was not observed, nor did any two winter range deer populations summer on the same range.

### Yampa Bench herd

Deer use of the Yampa Bench, as determined by pellet group transects and observations was limited almost exclusively to the winter months of December through March.

Pellet group transects: Nine pellet group transects on the Yampa Bench provided information on deer numbers in the form of deer days use per acre. From mid-spring to mid-fall in 1966, the use per acre ranged from 0 to 6.9 deer days; whereas, from mid-fall to mid-spring, it ranged from 2.3 to 50.0 deer days use on the same transects (Table 3).

Observations: Deer counts during the late spring, summer, and fall months ranged from 0 to 11 deer along a 28.5 mile route, the distance from Echo Park to the Thanksgiving Gorge entrance to the Monument. This route covered the entire length of Yampa Bench. Counts on the Bench were much higher during the winter months than during other seasons of the year. In winter these counts ranged from 42 to 220 deer on the same route (Table 4).

Movements: From the 59 deer ears tagged on the Yampa Bench the first were observed in migration along the base of Blue Mountain on March 21,

Table 3. Deer days' use per acre on Yampa Bench pellet group transects during 1966 and 1967. Dinosaur National Monument.

| Transect No.[a] | 1966 | | 1967 | |
|---|---|---|---|---|
| | May 1 | Nov. 1 | May 1 | Nov. 1 |
| | Deer Days Use Per Acre | | | |
| 1 | 50.0 | 0 | 43.1 | 0 |
| 2 | 33.8 | 0.8 | 16.9 | 0.8 |
| 3 | 13.1 | 2.3 | 13.8 | 0 |
| 4 | 10.8 | 3.8 | 18.5 | 2.3 |
| 5 | 3.8 | 0 | 13.1 | 0.8 |
| 6 | 2.3 | 0 | 0 | 0 |
| 7 | 4.6 | 0 | 6.9 | 0 |
| 8 | 16.9 | 0 | 0.8 | 1.5 |
| D-401[b] | 3.8 | 6.9 | 3.8 | 4.6 |
| Mean: | 15.5 | 1.5 | 13.0 | 1.1 |

[a]Transects were numbered from west to east; thus, transect No. 1 is the furthest west and transect No. D-401 is the furthest east.

[b]Transect D-401 was used by deer almost on a year-round basis. Although located at a somewhat higher elevation than the Yampa Bench, it was very close to it.

Table 4. Deer counts made at various times of the year across the Yampa Bench, 1964-1967. Dinosaur National Monument.

Winter Counts:

| Date | Observer | Route | Length of Route | Number of Deer Seen |
|---|---|---|---|---|
| | | | (miles) | |
| 1/6/64 | Paul Ellis | Echo Park to Thanksgiving Gorge | 28.5 | 42 |
| 1/27/66 | R. Franzen | " " | 28.5 | 91 |
| 2/23/66 | R. Franzen | " " | 28.5 | 89 |
| 3/4/66 | R. Franzen | Echo Park to Castle Park road | 11.0 | 117 |
| 3/5/66 | R. Franzen | Echo Park to Thanksgiving Gorge | 28.5 | 150 |
| 4/10/66 | R. Franzen | " " | 28.5 | 49 |
| 2/9/67 | L. Hanneman & R. Franzen | " " | 28.5 | 220 |
| | | | $\bar{X}$ = | 108 |

Spring, Summer, and Fall Counts:[a]

| Date | Observer | Route | Length of Route | Number of Deer Seen |
|---|---|---|---|---|
| | | | (miles) | |
| 7/4/64 | L. Casterline | Echo Park to Thanksgiving Gorge | 28.5 | 10 |
| 8/6/65 | L. Casterline | " " | 28.5 | 0 |
| 11/26/65 | R. Franzen | " " | 28.5 | 11 |
| 6/25/66 | L. Casterline | " " | 28.5 | 1 |
| 8/5/66 | L. Casterline | " " | 28.5 | 1 |
| 11/21/66 | R. Franzen | " " | 28.5 | 9 |
| 6/10/67 | L. Casterline | " " | 28.5 | 11 |
| 7/9/67 | L. Casterline | " " | 28.5 | 8 |
| 8/7/67 | L. Casterline | " " | 28.5 | 8 |
| 8/25/67 | L. Casterline | " " | 28.5 | 7 |
| | | | $\bar{X}$ = | 7 |

[a]During spring, summer and fall counts deer were generally seen in the Thanksgiving Gorge area near the Yampa Bench. The Gorge area is 7,000 feet in elevation whereas the adjoining Bench is from 5,250 to 6,400 feet.

1966 in such places as Trail Draw, Iron Springs Bench, Pearl Park, Red Rock Bench, and Johnson Draw. The incidence of such groups at the base of Blue Mountain increased until, by April 3, they appeared to have all moved onto these higher flats of the Yampa Bench. The first deer on the Blue Mountain Plateau were seen along the north rim on April 9. By April 15, four to 12 head of deer were quite commonly seen between the Doug Chew cabin and the point of Harpers Corner. This progressive movement continued until, by May 10, few to no deer were seen on the Bench; but deer were commonly seen on all sections of the Blue Mountain Plateau.

Eight tagged deer were seen in the company of untagged deer at intermediate locations between Yampa Bench and Blue Mountain between April 2 and 12, 1966 (Appendix Table 3).

Five deer with red streamers were seen crossing Utah Highway #44 on April 13, 1966, approximately 11 miles north of Vernal, Utah. These deer could have been either from Yampa Bench or Dutch John. The Utah Division of Fish and Game had tagged deer in Dutch John with red streamers for several years. Dutch John is approximately 22 air miles north of the sighting location and Yampa Bench is approximately 27 air miles to the southeast. On October 21, 1967 a large four-point buck that had been tagged with red streamers on the Yampa Bench was killed on the west end of Hoy Mountain on the Diamond Mountain Plateau. This buck had travelled 12 air miles to the northwest from where it was tagged on the Yampa Bench. All other sightings and hunting kills of Yampa Bench deer were from the Blue Mountain Plateau area which is south of the Yampa Bench (Figure 2). Apparently, few deer from the Yampa Bench migrate to the Diamond Mountain Plateau.

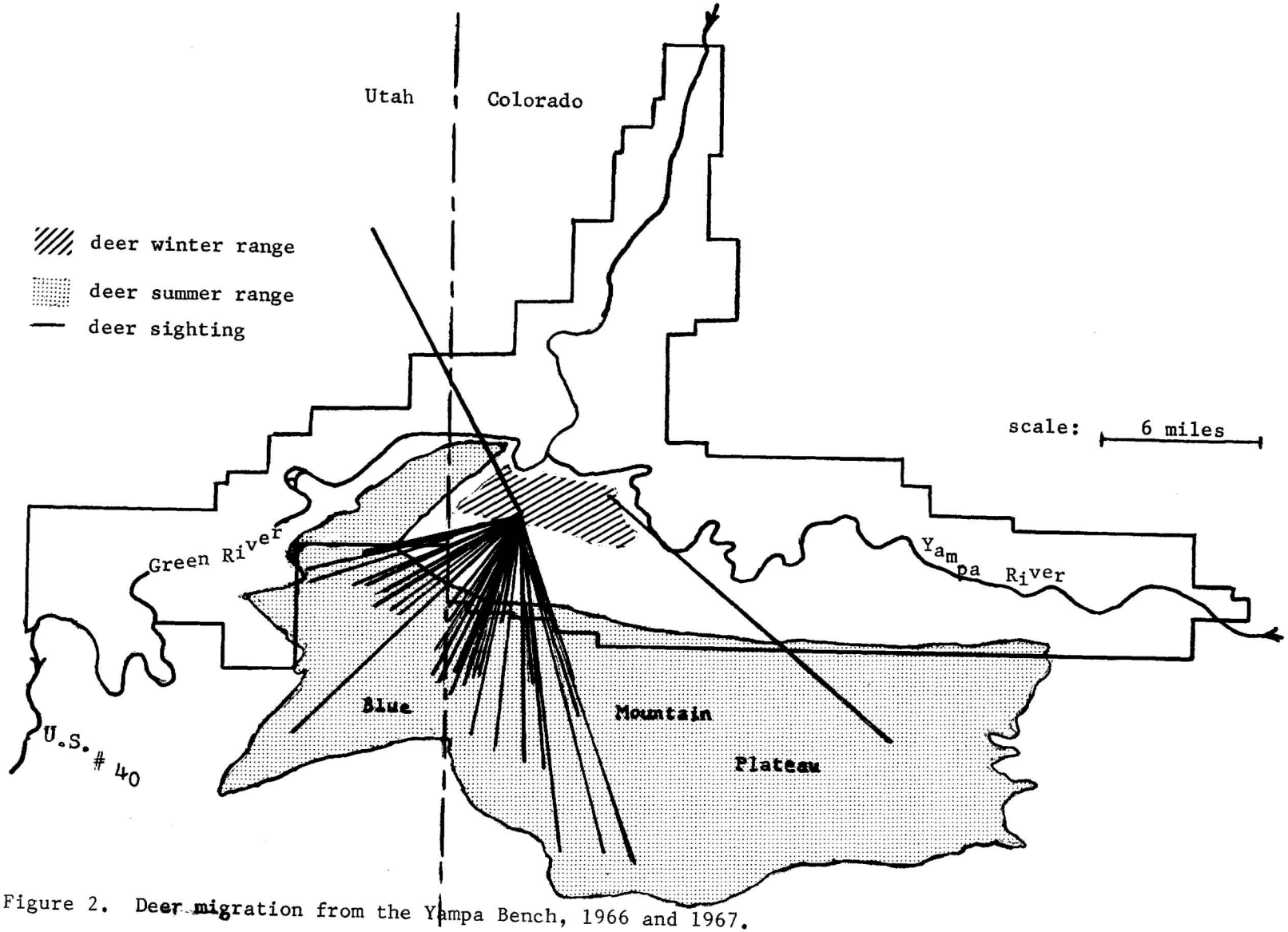


Figure 2. Deer migration from the Yampa Bench, 1966 and 1967.

A total of 35 sightings of 44 tagged deer were observed between April 14 and November 28, 1966. Several tagged deer occasionally were seen together or within close proximity to each other. Most sightings of tagged deer on Blue Mountain were between the Doug Chew corral on the Harpers Corner road and Stuntz Ridge, approximately 5.5 to 8.5 air miles south-southwest of the Yampa Bench deer tagging areas. The furthest tagged deer sighting to the south was of two tagged deer in the Moosehead region on the south rim of Blue Mountain Plateau, 14 air miles south of the tagging location. The furthest sighting of a tagged deer to the west (except for the Diamond Mountain sighting) was at Point of Pines on the southwestern rim of the Blue Mountain Plateau, 11.5 air miles southwest of the Yampa Bench tagging location. A tagged deer seen near the Pittman Ranch was the furthest sighting to the east, and was a distance of 14.8 air miles from the tagging site.

Tagged deer were seen in the vicinity of the 1966 tagging site on Yampa Bench during the late fall of 1966 and the winter of 1967. According to sightings of both tagged and untagged deer, deer began to enter the Yampa Bench in November, 1966 and to leave in April, 1967 (Appendix Table 3).

Deer with red streamers were seen again on Blue Mountain during the summer of 1967. A total of 14 sightings of 21 red streamered deer were recorded. Most sightings were made on the western portion of Blue Mountain in approximately the same areas as red streamered deer sighted during the summer of 1966 (Appendix Table 3).

To summarize, the Yampa Bench wintering deer herd migrated south to the Blue Mountain Plateau during April. They summered there until

November when they began to migrate back to the Bench. Some deer which summer on Blue Mountain also winter on the south base of the Plateau but apparently not to the extent that they do on the north base of the mountain known as the Yampa Bench. Only one tagged deer was seen on the Bench during the 1966 summer period. All other tagged deer apparently migrated to higher elevations outside the Monument.

Island Park herd

Use of the Island Park area is limited primarily to the winter months of December through March.

Pellet group transects. Deer days use per acre from the three Island Park pellet groups transects showed a much higher use of this area during the winter months than during the remainder of the year (Table 5). Deer days use per acre from November 1, 1966 to May 1, 1967 varied from 20.0 to 28.5 for the various transects. Whereas, from May 1 to November 1, 1967, use ranged from 1.5 to 3.8 deer days per acre.

Observations. Deer counts made via vehicle in the Island Park and adjoining Rainbow Park areas during the winter months were much higher than were spring, summer, or fall counts (Table 6). Winter counts during 1966 and 1967 ranged from 28 to 75 deer, whereas, spring, summer, and fall counts ranged from 0 to 16 deer.

Movements. A total of 110 deer were ear tagged in the Island Park area between January 10 and March 2, 1967. After the tagging operation, groups of deer were observed further and further west and north of the Island Park area in the direction of the Diamond Mountain Plateau. By April 15, very few deer were observed in the Island Park area. From April 1 to May 5, between 10 and 25 deer were seen via horseback in the

Table 5. Deer days use per acre on Island Park pellet groups transects during 1966 and 1967. Dinosaur National Monument.

| Transect No. | 1966 | | 1967 | |
|---|---|---|---|---|
| | May 1 | Nov. 1 | May 1 | Nov. 1 |
| | Deer Days Use Per Acre | | | |
| 9 | 13.8 | 0 | 22.3 | 3.8 |
| 10 | - | 0 | 20.0 | 1.5 |
| 11 | 67.7 | 0 | 28.5 | 1.5 |
| Mean: | 40.8 | 0 | 23.6 | 2.3 |

Table 6. Deer counts made at various times of the year via vehicle in the Island Park area, 1962-1967. Dinosaur National Monument.

Winter Counts:

| Date | Observer | Deer Seen |
|---|---|---|
| 1/15/62 | George Goick | 127 |
| 1/25/62 | George Goick | 314 |
| 1/15/63 | James Todd | 85 |
| 11/17/63 | George Goick | 84 |
| 11/23/64 | Darryl Steele | 51 |
| 12/6/64 | Darryl Steele | 29 |
| 2/10/65 | Wayne Welch | 65 |
| 12/16/65 | Wayne Welch | 64 |
| 12/18/65 | Robert Franzen | 75 |
| 11/23/66 | Robert Franzen | 28 |
| 2/15/67 | Robert Franzen | 68 |
| | $\bar{X}$ = | 90 |

Spring, Summer, and Fall Counts:

| Date | Observer | Deer Seen |
|---|---|---|
| 4/3/66 | Robert Franzen | 12 |
| 4/11/67 | Robert Franzen | 16 |
| 5/5/67 | Robert Franzen | 9 |
| 6/20/67 | Robert Franzen | 2 |
| 7/1/67 | Robert Franzen | 0 |
| 7/10/67 | Robert Franzen | 6 |
| 8/1/67 | Robert Franzen | 0 |
| 8/27/67 | Robert Franzen | 2 |
| 9/1/67 | Robert Franzen | 2 |
| | $\bar{X}$ = | 5 |

six-mile-wide area between Island Park and the east rim of the Diamond Mountain Plateau. Between May 5 and May 15 only two to 10 deer were observed.

Nearly all of the deer wintering in Island Park migrated to the Diamond Mountain Plateau and Ashley National Forest to the northwest. Deer tagged with light blue streamers in Island Park were seen on the Diamond Mountain Plateau and Ashley National Forest areas from May 8 to October 28, 1967. A total of 70 sightings for 83 of these tagged deer were recorded (Appendix Table 4). Tagged deer were observed primarily in the following areas: McKee Draw, McKee Spring, Aspen Spring, and Diamond Gulch. The average distance for all summer range sightings of tagged deer was 22.6 air miles from Island Park (Figure 3).

The most distant sightings of tagged deer were of bucks. The furthest sighting of a deer from the Island Park winter range was of a two-point buck seen on Farm Creek Mountain in Ashley National Forest, a distance of 44.0 air miles from the tagging site. An adult buck with blue streamers was seen near the Dutch John airfield on July 25, 1967, 30.6 air miles from Island Park. This buck had traveled from a winter range through a summer range and then onto another winter range area. Another adult buck with blue streamers was seen at Eagle Creek in Ashley National Forest, a distance of 31.6 air miles from the tagging site. One blue streamered adult buck was seen on July 10, 1967 on the Richard Peterson property of Blue Mountain. It had migrated 12.0 air miles to the southeast of Island Park. This was the only sighting of an Island Park deer on Blue Mountain.

Only three of the 110 deer tagged in Island Park during the winter of 1967 remained in the immediate vicinity through the summer months.

