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Some of the Relationships Between Livestock Grazing and Duck Nesting in the Saltgrass Vegetation Type in Utah

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SOME OF THE RELATIONSHIPS BETWEEN LIVESTOCK GRAZING AND DUCK NESTING IN THE SALTGRASS VEGETATION TYPE IN UTAH

by

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INTRODUCTION

Little is known of the relationships between livestock grazing and duck nesting. This dearth of information occurs in spite of the fact that an understanding of these relationships is necessary in order to evaluate duck production on range land, and to formulate grazing policies for lands devoted to the production of ducks.

Recognizing the need for information on this subject, the Utah Cooperative Wildlife Research Unit and the Wildlife Management Institute jointly sponsored a study, during 1948-1949, of livestock grazing - duck nesting relationships in the saltgrass vegetation type in northern Utah. The study was financed by the institute and supervised by the research unit. The writer was employed to make the study. This thesis presents his findings.

The saltgrass type was chosen for study because it is an extensive vegetation type on the wet, alkaline lands of the Great Basin. It occurs at the duck-producing river deltas and marshes on land which is too alkaline for agriculture and is therefore used for grazing. Such lands are low enough in monetary value to permit their purchase for waterfowl management areas.

REVIEW OF LITERATURE

The first published study of relationships between livestock grazing and duck nesting was made by Bennett (1937) on three small bluegrass areas in Iowa. When lightly grazed the areas contained more duck nests than when overgrazed or ungrazed. When protected from grazing the badger and skunk populations increased abnormally. He concluded that a certain amount of grazing was beneficial to nesting ducks.

A second study of grazing in relation to duck production was made by Bue (1952) on fifty stock ponds in western South Dakota. Bue found that the ducks utilized the tallest, densest cover available for nesting; and that 19 out of 20 nests he located were in areas where grazing intensity did not exceed proper use.

A study of livestock grazing-duck nesting relationships is being made in North Dakota and Nebraska (Hammond, 1947-1951).

METHODS

All of the field work for this study was done on a single area, referred to as the Bear River Silts Land Study Area, during the spring and summer of 1948 and 1949. The following presentation of methods describes this study area and the two methods of investigation, a nesting study and a range vegetation and utilization survey.

Bear River Silts Land Study Area

Location

The study area was located in southeastern Box Elder County, Utah, in a general area known as the Bear River Silts Land. It lay south of the county road from Brigham City to the Bear River Migratory Bird Refuge, and was bounded on the south by Unit 5 of the refuge.

Size

This area measured roughly 3.1 miles east-west and 3.4 miles north-south, totaling approximately 10.5 square miles.

Topography

The topography of the area is extremely flat, originating from the deposition of silt by the Bear River in the shallow, northern reaches of the Great Salt Lake during earlier periods of high lake levels. The area has a very gentle north-to-south slope of 1.2 feet per mile. The flatness of the area is typified by the fact that the maximum relief is only 4 feet, which is identical to the total drop of the north-to-south

slope of the surface.

Drainage

The study area is drained by a complicated system of intermingling channels and oxbows of the Reeder's Channel Overflow of the Bear River and by Box Elder Creek. The Box Elder Creek system is the least extensive of the two and covers only the northeastern quarter of the study area. A channel of this stream enters the study area in the extreme northeast corner and is impounded by two earthen dams into 800-acre Knudson's Marsh (Figure 1).

The remainder of the study area is dominated by the Reeder's Channel System. The main stem of this system enters the study area northwest of Knudson's Marsh. At a point west of the marsh, it divides into east and west branches, each of which continues south to the refuge. To the east of each of these branches is a tributary channel (Channels A and B) which rises within the study area, parallels the branch, but does not join the main stream within the study area.

One other water area of importance, Channel C, exists in the southeastern corner of the study area. This is a short, dead-end channel which rises and ends within the study area.

Many old river channels exist within the study area. These are now just shallow depressions which hold a few inches of water for a short time in the early spring and after heavy rains. These temporary water areas are not shown in Figure 1.

