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A PROGRESS REPORT

N O R T H R I M D E E R H E R D

GRAND CANYON NATIONAL PARK

GRAND CANYON NATIONAL PARK
GRAND CANYON, ARIZONA

DECEMBER 1964

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S U M M A R Y

The North Kaibab deer herd, of which the North Rim herd is a part, has had an interesting and well-known history. A deer population explosion which occurred during the 1920's created poor range conditions which remain in evidence today. Because of past heavy range use, proper range management limits numbers of deer utilizing the range, both on the Kaibab National Forest and the North Rim of Grand Canyon National Park. Some areas on the North Rim need to be observed carefully during future years to insure that overpopulations of deer do not occur again, and thereby insure the normal healthy growth and reproduction of range plants and of the animals themselves.

This report describes in detail the range and deer studies that have been in progress for the past five years. Studies have included the establishing and reading of line-point transects to determine ground and overstory cover; semi-annual browse plant growth and deer utilization checks; the installation of permanent pellet-counting plots and annual counts; and deer herd composition counts to determine adequacy of the buck population for breeding purposes and the winter loss of fawns.

The study also includes the recommended action plan and concise management plan, based upon maximum population criteria. It is recommended that this plan be followed, with National Park Service personnel accomplishing the field work. The cooperation of the Arizona Game and Fish Department should be enlisted to attempt proper harvest of the deer migrating out of the park. Where this harvest fails to adequately control deer numbers in the park, direct control measures should be taken by National Park Service personnel in those areas indicating the need.

Prepared by:

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Park Biologist

A PROGRESS REPORT

N O R T H R I M D E E R H E R D

GRAND CANYON NATIONAL PARK

Introduction

Deer populations and range use on the North Rim District of Grand Canyon National Park have been more or less consistent with that of the entire North Kaibab Plateau over the past fifty years. Over-utilization of browse on the North Rim during the early 1900's is still evident, and deer numbers today remain limited by this early use. Because late hunting seasons on the North Kaibab affect only the deer which migrate out of the park to the north, some form of management for the south-moving park deer may be necessary. Efforts to harvest park deer outside the park should be continued.

The purpose of this report is to illustrate the need for deer and range management on the North Rim, and to recommend procedures for determining amounts and methods of deer population controls.

Concentrated studies of the North Rim deer herd were begun in 1953 with work being accomplished on the determination of established deer migration patterns. Since that time, additional studies including range composition, browse use, herd composition, herd production and survival, and population trends have been in progress. Results of this work are presented in this report.

Location and Description of Range

The North Rim of Grand Canyon National Park was established from lands formerly included in the Kaibab National Forest and includes approximately 363,000 acres of rugged terrain stretching from the Colorado River at 2,400 feet above sea level north to the North Kaibab National Forest at over 9,000 feet. The great differences in elevations cause the presence of several cover types which are consistent with life zones progressing from the Lower Sonoran near the river to the Canadian zone in the higher elevations.

Because the deer carrying capacity of the North Rim is limited by the summer and intermediate ranges, studies have been restricted mostly to those areas. Included in this report, therefore, are results of studies which have taken place on top of the plateau; cover types have included deep forests of ponderosa pine, fir, spruce, and aspen; open meadows and meadow margins; pinyon and juniper; and cliffrose, sage, and mahogany.

HISTORY OF THE AREA

Past Land Use. The first known inhabitants of the North Kaibab area, of which the North Rim of Grand Canyon National Park is a part, were the Kaibabits Indians, a division of the Piute Indians of Southern Utah. This tribe met in the fall with Navajos and other Southwestern tribes to trade, the main trading item being deer hides. This would indicate that for many years deer have been found in the area in moderate to large numbers. Writings resulting from interviews of "old timers" claim that the Kaibabits did most of the hunting, that hunters of this tribe did not number more than 200, and that the probable harvest of deer did not amount to over 800 per year. No attempt has been made to estimate the deer population prior to 1904, but because of the Indian's attitude toward predators, it would be safe to assume that the population was kept at or below the carrying capacity. The cougar was not molested by the Indians, and only occassionally did they kill bobcats or coyotes. The Navajos never killed coyotes because of a religeous taboo.