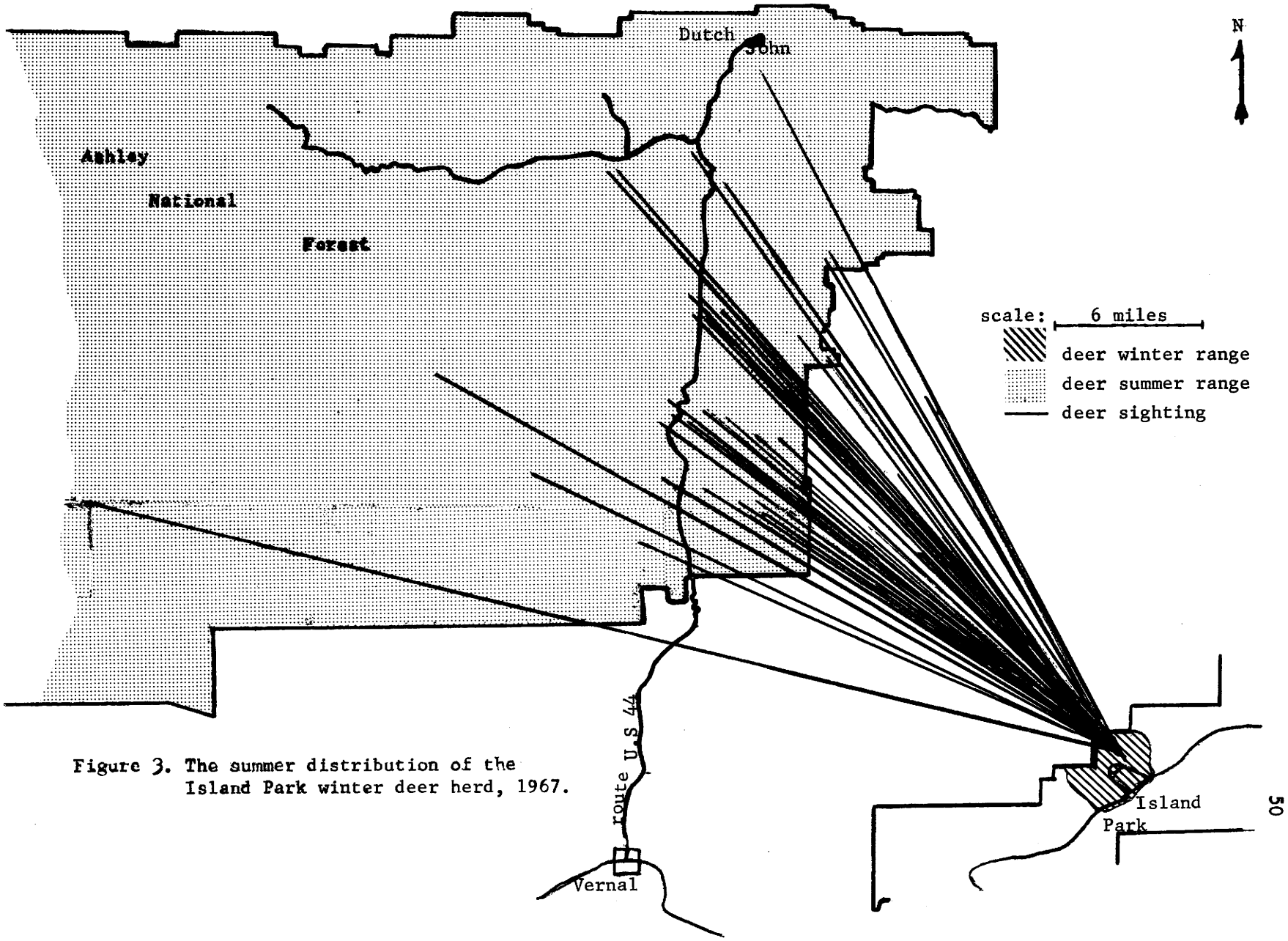


Figure 3. The summer distribution of the Island Park winter deer herd, 1967.

These were all does which were frequently seen on the islands formed by the Green River. The first fawn observed in the last spring of 1967 was seen with a blue-streamered doe on one of the islands. Three blue-streamered does also were observed with three fawns on the furthest west island of Island Park on July 10, 1967. It appears that these islands were used as a fawning ground by a few resident doe deer.

To summarize, the Island Park area is a major deer winter range in the Monument. Deer begin to immigrate into Island Park in late October and emigrate in late March or early April. Deer tagged in Island Park during the winter were found to migrate to the northwest onto the Diamond Mountain Plateau and the Ashley National Forest. The distances traveled varied from 10 to 44 air miles.

Most of the summer range used by Island Park deer is owned by the U.S. Forest Service. Deer also used Bureau of Land Management and some private lands, particularly on the Diamond Mountain Plateau.

Harpers Corner herd

Harpers Corner is a northerly extension on the west end of the Blue Mountain Plateau and is located entirely within the boundaries of the Monument. Deer use on Harpers Corner was continuous from early spring nearly to mid-winter, depending upon snow depth and winter severity. Both pellet group transects and observations gave evidence that partial winter use does occur.

Pellet group transects. The data on deer days use per acre obtained from four Harpers Corner pellet group transects disclosed that deer used the area during both the summer and winter. But data for deer days use during the winter period (November 1 to May 1) were somewhat lower than

from May 1 to November 1 (Table 7). This was logical, because in mid-winter (February) the deer were forced to lower elevations such as the Yampa Bench and the Trail Draw areas. The first deer seen on Blue Mountain in the spring were generally observed on the Harpers Corner area during either the last week in March or the first week in April. As a result of this late migration from and the early migration back onto the Harpers Corner area, there was a period of from only seven to eight weeks when deer were not using the Harpers Corner area.

Observations. A total of 17 deer counts made via vehicle on Harpers Corner demonstrated that the number of deer on the area was quite stable during the time when vehicular travel was possible (Table 8). Counts ranged from six to 19. The lowest count was made on January 22, 1966, the last day of trapping there. Four of the six deer seen on this count were in the Trail Draw portion of Harpers Corner. Trail Draw is one of two locations where deer have access to the lower elevation Yampa Bench.

An aerial reconnaisance was made of the west end of the Blue Mountain Plateau, including the south end of the Harpers Corner area, on March 6, 1967. No deer tracks were seen on this area during the flight. The first tracks on the slopes of the Plateau were seen on the south slopes at approximately 7,000 feet elevation.

Movements: A total of 16 deer were tagged on Harpers Corner between January 11-22, 1966. Snow depth was 11 inches during this period, but by January 22 very few untagged or "new" deer were being trapped and deeper snows were inhibiting trapping activities. Therefore, the trapping operation was moved to the Yampa Bench.

Table 7. Deer days' use per acre on Harpers Corner pellet group transects during 1966 and 1967. Dinosaur National Monument.

| Transect No. | 1966 | | 1967 | |
|---|---|---|---|---|
| | May 1 | Nov. 1 | May 1 | Nov. 1 |
| | Deer Days Use Per Acre | | | |
| D-50 | 12.3 | 14.6 | 4.6 | -[a] |
| 18 | -[b] | 17.7 | 9.2 | 10.0 |
| 19 | - | 9.2 | 9.2 | 7.7 |
| 20 | - | 3.1 | 3.8 | 0 |
| Mean: | 12.3 | 11.2 | 6.7 | 8.8 |

[a]This transect was moved in August of 1967 because a total exclosure was built there.

[b]Transects 18, 19, and 20 were not installed until May, 1966.

Table 8. Deer counts made at various times of the year via vehicle on the Harpers Corner area, 1963-1967. Dinosaur National Monument.

Winter Counts:

| Date | Observer | Deer Seen |
|---|---|---|
| 1/12/66 | Robert Franzen | 14 |
| 1/22/66 | Robert Franzen | 6 |
| | | $\bar{X}$ = 10 |

Spring, Summer, and Fall Counts:

| Date | Observer | Deer Seen |
|---|---|---|
| 10/21/63 | Paul Ellis | 0 |
| 7/5/64 | Leonard Casterline | 17 |
| 6/27/65 | Leonard Casterline | 8 |
| 11/26/65 | Robert Franzen | 11 |
| 4/14/66 | Robert Franzen | 8 |
| 4/18/66 | Robert Franzen | 7 |
| 4/21/66 | Robert Franzen | 11 |
| 4/29/66 | Robert Franzen | 13 |
| 6/27/66 | Leonard Casterline | 7 |
| 8/7/66 | Leonard Casterline | 13 |
| 11/27/66 | Robert Franzen | 7 |
| 4/12/67 | Robert Franzen | 10 |
| 4/15/67 | Larry Hanneman | 10 |
| 6/9/67 | Larry Hanneman | 9 |
| 7/10/67 | Dennis Murano | 19 |
| | | $\bar{X}$ = 11 |

Deep winter snows prevented travel upon Harpers Corner until the first week of April in 1966. One white-streamered deer was seen on Harpers Corner on April 9. This was the first tagged deer seen on Harpers Corner since the January trapping operation. A total of 20 sightings of 49 white-streamered deer were seen on Harpers Corner between April 9 and November 27, 1966. Except for one doe seen five miles southeast of Harpers Corner on September 11 and another doe seen near the junction of the Yampa Bench and Harpers Corner roads on October 26, all were on the Harpers Corner area. The first doe was the furthest any Harpers Corner deer was seen from the trapping area. The last white-streamered deer seen in 1966 was observed on Harpers Corner on November 27 (Appendix Table 5). Shortly thereafter, heavy snows prohibited vehicular travel on this area.

White streamered deer were seen on April 9 and 11, 1967, near the Rial Chew Ranch on the Yampa Bench, approximately four air miles from the nearest tagging location. These two sightings gave evidence that deep snows moved deer off the Harpers Corner area to the lower elevation Yampa Bench area. The best access route to the Bench from Harpers Corner is Trail Draw. Both sightings were within one mile of where Trail Draw enters the Yampa Bench. Also, in late fall and early spring small groups of deer were seen from the Harpers Corner road in the vicinity of Trail Draw. Deer tracks were numerous in this area with a trend in the direction of the Bench.

Yampa Bench is the closest and most accessible lower elevation area for Harpers Corner deer. The only other nearby winter range would be the Island Park area on the southwest side of Harpers Corner. However, no

white-streamered deer were trapped or observed in Island Park during the 1967 trapping operation.

During the spring of 1967, the first deer were seen on March 24. This was during the same week that the Harpers Corner road was opened for vehicular travel. A total of 12 sightings of 15 white-streamered deer were recorded between March 24 and November 15, 1967 (Appendix Table 5). All were seen on the Harpers Corner area and the furthest sighting was only one-half mile from the 1966 trapping sites. In the fall of 1967 the last tagged deer seen was on November 15, shortly before the Harpers Corner road became impassible because of deep snows.

To summarize, the Harpers Corner deer herd is a resident herd within the Monument. In the winter the herd remains on Harpers Corner until the last week of January or first week of February. Heavy snows then force them to lower elevations such as the lower portion of Trail Draw and the west end of the Yampa Bench. In the very early spring, these deer then move back to the Harpers Corner flats, drainage ways, and breaks where they remain until the following February. Because Harpers Corner deer are year-round residents of the Monument, it is possible that this area and its deer herd could become a problem.

Split Mountain herd

The Split Mountain winter range consists of approximately 5.8 square miles of Monument property. It also includes some private property such as the Doug Chew ranch lands along the Green River. This small area supports approximately 70 deer during the winter months.

Pellet group transects. Deer days use per acre figures on three pellet group transects for the winter periods on the Split Mountain area

were somewhat higher than for the summer periods. A small group of deer apparently used transect No. 12 frequently during the summer of 1967, and this caused the deer days use figures for the area to be unusually high for the summer period (Table 9).

Observations. Deer counts made via vehicle in the Split Mountain area during the winter months varied from 14 to 16 deer in 1966 and from 19 to 28 deer during the winter of 1967 (Table 10). Summer counts varied from 0 to 8 deer.

Movements. Several of the Monument rangers tagged a total of 25 deer with red vinyl streamers on the Split Mountain area during the winter of 1965. Since then, a total of 13 sightings of 22 red-streamered deer have been recorded (Appendix Table 6). Most sightings were in the Split Mountain area during the late fall and winter months when deer were returning or had returned to the winter range. Deer seen during the summer months were almost invariably does with fawns. This suggests that the Split Mountain area is used as a fawning grounds.

The furthest that a Split Mountain deer was recorded from the tagging location was 15.0 air miles. This was an adult buck that was killed on Asphalt Ridge during the 1965 deer hunting season. Another adult buck was found dead in Jensen, Utah, a distance of 6.2 air miles from the tagging site.

To summarize, the Split Mountain area is small and was used primarily as winter range. The few deer which inhabited the area during the summer were mostly does using the area as a fawning grounds.

Table 9. Deer days' use per acre on Split Mountain pellet group transects during 1966 and 1967. Dinosaur National Monument.

| Transect No. | 1966 | | 1967 | |
|---|---|---|---|---|
| | May 1 | Nov. 1 | May 1 | Nov. 1 |
| | Deer Days Use Per Acre | | | |
| 12 | 20.0 | 5.4 | 16.2 | 14.6 |
| 13 | 8.5 | 0.8 | 12.3 | 2.3 |
| 14 | 3.1 | 0 | 10.8 | 1.5 |
| Mean: | 10.5 | 2.1 | 13.1 | 6.1 |

Table 10. Deer counts made at various times of the year via vehicle on the Split Mountain area, 1965-1967. Dinosaur National Monument.

| Date | Observer | Deer Seen |
|---|---|---|
| 12/17/65 | James Todd | 16 |
| 12/20/65 | Robert Franzen | 14 |
| 2/20/66 | Wayne Welch | 15 |
| 1/11/67 | Wayne Welch | 21 |
| 1/17/67 | Wayne Welch | 28 |
| 4/3/67 | C. G. McKnight | 19 |
| | $\bar{X}$ = | 19 |

## DEER DENSITIES ON WINTER RANGES

Estimates of deer populations on winter ranges are based largely on a "Lincoln Index" (Lincoln, 1930) or ratio of tagged to untagged deer at the end of the tagging operation. An estimated total of 1,265 deer used 73.1 square miles in the Monument during the winter of 1967 (Table 11). Areas encompassed by the winter ranges were estimated by using a planimeter on a contour map of the area. The area measured was that delineated by the elevation above which deer activity was either slight or nonexistent.

The Yampa Bench was divided into two parts to facilitate vegetative analysis. The west end of the Yampa Bench is the Chew grazing allotment and receives much more use by livestock and deer than does the remainder of the Bench, which is the Mantle allotment.

Estimates of deer numbers on the smaller winter ranges such as Split Mountain, Deerlodge, and Lodore are based largely on actual counts. Such estimates take into consideration that many deer are not being counted.

The number of deer using particular summer ranges was not determined. Deer using a summer range often come from various winter range areas. Therefore, a summer range does not carry deer from only one winter range.

Table 11. Estimates of deer populations on winter ranges within Dinosaur National Monument, 1966 and 1967.

| Wintering area | Total Winter Range Area (square miles) | Estimated Winter[a] Population | Deer Per Square Mile |
|---|---|---|---|
| Major wintering areas: | | | |
| 1966 | | | |
| Yampa Bench (Chew allotment) | 11.5 | 475 | 41.3 |
| Yampa Bench (Mantle allotment) | 35.0 | 200 | 5.7 |
| 1967 | | | |
| Yampa Bench (Chew allotment) | 11.5 | 525 | 45.7 |
| Yampa Bench (Mantle allotment) | 35.0 | 200 | 5.7 |
| Island Park | 9.0 | 330 | 36.7 |
| Secondary wintering areas: | | | |
| Split Mountain | 5.8 | 70 | 12.0 |
| Deerlodge | 3.0 | 40 | 13.0 |
| Lodore | 2.0 | 70 | 35.0 |
| Harpers Corner[b] | 7.8 | 50 | 6.4 |
| Overall totals | 73.1 | 1,265 | 17.3 |

[a]These estimates are based on a "Lincoln Index" of tagged to untagged deer at the close of the tagging period.

[b]Harpers Corner is used as a 10+ month-long range. When winter snows become too deep for movement and forage these deer then migrate down onto the Yampa Bench.

## WINTER RANGE CARRYING CAPACITY

Vegetation composition and density data was taken on four of the Monument's winter ranges. These data were used to derive carrying capacity for the deer and livestock using the ranges. The data for each winter range are analyzed separately and tabulated in table form. Cook's (1954) method of deriving carrying capacity from common use was used in these computations. Proper use factors used are for the winter period unless otherwise specified. The forage acre requirement figure and proper use factor figures were provided by the Bureau of Land Management office in Vernal, Utah and were derived from an area of comparable vegetation, rainfall, and elevation close to the Monument. All plant species symbols used in the vegetation composition and density tables are explained in Appendix Table 7.

### Yampa Bench

The Yampa Bench supports cattle, sheep, deer and several horses during the winter months. The Bench is divided into two grazing allotments, the Chew allotment on the west end is where sheep are wintered, and the Mantle allotment on the eastern portion where cattle are wintered. A livestock fence from the Billiard Table to Warm Springs Overlook separates the two allotments.

Chew allotment. The Chew grazing allotment is used by Dean and Douglas Chew to winter approximately 950 sheep. Rial Chew also winters approximately 45 cows and 10 horses on this area. This portion of the

Bench is also the most heavily used by deer. Approximately 500 deer also winter in this 11.5-square-mile area each winter.

The range on the Yampa Bench is composed largely of large, flat areas of big sage, shadscale, cheat grass and needle and thread grass. Rock breaks, canyon rims and drainage-ways have numerous juniper and occasionally a few mountain mahogany plants.

The vegetative composition and density analysis of the area gave a total carrying capacity of 1,517 AUMs (1 AUM = forage required to sustain 1 steer or bull for 1 month; or 5 deer or sheep for 1 month). Cattle and deer use of the range is presently well within the forage available to them (Table 12). Sheep use on the area would require 760 AUMs of forage, however, only 526 AUMs of forage are available to them. The total forage acre factors for sheep and deer indicates that they are using the available vegetation to a similar degree. This suggests competition between these two classes of animals. Although there are 174 AUMs extra for deer, these AUMs should not be allocated for sheep use. The extra deer AUMs should be kept in reserve for deer use in the event of a severe winter and greater numbers of deer using the Bench. Thus, to properly stock this portion of the Yampa Bench, the number of sheep should be reduced from 950 to 657 sheep for the four month winter period.