The water in the more permanent channels is turbid and

the current is slow. The deepest channels are the main stem and east branch of Reeder's Channel which have a maximum depth of 5-6 feet. Water depths in the other channels average 2-4 feet. There is on the area 21.3 miles of channels and 8.9 miles of marsh edge, totaling 30.2 miles marsh and channel banks.

Vegetation

The vegetation on the study area consisted of desert saltgrass (Distichlis stricta), glasswort (Salicornia rubra), Mediterranean barley (Hordeum hystrix), foxtail barley (Hordeum jubatum), spike rush (Eleocharis sp.), and bulrush (Scirpus paludosus). Most of the common aquatic plants of this region occurred within Knudson's Marsh, but this study was concerned only with the periphery of this marsh so these species will not be mentioned. No trees, sage brush, or other woody plants of any kind occurred on the study area.

Of the plant species listed above, only the saltgrass and foxtail could be considered potential nesting cover for ducks.

Over most of the study area the saltgrass was confined to the channel and marsh banks in a strip of varying width. Mixed with the saltgrass was an occasional clump of foxtail. The saltgrass attained greater density and more luxuriant growth on the southern portion of the study area than on the northern. This was due to a combination of three factors: (1) The channel banks were higher above the water level (1-4 feet) on the northern part of the area than on the

southern portion (less than 1 foot), thus creating more arid, and therefore less favorable, conditions for the growth of saltgrass on the northern part of the area. (2) The lower relief of the southern part of the area resulted in flooding of the channel banks during periods of high water, thus creating more favorable conditions for the growth of saltgrass. (3) The only shelter and feed lot for cattle was located in the extreme northern part of the area, which resulted in greater utilization of the saltgrass by cattle in the north with decreasing utilization to the south.

The density and height of the saltgrass decreased with increasing distance from the channel and marsh banks. In the southern portion of the area the saltgrass was replaced, as it thinned out, by glasswort and bare alkali flats. In the northern portion of the area the saltgrass was replaced by Mediterranean barley.

In the southeastern quarter of the area thin stands of spikerush and bulrush grew in a few shallow depressions.

Biota

The mammals known to reside on the study area were limited in species and low in numbers. These consisted of a low population of field mice (Microtus sp.) which inhabited the saltgrass, and a family of skunks (Mephitis mephitis) that denned under the abandoned house.

The predaceous birds which were observed on the area were magpies (Pica pica), marsh hawks (Circus hudsonius), ravens (Corvus corax), and California gulls (Larus californicus).

Several pairs of magpies nested in trees north of the study area and frequented only the northern extremity of the area. Marsh hawks were seen frequently, hunting over the whole of the area. Ravens were observed frequently, but only in flight over the study area. None was observed on the ground or cruising the area in search of food. California gulls were numerous. These birds nested in large colonies on the Bear River Refuge. The study area was a part of their feeding area and each day several hundred of these gulls cruised low over the channel banks in search of food.

Land Use

Land use on the study area was restricted to grazing. No humans resided on the area, and the only buildings were an abandoned house and a cattle shed in the extreme northeast corner. The cattle were owned by one rancher. Grazing occurred throughout the year. There were no interior fences, so the cattle roamed freely over the whole of the area. However, the cattle were winter-fed at the shed in the northeast corner of the area. This resulted in heavier grazing during winter months in the northern part of the area. Even during the summer months there was a noticeable tendency for the cattle to frequent the northern part of the area more than the southern.

Coverage

The whole of the study area, as described above, was not covered during the study. Investigations were restricted to the saltgrass type within the area. Enough coverage was

given the other types to appraise their value as nesting habitat, but they were not included in the intensive coverage. Thus, intensive work on the study area was limited to a strip of varying width, determined by the occurrence of saltgrass, along the channel and marsh banks. The interior of Knudson's Marsh and the Salicornia and mud flats between the channels were given only incidental attention.