The first whites to enter the North Kaibab were Mormon pioneers from the north, arriving in the late 1850's and finding the area rich in both Indian tradition and economic value. Major John Wesley Powell began the first government exploration of the country north of the Grand Canyon in 1870, the year following his first descent of the Colorado River. In the written report of 1875 he says, "the most elevated portion of the country is a central belt, about twenty-five or thirty miles in width and about eighty miles in length. This is called by the Indians Kaibab, or 'mountain lying down', and we have adopted the name."

Records indicate that the North Kaibab has been an important livestock area for the past eighty years. The earliest use known was by feral or semi-wild cattle which wandered in from herds in the surrounding lowlands about 1882. In 1885, two thousand cattle were placed on this range, and by 1887 at least 200,000 sheep, 20,000 cattle, and "many" horses were using the

range and surrounding desert. Information gained from stockmen indicates that at that time the Kaibab was considered as having an unlimited supply of forage for livestock, while, in fact, the plateau was already suffering from its first known overpopulation in excessive herds of cattle, horses, and sheep.

The proclamation of February 20, 1893, by President Benjamin Harrison created the Grand Canyon Forest Reserve which included the Kaibab Plateau, the Grand Canyon, and the adjoining area on the South Rim. On November 28, 1906, President Theodore Roosevelt created the Grand Canyon National Game Preserve, which included approximately the same territory as is now in the Kaibab National Forest and the Grand Canyon National Park north of the Colorado River. He also created the Grand Canyon National Monument (now the park) by proclamation of January 11, 1908, and by the same means established the name of Kaibab National Forest for the area north of the Grand Canyon, July 21, 1908. Grand Canyon National Park was created by an Act of Congress on February 26, 1919 and included approximately the southern one-fourth of the Plateau. With the 46,000 acres added in 1927, the North Rim of the park consisted of 363,000 acres, and the Kaibab National Forest north of the Colorado River, 706,000 acres. Since that time, little or no livestock range use has occurred on lands controlled by the National Park Service, and it is these lands with which we will be concerned in this report.

Deer Numbers. Although this report concerns mainly park lands, it is necessary to review early attempts to manage game on the North Kaibab to determine reasons for the very apparent low carrying capacity within the park at present.

Prior to the 1880's the Indians, predators, and explorers, unchecked as they were, accomplished the needed deer population controls simply by hunting for food and hides. According to early-day records, the range could not have been in better condition, and there was game for all. Although the preserve established in 1906 was intended to conserve the deer herd, it was the first act in a long line of mistakes, so far as deer and range were concerned. Along with the establishment of the preserve came the regulation that hunting be prohibited, that the sheep herds be markedly decreased, and that predatory animal numbers be severely cut. From 1906 to 1931, seven hundred eighty-one cougars, 30 wolves, 4,889 coyotes, and 554 bobcats were trapped or shot. In addition, from 1931 - 1939 sport hunting resulted in the killing of 35 additional cougars, and fur hunting an additional 2,499 coyotes and 309 bobcats. This work caused the extermination of

the wolf, and definite reduction of the other species. The decrease in competition for forage, the check on natural enemies, and the prevention of killing by man caused a population explosion in the deer herd on this ideal deer range. During the 18 years following 1906 the increase was allowed to continue without any check whatsoever, and by 1924 the estimated 4,000 deer had increased to an enormous herd of near 100,000. At this point, the peak was reached, the range depleted, and the deer population started downhill. Deer died by the thousands of malnutrition and related causes. It was estimated that about 60 percent of the herd died during the winters of 1924-25 and 1925-26.

Hunting on the National Forest began in 1924, both sport hunting by permit and by government employees. Public hunting continues to this day. Populations of deer decreased to 20,000 by 1929, but the range had been so severely damaged that 20,000 was an excessive population from the standpoint of forage conditions. The herd continued to decrease, because of both hunting and starvation loss, until in 1939 it numbered 10,000 deer. As of 1965, it is generally agreed by wildlife and range technicians that between 10,000 and 12,000 is the acceptable herd size for available feed. The objective, therefore, is to hold the population at about that level until carrying capacities increase.