The question now arises as to which class or classes of animals the Monument should maintain -- deer and/or, livestock and in what proportion. This problem is one which involves Park Service policy and commitment.

Actual measurements made on mountain mahogany plants on the Yampa Bench found a utilization of 71 percent during the winter of 1967 (Appendix Table 8). This is high utilization, and it is doubtful that

Table 12. Carrying capacity for cattle, sheep and deer on the west end of the Yampa Bench, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors: Cattle | Sheep | Deer | Forage Acre Factors: Cattle | Sheep | Deer | Highest FAF |
|---|---|---|---|---|---|---|---|---|
| Browse: | | | | | | | | |
| Artrt | 0.0714 | 0.15 | 0.30 | 0.50 | 0.0107 | 0.0214 | 0.0357 | 0.0357 |
| Atco | 0.0282 | 0.20 | 0.40 | 0.30 | 0.0056 | 0.0113 | 0.0085 | 0.0113 |
| Forbs: | | | | | | | | |
| Aster | 0.0002 | 0.10 | 0.30 | 0.10 | 0 | 0.0001 | 0 | 0.0001 |
| Canun | 0.0002 | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 |
| Eriog | T[b] | 0.10 | 0.10 | 0.10 | 0 | 0 | 0 | 0 |
| Phho | 0.0007 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Grasses: | | | | | | | | |
| Agsp | 0.0002 | 0.50 | 0.40 | 0.20 | 0.0001 | 0.0001 | 0 | 0.0001 |
| Brtet | 0.0187 | 0.10 | 0.10 | 0.10 | 0.0019 | 0.0019 | 0.0019 | 0.0019 |
| Festu | T | 0.10 | 0.10 | 0.20 | 0 | 0 | 0 | 0 |
| Orhyh | 0.0120 | 0.50 | 0.50 | 0.20 | 0.0060 | 0.0060 | 0.0024 | 0.0060 |
| Poa | 0.0007 | 0.50 | 0.30 | 0.20 | 0.0004 | 0.0002 | 0.0001 | 0.0004 |
| Sihy | 0.0007 | 0.50 | 0.40 | 0.10 | 0.0004 | 0.0003 | 0.0001 | 0.0004 |
| Stco3 | 0.0292 | 0.50 | 0.30 | 0.20 | 0.0146 | 0.0088 | 0.0058 | 0.0146 |
| Cactus: | | | | | | | | |
| Oppo | 0.0007 | 0 | 0 | 0 | 0 | | 0 | 0 |
| Total forage acre factors: | | | | | 0.0397 (cattle) | 0.0501 (sheep) | 0.0545 (deer) | 0.0705 (common use) |

[a]Taken from 20, 100-square foot plots

[b]T indicates a trace, less than 0.25 square foot

Table 12. Continued

Calculations:

Common use forage acre factor X surface acres = total forage acres
0.0705 X 7,360 = 518.88 forage acres

Forage acres ÷ forage acre requirement = total AUMs available
$\frac{518.88}{0.342}$ = 1,517.2 AUMs available

Suitability ratio expresses as a percent:

| | | |
|---|---|---|
| 0.0397 | cattle | 27.5 % |
| 0.0501 | sheep | 34.7 % |
| 0.0545 | deer | 37.8 % |
| 0.1443 | | |

AUMs available for each animal class:

1,517.2 AUMs X 27.5 % = 417 AUMs available for cattle
1,517.2 AUMs X 34.7 % = 526 AUMs available for sheep
1,517.2 AUMs X 37.8 % = 574 AUMs available for deer

AUMs needed to support each animal class:

45 cows = 45 AUMs needed per month
45 AUMs per month for 4 months = 180 AUMs required for cattle

$\frac{950 \text{ sheep}}{5}$ = 190 AUMs needed per month
190 AUMs per month for 4 months = 760 AUMs required for sheep

$\frac{500 \text{ deer}}{5}$ = 100 AUMs needed per month
100 AUMs per month for 4 months = 400 AUMs required for deer
Total: 1340 AUMs required for all classes

Summary:

| AUMs available: | AUMs required: | AUMs difference: |
|---|---|---|
| cattle: 417 | 180 | 237 extra for cattle |
| sheep: 526 | 760 | 234 additional required |
| deer: 574 | 400 | 174 extra for deer |

The 526 AUMs available for sheep will support only 657 sheep for four months, therefore, the area is being overstocked by approximately 293 sheep.

the plants will be able to tolerate such use for many winters. Use on big sage was found to be 41 percent on the Chew allotment during the winter of 1967. This percentage was derived by the "Cole" estimation method of assessing utilization (Appendix Table 9). Most juniper on the Chew allotment has been high-lined by deer and livestock (Figure 4).

Mantle allotment. The eastern portion of the Yampa Bench is the grazing allotment of Charles Mantle and Sons. This 35-square-mile area annually winters approximately 200 deer, 200 cattle, and 10 horses.

The vegetation composition and density analysis of this area found that it produced 3,733 AUMs of forage in 1967 (Table 13). Of these 3,733 AUMs available, 2,038 are available for deer, and 1,695 are available for cattle. Of those AUMs available for each kind of animal 160 AUMs are required for deer and 900 AUMs are required for cattle. Therefore, the present stocking rate is well within the carrying capacity limits. However, an area 3.75 miles long between the Castle Park road intersection and the Chew-Mantle allotment fence receives the majority of the cattle and deer use. If cattle winter use could be distributed over the entire allotment, there would not be the heavy use on this area that there is at present. Mr. Mantle feeds his cattle some supplemental feed during the winter in this area and this feeding results in the grouping of the cattle and consequent heavy use in the vicinity. The utilization on big sage in this area ranged from 13 to 56 percent, whereas the remainder of the allotment received a range of only 0 to 10 percent (Appendix Table 9).

Mountain Mahogany from the eastern portion of the Mantle allotment shows evidence of heavy past hedging but recent good growth (Figure 5).

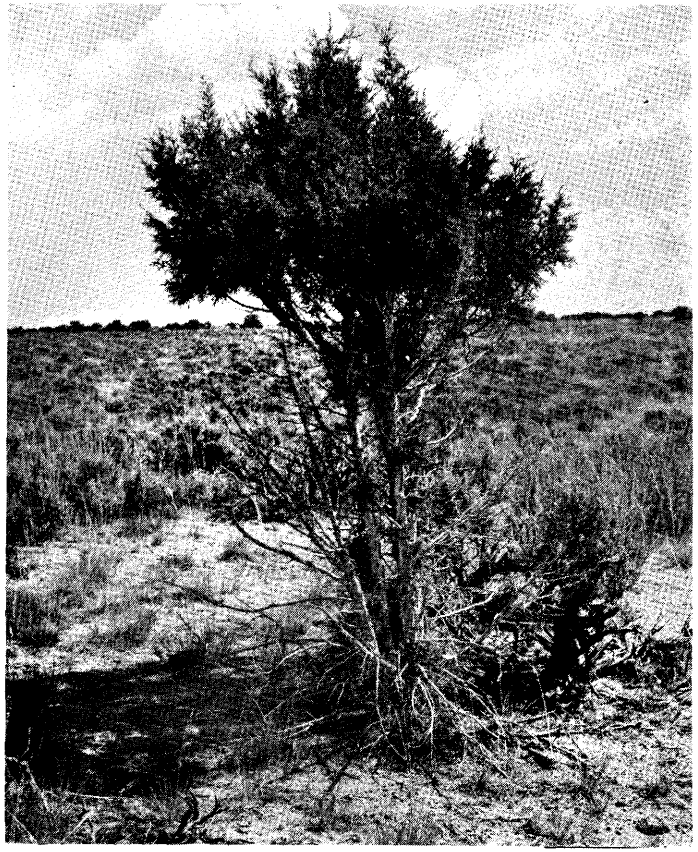

Figure 4. Typical juniper high-lined by deer and sheep on the west end of the Yampa Bench (Warm Springs Overlook, Sept. 9, 1967).

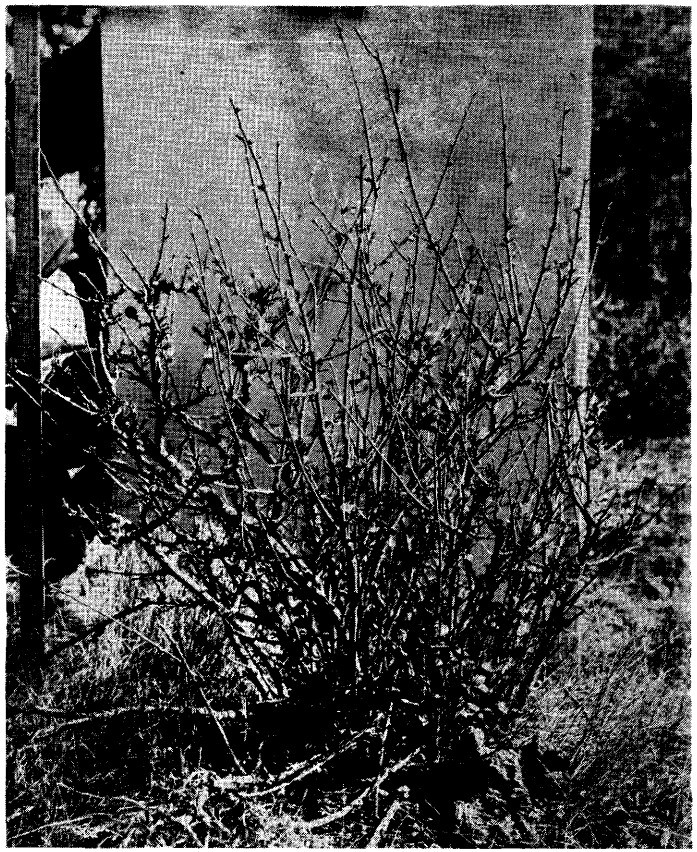

Figure 5. Mountain mahogany from the east end of the Yampa Bench demonstrating heavy past hedging but recent good leader growth (Thanksgiving Gorge area, Oct. 25, 1966).

Table 13. Carrying capacity for cattle and deer on the east end of the Yampa Bench, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors: Cattle | Proper Use Factors: Deer | Forage Acre Factors: Cattle | Forage Acre Factors: Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Browse: | | | | | | |
| Artrt | 0.0496 | 0.15 | 0.50 | 0.0074 | 0.0248 | 0.0248 |
| Atco | 0.0028 | 0.20 | 0.30 | 0.0006 | 0.0008 | 0.0008 |
| Cemom | 0.0158 | 0.60 | 0.50 | 0.0095 | 0.0079 | 0.0095 |
| Chna | 0.0005 | 0.20 | 0.30 | 0.0001 | 0.0002 | 0.0002 |
| Chvi | 0.0049 | 0.20 | 0.50 | 0.0010 | 0.0025 | 0.0025 |
| Eula | 0.0005 | 0.60 | 0.40 | 0.0003 | 0.0002 | 0.0003 |
| Gusa | 0.0013 | 0 | 0.10 | 0 | 0.0001 | 0.0001 |
| Junip | 0.0018 | 0 | 0.05 | 0 | 0.0001 | 0.0001 |
| Sylo | 0.0006 | 0 | 0.25 | 0 | 0.0002 | 0.0002 |
| Forbs: | | | | | | |
| Asdu | 0.0003 | 0.10 | 0.10 | 0 | 0 | 0 |
| Asen2* | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Aster | 0.0014 | 0.10 | 0.10 | 0.0001 | 0.0001 | 0.0001 |
| Astra | 0.0002 | 0.10 | 0.10 | 0 | 0 | 0 |
| Basa | 0.0020 | 0.10 | 0.10 | 0.0002 | 0.0002 | 0.0002 |
| Canun | 0.0002 | 0 | 0.10 | 0 | 0 | 0 |
| Copa2 | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Eriog | 0.0022 | 0.10 | 0.10 | 0.0002 | 0.0002 | 0.0002 |
| Ermi | 0.0004 | 0.10 | 0.10 | 0 | 0 | 0 |
| Erut | 0.0008 | 0 | 0.10 | 0 | 0.0001 | 0.0001 |
| Lepu2 | 0.0038 | 0 | 0 | 0 | 0 | 0 |
| Lile2 | 0.0002 | 0 | 0.10 | 0 | 0 | 0 |
| Lupin | 0.0001 | 0.20 | 0.10 | 0 | 0 | 0 |
| Oeca | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Pemo | 0.0002 | 0 | 0.10 | 0 | 0 | 0 |
| Penst | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Phdi | 0.0011 | 0 | 0 | 0 | 0 | 0 |
| Phho | 0.0044 | 0 | 0 | 0 | 0 | 0 |
| Sakat | 0.0013 | 0.30 | 0.10 | 0.0004 | 0.0001 | 0.0004 |
| Senec | 0.0009 | 0 | 0.10 | 0 | 0.0001 | 0.0001 |
| Spco | 0.0004 | 0.20 | 0.10 | 0.0001 | 0 | 0.0001 |
| Stlo3 | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Taof | T[b] | 0.10 | 0.10 | 0 | 0 | 0 |
| Trlo | T | 0.10 | 0.10 | 0 | 0 | 0 |
| Grasses: | | | | | | |
| Agrop | 0.0011 | 0.50 | 0.20 | 0.0006 | 0.0002 | 0.0006 |
| Agsp | 0.0031 | 0.50 | 0.20 | 0.0015 | 0.0006 | 0.0015 |
| Brtet | 0.0064 | 0.10 | 0.10 | 0.0006 | 0.0006 | 0.0006 |
| Feoc | T | 0.10 | 0.20 | 0 | 0 | 0 |
| Hojuj | 0.0003 | 0.30 | 0.10 | 0.0001 | 0 | 0.0001 |
| Orhyh | 0.0016 | 0.50 | 0.20 | 0.0008 | 0.0003 | 0.0008 |
| Poa | 0.0084 | 0.50 | 0.20 | 0.0042 | 0.0017 | 0.0042 |
| Sihy | 0.0003 | 0.50 | 0.10 | 0.0002 | 0 | 0.0002 |
| Stco3 | 0.0186 | 0.50 | 0.20 | 0.0093 | 0.0037 | 0.0093 |

Table 13. Continued

| Species | Average Density | Proper Use Factors: Cattle | Proper Use Factors: Deer | Forage Acre Factors: Cattle | Forage Acre Factors: Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Cactus: | | | | | | |
| Oppo | 0.0025 | 0 | 0 | | 0 | 0 |
| | Total forage acre factors: | | | 0.0372 (cattle) | 0.0447 (deer) | 0.0570 (common use) |

[a]Taken from 40, 100-square foot plots

[b]T indicates a trace, less than 0.25 square foot

Calculations:

Common use forage acre factors X surface acres = total forage acres
0.0570 X 22,400 = 1,276.80 forage acres

Forage acres forage acre requirement = total AUMs available
1,276.80 = 3,733 AUMs available
0.342

Suitability ratio expressed as a percent:
0.0372 cattle 45.4 %
0.0047 deer 54.6 %
0.0819

AUMs available for each animal class:
3,733 AUMs X 45.4 % = 1,695 AUMs available for cattle
3,733 AUMs X 54.6 % = 2,038 AUMs available for deer

AUMs needed to support each animal class:
200 deer / 5 = 40 AUMs needed per month
40 AUMs per month for 4 months = 160 AUMs needed for deer
900 AUMs needed for cattle
1,060 AUMs needed for both classes

Summary:

| AUMs available: | AUMs required: | AUMs difference: |
|---|---|---|
| Deer: 2,038 | 160 | 1,878 extra for deer |
| Cattle: 1,695 | 900 | 795 extra for cattle |

*Symbols for genera are the capitalized first five letters of the genus name, except for generic names that are duplicated. If the first five letters of two or more generic names are identical and would thus give duplicate symbols, a numeral replaces the last letter of any duplicate symbol according to alphabetic order of the whole name. For example, the general Anemone and Anemopsis have initial Anemo- in common. Since Anemone precedes, it is coded ANEMO, and Anemopsis is coded ANEM2.

Island Park

The Island Park and adjoining Rainbow Park area support both cattle and deer during the winter. Approximately 20 cattle which use 27 AUMs graze the area prior to January 31 of each year, and approximately 300 deer winter in this vicinity.

The vegetative composition and density analysis of this nine-square mile area gave a carrying capacity of 1,133 AUMs of forage available for use in 1967 (Table 14). The 300 deer that winter in Island Park require 240 AUMs for forage and have 677 AUMs available to them. The 20 cattle require 27 AUMs and have 457 AUMs available to them. Thus, the present stocking of the Island Park wintering area is well within proper use limits.

Measurements on big sage determined utilization during the winter of 1966 to range from 7 to 11 percent. During the winter of 1967 such measurements determined utilization on sage to range from 30 to 34 percent (Appendix Table 8). The "Cole" estimation method was also used on sage to determine utilization in Island Park during the winter of 1967. This method was used at the three pellet group transects and derived the use at these locations to be 17 percent (Appendix Table 9). The utilization on sage during these two winters in Island Park was therefore within proper use limits.

Harpers Corner

The 7.8 square-mile Harpers Corner area supports deer for more than 10 months of the year, as well as cattle during the summer months. Approximately 50 deer use this area. In addition, Glenn Murray summers 50 head of cattle for a total of 195 AUMs of cattle use.