Duck Nesting Studies

Duck nesting studies were made on the study area during the spring and summer of 1948 and 1949. The purpose of these studies was to determine: (1) the amount of duck nesting on the area, (2) the success of duck nesting on the area, (3) the vegetation requirements of the ducks for nesting, and (4) the relation of grazing to each of the first 3 phenomena.

Nests were located by systematicelly cruising the saltgrass on foot from April through July. Nests were marked by noting their distance and direction from landmarks such as pieces of driftwood. Where landmarks were lacking a willow wand with a numbered tag was placed at a known distance and direction from the nest. These sticks attracted the attention of cattle which frequently destroyed them by trampling and rubbing. To save the markers and prevent attracting cattle and predators to the nest site, the willow wands were placed in the river channel whenever convenient.

Each nest was visited about once a week until it was terminated. The writer was careful not to expose nests in the presence of predators, especially gulls. After examination

the eggs were covered with down, and the surrounding vegetation was arranged to conceal the nest.

When each nest was first located it was given an identifying number. The location of the nest on the study area was described, a nest history was started, and the relationship of the nest site to its surroundings was recorded. The relationship of the nest site to its surroundings was described by recording the following facts:

1. The species of vegetation at the nest site.
2. Whether the vegetation at the nest site was: high, medium-high, medium, medium-low, or low in respect to the height of vegetation over the area as a whole.
3. Whether the vegetation at the nest location was: ungrazed, lightly grazed, moderately grazed, or heavily grazed.
4. Whether the density of vegetation at the nest site was: low, medium-low, medium, medium-high, or high.
5. Whether the vegetation on the pheriphery of the nest was grazed or ungrazed (in 1949 only).
6. Whether the vegetation at the nest site was higher, the same, or lower than that surrounding the nest site.
7. Whether the density of vegetation at the nest site was higher, the same, or lower than that surrounding the nest site.
8. Whether the vegetation at the nest location was

grazed more, the same, or less than that surrounding the nest site.

9. The distance of the nest site from water.
10. Whether the nearest water was a channel or marsh.
11. A brief description of the topography at the nest site and in the imediate vicinity.
12. The height of the nest site above present and high water levels.
13. The average height of the vegetation within 3 inches of the nest (in 1949 only).

Vegetation and Livestock Utilization Survey

During March and April of 1949 a survey was made of the height, density and degree of utilization of saltgrass on the study area. This survey was concerned with the condition of the previous year's growth of saltgrass still standing at the start of the nesting season. The methods of this survey are described under the headings of Sampling Method, Measurement Method, and Method of Estimating Utilization.

Sampling Method

The basic sampling unit was 1 square foot. This section explains how the sampling points for the one-square-foot samples were located. First, it was necessary to construct a frame from which the samples could be drawn. This was accomplished by pacing the channels and the periphery of Knudson's Marsh. The paces were numbered consecutively so that each individual pace number represented one particular point on the channels or the marsh periphery. During this

initial pacing the pace number was plotted on a map at each point where a channel entered or left the study area, wherever two channels joined, and at each conspicuous landmark such as a log. Thus, any particular pace location could be relocated by the number of paces and direction from a given landmark.

The total number of paces was 37,402. A table of random numbers was used to draw the locations along the channel and marsh banks. The table was marked off into 5-digit numbers, and each number not exceeding 37,402 was considered a pace number and was recorded. A total of 1,000 sample locations was drawn in this manner.

Next, a method was devised for determining the distance from the channel or marsh bank at which each sample was to be taken. During field work in 1948 it was noticed that, over most of the study area, saltgrass more than 30 feet from a channel or marsh bank was obviously too short and sparse to be of value for duck nesting. In addition, more than three-fourths of the duck nests found in 1948 were within 30 feet of the channel and marsh banks. For these reasons, it was decided to limit the width of this survey to saltgrass within 30 feet of the banks. The table of random numbers was blocked off into 2-digit numbers. Those not exceeding 30 were used to represent distances from the bank. Each was recorded consecutively opposite the pace numbers previously drawn.