PRESENT RANGE SITUATION

Plant Associations. Generally, the North Rim forest is composed of varying types of trees in stands considered to be too dense to produce good browse. To a lesser degree, there occur stands where browse is plentiful. Large meadow areas produce adequate grazing stands of perennial and annual grasses and forbs; although, many of these meadows are being invaded by surrounding forest trees. Probably the most important areas, and the most over-utilized by deer, are the points which jut into the canyon. These are covered by cliffrose, sage, mahogany, and pinyon and feed deer that migrate both into the canyon and to the North Kaibab intermediate and winter ranges. According to the 1953 migration study by Bendt (unpublished) approximately one-third of the North Rim deer herd does not migrate out of the park to hunting areas. These would be the deer which inhabit the overbrowsed promontories spoken of above.

Table I shows the ground cover composition of 43 transects placed at random over the entire North Rim. The next table (Table II) illustrates the differences between transects in the timber-meadow types and those on the points jutting into

the canyon. By studying these tables it can easily be noted that the bulk of the deer browse plants on the North Rim occur on the ten plots which are usually available year-long. These plots are located on open points along the rim.

TABLE I

GROUND COVER COMPOSITION PERCENTAGE
North Rim - 1961

	Percent Ground Cover	Total	Percent Living Ground Cover	Total
Non-Productive				
Bare	4.1			
Rock	2.6			
Erosion Pavement	2.4			
Litter	59.6	68.7		
Vegetative Cover				
Annual Grass	0.0		0.0	
Annual Weeds	4.7		16.3	
Perennial Grass	9.5		32.6	
Mosses, etc.	0.7		2.3	
Cliffrose	1.7		5.9	
Sagebrush	1.6		5.6	
Rabbitbrush	0.3		1.1	
Snowberry	0.1		0.3	
Buckwheat	0.2		0.9	
Cactus	0.1		0.2	
Yucca	0.0		0.0	
Bracken	0.9		3.0	
Oregon Grape	0.2		0.6	
Manzanita	0.5		1.8	
Mushroom	0.1		0.2	
Ponderosa Pine *	1.6		5.3	
Fir *	2.8		9.7	
Spruce *	2.3		7.8	
Aspen *	0.5		1.7	
Locust *	0.5		1.8	
Gambel Oak *	0.2		0.9	
Pinyon *	0.1		0.3	
Miscellaneous	0.5	29.1	1.7	100.0
Dead Cover				
Cliffrose	0.4			
Sagebrush	0.3			
Rabbitbrush	0.1			
Manzanita	0.1			
Ponderosa Pine *	0.1			
Fir *	0.6			
Spruce *	0.1			
Aspen *	0.2			
Locust *	0.1			
Gambel Oak *	0.2	2.2		
Totals		100.0		100.0

* Understory only; does not include plants or parts of plants above five feet.

TABLE II

GROUND COVER COMPOSITION PERCENTAGE
North Rim - 1961

	Summer Range Percent Ground Cover 33 transects	Total	Possible Year-long Range Percent Ground Cover 10 transects	Total
Non-Productive				
Bare	3.0		7.8	
Rock	2.2		3.8	
Erosion Pavement	1.2		6.4	
Litter	64.8	71.2	42.4	60.4
Vegetative Cover				
Annual Weeds	5.8		1.1	
Perennial Grass	8.9		11.6	
Mosses, Lichens, etc.	0.9		0.0	
Cliffrose	0.0		7.4	
Sagebrush	0.0		7.0	
Rabbitbrush	0.0		1.4	
Snowberry	0.1		0.0	
Buckwheats	0.0		1.0	
Cactus	0.0		0.3	
Yucca	0.0		0.0	
Bracken	1.2		0.0	
Oregon Grape	0.0		0.7	
Manzanita	0.7		0.0	
Mushroom	0.1		0.0	
Ponderosa Pine*	1.7		1.1	
Fir*	3.5		0.4	
Spruce*	3.0		0.0	
Aspen*	0.6		0.0	
Locust*	0.6		0.3	
Gambel Oak*	0.0		1.0	
Pinyon Pine*	0.0		0.4	
Miscellaneous	0.3	27.4	1.3	35.0
Dead Cover				
Cliffrose	0.0		1.6	
Sagebrush	0.0		1.5	
Rabbitbrush	0.0		0.1	
Manzanita	0.2		0.0	
Ponderosa Pine*	0.1		0.0	
Fir*	0.8		0.0	
Spruce*	0.0		0.0	
Aspen*	0.2		0.0	
Locust*	0.1		0.0	
Gambel Oak*	0.0	1.4	1.2	4.6
Grand Total		100.0		100.0

* Understory only; does not include plants or parts of plants above five feet.