Table 14. Carrying capacity for cattle and deer on the Island Park winter range, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors: Cattle | Deer | Forage Acre Factors: Cattle | Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Browse: | | | | | | |
| Artrt | 0.0843 | 0.15 | 0.50 | 0.0126 | 0.0421 | 0.0421 |
| Atco | 0.0023 | 0.20 | 0.30 | 0.0005 | 0.0007 | 0.0007 |
| Junip | 0.0003 | 0 | 0.05 | 0 | 0 | 0 |
| Savev | 0.0013 | 0.10 | 0.50 | 0.0001 | 0.0006 | 0.0006 |
| Gusa | 0.0051 | 0 | 0.10 | 0 | 0.0005 | 0.0005 |
| Forbs: | | | | | | |
| Aster | 0.0002 | 0.10 | 0.10 | 0 | 0 | 0 |
| Asdu | 0.0002 | 0.10 | 0.10 | 0 | 0 | 0 |
| Cabu2 | 0.0002 | 0 | 0.10 | 0 | 0 | 0 |
| Canun | 0.0005 | 0 | 0 | 0 | 0 | 0 |
| Eriog | T [b] | 0.10 | 0.10 | 0 | 0 | 0 |
| Grasses: | | | | | | |
| Agsp | 0.0208 | 0.50 | 0.20 | 0.0104 | 0.0042 | 0.0104 |
| Brtet | 0.0221 | 0.10 | 0.10 | 0.0022 | 0.0022 | 0.0022 |
| Orhyh | 0.0038 | 0.50 | 0.20 | 0.0019 | 0.0008 | 0.0019 |
| Sihy | 0.0033 | 0.50 | 0.10 | 0.0016 | 0.0003 | 0.0016 |
| Stco3 | 0.0146 | 0.50 | 0.20 | 0.0073 | 0.0029 | 0.0073 |
| Cactus: | | | | | | |
| Oppo | 0.0013 | 0 | 0 | 0 | 0 | 0 |
| | Total forage acre factors: | | | 0.0366 (cattle) | 0.0543 (deer) | 0.0673 (common use) |

[a]Taken from 20, 100-square foot plots

[b]T indicates a trace, less than 0.25 square foot

Table 14. Continued

Calculations:

Common use forage acre factor X surface acres = total forage acres
0.0673 X 5,760 = 387.65 forage acres

Forage acres ÷ forage acre requirement = total AUMs available
$\frac{387.65}{0.342}$ = 1,133.5 AUMs available

Suitability ratio expressed as a percent:

| | | |
|---|---|---|
| 0.0366 | cattle | 40.3 % |
| 0.0543 | deer | 59.7 % |
| 0.0909 | | |

AUMs available for each animal class:

1,133.5 AUMs X 40.3 % = 457 AUMs available for cattle
1,133.5 AUMs X 59.7 % = 677 AUMs available for deer

AUMs needed to support each animal class:

$\frac{300 \text{ deer}}{5}$ = 60 AUMs needed per month

60 AUMs per month for 4 months = 240 AUMs needed for deer
27 AUMs needed for cattle
Total: 267 AUMs needed for both classes

Summary:

| | AUMs available: | AUMs required: | AUMs extra: |
|---|---|---|---|
| deer: | 677 | 240 | 437 for deer |
| cattle: | 457 | 27 | 430 for cattle |

The vegetative composition and density analysis of this area gave a carrying capacity of 762 AUMs of forage available in 1967 (Table 15). The 50 deer require 110 AUMs and have 567 AUMs available to them. The 50 cattle require 195 AUMs and have 195 AUMs available to them. Thus, the area will sustain considerably more use by deer, but will not sustain any additional use by cattle. The present use of Harpers Corner is barely within the proper use limit.

Cattle use on Harpers Corner runs from May 1 to October 31 of each year. The late summer cattle use results in less and less use on the grasses and increased use on browse species. Bitterbrush is not very plentiful on Harpers Corner and is likely sought by both cattle and deer as a special item for the diet. This combined use on a scarce plant results in heavy utilization. Nearly all bitterbrush plants have been badly hedged and have a low, prostrate growth form (Figure 6). To assess whether or not the bitterbrush plants could recover from heavy utilization several plants were caged to prevent use for one year. These plants recovered well with good leader growth and erect form (Figure 7). Mountain Mahogany receives similarly heavy use from cattle and deer in the fall which also results in a poor growth form (Figure 8). When these plants were caged and protected for one year, they also put on good leader growth showing that they do have the potential to recover if use on them is reduced (Figure 9). Perhaps if cattle use were removed in late August, this heavy use on bitterbrush and mountain mahogany would be alleviated.

Utilization of big sage on Harpers Corner was determined by measurement to range from 1 to 10 percent during the winter period of 1967

Table 15. Carrying capacity for cattle and deer on the Harpers Corner range, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors:[b] Cattle | Deer | Forage Acre Factor: Cattle | Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Browse: | | | | | | |
| Arno | 0.0173 | 0.10 | 0.50 | 0.0017 | 0.0087 | 0.0087 |
| Artrt | 0.0579 | 0.05 | 0.50 | 0.0029 | 0.0290 | 0.0290 |
| Chvi | 0.0053 | 0.10 | 0.50 | 0.0005 | 0.0026 | 0.0026 |
| Eula | 0.0001 | 0.40 | 0.40 | 0 | 0 | 0 |
| Junip | 0.0016 | 0 | 0.05 | 0 | 0.0001 | 0.0001 |
| Pied | 0.0004 | 0 | 0.05 | 0 | 0 | 0 |
| Putr | 0.0010 | 0.50 | 0.50 | 0.0005 | 0.0005 | 0.0005 |
| Forbs: | | | | | | |
| Asdu | 0.0010 | 0.10 | 0.10 | 0.0001 | 0.0001 | 0.0001 |
| Asen2 | 0.0010 | 0.30 | 0.10 | 0.0003 | 0.0001 | 0.0003 |
| Aster | 0.0010 | 0.30 | 0.10 | 0.0003 | 0.0001 | 0.0003 |
| Basa | 0.0101 | 0.20 | 0.10 | 0.0020 | 0.0010 | 0.0020 |
| Cach3 | 0.0001 | 0.10 | 0.10 | 0 | 0 | 0 |
| Copa2 | T[c] | 0 | 0.10 | 0 | 0 | 0 |
| Erca | T | 0 | 0.10 | 0 | 0 | 0 |
| Eriog | 0.0074 | 0.10 | 0.10 | 0.0007 | 0.0007 | 0.0007 |
| Ermi | 0.0001 | 0.10 | 0.10 | 0 | 0 | 0 |
| Gilia | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Lepu2 | 0.0004 | 0 | 0 | 0 | 0 | 0 |
| Lupin | 0.0045 | 0.20 | 0.10 | 0.0009 | 0.0005 | 0.0009 |
| Pemo | 0.0009 | 0 | 0.10 | 0 | 0.0001 | 0.0001 |
| Pery | 0.0001 | 0 | 0.10 | 0 | 0 | 0 |
| Phho | 0.0136 | 0 | 0 | 0 | 0 | 0 |
| Pofr3 | 0.0008 | 0.20 | 0.10 | 0.0002 | 0.0001 | 0.0002 |
| Senec | 0.0060 | 0 | 0.10 | 0 | 0.0006 | 0.0006 |
| Trlo | T | 0.80 | 0.10 | 0 | 0 | 0 |
| Grasses: | | | | | | |
| Agda | T | 0.50 | 0.20 | 0 | 0 | 0 |
| Aggr2 | T | 0.50 | 0.20 | 0 | 0 | 0 |
| Agrop | 0.0013 | 0.50 | 0.20 | 0.0007 | 0.0003 | 0.0007 |
| Agsp | 0.0004 | 0.50 | 0.20 | 0.0002 | 0.0001 | 0.0002 |
| Brtet | 0.0033 | 0.10 | 0.10 | 0.0003 | 0.0003 | 0.0003 |
| Feov | 0.0049 | 0.50 | 0.20 | 0.0025 | 0.0010 | 0.0025 |
| Festu | 0.0003 | 0.50 | 0.20 | 0.0002 | 0.0001 | 0.0002 |
| Orhyh | 0.0001 | 0.60 | 0.20 | 0.0001 | 0 | 0.0001 |
| Poa | 0.0005 | 0.50 | 0.20 | 0.0003 | 0.0001 | 0.0003 |
| Pocu2 | 0.0001 | 0.50 | 0.20 | 0.0001 | 0 | 0.0001 |
| Sihy | 0.0001 | 0.30 | 0.10 | 0 | 0 | 0 |
| Stco3 | 0.0043 | 0.40 | 0.20 | 0.0017 | 0.0009 | 0.0017 |

Table 15. Continued

| Species | Average[a] Density | Proper Use Factors: Cattle | Deer | Forage Acre Factors: Cattle | Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Cactus: | | | | | | |
| Oppo | T | 0 | 0 | 0 | 0 | 0 |
| | Total forage acre factor: | | | 0.0162 (cattle) | 0.0470 (deer) | 0.0522 (common use) |

[a]Taken from 20, 100-square foot plots
[b]Cattle PUF is for summer season; deer PUF is average for spring, summer,
[c]and fall
[c]T indicates a trace, less than 0.25 square foot

Calculations:

Common use forage acre factor X surface acres = total forage acres
0.0522 X 4,992 = 260.58 forage acres

Forage acres ÷ forage acre requirement = total AUMs available
260.58 / 0.342 = 762 AUMs available

Suitability ratio expressed as a percent:

0.0162 cattle 25.6 %
0.0470 deer 74.4 %
0.0632

AUMs available for each animal class:
762 AUMs X 25.6 % = 195 AUMs available for cattle
762 AUMs X 74.4 % = 567 AUMs available for deer

AUMs needed to support each animal class:

50 deer / 5 = 10 AUMS needed per month

10 AUMs per month for 11 months = 110 AUMs needed for deer
195 AUMs needed for cattle
305 AUMs needed for both classes

Summary:

| AUMs available: | | AUMs required: | AUMs difference: |
|---|---|---|---|
| deer: | 567 | 110 | 457 extra for deer |
| cattle: | 195 | 195 | 0 |

Figure 6 . Severely hedged bitterbrush on Harpers Corner. These plants were within 100 feet of the protected plants shown below (Oct. 26, 1966).

Figure 7 . Bitterbrush after one year of protection on Harpers Corner (Oct. 26, 1966).

Figure 8 . Severely hedged mountain mahogany on Harpers Corner. This plant was within 100 feet of the protected plant shown to the right (Oct. 20, 1966).

Figure 9 . Mountain mahogany after one year of protection on Harpers Corner (Oct. 20, 1966).

(Appendix Table 8). The "Cole" estimation method found over-winter utilization on sage to range from 0 to 2 percent on the pellet group transects of Harpers Corner (Appendix Table 9). This use is light and has little effect upon the big sage. Other plant species on Harpers Corner are in good condition.

Split Mountain

The 5.8-square-mile Split Mountain area supports approximately 70 deer during the winter and 142 cattle during the period from mid-spring to early fall. The cattle are owned by William Karren, Sadie MacKnight, and Sara Slaugh, and they take approximately 419 AUMs annually.

The vegetation composition and density analysis of this area gave a carrying capacity of 427 AUMs available in 1967 (Table 16). The 70 deer require 56 AUMs and have 336 AUMs available to them. The cattle require 419 AUMs and have only 91 AUMs available to them. Thus the cattle require an additional 328 AUMs which is not available to them. This heavy use has resulted in an increase of browse plants on this range with a consequent decrease of grasses. Cattle use of the area presently begins on April 16 of each year. If this date were delayed until about June 1 the grasses would be able to put on additional growth and thus provide more forage available for use.

If the 328 AUMs that should be reduced on the Split Mountain range could be transferred to the Island Park area the Split Mountain range should then improve. There are 430 extra cattle AUMs available in the Island Park area.

Over-winter use on sage by deer alone was determined by the measurement method to be 20 percent in 1966 and 43 percent in 1967. Mountain

Table 16. Carrying capacity for cattle and deer on the Split Mountain range, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors: Cattle[b] | Deer | Forage Acre Factors: Cattle | Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Browse: | | | | | | |
| Artrt | 0.0627 | 0.10 | 0.50 | 0.0063 | 0.0313 | 0.0313 |
| Atco | 0.0093 | 0.20 | 0.30 | 0.0019 | 0.0028 | 0.0028 |
| Chvi | 0.0020 | 0.10 | 0.50 | 0.0002 | 0.0010 | 0.0010 |
| Gusa | 0.0193 | 0 | 0.10 | 0 | 0.0019 | 0.0019 |
| Tenu | 0.0003 | 0 | 0.20 | 0 | 0.0001 | 0.0001 |
| Tesp | 0.0013 | 0 | 0.20 | 0 | 0.0003 | 0.0003 |
| Forbs: | | | | | | |
| Asca | 0.0012 | 0.30 | 0.10 | 0.0004 | 0.0001 | 0.0004 |
| Astra | 0.0007 | 0.20 | 0.10 | 0.0001 | 0.0001 | 0.0001 |
| Crke | T[c] | 0 | 0.10 | 0 | 0 | 0 |
| Crpa2 | T | 0 | 0.10 | 0 | 0 | 0 |
| Dene | 0.0005 | 0.40 | 0.10 | 0.0002 | 0.0001 | 0.0002 |
| Geran | 0.0003 | 0.30 | 0.10 | 0.0001 | 0 | 0.0001 |
| Gico | 0.0002 | 0 | 0.10 | 0 | 0 | 0 |
| Oeca | T | 0 | 0.10 | 0 | 0 | 0 |
| Grasses: | | | | | | |
| Agsp | 0.0005 | 0.60 | 0.20 | 0.0003 | 0.0001 | 0.0003 |
| Brtet | 0.0003 | 0.60 | 0.10 | 0.0002 | 0 | 0.0002 |
| Festu | 0.0005 | 0.50 | 0.20 | 0.0002 | 0.0001 | 0.0002 |
| Mesp | T | 0.50 | 0.20 | 0 | 0 | 0 |
| Orhyh | T | 0.70 | 0.20 | 0 | 0 | 0 |
| Sihy | 0.0002 | 0.50 | 0.10 | 0.0001 | 0 | 0.0001 |
| Spai | 0.0002 | 0.40 | 0.10 | 0.0001 | 0 | 0.0001 |
| Stco3 | 0.0003 | 0.60 | 0.20 | 0.0002 | 0.0001 | 0.0002 |
| Cactus: | | | | | | |
| Oppo | 0.0005 | 0 | 0 | 0 | 0 | 0 |
| Total forage acre factors: | | | | 0.0103 (cattle) | 0.0380 (deer) | 0.0393 (common use) |

[a] Taken from 15, 100-square foot plots

[b] Cattle PUF is for spring season as this is their period of use; deer PUFs are for winter.

[c] T indicates a trace, less than 0.25 square foot

Table 16. Continued

Calculations:

Common use forage acre factor X surface acres = total forage acres
0.0393 X 3,712 = 145.88 forage acres

Forage acres ÷ forage acre requirement = total AUMs available

$\frac{145.88}{0.342}$ = 427 AUMs available

Suitability ratio expressed as a percent:

0.0103 cattle 21.3 %
0.0380 deer 78.7 %
0.0483

AUMs available for each animal class:

427 AUMs X 21.3 % = 91 AUMs available for cattle
427 AUMs X 78.7 % = 336 AUMs available for deer

AUMs needed to support each animal class:

$\frac{70 \text{ deer}}{5}$ = 14 AUMs needed per month

14 AUMs per month for 4 months = 56 AUMs needed for deer
419 AUMs needed for cattle
Total: 475 AUMs needed for both classes

Summary:

| | AUMs available: | AUMs required: | AUMs difference: |
|---|---|---|---|
| deer: | 336 | 56 | 280 extra for deer |
| cattle: | 91 | 419 | 328 additional required |

mahogany plants received 12 percent utilization during the winter of 1966 and 36 percent during the winter of 1967 (Appendix Table 8). The "Cole" estimation method found the utilization on sage at the three pellet group transects to range from 7 to 19 percent during the winter of 1967 (Appendix Table 9). This use of sage is not excessive.

Deerlodge

The 3.0 square-mile Deerlodge area supports deer and cattle during the winter season. Approximately 40 deer winter in this area as well as cattle owned by George Rinker.

The vegetation composition and density analysis of this area gave a carrying capacity of 255 AUMs of forage available in 1967 (Table 17). Of these 255 AUMs, 149 AUMs are available for deer and 106 AUMs are available for cattle. The deer require 32 AUMs and the cattle require 32 AUMs; therefore, the present use of Deerlodge is well within proper use limits.

The "Cole" method of estimating utilization was found to be 39 percent on big sage during the winter of 1967 (Appendix Table 9). This utilization is not excessive. The various plant species at Deerlodge are in good condition, and there is a fair balance of browse and grasses.