Then, the table of random numbers was used as single-

digit numbers to determine whether the sample was to be taken on the left or right bank, depending on whether the number was odd or even. In the field these left and right bank designations were ignored if the sample were taken on Knudson's Marsh.

In this manner a list of 1,000 sample locations was randomly drawn. Each description of a sample location consisted of (1) the pace-number location on the channel or marsh banks, (2) the distance (up to 30 feet) of the sample from the bank, and (3) whether the sample, if on a channel, was to be taken on the right or left bank. To facilitate field work the list was copied in the numerical order of the pace numbers.

To find a sample location in the field the writer started at a landmark which had its pace-number recorded on the map. He then paced off the number of paces which separated the landmark from the sample location on the channel or marsh bank. The direction in which to pace was indicated by the pace-numbers on the map. Having arrived at the proper location on the channel or marsh bank, he then crossed to the opposite bank if the sample description indicated it was necessary.

The point at which the one-square-foot sample was to be taken was found by measuring with a tape the designated number of feet from the bank. This was accomplished alone by using 2 aluminum rods. One rod was placed upright on the edge of the bank at the point designated by the pace number.

A metal ring on the end of the tape was slipped over the rod. The tape was stretched tight and the second rod was placed 1 foot short of the required distance. The square-foot sample was taken in the next foot beyond this second rod.

Measurement Method

To facilitate measurement of the one-square-foot sample, a wire rectangle measuring 4" x 12" was used to delineate one-third of the plot at a time. This unit was used 3 times to cover the 1 square foot. The measurements for each of the 3 units were recorded, and were averaged later to give the measurement for the square-foot sample. The data recorded for each sample were (1) the plant species, (2) the estimated average height of the vegetation, and (3) the estimated plant density.

The average height of the vegetation was estimated by choosing the point which seemed to represent the average height of the vegetation. The distance from this point to the ground was then measured with a ruler to the nearest one-half inch. This value was the estimate of average height.

The density of vegetation was estimated as a percent. Zero represented bare ground with no vegetation; and 100 percent represented maximum density, such as occurs in a luxurious growth of ungrazed saltgrass. Density was estimated by 10 percent intervals, such as 10 percent, 20 percent, 30 percent and so forth.

Method of Estimating Utilization

The method used to estimate the degree to which the saltgrass was utilized by cattle was based on the average height of the saltgrass. To convert the average height to an estimate of Percent Utilization, a height-weight distribution curve was calculated similar to those used by Crafts (1938) and Lommasson and Jensen (1938).

Fifty stems were clipped at ground level from a luxuriant stand of ungrazed saltgrass on the banks of the West Branch of Reeder's Channel in the Bear River Refuge a few yards south of the study area boundary. The plants were air-dried for two weeks and then tied in bundles of ten. Assuming that the forage within an inch of the ground is not available to cattle, the bottom inch of the bundles was clipped off and discarded.

Then, starting at the bottom, the bundles were clipped at 1-inch intervals. The forage removed from each bundle in each 1-inch interval was weighed to the nearest one-tenth of a gram. The total amount of forage in each bundle was calculated as the sum of the forage weights that occurred in each inch interval of the bundle. The forage weights for each corresponding interval in each bundle and the total forage weight of each bundle were added to give values for the total sample of 50 plants (Table 11).

Next, using the total sample values, the percent of the forage that occurred in each 1-inch interval was calculated. Then, starting at the top, accumulated percentages

were calculated to indicate the weight of forage above each 1-inch interval of plant height.

Thus, the height-volume distribution of forage in saltgrass plants was estimated, using air-dry weight to represent volume. From this the Percent Utilization of a sample of saltgrass can be estimated by comparing the height to which the sample was grazed with the height-volume curve to indicate the percent of forage that had been consumed.