TABLE III

FORAGE FORM CLASS PERCENTAGES
North Rim - 1961

	Cliffrose	Sagebrush	Aspen	Locust
Total Plants	35	45	17	18
Form Class*				
1	0	4	89	50
2	20	24	11	33
3	26	72	0	17
4	0	0	0	0
5	9	0	0	0
6	45	0	0	0
Total	100	100	100	100

* Form class description:

1 - Available, little or no hedging.
2 - Available, moderately hedged.
3 - Available, heavily hedged.
4 - Partly available, little or no hedging.
5 - Partly available, moderately hedged.
6 - Partly available, heavily hedged.
7 - Mostly unavailable.

TABLE IV

FORAGE AGE CLASS PERCENTAGES
North Rim - 1961

Species	Seedling	Young	Mature	Decadent*	Total
Cliffrose	0	11	63	26	100
Sagebrush	0	0	84	16	100
Aspen**	16	84	0	0	100
Locust**	28	72	0	0	100

* At least 25% of crown dead. Plant not dead, but possibly dying.

** Understory only.

TABLE V

LIVING OVERSTORY PERCENTAGES
North Rim - 1961

	Percent Overstory by Species	Percent of Area Covered by Species*
Ponderosa Pine	51.8	20.6
Fir	8.9	3.5
Spruce	11.7	4.7
Aspen	26.5	10.5
Locust	0.5	0.2
Gambel Oak	0.6	0.2
Pinyon Pine	0.0	0.0
Total Percentage	100.0	39.7

* Useful in determining changes in the range.

Transect Work. Forty-two line point and forage transects were installed on the North Rim in August, 1959. In August, 1961, the year following the Saddle Mountain fire, another transect was installed in the fire area, bringing the total number to 43. These transects were placed at random by mileage along main roads and fire roads. There are two objects to the placement of permanent transects, the first being the determination of ground and overstory cover; periodic reading of the transects, probably each five years, will indicate changes in cover caused by overbrowsing, invasion, fire, insect damage, and other decimating factors. The second purpose is to provide guides to the location of plants being measured to determine plant growth, plant deaths, and browse utilization by deer. The forage surveys are run twice a year with the fall measurements providing data on growth and summer browsing, and the spring surveys giving data on total year's use.

Results of the studies begun in 1959 indicate that the key forage species is cliffrose (Cowania mexicana var. stanisburianna). This was determined by the heavy use by deer of this plant, and by the fact that it is the easiest plant to measure and estimate use. A key species is generally considered to be the species having these characteristics, and is an indicator of the use of other plants to a greater or smaller degree. The naming of a key species does not necessarily mean that it is the most numerous nor most important food plant. Utilization by deer of forage plants has been recorded since the study began in 1959. Some early records indicating extremely heavy use are available, but in most cases the readings were taken from plants chosen by their overbrowsed appearance and not on a random sample basis. They are, therefore, considered biased, and are not included in this report. Tables VI, VII, and VIII present data collected on percent utilization of cliffrose and sagebrush, utilization by use class, and utilization indices.