Table 17. Carrying capacity for cattle and deer on the Deerlodge Park range, Dinosaur National Monument, 1967.

| Species | Average[a] Density | Proper Use Factors: Cattle | Deer | Forace Acre Factors: Cattle | Deer | Highest FAF |
|---|---|---|---|---|---|---|
| Browse: | | | | | | |
| Artrt | 0.0175 | 0.15 | 0.50 | 0.0026 | 0.0087 | 0.0087 |
| Chvi | 0.0410 | 0.20 | 0.50 | 0.0082 | 0.0205 | 0.0205 |
| Forbs: | | | | | | |
| Asca | 0.0025 | 0.10 | 0.10 | 0.0003 | 0.0003 | 0.0003 |
| Aster | 0.0080 | 0.10 | 0.10 | 0.0008 | 0.0008 | 0.0008 |
| Taof | 0.0005 | 0.10 | 0.10 | 0.0001 | 0.0001 | 0.0001 |
| Grasses: | | | | | | |
| Agrop | 0.0030 | 0.50 | 0.20 | 0.0015 | 0.0006 | 0.0015 |
| Brtet | 0.0325 | 0.10 | 0.10 | 0.0033 | 0.0033 | 0.0033 |
| Orhyh | 0.0055 | 0.50 | 0.20 | 0.0028 | 0.0011 | 0.0028 |
| Stco3 | 0.0150 | 0.50 | 0.20 | 0.0075 | 0.0030 | 0.0075 |
| Cactus: | | | | | | |
| Oppo | 0.0650 | 0 | 0 | 0 | 0 | 0 |
| Total forage acre factors: | | | | 0.0271 (cattle) | 0.0384 (deer) | 0.0455 (common use) |

[a]Taken from five, 100-square foot plots

Table 17. Continued

Calculations:

Common use forage acre factor X surface acres = total forage acres
0.0455 X 1920 = 87.36 forage acres

Forage acres ÷ forage acre requirement = total AUMs available

$\frac{87.36}{0.342}$ = 255 AUMs available

Suitability ratio expressed as a percent:

| | | |
|---|---|---|
| 0.0271 | cattle | 41.4 % |
| 0.0384 | deer | 58.6 % |
| 0.0655 | | |

AUMs available for each animal class:

255 AUMs X 41.4 % = 106 AUMs available for cattle
255 AUMs X 58.6 % = 149 AUMs available for deer

AUMs needed to support each animal class:

$\frac{40 \text{ deer}}{5}$ = 8 AUMs needed per month

8 AUMs per month for 4 months = 32 AUMs needed for deer
32 AUMs needed for cattle
Total: 64 AUMs needed for both classes

Summary:

| AUMs available: | AUMs required | AUMs difference: |
|---|---|---|
| deer: 149 | 32 | 117 extra for deer |
| cattle: 106 | 32 | 74 extra for cattle |

## MORTALITY FACTORS

Mortality from hunting is the dominant factor affecting the deer that migrate from the Monument. Accidents, predation, illegal hunting, and disease and starvation apparently contribute very little to the overall mortality of the various deer herds that winter in the Monument.

### Legal hunting

Hunting is not permitted within Dinosaur National Monument; however, most of the deer which winter on the Monument migrate to higher elevations off the Monument where they are subject to hunting. Three deer hunting units adjoin the Monument in Colorado and one adjoins the Monument in Utah (Figure 10).

Both Colorado and Utah tabulate unit deer kills by means of returned questionnaire cards (Table 18). It may be noted from the annual unit kill totals that there are wide differences between the kill of consecutive years. The number of deer killed declined drastically between 1964 and 1967 on the three Colorado units probably as a result of the two or three deer either sex seasons on these units in 1963 (Appendix Tables 10 and 11). Another effective reduction factor, however, was the severe winter of 1964 which resulted in heavy fawn mortality.

With increased hunting pressure each year, the possibility of an over-population of deer will be less. Eventually, the hunting pressure may reach a point where a continued buck only season may be advisable.

### Accidents

Accidents claiming the lives of deer were apparently low in the

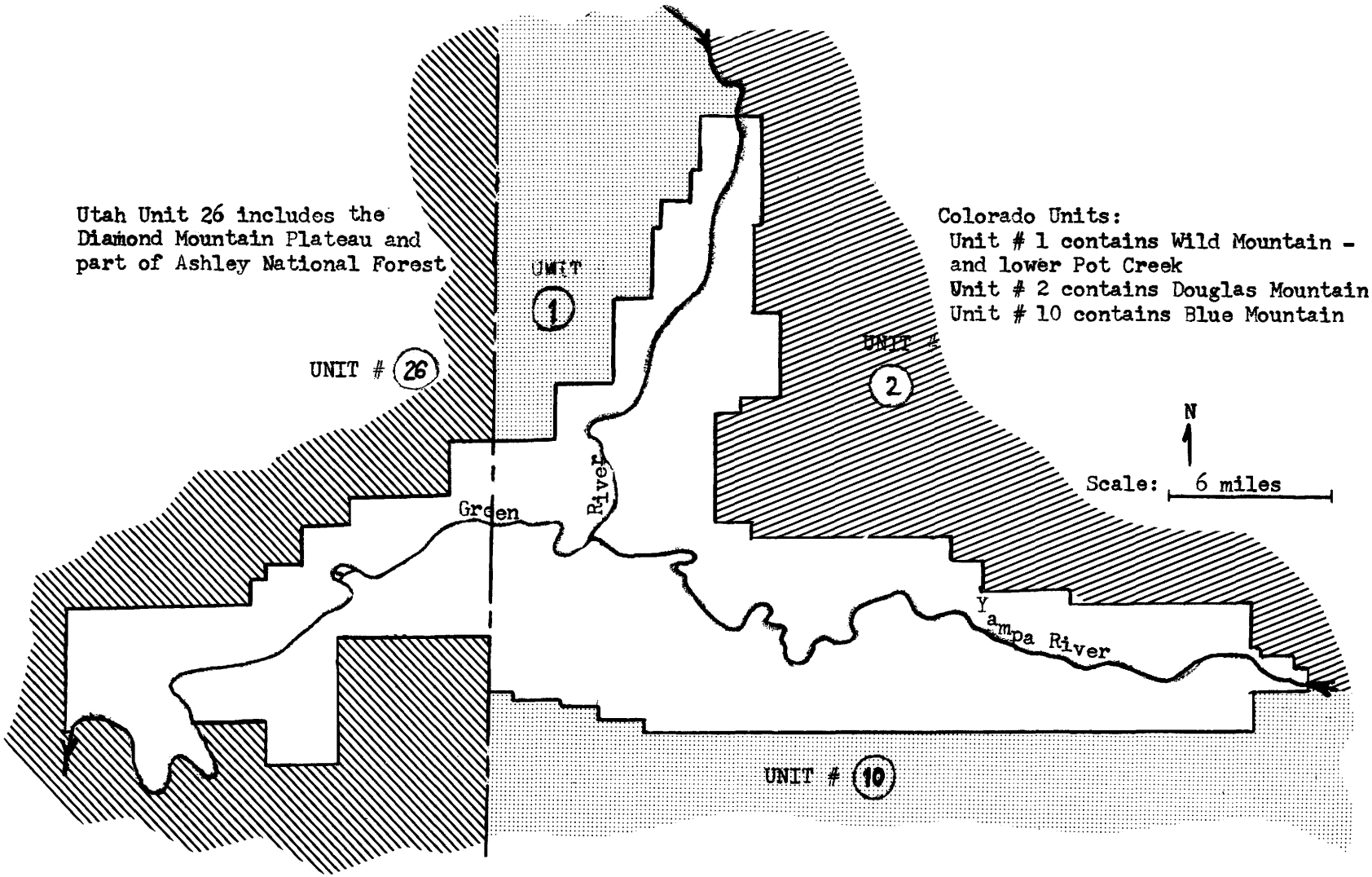


Figure 10. The Deer Hunting Units that adjoin Dinosaur National Monument.

Table 18. Deer kill for hunting units adjoining Dinosaur National Monument, 1950 to 1967.[a]

| Year | Utah Unit 26 | Colorado Unit 1 | Colorado Unit 2 | Colorado Unit 10 |
|---|---|---|---|---|
| 1950 | 1,489 | 222 | 163 | 322 |
| 1951 | 1,966 | 60 | 167 | 324 |
| 1952 | 2,144 | 337 | 728 | 356 |
| 1953 | 2,268 | 309 | 427 | 589 |
| 1954 | 1,886 | 142 | 469 | 714 |
| 1955 | 1,819 | 350 | 474 | 1,259 |
| 1956 | 2,358 | 514 | 753 | 959 |
| 1957 | 2,122 | 327 | 1,389 | 1,543 |
| 1958 | 1,982 | 497 | 469 | 1,368 |
| 1959 | 2,146 | 102 | 396 | 1,643 |
| 1960 | 3,097 | 174 | 1,310 | 1,669 |
| 1961 | 2,213 | 162 | 1,218 | 3,004 |
| 1962 | 2,294 | 965 | 919 | 1,005 |
| 1963 | 1,987 | 971 | 2,260 | 5,731 |
| 1964 | 2,368 | 483 | 1,011 | 1,585 |
| 1965 | 1,442 | 51 | 480 | 247 |
| 1966 | 1,021 | 50 | 574 | 370 |
| 1967 | 2,218 | 45 | 611 | 305 |
| Mean: | 2,046 | 320 | 768 | 1,277 |
| 3 year $\bar{X}$ : (1965-67) | 1,560 | 49 | 555 | 307 |

[a]Kill totals are from the 1965 Annual Mule Deer Migration and Ecology report for Dinosaur National Monument and the annual Utah Big Game Harvest publications (1950-1967).

Monument. Deaths from accidents, were from two causes: (1) entanglement in fences, and (2) automobiles.

Four deer (three fawns and one yearling doe) were found dead in fences during the study period. It appears that fawns have the most difficulty in jumping fences. The 35-mile access road from route U.S. #40 across Blue Mountain to Harpers Corner, fenced on both sides, presents a threat to the fawns on Blue Mountain; but, it is essential to prevent livestock from entering the highway.

Several deer were killed by automobiles during the study period. Two deer were killed on the Diamond Mountain road during the summer, 1967. A two-point buck also was killed on the Harpers Corner road August 8, 1967. A total of nine deer were killed on U.S. #40 between the Monument headquarters and Dinosaur, Colorado between October 1 and November 30, 1966.

Predation

Deer predation was not a significant mortality factor for either the Yampa Bench or the Island Park winter range areas. The primary deer predators in the Monument are coyotes and bobcats. Mountain lions apparently exist only in low numbers. Rangers saw a mountain lion in the Zenobia Basin in July, 1967, the only one reported within the Monument during the study period.

Coyotes generally could be heard "howling" in the afternoons and evenings on the west end of the Yampa Bench during the winter of 1966. Nevertheless, only two incidents of possible deer predation by coyotes were found: a yearling doe near the mouth of Sand Canyon and an adult doe near the Baker cabin had been fed upon by coyotes.

Coyotes occasionally were heard "howling" in the Island Park area during 1967. Coyotes entered a deer trap through the rabbit bars at the bottom and killed a female fawn inside on February 13, 1967. This was the only known instance of predation on deer by coyotes in Island Park.

Bobcats and coyotes apparently are not an important mortality factor on the Yampa Bench since there was little, if any, predation on the 950 sheep on the Bench.

Bobcats were plentiful on the Yampa Bench as attested by numerous tracks and the remains of cottontail rabbits. A local rancher trapped approximately 30 bobcats during the winter of 1966 on his private lands on the Yampa Bench.

Bobcats were not seen in the Island Park area, but their tracks were frequently seen in the McKee Draw area, 300 yards inside the Monument on the Island Park road. A buck fawn that had been killed and partially eaten by a bobcat was found in the McKee Draw area on January 13, 1967. The point of attack and a drag trail of approximately 70 feet were still evident in the snow. A bone marrow check on this fawn showed that it was in poor condition. The fawn was exceptionally small and light in weight.

Forty samples of bobcat feces collected for analysis during the month of April, 1967, showed that rabbit hair and bones were the most prevalent items in the feces. Deer hair was found in nine of these samples, but this does not indicate that the bobcats had killed a deer, merely that they had fed upon deer (Table 19).

Starvation

Starvation of deer on winter ranges in the Monument was slight during the study. However, range analysis of the west end of the Yampa Bench

Table 19. Analysis of 40 bobcat feces collected on the west end of the Yampa Bench during the winter of 1967, Dinosaur National Monument.

| Items found | Times found | Percentage of frequency | Percentage of all occurrences |
|---|---|---|---|
| Rabbit hair (Sylvilagus) | 31 | 77.5 | 35.3 |
| Rabbit bones (Sylvilagus) | 24 | 60.0 | 27.3 |
| Deer hair (Odocoileus) | 9 | 22.5 | 10.2 |
| Mice hair & bones (Microtus) | 7 | 17.5 | 8.0 |
| Porcupine hair (Erethizon) | 4 | 10.0 | 4.5 |
| Sandstone rock pebbles | 4 | 10.0 | 4.5 |
| Juniper leaves (Juniperus) | 4 | 10.0 | 4.5 |
| Ground squirrel (Citellus) | 3 | 7.5 | 3.5 |
| Skunk hair (Mephitis) | 1 | 2.5 | 1.1 |
| Pinyon pine seeds (Pinus) | 1 | 2.5 | 1.1 |
| | 88 | | 100.0 |

Total occurrences: 88

suggests that a combination of a dry summer with little plant growth and a severe winter could result in the starvation of deer on this overstocked winter range. The exceptionally harsh winters of 1948 and 1949 resulted in some mortality on the Yampa Bench. A rancher reported some deer winter loss on the Yampa Bench and Iron Springs Bench during the winter of 1964 (Chew, 1967).

Several deer were found dead on winter ranges during the winters of 1966 and 1967. These deer died as a result of various causes, e.g., trapping, predation, accidents, and several from unknown causes. Sex and age of these deer are summarized as follows:

| Year | Location | Adult buck | Adult doe | Yearling | Fawn | Total |
|---|---|---|---|---|---|---|
| 1966 | Yampa Bench | 1 | 1 | 1 | 4 | 7 |
| 1967 | Yampa Bench | 1 | 2 | 2 | 3 | 8 |
| 1967 | Island Park | - | - | 1 | 7 | 8 |

A bone marrow test on four fawns, one adult doe, and one adult buck showed two fawns found in March, 1966, had bloody, gelatinous bone marrow, signifying poor fat storage in the body. The fat storage in these fawns was only enough to carry them until March and not quite enough to last until spring.

Four fawns and a yearling doe from Island Park were given the bone marrow test during the winter of 1967. Two fawns had a gelatinous, bloody bone marrow. One of these was a bobcat kill and the other died from being entangled in a barbed wire fence. The other three deer were trapping losses and their marrow was white and fatty signifying good fat storage still remained in the body.

## Diseases and parasites

Ectoparasites: Two species of ectoparasites were collected during trapping operations. These were the winter tick (Dermacentor albipictus) and a species of lice (Damalinia sp.). It was noted, as the trapping season progressed on the Yampa Bench during the winter of 1966, that the prevalence and number of ticks and lice found on deer increased sharply. One to five ticks generally could be found on a deer's ear at the beginning of the trapping operation on January 11; but, by early March, from 10 to 40 ticks could be found on the ears. An adult doe examined on March 5 had 42 ticks on her ears.

Endoparasites: Eleven larvae of the deer botfly (Cephenemyia jellisoni) were found in the vicinity of the nasal cavity of a buck fawn which died on March 2, 1966.

Diseases. The prevalence of mange on the back, sides, and the neck of deer followed a progression similar to that of the ticks. None of the 19 deer trapped in January, 1966, had mange. Four of the 44 trapped in February and five of the 12 trapped in March had mange. The presence of mange was indicated by small red inflamed spots on the hairless area. It is probable that the red spots were where lice had been attached as this was where they were collected.

The size of bare, mange areas ranged from four-inch-diameter bare spots on the neck and sides to an area 13 inches in diameter found on the midsection of the back of several deer. This condition also was noted in the Daggett deer herd by Richens (1961).

Papillomas were found on the face (either around the eyes, on the nose, or on the deer's lips) of four of the 75 deer tagged in the Harpers

Corner and Yampa Bench areas. Papillomas have the appearance of water or puss filled sacs on the surface skin of the animal.

One case of "lumpy jaw" was observed on a mature four-point buck killed on the Moosehead region of the Blue Mountain Plateau during the 1966 Colorado deer season. This deer's jaw bone was swollen and infected. Grass stalks and seed awns which had probably provided entrance for bacteria were present in the infected area between the mandible and a molar.

Illegal hunting

Illegal hunting of deer within and in the vicinity of Dinosaur National Monument during the winter months was because of two factors: (1) deer are plentiful and (2) the back country in the Monument is seldom patrolled during this time of year.

Monument rangers occasionally warn persons engaged in hunting deer and other animals near the Monument. The Harpers Corner access road to the Monument is National Park Service property, but cuts across private and Bureau of Land Management lands before it reaches the Monument boundary. Each deer hunting season a problem exists from hunters that either hunt from this road or within the road's boundary fences. Hunters seem to find it easy to forget that hunting from this road or its right of way is prohibited.

The arrest and prosecution of a hunter who had illegally killed a deer within the Monument was made in the fall of 1967. Not only was the deer killed on Park Service property, but it also had been taken out of season.

## HERD COMPOSITION

The buck-doe ratio for Blue Mountain and Harpers Corner in 1966 was 0.66:1.0; and in 1967 it was 0.63:1.0. The doe-fawn ratio was 1.0:0.91 in 1966 and 1.0:0.95 in 1967 (Table 20). These pre-hunting season ratios are comparable with ratios found on other Utah deer ranges (Nielson, 1966). These ratios suggest that the herd is in good condition with a relatively high number of bucks and a very good fawn crop.

The post-hunting season buck-doe ratio in 1966 of 0.46:1.0 was probably the result of hunter selectivity and the fact that there was a buck only season on the Utah portion of Blue Mountain in 1966.