PRESENTATION OF DATA

Nesting Study

Nest Density

A total of 77 duck nests were found on the study area during the 2 years of study. Forty nests were found in 1948 and 37 were located in 1949. The study area embraced approximately 10.5 square miles; but about 1¼ square miles of this area was in Knudson's Marsh, which was not covered during this study. Thus, excluding Knudson's Marsh, there were about 9.3 square miles in the study area. This indicates low densities of 4.3 nests per square mile in 1948 and 4.0 nests per square mile in 1949. On a linear mile basis there were only 1.3 nests per mile of channel and marsh banks in 1948, and 1.2 per linear mile in 1949. Average densities for the 2 years were 4.2 nests per square mile and 1.3 nests per linear mile of channel and marsh banks.

All of the nests found during this study were within 75 feet of the channels or marsh. The acreage of saltgrass within this distance of the channels and marsh was 469 acres. This area of saltgrass is considered to be the habitat acreage of saltgrass on the study area. Thus, nest densities were 8.7 nests per 100 habitat acres in 1948 and 7.9 nests per 100 habitat acres in 1949. The average nest density for the two years was 8.3 nests per 100 habitat acres.

Species Composition

The species composition of the nests found on the study area appears in Table 1. The percent composition was fairly consistent for the 2 years. The cinnamon teal was by far the most numerous species, averaging 46 percent of all nests found during the 2 years. Mallard and pintail nests were found in about equal proportions, averaging 17 percent and 16 percent respectively for the 2 years. Shoveller and gadwall nests ranked next, each averaging 10 percent composition over the 2-year period. The redhead was apparently an incidental species for the area. Only 1 redhead nest was found, in 1948.

Nest Distribution

The location of each of the nests found during this study is plotted in Figure 1. From this map it can be seen that the nests were not evenly distributed over the study area. After this distribution was noticed in 1948, the study area was marked off into 3 zones for the purpose of studying nest distribution. The southern zone (Zone 3) was intentionally delimited to embrace the area where most of the ducks nested. The northern zone (Zone 1) was set so that it included the whole of Knudson's Marsh. The middle zone (Zone 2) had no special significance, except that the writer felt that having an intermediate zone might be of value in studying differences between Zones 1 and 3.

Data pertaining to the distribution of duck nests by zones appear in Table 2. The 3 zones varied considerably

Table 1. Species composition of nests on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

	Number of Nests			Percent of Nests		
Species	1948	1949	Total	1948	1949	Total
Cinnamon Teal	17	18	35	42	49	46
Mallard	7	6	13	17	16	17
Pintail	6	6	12	15	16	16
Shoveller	5	3	8	13	8	10
Gadwall	4	4	8	10	11	10
Redhead	1	0	1	3	-	1
Totals	40	37	77	100	100	100

in size and the amount of channel and marsh banks they contained. Zone 1 was the largest (4.1 square miles) and contained more channel and marsh banks (17.4 linear miles) than either of the other zones. Zones 2 and 3 were equal in size (2.6 square miles) but Zone 3 contained almost twice as much channel and marsh banks (8.1 linear miles) as did Zone 2 (4.7 linear miles).

The number of duck nests found in each zone varied little during the 2 years. In Zone 1 five nests were found in 1948 and only 2 in 1949. Zone 2 contained 1 nest and Zone 3 contained 34 nests both years.

In respect to the density of nests per square mile, Zone 3 ranked much higher than the other zones, and averaged 13.1 nests per square mile for the 2-year period. Zone 2 had the lowest density, with a 2-year average of only 0.4 nests per square mile. Zone 1 rated only slightly higher than Zone 2 with an average density for the 2 years of 0.9 nests per square mile.

The comparative densities of duck nests per linear mile of channel and marsh banks were similar to the area densities described above. Zone 3 had much greater densities than the other zones and averaged 4.2 nests per linear mile of bank for the 2 years. Zones 1 and 2 had the same 2-year average of 0.2 duck nests per mile of channel and marsh banks.