TABLE VI

AVERAGE PERCENTAGE UTILIZATION OF BROWSE PLANTS
North Rim

Year	Cliffrose	Sagebrush
1959-60	43.3	0.4
1960-61	4.8	0.0
1961-62	3.6	0.1
1962-63	2.2	0.6
1963-64	2.[illegible]	0.0

TABLE VII

DISTRIBUTION OF UTILIZATION
Percentage of Total Plots in Each Use Class
Spring - North Rim

Percentage Utilization Classes		Cliffrose				
		1959-60	1960-61	1961-62	1962-63	1963-64
0 - 24.9%	29	100	100	98	98	
25 - 49.9%	43	0	0	0	2	
50 - 74.9%	14	0	0	2	0	
75%	14	0	0	0	0	

TABLE VIII

CLIFROSE UTILIZATION INDICES*
North Rim

	1959-60	1960-61	1961-62	1962-63	1963-64
Average Leader Length	2.0"	3.8"	2.8"	2.5"	1.2"
% Use	42.3%	4.8%	3.6%	2.2%	2.8%
Inches Taken (Indices)	.85"	.18"	.10"	.06"	.03"

* Indices determined by multiplying average leader length by percent use.

THE DEER HERD

Pellet Transects. Because the pellet count reflects to a greater degree the deer use of range than any other method of counting, it was decided that this method would be utilized on the North Rim. During the summer of 1960 twenty pellet-counting transects were installed in conjunction with 20 of the forage survey transects. In 1961 another pellet transect was added in the Saddle Mountain burn, bringing these transects to a total of 21.

Each transect is composed of ten stakes, placed one chain apart, in a line running off the end of the forage transect. Using a chain 11 feet, 9 inches long, a circle is circumscribed around each stake and pellet groups within the circle are counted and thrown out of the circle. Each circle contains .01 of an acre, the ten circles in each transect adding up to .1 acre. From these counts we can determine pellet groups per acre and deer-days-use per acre. Differences between these figures from year to year indicate deer population trends.

Data covering results of these studies are presented in Table IX and indicate that since the counts began in 1960-61 a decrease in the deer herd has occurred. This has been borne out to some extent by forage survey results, as well.

TABLE IX

PELLET COUNT DATA
North Rim

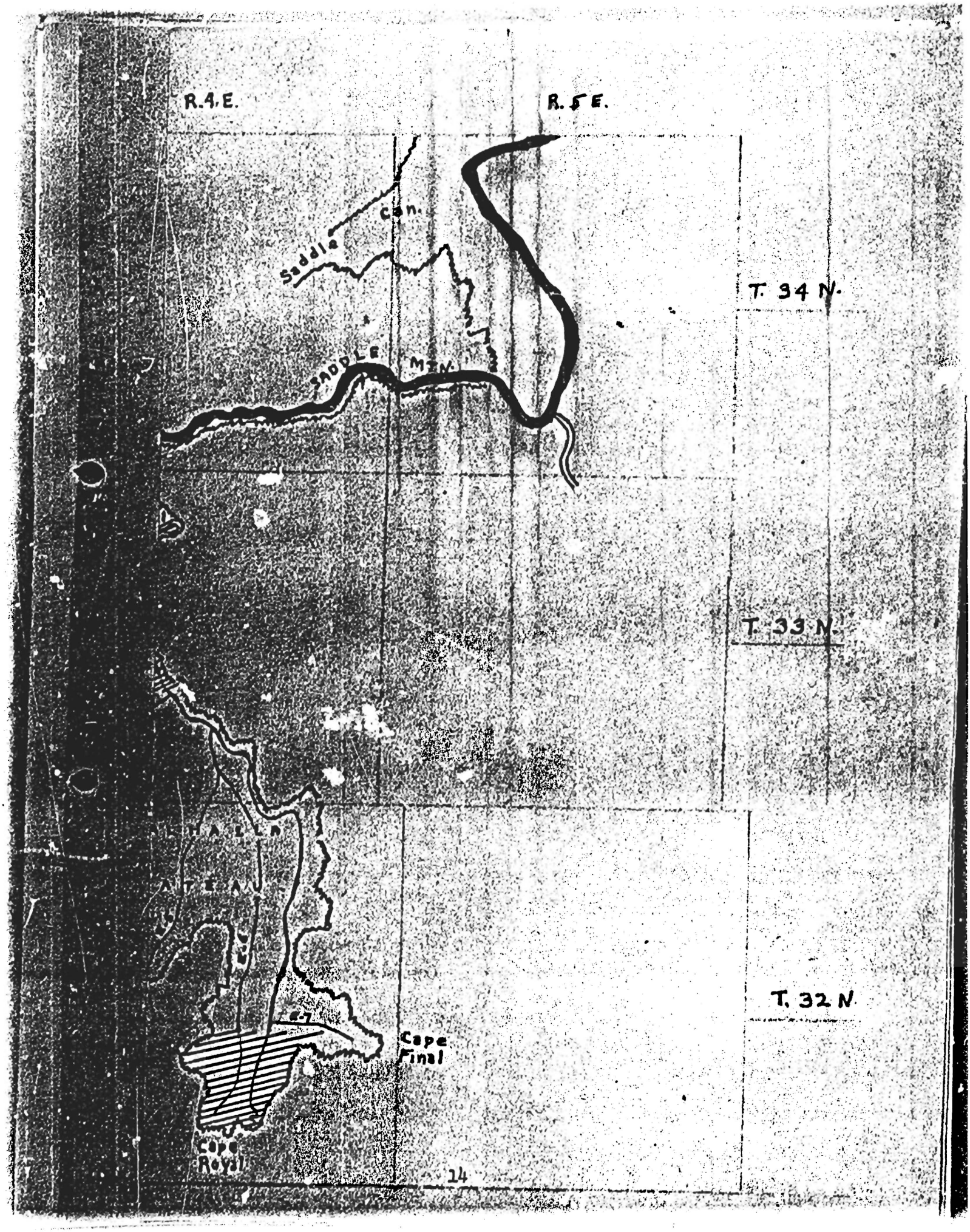
Year	Pellet Groups per Acre	Deer-Days-Use per Acre*
1960-61	362.6	27.8
1961-62	117.6	9.0
1962-63	70.5	5.4
1963-64	25.7	2.0