Sex and age ratios for trapped deer were not consistent with those observed in the field. This inconsistency also was noted by Richens (1961) on the Daggett deer herd. This probably resulted because antlered bucks do not enter traps as readily as does and fawns, and does generally enter traps before fawns.

Table 20. Sex and age ratios of deer observed on the Blue Mountain summer range south of Dinosaur National Monument, 1966 and 1967.

| Fall, 1966 | | Sex and age classification | | | |
|---|---|---|---|---|---|
| Date | | Buck | Doe | Fawn | Location |
| August | 23 | 30 | 23 | 18 | Harpers Corner to the Doug Chew cabin |
| September | 30 | 4 | 5 | 5 | Escalante Overlook to Point of Pines |
| October | 1 | 2 | 3 | 3 | Joseph Haslem property |
| October | 2 | 18 | 16 | 10 | Escalante Overlook to Point of Pines |
| October | 5 | 0 | 19 | 17 | Escalante Overlook to Harpers Corner |
| October | 6 | 0 | 15 | 20 | Stuntz reservoir to switchbacks |
| October | 7 | 0 | 1 | 2 | Switchbacks to Iron Springs Bench |
| | | 54 | 82 | 75 | = 211 Total |
| ratios: | | buck:doe:fawn | | | |
| | | 65.9:100:91.5 | | | |
| | | (0.66:1.0:0.91) | | | |

| Fall, 1967 | | Sex and age classification | | | |
|---|---|---|---|---|---|
| Date | | Buck | Doe | Fawn | Location |
| September | 6 | 0 | 9 | 8 | South rim of Blue Mountain |
| September | 7 | 8 | 3 | 4 | Escalante Overlook to Round Top |
| September | 7 | 3 | 0 | 0 | Point of Pines |
| September | 8 | 8 | 17 | 14 | Joseph Haslem property to Round Top |
| September | 12 | 7 | 5 | 6 | Peterson property to Point of Pines |
| September | 13 | 4 | 8 | 6 | Moosehead area |
| September | 18 | 4 | 10 | 11 | Doug Chew cabin to Wolf Creek road |
| September | 23 | 2 | 5 | 5 | Doc's Valley area |
| | | 36 | 57 | 54 | = 147 |
| ratios: | | buck:doe:fawn | | | |
| | | 63.2:100:94.7 | | | |
| | | (0.63:1.0:0.95) | | | |

# RECOMMENDATIONS

1. The 15 permanent vegetation analysis plots that have been established at each of the three range study exclosure sites should be evaluated every third summer to assess range trend. The range trend plot frame should be used for this analysis. These analyses can be compared with the original analysis made during this study that is on file at the Monument headquarters.
2. The "Cole" estimation method should be used to determine winter browse utilization on the Monument's deer winter ranges. The Park Services' deer hunting recommendations for units adjoining the Monument should be based on such criteria.
3. Annual deer population indices should be ascertained for the various deer winter ranges in the Monument by means of the 21 established pellet group transects.
4. If the actual measurement method is used to assess browse utilization on winter ranges a "growth index" should be used to assist in properly interpreting vegetative use.
5. Systematic winter deer counts via vehicle should be made on all winter ranges.
6. Plant utilization and pellet group transects on Harpers Corner should be assessed annually to determine the status of the deer population.

7. Vegetation composition and density data gave evidence that the sheep and deer which use the west end of the Yampa Bench are competing for forage. Carrying capacity data suggests that sheep use of this area should be reduced by 234 AUMs of use or 293 sheep during the four month winter period.
8. Heavy use of bitterbrush on Harpers Corner could probably be reduced if cattle were taken off this area in late August. The combined use of cattle and deer from August to late October result in over-utilization of this species.
9. Vegetation composition and density data gave evidence that the Split Mountain range is being too heavily stocked with cattle for the forage available. Cattle use on the area presently begins on April 16 of each year. If this use were delayed until June 1 the grasses would be able to put on additional growth and thus provide more forage available. Also, if some cattle use could be transferred to the Island Park area, the Split Mountain area could rehabilitate. Use of the Island Park area is presently well within the carrying capacity limit.
10. Winter cattle use on the Mantle allotment should be better distributed over the entire allotment. Present winter use of this allotment results in concentrations of cattle on the 3.75 mile area between the Castle Park road and the Chew-Mantle allotment fence. This area has been badly over-utilized. The allotment can easily carry the present stocking rate if the cattle are well distributed over it.

11. Fences in the Monument that are no longer used or needed should be removed. They present a hazard to deer, particularly fawns, and detract from the aesthetic values of the Monument.
12. Winter patrols into the Monument back-country should be made frequently to deter illegal kill of deer.
13. Either sex deer hunting seasons should be conducted on deer hunting units adjoining the Monument in order to maintain the deer population at its present level.
14. Deer migration studies on the Zenobia Basin summering herd should be undertaken.

# SUMMARY

This study was undertaken to determine the distribution, abundance, migration, and condition of the mule deer (Odocoileus h. hemionus) herds that winter within Dinosaur National Monument and the measures needed to maintain these herds in balance with their respective winter ranges. Overpopulation, range deterioration, high winter mortality, and no apparent control measures led to the initiation of this study.

Dinosaur National Monument is comprised of 206,409 acres and is located in northwestern Colorado and northeastern Utah. Field work was conducted from November, 1965 to June, 1966 and from September, 1966 to October, 1967.

High populations of deer and heavy deer mortality were reported for the winter ranges within the Monument during the severe winters of 1944, 1949, 1950, 1952, and 1956. Where the deer that winter within the Monument came from or went after the winter period was not known.

Deer winter ranges within the Monument are located on the lower elevation benches and flats along the Green and Yampa Rivers. The two major deer winter ranges are the Yampa Bench where approximately 500 deer winter and Island Park where approximately 300 deer winter. Other smaller winter ranges are Split Mountain, Lodore, and Deerlodge where 70, 70, and 40 deer winter respectively. In addition, Harpers Corner, a northern extension of the Blue Mountain Plateau that adjoins the Yampa Bench, is used by approximately 50 deer for 10 months or more of the year, depending on the severity of the winter.

Deer were ear tagged with colored streamers on winter ranges to facilitate their identification during other seasons of the year and at other locations.

Fifty-nine deer eag tagged on the Yampa Bench during the winter of 1966 migrated during April south from the Monument onto the Blue Mountain Plateau. These deer spent the summer and fall months on Blue Mountain and returned to the Yampa Bench in November and December. The average distance of sightings of these deer while on summer range was 7.3 air miles from the tagging site on the Bench.

Sixteen deer were ear tagged on Harpers Corner during January of 1966. Through observations of these deer at Harpers Corner they were found to migrate down Trail Draw onto the west end of the Yampa Bench. This movement occurs about the first week of February when deep winter snows impeded their movements on Harpers Corner. Migration back onto Harpers Corner took place about the first week of April when the snows receded. These deer spent the entire year within the Monument; therefore, they were not subjected to reduction during the deer hunting season. The bitterbrush on Harpers Corner is scarce and is in an overbrowsed condition from both deer and cattle use, although other plants are in good condition.

Observations of 110 deer, ear tagged in Island Park during the winter of 1967 found that this herd migrates to the northwest onto the Diamond Mountain Plateau and Ashley National Forest. These deer leave Island Park in April and return in late November and December. The average sighting distance of these deer on summer range was 22.6 air miles from Island Park.

Twenty-five deer tagged on the Split Mountain range during the winter of 1965 were found to migrate and summer on Bureau of Land Management and private lands to the south and southwest.

Grazing permits for livestock grazing privileges on the Monument are issued annually to approximately 24 permittees. The higher elevation areas on the Monument are generally in good condition. Lower elevation areas which are deer winter ranges receive a concentration of livestock and deer during the winter period which results in higher utilization of the vegetation.

Vegetative composition and density data from the west end of the Yampa Bench gave a carrying capacity of 1,517 AUMs available for use. The 950 sheep using this area in winter require 760 AUMs to sustain them. There are 526 AUMs available to sheep use, thus, 234 additional AUMs are needed to sustain the sheep. Consequently to safeguard this range in the event of a severe winter and higher numbers of deer using the area the sheep use on the Bench should be reduced.

The Split Mountain winter range gave a carrying capacity of 427 AUMs in 1967. Of this total, 91 AUMs were available for use by cattle and 336 AUMs were available for deer. The cattle required 419 AUMs and the deer required 56 AUMs, thus, 328 AUMs additional AUMs are needed for the cattle. Cattle should therefore be reduced on this range.

The Island Park, Harpers Corner, Deerlodge, and eastern portion of the Yampa Bench are well within carrying capacity limits. If possible and practical, some of the livestock from areas of heavy use should be transferred to areas that can sustain additional use. This will serve to

safeguard these critical deer winter ranges and will allow them to rehabilitate.

Bighorn sheep exist within the Lodore Canyon portion of the Monument. Deer use within the Canyon is very slight and limited mainly to the winter months. Bighorn sheep were not observed on the mountain plateaus bordering the Canyon. Therefore, they do not compete with the deer on their summer ranges.

The physical condition of deer on their winter ranges was very good during the winters of 1966 and 1967. Consequently, deer winter mortality was found to be slight on the Monument's ranges during these two winters.

Four deer hunting units adjoin Monument boundaries. With the present hunting pressure on these units, one deer, either-sex seasons are sufficient to keep deer numbers on the Monument's winter ranges within their carrying capacities.

Deer predation by bobcats, coyotes, and mountain lions was slight during the winters of 1966 and 1967. Accidental deaths resulted largely from automobiles and entanglement in fences. Fences not used should be removed.

Illegal hunting of deer during the winter was noted on winter ranges in the Monument. Periodic winter patrols into the back country would help minimize poaching.

In conclusion, most deer that winter in the Monument migrate in April to higher elevation areas off the Monument and do not return until November. Thus they are subject to reduction by hunting. If the annual deer production continues to be cropped and livestock use is reduced on critical ranges, the well being of the Monument's herds will be insured.

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# APPENDIX

Appendix Form 1. The "Cole" estimation method field form for determining utilization used at Dinosaur National Monument in 1967.

BROWSE FIELD FORM

Sample Unit No. _____

District _____ Area _____ Date _____ Key Sp. _____

Location _____

Forage Availability _____ Veg. Type _____

Dot-tally - Form Class 7 _____ 8 _____ Examiner _____

| Plant No. | Form Class 1 | 2 | 3 | 4 | 5 | 6 | Age Class | Leader Use | Plant No. | Form Class 1 | 2 | 3 | 4 | 5 | 6 | Age Class | Leader Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | 16 | | | | | | | | |
| 2 | | | | | | | | | 17 | | | | | | | | |
| 3 | | | | | | | | | 18 | | | | | | | | |
| 4 | | | | | | | | | 19 | | | | | | | | |
| 5 | | | | | | | | | 20 | | | | | | | | |
| 6 | | | | | | | | | 21 | | | | | | | | |
| 7 | | | | | | | | | 22 | | | | | | | | |
| 8 | | | | | | | | | 23 | | | | | | | | |
| 9 | | | | | | | | | 24 | | | | | | | | |
| 10 | | | | | | | | | 25 | | | | | | | | |
| 11 | | | | | | | | | 26 | | | | | | | | |
| 12 | | | | | | | | | 27 | | | | | | | | |
| 13 | | | | | | | | | 28 | | | | | | | | |
| 14 | | | | | | | | | 29 | | | | | | | | |
| 15 | | | | | | | | | 30 | | | | | | | | |

Form Classes

Percentages

_____ _____ 1 all available, little or no hedging
_____ _____ 2 all available, moderately hedged
_____ _____ 3 all available, severely hedged
_____ _____ 4 partly available, little or no hedging
_____ _____ 5 partly available, moderately hedged
_____ _____ 6 partly available, severely hedged
_____ 7 unavailable )
_____ 8 dead ) dot-tally

R

_____ S - Seedling
_____ _____ Y - Young
_____ _____ M - Mature
_____ _____ D - Decadent

Age Classes

Leader Use Est. %

0 non-use
5 1-9
25 10-39
50 40-59
75 60-89
95 90-100

Leader Use Av.

_____

Appendix Form 2. Tagged deer observation recording form used in the vicinity of Dinosaur National Monument

MEMORANDUM

TO All persons working or engaged in other activities in the area of Diamond Mountain, Blue Mountain and other areas in or around Dinosaur National Monument, Uintah County, Utah, and Moffat County, Colorado.

SUBJECT Deer Migrations From Dinosaur National Monument.

There are approximately 300 deer in this area that have been ear tagged with aluminum ear tags and light blue, white or red plastic vinyl ear streamers.

It is important that anyone sighting a tagged deer record the following data on the sighting: date, location, streamer color, and the observers name.

This sheet has been supplied for the recording of tagged deer. Your cooperation will be greatly appreciated. The observers will be given credit for their sightings in the report of this study. Please send sheets or sighting recordings to:

Dinosaur National Monument
Dinosaur, Colorado 81610
Attention: Robert Franzen

Thank you.

TAGGED DEER SIGHTINGS

Date Sighting location (as accurately as possible) Streamer color observer

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

Appendix Table 1. Past sightings and the present status of large mammals that inhabited Dinosaur National Monument from 1825 to 1925.

| Species | Sighting Location within the Monument | Observer and Date | Reference | Present Status |
|---|---|---|---|---|
| American Bison (*Bison bison*) | Island Park | William Ashley-1825 | Dale, 1941 | extirpated |
| Bighorn Sheep (*Ovis c. canadensis*) | Lodore Canyon | Fremont-1845 | Fremont, 1845 | died out by 1950 reintroduced in 1952 now common |
| Mule Deer (*Odocoileus hemionus*) | along the Green River | John Powell-1875 | Powell, 1875 | common throughout |
| Moose (*Alces alces*) | Island Park | Henry Ruple-1875 | Cole, 1954 | absent |
| Elk (*Cervus canadensis*) | Zenobia Basin | Chew-1920 | Chew, 1967 | occasional inhabitant |
| Pronghorn Antelope (*Antilocapra americana*) | Deerlodge Park | Chew-1920 | Chew, 1967 | occasional inhabitant |
| Grizzly Bear (*Ursus horribilis*) | Island Park | Henry Ruple-1885 | Cole, 1954 | extirpated |
| Black Bear (*Ursus americana*) | no records found | | | occasional inhabitant |
| Gray Wolf (Canis lupus) | Gates of Lodore | Almon Thompson-1871 | Thompson, 1939 | extirpated |
| Mountain Lion (*Felis concolor*) | Zenobia Basin | 1905 | Cary, 1911 | present but not common |
| Coyote (*Canis latrans*) | common throughout | Powell-1875 | Powell, 1875 | common throughout |

Appendix Table 2. A summary of actual grazing use at Dinosaur National Monument from 1943 to 1966.

| Year | No. of Permittees | Cattle | | Horses | | Sheep or Goats | | Total AUM |
|---|---|---|---|---|---|---|---|---|
| | | head | AUM | head | AUM | head | AUM | |
| 1943 | no record | 258 | 709 | 21 | 86 | 3,615 | 1,985 | 2,780 |
| 1944 | no record | 258 | 709 | 21 | 86 | 3,615 | 1,985 | 2,780 |
| 1945 | 29 | 1,969 | 4,365 | 160 | 379 | 19,808 | 4,773 | 9,517 |
| 1946 | 29 | 1,999 | 4,306 | 155 | 382 | 18,863 | 4,475 | 9,163 |
| 1947 | 25 | 1,707 | 3,985 | 122 | 352 | 13,865 | 4,802 | 9,139 |
| 1948 | 24 | 1,707 | 4,086 | 142 | 412 | 12,490 | 3,570 | 8,068 |
| 1949 | 21 | 1,837 | 4,113 | 122 | 399 | 11,255 | 3,527 | 8,039 |
| 1950 | 23 | 1,804 | 4,392 | 127 | 435 | 10,095 | 3,127 | 7,954 |
| 1951 | 22 | 1,937 | 4,601 | 147 | 477 | 8,965 | 2,912 | 7,990 |
| 1952 | 20 | 2,018 | 4,739 | 141 | 435 | 9,606 | 2,958 | 8,132 |
| 1953 | 21 | 1,945 | 4,735 | 96 | 303 | 9,040 | 3,217 | 8,255 |
| 1954 | 22 | 1,874 | 4,215 | 116 | 311 | 9,650 | 3,218 | 7,744 |
| 1955 | 25 | 2,031 | 4,335 | 120 | 249 | 10,070 | 3,108 | 7,692 |
| 1956 | 24 | 2,121 | 4,410 | 121 | 268 | 10,020 | 3,011 | 7,689 |
| 1957 | 25 | 1,527 | 3,680 | 64 | 126 | 7,160 | 2,726 | 6,532 |
| 1958 | 22 | 1,339 | 2,706 | 69 | 132 | 8,660 | 2,819 | 5,657 |
| 1959 | 21 | 1,893 | 3,442 | 74 | 121 | 9,206 | 2,538 | 6,101 |
| 1960 | 29 | 1,734 | 3,451 | 56 | 191 | 18,445 | 2,935 | 6,577 |
| 1961 | 27 | 2,324 | 3,603 | 74 | 143 | 20,965 | 3,144 | 6,890 |
| 1962 | 26 | 2,538 | 4,101 | 69 | 115 | 22,565 | 3,000 | 7,216 |
| 1963 | 26 | 2,361 | 3,631 | 89 | 128 | 21,779 | 2,912 | 6,671 |
| 1964 | 25 | 2,493 | 3,709 | 75 | 150 | 19,595 | 2,352 | 6,211 |
| 1965 | 24 | 2,494 | 3,801 | 74 | 148 | 14,662 | 1,961 | 5,910 |
| 1966 | 24 | 2,596 | 3,555 | 84 | 141 | 18,340 | 2,144 | 5,840 |

Source: From grazing reports in the Dinosaur National Monument's files, and from Hartzog (1966).

Appendix Table 3. Sightings of red streamered deer tagged on Yampa Bench during the winter of 1966.

Sightings at intermediate locations between winter and summer range:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/2/66 | 2 | near Sand Canyon on Iron Springs Bench | R. Franzen | 2.8 |
| 4/4/66 | 2 | near Vivas Cake Hill on Iron Springs Bench | Ben Trujillo | 4.2 |
| 4/5/66 | 1 | Billiard Table near Red Rock Canyon | R. Franzen | 2.8 |
| 4/5/66 | 2 | Red Rock Bench | R. Franzen | 3.8 |
| 4/12/66 | 1 | at top of Trail Draw | R. Franzen | 4.3 |
| 4/13/66 | 5 | Utah Highway #44, 11 miles north of Vernal, Utah | Utah Fish & Game | 27.0 |

Sightings of deer that remained on the Bench during the summer of 1966:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/24/66 | 1 | one mile northwest of Chew Ranch on Yampa Bench | Rial Chew | 2.0 |
| 8/11/66 | 1 | Chew air strip on Yampa Bench | Rial Chew | 0 |
| 10/16/66 | 1 | Chew air strip on Yampa Bench | Rial Chew | 0 |

Sightings of tagged deer on Blue Mountain summer range:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/14/66 | 1 | near Doug Chew sheep corral | Doug Chew | 5.6 |
| 4/21/66 | 2 | near Rial Chew sheep camp and corral | R. Franzen | 8.6 |
| 5/4/66 | 1 | Wilkins cabin | R. Franzen | 6.4 |
| 5/5/66 | 1 | Point of Pines | Dean Chew | 11.5 |
| 5/5/66 | 1 | three miles east of Pittman Ranch | Robert Pittman | 14.8 |
| 5/12/66 | 1 | Doug Chew corral | Joe Hacking | 6.3 |
| 6/18/66 | 1 buck | Peterson property | Larry Hanneman | 8.6 |
| 8/26/66 | 3 doe | three miles south of Stuntz pond | Richard McMullen | 8.3 |
| 8/26/66 | 1 buck | Joseph Haslem property | Thomas Slawson | 9.2 |
| 8/28/66 | 1 buck, 2 doe | three miles southeast of Stuntz pond | Richard McMullen | 8.6 |
| 9/4/66 | 1 doe | Rial Chew sheep camp reservoir | Thomas Slawson | 6.0 |
| 9/10/66 | 1 doe | Rial Chew sheep camp | Thomas Meier | 6.0 |

Appendix Table 3. Continued

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 9/11/66 | 1 doe | Monument boundary on Harpers Corner road | Thomas Meier | 6.0 |
| 9/17/66 | 1 buck | three miles south of Stuntz pond | Raymond Hume | 8.2 |
| 9/22/66 | 1 doe | Round Top-Harpers Corner road intersection | Thomas Slawson | 6.2 |
| 10/4/66 | 1 doe | Canyon Overlook-Harpers C. road intersection | Thomas Meier | 3.7 |
| 10/6/66 | 1 doe | one-half mile west of Stuntz pond | R. Franzen | 6.5 |
| 10/6/66 | 1 doe | Doc's Valley | R. Franzen | 8.0 |
| 10/12/66 | 1 buck | one-fourth mile east of Doc's Valley | Dudley brothers | 8.0 |
| 10/15/66 | 1 doe | three miles east of Escalante Overlook | hunter report | 12.8 |
| 10/15/66 | 1 buck | killed in Moosehead area-near livestock ponds | Marye Luce | 14.2 |
| 10/16/66 | 1 doe | Escalante Overlook | hunter report | 11.8 |
| 10/16/66 | 1 doe | one-fourth mile south of the Dan Wall cabin | R. Franzen | 4.9 |
| 10/20/66 | 1 doe | 300 yards south of Stuntz pond | R. Franzen | 6.4 |
| 10/20/66 | 1 doe | three-fourths mile northwest of Stuntz pond | R. Franzen | 6.4 |
| 10/20/66 | 1 doe | found dead 300 yards southeast of Stuntz pond | R. Franzen | 6.4 |
| 10/22/66 | 1 buck | killed one-half mile west of Stuntz pond | R. Franzen | 6.5 |
| 10/23/66 | 1 doe | one-half mile southeast of Wilkins cabin | Larry Hanneman | 5.7 |
| 10/28/66 | 1 doe | one-fifth mile northeast of Doug Chew cabin | Ben Trujillo | 5.9 |
| 10/29/66 | 1 doe | 1.5 miles southwest of Doug Chew cabin | Richard McMullen | 7.2 |
| 10/30/66 | 1 doe | 2.5 miles southwest of Doug Chew cabin | R. Franzen | 8.2 |
| 11/16/66 | 1 buck,2 doe | 300 yards west of Rial Chew sheep camp | Thomas Slawson | 6.2 |
| 11/17/66 | 3 doe | 300 yards southwest of Rial chew sheep camp | R. Franzen | 6.2 |
| 11/26/66 | 1 doe | one-half mile southeast of Doug Chew corral | Larry Hanneman | 6.0 |
| 11/28/66 | 1 doe | two miles northwest of Stuntz pond | R. Franzen | 6.2 |
| total: 35 | 44 | | $\bar{X}$ distance = | 7.6 |

Appendix Table 3. Continued

Sightings of deer that returned to the Bench for the winter of 1967:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 11/27/66 | 1 doe | Rial Chew airstrip | McMullen & Franzen | 0 |
| 11/27/66 | 1 doe | near Pat Lynch cave | McMullen & Franzen | 0.7 |
| 2/9/67 | 2 | Rial Chew airstrip | Hanneman & Franzen | 0 |
| 2/10/67 | 5 | Rial Chew airstrip and flats to the north | Doug Chew | 0 to 0.5 |
| 2/21/67 to 4/8/67 | 3 to 8 daily | Many locations in Chew allotment of Yampa Bench | Ben Trujillo | 0 to 2.0 |
| 3/6/67 | 2 | north end of Billiard Table | R. Franzen | 1.0 |
| 4/8/67 | 3 | 100 yards north of Rial Chew airstrip | R. Franzen | 0 |
| 4/9/67 | 3 | 200 yards east of Rial Chew airstrip | R. Franzen | 0 |

Sightings of tagged deer on Blue Mountain during the summer of 1967:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/14/67 | 1 | one-half mile southeast of Canyon Overlook | Lee Wilkins | 5.2 |
| 4/15/67 | 3 | one-half mile southeast of Canyon Overlook | Larry Hanneman | 5.2 |
| 4/15/67 | 1 | found dead 1.5 miles southeast of Canyon Overlook | Joe Hacking | 5.9 |
| 5/1/67 | 3 | near Doug Chew corral | Joe Hacking | 6.3 |
| 5/10/67 | 1 | one-fourth mile southeast of Canyon Overlook | Joe Hacking | 5.1 |
| 5/10/67 | 2 | one mile southeast of Canyon Overlook | Joe Hacking | 5.7 |
| 6/1/67 | 1 | three miles east of Doug Chew sheep corral | Leon Robinson | 6.3 |
| 6/26/67 | 1 doe | two miles southeast of Doug Chew sheep corral | Curly Schurz | 5.9 |
| 7/4/67 | 1 doe | one-half mile south of Canyon Overlook | Charles Johnson | 5.2 |
| 7/11/67 | 1 doe | 0.4 mile south of Canyon Overlook | Larry Hanneman | 5.2 |
| 9/6/67 | 1 doe | BLM water catchment basin on Stuntz Ridge | R. Franzen | 9.5 |
| 10/16/67 | 1 doe | one-half mile southwest of Canyon Overlook | Frank McKnight | 5.3 |
| 10/19/67 | 3 doe | one-half mile west of Stuntz pond | George Chew | 6.0 |
| 10/21/67 | 1 buck | killed on west end of Hoy Mountain | Larry Lee | 12.0 |
| total: 14 | 21 | | $\bar{X}$ = | 6.3 |
| 49 | 65 | | overall $\bar{X}$ = | 7.3 |

Appendix Table 4. Sightings of blue streamered deer tagged in Island Park during the winter of 1967.

Sightings of tagged deer that remained in Island Park during the summer of 1967:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 5/2/67 | 1 doe | near range study exclosures | R. Franzen | 0.2 |
| 5/3/67 | 3 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 5/5/67 | 1 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 5/6/67 | 1 doe | 1.5 miles southeast of ranger station | R. Franzen | 1.7 |
| 6/16/67 | 1 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 6/20/67 | 1 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 6/24/67 | 1 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 7/10/67 | 3 doe | river island: Bobby Hog 1 | R. Franzen | 0.5 |
| 8/27/67 | 1 doe | along Green River by Ruple Ranch | R. Franzen | 0.2 |
| 10/20/67 | 1 doe | Rainbow Park campground | Curly Schurz | 0.2 |

Sightings of tagged deer on summer range:

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 5/8/67 | 1 | 0.5 mile east of Forest Service boundary on Brush Creek Mountain | C. V. McConkie | 18.5 |
| 5/15/67 | 1 | Greendale Junction | Paul Stringham | 15.1 |
| 6/1/67 | 1 doe | Deer Run on the Diamond Mountain Plateau | Buell Bennett | 17.8 |
| 6/5/67 | 1 | Bassett Springs | Buell Bennett | 22.9 |
| 6/14/67 | 1 doe | lower end of Red Castle Trail | Marvin Coons | 24.0 |
| 6/15/67 | 1 doe | where Burnt Creek crosses Utah Highway #44 | Howard Metsker | 22.2 |
| 6/18/67 | 1 | McKee Draw | Lynn King | 25.4 |
| 6/23/67 | 1 | McKee Draw | Jean Stringham | 25.4 |

Appendix Table 4. Continued

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 6/25/67 | 1 | McKee Draw | Lynn King | 25.4 |
| 6/26/67 | 1 | near Cart Creek crossing on Utah Highway #44 | Lowell Thacker | 27.6 |
| 7/1/67 | 2 buck | McKee Draw | Henry Schaefermyer | 25.5 |
| 7/1/67 | 1 doe | Cart Creek crossing | Richard McMullen | 27.7 |
| 7/2/67 | 1 doe | Cart Creek crossing | Lowell Thacker | 27.6 |
| 7/3/67 | 1 | East McKee Draw area | Steve Stringham | 23.5 |
| 7/3/67 | 1 buck | Diamond Mountain Counting corral | Ned Stringham | 19.8 |
| 7/4/67 | 1 | East McKee Draw | Steve Stringham | 23.5 |
| 7/5/67 | 1 | Red Spring | Forest Service | 26.2 |
| 7/6/67 | 1 | Reader Creek | Steve Stringham | 21.0 |
| 7/8/67 | 3 | McKee Springs | Paul Conrad | 20.0 |
| 7/10/67 | 1 doe | Barker Springs | Jess Caldwell | 20.0 |
| 7/10/67 | 1 buck | Richard Peterson property on Blue Mountain | Dave Rasmussen | 12.0 |
| 7/12/67 | 2 doe | Bassett Springs | Curtis Dastrup | 22.8 |
| 7/14/67 | 1 buck | lower portion of Diamond Gulch | Tom Anderson | 13.5 |
| 7/18/67 | 1 doe | East McKee Draw | Bill Davis | 24.5 |
| 7/19/67 | 1 doe | one mile east of East McKee Draw | Howard Allen | 23.0 |
| 7/20/67 | 1 buck | Eagle Creek | Dick Murray | 31.6 |
| 7/21/67 | 1 doe | Cart Creek crossing | Larry Hanneman | 28.0 |
| 7/25/67 | 1 doe | 0.5 mile northwest of Diamond Mtn. Counting corral | R. Franzen | 20.3 |
| 7/25/67 | 1 buck | Dutch John airfield | Clark Warren | 30.6 |
| 7/25/67 | 1 buck | Dutch John Junction | Paulette Welder | 29.0 |
| 8/2/67 | 1 buck | Queant Basin | Sandan | 40.0 |
| 8/4/67 | 1 buck | Eagle Creek crossing | Dick Murray | 31.6 |
| 8/6/67 | 1 doe | found dead near Kabel Hollow | Neil Caldwell | 23.0 |
| 8/12/67 | 1 doe | Little Brush Creek on Forest Service boundary | Klyn Bennett | 19.0 |
| 8/12/67 | 2 doe | 0.25 mile southeast of Diamond Mtn. Counting corral | Klyn Bennett | 19.8 |
| 8/15/67 | 1 doe | Limestone Mountain of Forest Service boundary | George Nay | 20.3 |
| 8/16/67 | 3 doe | Burnt Hollow Draw | Jess Caldwell | 20.1 |

Appendix Table 4. Continued

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 8/18/67 | 1 buck | Farm Creek Mountain | Utah F & G | 44.0 |
| 8/21/67 | 1 buck | Bassett Springs | Clark Warren | 22.9 |
| 8/26/67 | 1 buck | Red Springs | Jim Hill | 26.2 |
| 8/29/67 | 1 buck | Lake Creek crossing | David Jacoby | 25.0 |
| 9/1/67 | 1 buck | Trout Creek Park | Curt Dudley | 31.0 |
| 9/1/67 | 1 buck | Clay Basin | Curt Dudley | 31.8 |
| 9/1/67 | 1 buck | two miles south of the Colton ranger station | Randy Simmons | 21.7 |
| 9/1/67 | 1 buck | Little Brush Creek Gorge | Dick Ufford | 22.0 |
| 9/1/67 | 1 doe | near Brush Creek cave | Ted Mecham | 27.0 |
| 9/7/67 | 1 buck | Aspen Spring | Blain Lunceford | 19.0 |
| 9/10/67 | 1 doe | Diamond Mtn. road intersection with Utah Highway #44 | Darlene Ufford | 22.2 |
| 9/15/67 | 1 buck | Davenport Draw in vicinity of upper Pot Creek | Lonnie Bouren | 24.0 |
| 9/15/67 | 1 doe | Diamond Mountain rim road | Lonnie Bouren | 10.5 |
| 10/12/67 | 1 doe | McKee Draw | Dick Bennett | 25.2 |
| 10/13/67 | 1 doe | Jones Hole road | Utah F & G | 18.0 |
| 10/15/67 | 2 doe | Blair Basin | Albert Slaugh | 15.2 |
| 10/16/67 | 1 doe | Davenport Draw in upper Pot Creek | Alvin Kay | 24.5 |
| 10/17/67 | 1 buck, 2 doe | Aspen Spring | Thomas Seavy | 19.0 |
| 10/19/67 | 2 doe | Diamond Mountain road three corners | Dean Sessions | 19.5 |
| 10/20/67 | 1 doe | Aspen Spring | Thomas Seavy | 19.0 |
| 10/21/67 | 1 doe | killed near Little V on Range Study Exclosure road | Utah F & G | 18.4 |
| 10/21/67 | 1 buck | killed near Little V on Range Study Exclosure road | Utah F & G | 18.0 |
| 10/21/67 | 2 doe | Diamond Gulch | Cordell Jones | 18.0 |
| 10/21/67 | 1 doe | Forest Service boundary on Diamond Mountain road | Lyal Holmes | 18.5 |
| 10/21/67 | 1 doe | last fence on Range Study Exclosures road | Hank Ledington | 17.5 |
| 10/21/67 | 1 doe | Reader Creek crossing on the Diamond Mtn. road | Marion Jones | 21.0 |
| 10/22/67 | 1 doe | Greendale Junction | Lomas Emper | 29.5 |
| 10/22/67 | 1 doe | near Hugh Colton Ranch | Dan Gardner | 18.3 |

Appendix Table 4. Continued

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 10/22/67 | 2 doe | Blair Basin | Albert Slaugh | 15.4 |
| 10/22/67 | 1 doe | killed on Donkey Flat | Earl Huff | 16.0 |
| 10/23/67 | 1 doe | 0.5 miles northeast of the Jackson Ranch | Theron Nay | 18.0 |
| 10/24/67 | 1 doe | Searle property, near Diamond Mtn. rim road | Glade Watkins | 15.0 |
| 10/28/67 | 1 doe | upper section of Pothold Canyon | Keith Campbell | 23.0 |
| total: 70 | 83 | | | $\bar{X}$ = 22.6 |

Appendix Table 5. Sightings of white streamered deer tagged on Harpers Corner during the winter of 1966.