* Converted on the basis of 13 pellet groups per deer per day.

The 1961-62 distribution of deer on the range, as indicated by numbers of pellet groups on the ground, is shown in Figure 1. Since the 1961-62 survey, deer numbers have decreased until in 1964 none of the transects indicated more than ten deer-days-use per acre, and all areas were considered to be less than fully stocked. The ten deer-days-use factor may or may not be the maximum allowable deer population; annual studies for many years will be needed to determine the proper use figure.

In all of the areas marked as over-populated in 1961-62 on Figure 1 it is possible and probable that deer spend much of the winter. These would be deer that are unavailable to hunters outside the park during regular deer seasons.

Herd Composition. Deer herd condition data are gathered each fall and spring through the use of herd composition counts. Buck:doe and doe:fawn ratios are determined each fall if sample counts are sufficient. These figures are indicators of the proper size buck herd and the fawn production of the past summer. Spring counts of the does and fawns show the loss of fawns through the winter. Because of snow conditions and the migration dates of this herd, composition counts must be made later in the spring and earlier in the fall than is customary on most ranges; but it is felt the count dates are adequately spaced to present accurate information if a representative sample is obtained. In many cases, however, the spring count has not netted a sufficient sample


R.4.E.
R.5E.
Saddle Can.
SADDLE MTN.
T. 34 N.
T. 33 N.
HALF
T. 32 N.
Cape Final
Cape Royal

because of the later arrival of the herd. Mid-summer counts are not accurate because of the nearness of the fawning season and the hermit-like attitude of the deer during that period. Consequently, Table X lists only the fall ratios. The table indicates that the buck herd has been adequate at all times, and that fawn production, except in 1962 and 1964 has been as high as could be expected for the range condition.

TABLE X

NORTH RIM HERD COMPOSITION
Number per 100 Does

Fall	Bucks	Fawns
1953	21	70
1954	--	--
1955	14	40
1956	28	103
1957	28	72
1958	--	--
1959	28	67
1960	20	57
1961	38	75
1962	13	24
1963	64	72
1964	36	29

Migration. Deep snow and severe cold weather make deer migration mandatory. Generally, no deer inhabit the higher areas of the North Rim from November to May or June, and highest concentrations appear in July, August, and September. Because elevations and snow conditions vary over the entire North Rim, it is necessary to discuss areas separately.