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/9/66 | 1 | near 1966 range reseeding area on Harpers Corner | R. Franzen | 0.5 |
| 4/14/66 | 4 | 0.2 mile south of old radio relay station | R. Franzen | 0.3 |
| 4/18/66 | 1 | 0.3 mile north of Echo Park Overlook | R. Franzen | 0 |
| 4/21/66 | 5 | near old radio relay station | R. Franzen | 0.2 |
| 4/22/66 | 6 | 0.3 mile north of Echo Park Overlook | R. Franzen | 0 |
| 4/29/66 | 7 | 300 yards south of Echo Park Overlook | R. Franzen | 0 |
| 5/1/66 | 1 | 0.5 mile north of Trail Draw | R. Franzen | 0.5 |
| 5/10/66 | 1 | 0.5 mile south of Echo Park Overlook | Frank McKnight | 0.2 |
| 6/19/66 | 1 buck | 0.5 mile south of Echo Park Overlook | Frank McKnight | 0.2 |
| 6/24/66 | 1 doe | one mile south of Echo Park Overlook | Frank McKnight | 0.7 |
| 6/27/66 | 1 buck,1 doe | 0.75 mile south of Echo Park Overlook | Leonard Casterline | 0.5 |
| 9/11/66 | 1 doe | 0.5 mile northwest of Stuntz pond | Richard McMullen | 5.0 |
| 10/5/66 | 1 doe | near old radio relay station | R. Franzen | 0.1 |
| 10/14/66 | 8 doe | circle at end of Harpers Corner road | Larry Hanneman | 0.2 |
| 10/16/66 | 1 doe | 200 yards north of Echo Park Overlook | R. Franzen | 0 |
| 10/22/66 | 1 doe | Echo Park Overlook | Larry Hanneman | 0.1 |
| 10/23/66 | 1 doe | 200 yards north of Echo Park Overlook | R. Franzen | 0 |
| 10/26/66 | 1 doe | at Monument boundary on Harpers Corner road | W. Lunford | 2.7 |
| 11/17/66 | 3 doe | 300 yards north of Echo Park Overlook | R. Franzen | 0 |
| 11/27/66 | 2 doe | 0.25 mile north of Echo Park Overlook | R. Franzen | 0.1 |
| 3/24/67 | 2 doe | circle at end of Harpers Corner road | Larry Hanneman | 0.2 |
| 4/9/67 | 1 doe | 100 yards north of Chew airstrip on Yampa Bench | R. Franzen | 4.2 |
| 4/11/67 | 1 doe | pasture west of Chew Ranch on Yampa Bench | George Chew | 4.1 |
| 4/12/67 | 1 doe | 0.5 mile west of old radio relay station | R. Franzen | 0.5 |
| 5/31/67 | 1 doe | 300 yards north of Echo Park Overlook | Larry Hanneman | 0 |
| 6/18/67 | 1 doe | near range study exclosures on Harpers Corner | Larry Hanneman | 0.2 |
| 6/22/67 | 1 doe | northwest side of Trail Draw | R. Franzen | 0 |

Appendix Table 5. Continued

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 8/21/67 | 1 doe | near old radio relay station | Thomas Hatch | 0.2 |
| 8/28/67 | 1 doe | 100 yards north of Echo Park Overlook | Glade Ross | 0 |
| 10/1/67 | 1 buck | 0.25 mile south of range study exclosures | visitor report | 0.5 |
| 10/16/67 | 1 doe | old radio relay station | Frank McKnight | 0.2 |
| 10/18/67 | 1 doe | 0.25 mile south of range study exclosures | Wayne Welch | 0.5 |
| 10/30/67 | 1 doe | near Echo Park Overlook | Larry Hanneman | 0 |
| 11/15/67 | 3 doe | 0.25 mile north of Iron Springs Overlook | Larry Hanneman | 0.1 |
| Total: 34 | 66 | | $\bar{X}$ = | 0.6 |

Appendix Table 6. Sightings of red streamered deer tagged on the Split Mountain range during the winter of 1965.

| Date | No. Seen | Location | Observer | Distance from tagging site (air miles) |
|---|---|---|---|---|
| 4/65 | 1 doe | found dead at Jensen, Utah | Utah F & G records | 6.2 |
| 11/1/65 | 1 buck | killed on southeast end of Asphalt Ridge | Utah F & G records | 15.0 |
| 12/17/65 | 3 | near Red Rock nature trail | James Todd | 0 |
| 2/20/66 | 2 | near Split Mountain campground | Wayne Welch | 0 |
| 7/28/66 | 1 doe | Prairie Dog Town on Split Mountain area | W. Cashion | 0 |
| 10/8/66 | 1 doe | near Green River campground | Don Durphy | 0 |
| 11/1/66 | 1 doe | near Split Mountain campground | Wayne Welch | 0 |
| 11/20/66 | 1 doe | near Green River campground | Wayne Welch | 0 |
| 1/11/67 | 2 doe | near Green River campground | Wayne Welch | 0 |
| 1/17/67 | 4 doe | near Green River campground | Wayne Welch | 0 |
| 4/3/67 | 3 | near Green River campground | C. G. McKnight | 0 |
| 6/21/67 | 1 doe | Brush Creek road 0.25 mile west of Utah Highway #149 | Larry Hanneman | 4.5 |
| 11/13/67 | 1 doe | near Green River campground | George Cooksey | 0 |
| Total: 13 | 22 | | $\bar{X}$ = | 2.0 |

Appendix Table 7. Interpretation of the symbols used in the vegetative composition and density tables.

Browse species:

| Symbol | Species | Symbol | Species |
|---|---|---|---|
| Arno | Artemisia nova | Junip | Juniperus spp. |
| Artrt | Artemisia tridentata | Pied | Pinus edulis |
| Atco | Atriplex confertifolia | Putr | Purshia tridentata |
| Cemom | Cercocarpus montanus | Savev | Sarcobatus vermiculatus |
| Chna | Chrysothamnus nauseosus | Sylo | Symphicarpos longiflorus |
| Chvi | Chrysothamnus viscidiflorus | Tenu | Tetradymia nuttallii |
| Eula | Eurotia lanata | Tesp | Tetradymia spinosa |
| Gusa | Gutierrezia sarothrae | | |

Forb species:

| | | | |
|---|---|---|---|
| Asca | Aster canescens | Gico | Gilia congesta |
| Asdu | Astragalus duchesnensis | Gilia | Gilia spp. |
| Asen2 | Aster engelmannii | Lepu2 | Leptodactylon pungens |
| Aster | Aster spp. | Lile2 | Linum lewisii |
| Astra | Astragalus spp. | Lupin | Lupinus spp. |
| Basa | Balsamorhiza sagittata | Oeca | Oenothera caespitosa |
| Cabu2 | Capsella bursa pastoris | Pemo | Penstemon moffattii |
| Cach3 | Castilleja chromosa | Penst | Penstemon spp. |
| Canun | Calochortus nuttallii | Pery | Penstemon rydbergii |
| Copa2 | Comandra pallida | Phdi | Phlox diffusa |
| Crke | Cryptantha kelseyana | Phho | Phlox hoodii |
| Crpa2 | Cryptantha pattersonii | Pofr3 | Potentilla fruticosa |
| Dene | Delphinium nelsonii | Sakat | Salsola kali tenuifolia |
| Erca | Erigeron caespitosus | Senec | Senecio spp. |
| Eriog | Eriogonum spp. | Spco | Sphaeralcea coccinea |
| Ermi | Eriogonum microthecum | Stlo3 | Streptanthella longirostris |
| Erut | Erigeron utahensis | Taof | Taraxacum officinale |
| Geran | Geranium spp. | Trlo | Trifolium longipes |

Grasses:

| | | | |
|---|---|---|---|
| Agda | Agropyron dasystachyum | Hojuj | Hordeum jubatum |
| Aggr2 | Agropyron griffithii | Mesp | Melica spectabilis |
| Agrop | Agropyron spp. | Orhyh | Oryzopsis hymenoides |
| Agsp | Agropyron spicatum | Poa | Poa spp. |
| Brtet | Bromus tectorum | Pocu2 | Poa cusickii |
| Feoc | Festuca octoflora | Sihy | Sitanion hystrix |
| Feov | Festuca ovina | Spai | Sporobolus airoides |
| Festu | Festuca spp. | Stco3 | Stipa comata |

These symbols are used by the U.S. Forest Service and are taken from Plummer, Monsen, and Christensen, 1966.

Appendix Table 8. Utilization of browse species on winter range areas within Dinosaur National Monument, as determined by actual measurement, 1966 and 1967.

| Location | Species | Inclusive dates | Number of plants | Total fall length (cm) | Total spring length (cm) | Utilization percent |
|---|---|---|---|---|---|---|
| Island Park: | | | | | | |
| deer-use-only exclosure | big sage | 12/19/65 to 4/3/66 | 33 | 1,801 | 1,596 | 11.4 |
| open area between exclosures | big sage | 12/20/65 to 4/3/66 | 40 | 2,125 | 1,975 | 7.1 |
| deer-use-only exclosure | big sage | 11/23/66 to 4/11/67 | 33 | 672 | 446 | 33.7 |
| open area between exclosures | big sage | 11/24/66 to 4/11/67 | 40 | 1,222 | 849 | 30.5 |
| Yampa Bench: | | | | | | |
| Chew airstrip | mountain mahogany | 11/27/66 to 4/9/67 | 23 | 1,650 | 482 | 70.8 |
| Split Mountain: | | | | | | |
| Red Rock trail | big sage | 11/25/65 to 3/19/66 | 15 | 843 | 676 | 19.8 |
| Red Rock trail | big sage | 11/18/66 to 4/14/67 | 12 | 514 | 294 | 42.8 |
| Red Rock trail | mountain mahogany | 11/26/66 to 3/19/66 | 8 | 595 | 523 | 12.1 |
| Red Rock trail | mountain mahogany | 11/18/66 to 4/14/67 | 7 | 488 | 313 | 35.9 |
| Harpers Corner: | | | | | | |
| transect #18 | big sage | 11/21/66 to 4/12/67 | 29 | 1,082 | 978 | 9.6 |
| transect #D-50 | big sage | 11/21/66 to 4/12/67 | 13 | 372 | 368 | 1.1 |

Appendix Table 9. The "Cole" assessment of range condition and utilization at the pellet group transects on Dinosaur National Monument, April 7-12, 1967.

| Transect No. | Species | Form Class Percentages | Age Class Percentages | Estimated Leader Use % | No. of dead plants per 50 living |
|---|---|---|---|---|---|
| Yampa Bench: | | | | | |
| 1 | big sage | 100% class 3 | 6% class 2, 24% class 3 70% class 4 | 40.5 | 44 |
| 2 | big sage | 100% class 3 | 38% class 2, 4% class 3 58% class 4 | 13.2 | 45 |
| 3 | big sage | 12% class 2, 88% class 3 | 30% class 2, 14% class 3, 56% class 4 | 24.1 | 60 |
| 4 | big sage | 100% class 3 | 2% class 2, 98% class 4 | 55.9 | 70 |
| 5 | big sage | 4% class 2, 90% class 3, 2% class 4, 2% class 5, 2% class 6 | 6% class 2, 75% class 3 18% class 4 | 10.2 | 11 |
| 6 | big sage | 16% class 2, 84% class 3 | 76% class 3, 24% class 4 | 0.2 | 19 |
| 7 | big sage | 20% class 2, 64% class 3, 12% class 5, 4% class 6 | 100% class 3 | 24.0 | 28 |
| 7 | mountain mahogany | 8% class 1, 64% class 2 28% class 3 | 80% class 3, 20% class 4 | 6.4 | 8 |
| 8 | big sage | 14% class 1, 44% class 2 42% class 3 | 12% class 2, 56% class 3, 32% class 4 | 0.1 | 20 |
| D-401 | mountain mahogany | 6% class 1, 28% class 2, 60% class 3, 4% class 5, 2% class 6 | 100% class 3 | 1.1 | 6 |
| Deerlodge: | | | | | |
| D-60 | big sage | 2% class 1, 4% class 2, 75% class 3, 18% class 6 | 16 % class 2, 26% class 3, 58% class 4 | 39.3 | 12 |
| Island Park: | | | | | |
| 9 | big sage | 14% class 1, 38% class 2, 48% class 3 | 8% class 2, 80% class 3 12% class 4 | 16.3 | 24 |

Appendix Table 9. Continued

| Transect No. | Species | Form Class Percentages | Age Class Percentages | Estimated Leader Use % | No. of dead plants per 50 living |
|---|---|---|---|---|---|
| Island Park: | | | | | |
| 10 | big sage | 4% class 2, 96% class 3 | 4% class 2, 80% class 3 16% class 4 | 17.5 | 17 |
| 11 | big sage | 24% class 1, 34% class 2 42% class 3 | 20% class 2, 60% class 3 20% class 4 | 16.4 | 17 |
| Split Mountain: | | | | | |
| 12 | big sage | 6% class 2, 94% class 3 | 6% class 2, 94% class 3 | 18.7 | 9 |
| 13 | big sage | 12% class 2, 88% class 3 | 98% class 3, 2% class 4 | 7.0 | 8 |
| 14 | big sage | 6% class 1, 8% class 2, 86% class 3 | 2% class 2, 96% class 3, 2% class 4 | 16.6 | 8 |
| Harpers Corner: | | | | | |
| 18 | big sage | 28% class 1, 40% class 2, 32% class 3 | 38% class 2, 42% class 3, 20% class 4 | 2.3 | 7 |
| 19 | big sage | 2% class 1, 6% class 2, 90% class 3, 2% class 6 | 12% class 2, 40% class 3, 48% class 4 | 2.1 | 11 |
| 20 | big sage | 2% class 2, 98% class 3 | 10% class 2, 28% class 3, 62% class 4 | 0.2 | 5 |
| D-50 | big sage | 2% class 1, 42% class 2, 56% class 3 | 6% class 2, 58% class 3, 36% class 4 | 1.7 | 13 |

| Form Classes | | Form Classes | | Age Classes | |
|---|---|---|---|---|---|
| 1 | all available, little or no hedging | 4 | partly available, little or no hedging | 1 | seedling |
| 2 | all available, moderately hedged | 5 | partly available, moderately hedged | 2 | young |
| 3 | all available, severely hedged | 6 | partly available, severely hedged | 3 | mature |
| | | | | 4 | decadent |

Appendix Table 10. Type of deer hunting seasons held on Colorado deer herd units 1, 2, and 10 from 1950 to 1967.

| Year | Unit 1 Length (days) | Unit 1 Type | Unit 2 Length (days) | Unit 2 Type | Unit 10 Length (days) | Unit 10 Type |
|---|---|---|---|---|---|---|
| 1950[a] | 17 | 2 deer | 17 | 1 deer AO | 17 | 1 deer AO |
| 1951 | 17 | 2 deer | 17 | 1 deer AO | 17 | 1 deer AO |
| 1952 | 17 | 2 deer | 17 | 1 deer | 17 | 1 deer AO |
| 1953 | 17 | 2 deer | 17 | 1 deer | 17 | 1 deer |
| 1954 | 17 | 2 deer | 17 | 1 deer | 17 | 1 deer |
| 1955 | 17 | 2 deer | 17 | 4 deer | 17 | 2 deer |
| 1956 | 17 | 2 deer | 17 | 4 deer | 17 | 4 deer |
| 1957 | 34 | 4 deer | 34 | 4 deer | 34 | 4 deer |
| 1958 | 19 | 4 deer | 19 | 1 deer | 19 | 2 deer |
| 1959 | 18 | 4 deer | 18 | 1 deer | 18 | 2 deer |
| 1960[b] | 27 | 4 deer | 19 | 2 deer | 20 | 2 deer |
| 1961 | 18 | 4 deer | 18 | 2 deer | 18 | 3 deer |
| 1962 | 16 | 1 deer | 16 | 1 deer | 16 | 1 deer |
| 1963 | 20 | 3 deer | 20 | 2 deer | 20 | 3 deer |
| 1964 | 20 | 2 deer | 20 | 1 deer | 20 | 1 deer |
| 1965 | 21 | 1 deer | 21 | 1 deer | 21 | 1 deer |
| 1966 | 19 | 1 deer | 17 | 1 deer | 17 | 1 deer |
| 1967 | 20 | 1 deer | 20 | 1 deer | 20 | 1 deer |

AO = antlered only

[a] 1950-59 seasons opened on October 15

[b] 1960-67 seasons opened on the third Saturday in October

Appendix Table 11. Type of deer hunting seasons held on Utah deer herd unit 26 (Ashley-Vernal) from 1950 to 1967.

| Year | Season length | Type of season |
|---|---|---|
| 1950 | not known | 1 deer either sex + 500 antlerless special permits |
| 1951 | Oct. 20-30 | 1 deer either sex |
| 1952 | Oct. 20-30 | 1 deer either sex |
| 1953 | Oct. 17-27 | 1 deer either sex |
| 1954 | Oct. 23-Nov. 2 | 1 deer either sex |
| 1955 | Oct. 22-Nov. 1 | 1 deer either sex + 200 antlerless special permits |
| 1956 | Oct. 20-30 | 1 deer either sex + 750 antlerless special permits |
| 1957 | Oct. 5-6, 12-13 19,Nov.3, Nov.9-11, 16-17 Blue Mountain area only | 1 deer either sex + 1 antlerless permit available for each hunter |
| 1958 | Oct. 18-28 | 1 deer either sex + 300 antlerless special permits |
| 1959 | Oct. 17-27 | 1 deer either sex + 350 antlerless special permits |
| 1960 | Oct. 20-Nov. 1 & Nov. 11-13 | 1 deer either sex + 400 antlerless special permits |
| 1961 | Oct. 20-30 | 1 deer either sex + 200 antlerless special permits |
| 1962 | Oct. 20-30 | 1 deer either sex |
| 1963 | Oct. 19-29 | 1 deer either sex |
| 1964 | Oct. 17-27 | 1 deer either sex |
| 1965 | Oct. 23-Nov. 2 | 1 deer either sex |
| 1966 | Oct. 22-Nov. 1 | 1 deer - bucks only |
| 1967 | Oct. 21-31 | 1 deer either sex |

# VITA

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