Summer Range Only. This area includes most of the more northerly high elevation spruce-fir-aspen type of forest where browse plants are in the minority. Deer in this part of the park feed mainly on grasses, forbs, and mushrooms. Migration patterns from these areas are generally to the north and west into winter ranges in the Kaibab National Forest. An estimated two-thirds of the deer which summer in the park pass through hunting areas in the North Kaibab to reach their winter ranges. Substantial numbers are harvested by hunters when deer seasons are set late enough in the fall.

All-Year Range. Spring and fall pellet counts over the entire North Rim have provided interesting data regarding seasons of use by deer. A few of the transects, principally those in cliffrose and sagebrush areas on points jutting out into the canyon to the south, show higher pellet counts between October and May than between May and October, thus indicating either winter use or very late fall and very early spring use. Because these deer inhabit these areas when deep snows cover the forest to the north, it is assumed that they must migrate into the canyon to the south if snow becomes too deep. It is estimated that approximately one-third of the North Rim deer herd follows this migration pattern. As a consequence, harvest of this portion of the herd is nil, and any control must necessarily be accomplished either on the points or in the canyon. Figure 2 shows areas on the North Rim which are inhabited by deer during the winter months.

RECOMMENDED ACTION

A. Objectives

The final objective of a deer management plan for the North Rim must necessarily be for the preservation of both the deer herd and the range in a state which is as near natural as possible. In order that park visitors may enjoy the area to the fullest extent, both the deer herd and range must be preserved in a healthy condition. To meet these conditions, the following objectives should be sought:

1. The depletion and overbrowsing of range plants, and hence the lack of their natural reproduction, must be halted not only to preserve the natural environment, but to insure future browse plants for the deer herd.

2. Deer numbers must be kept at a level which is in balance with the range to insure normal, healthy animals without detriment to the plant cover.

3. Predatory animals will continue to be afforded full protection in order to preserve both the predators and the natural balance of nature.

B. Management Plan

1. Reduce the number of deer on each study unit such that the annual range use does not exceed 10 deer-days-use per acre

per year or 50 percent utilization of the annual growth of cliffrose (Cowania mexicana) or 40 percent of sagebrush (Artemesia sp.)

2. Attempt to sustain optimum deer populations which will permit improvement of range conditions, utilizing semi-annual forage surveys and annual pellet counts to determine population limits.

3. Continue to cooperate with the Arizona Game and Fish Department, United States Forest Service, and United States Fish and Wildlife Service in studies outside the park boundary, and in meetings concerning deer hunt seasons and bag limits, with a view toward achieving proper herd control through public hunting of migratory deer in the North Kaibab National Forest. Data collected from park studies should be made available to the Arizona Game and Fish Department to assist them in continuing adequate harvest of park deer outside the park boundary.

4. Because early spring and late fall deer use of most trouble areas on the North Rim preclude the use of traps, and because hunting seasons outside the park boundaries do not adequately control deer numbers in some sections of the park, direct control procedures should be instituted where it is determined that the the deer causing the range damage will not be otherwise eliminated.

5. An active information program regarding the need for deer control, research, and management programs will be carried on with the general public.

6. Protection of predatory animals, both within the Park and within the three-mile buffer zone outside the park boundaries, will continue to be stressed.

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Concurred in by:

Signed

A. Lynn Coffin
Chief Park Ranger

APPENDIX

DEER CONTROL NUMBER DETERMINATION TABLE

(1) Pellet Groups per Acre	(2) 35 Acres	(3) 100 Acres
130	0	0
140	.07	.21
150	.12	.34
160	.22	.63
170	.30	.86
180	.37	1.06
190	.44	1.26
200	.52	1.49
210	.59	1.69
220	.66	1.89
230	.74	2.12
240	.81	2.32
250	.89	2.55
260	.96	2.77
270	1.03	2.95
280	1.11	3.18
290	1.18	3.38
300	1.25	3.58

The left-hand column (1) is a list of pellet groups per acre. Columns (2) and (3) are the number of deer to be taken off the range per 35 or 100 acres in order to retain 1 deer per 35 acres (10 deer-days-use per acre per year) as recommended in the management plan.

Example: In the event an average of 250 pellet groups per acre be found in one group of plots, and the acreage covered in the area is 2,700 acres (acreage determined by forage utilization and deer observation), the total control should be 69 deer (2.55 x 27).

APPENDIX

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