In summary, Zone 1, which contained 44 percent of the study area and 57 percent of the channel and marsh banks, had only 8 percent of the nests. Zone 2, which embraced

Table 2. Comparison of duck nest densities by zones on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

	Zone 1	Zone 2	Zone 3	Total
BASIC DATA				
Square miles	4.1	2.6	2.6	9.3
Linear miles of channel and marsh banks	17.4	4.7	8.1	30.2
Nests in 1948	5	1	34	40
Nests in 1949	2	1	34	37
Nests, 2-year average	4	1	34	39
AREA COMPARISON				
Nests per square mile in 1948	1.2	0.4	13.1	4.3
Nests per square mile in 1949	0.5	0.4	13.1	4.0
Nests per square mile, 2-year average	0.9	0.4	13.1	4.2
LINEAR COMPARISON				
Nests per mile of bank in 1948	0.3	0.2	4.2	1.3
Nests per mile of bank in 1949	0.1	0.2	4.2	1.2
Nests per mile of bank, 2-year average	0.2	0.2	4.2	1.3
PERCENTAGE COMPARISON				
Percent of area	44	28	28	100
Percent of channel and marsh banks	57	16	27	100
Percent of nests in 1948	12	3	85	100
Percent of nests in 1949	5	3	92	100
Percent of nests, 2-year average	8	3	89	100

28 percent of the area and 16 percent of the banks, contained only 3 percent of the nests. Zone 3 contained only 28 percent of the study area and 27 percent of the banks, but had 89 percent of the nests.

As Figure 1 indicates, the distribution of nests within Zone 3 was, with one exception, fairly uniform along the channels. The exception was the heavily grazed East Branch of Reeder's Channel on which only 1 nest was found during the 2 years of study.

Nest Success

Seventy-five of the 77 nests found on the study area were followed through until they terminated. These nests, of which there were 40 in 1948 and 35 in 1949, were used to calculate nesting success (Table 3). Nesting success was 28 percent in 1948; 34 percent in 1949; and averaged 30 percent for the 2 years. This is very low nesting success, and to the writer's knowledge is one of the poorest on record. Kalmbach (1939) summarized the degree of success found in 22 duck nesting studies. The average success found in these studies was 60 percent. The lowest recorded were comparable to the success found in this study and were 29 percent and 33 percent.

The causes of nest failure in the order of their importance were: (1) predation by California gulls, (2) desertion, (3) trampling by cattle, and (4) marsh hawk predation. One unsuccessful nest was found for which the cause of failure could not be determined. The nest was that of a teal

Table 3. Success of nests and cause of failure on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

	1948		1949		Total	
NEST SUCCESS						
Number of nests	40		35[1]		75	
Number of successful nests	11		12		23	
Percent of nests successful	28		34		30	
CAUSE OF FAILURE						
Unsuccessful nests	29	(100%)	23	(100%)	52	(100%)
California gull	24	(84%)	21	(91%)	45	(87%)
Desertion	1	(3%)	2	(9%)	3	(5%)
Trampling by cattle	2	(7%)	0	-	2	(4%)
Marsh hawk	1	(3%)	0	-	1	(2%)
Cause unknown	1	(3%)	0	-	1	(2%)

(1) Thirty-seven nests were found in 1949, but the fate of two was not determined.

from which all of the eggs (at least 7) had been removed without a sign of disturbance. There were no egg shells in the nest, and none was found within a 100-yard radius of the nest.

Predation by California gulls was by far the most important factor causing nest losses. Sixty percent of the nests found during this study, or 87 percent of the unsuccessful nests, were destroyed by these gulls. During 1948 and 1949 California gulls were responsible for 84 percent and 91 percent of the nest losses. Usually, but not always, all of the eggs in a clutch were either broken at the nest or carried a short distance and then broken. When part of the eggs in a clutch were broken in the nest, the nest was subsequently deserted. No gulls were seen in the act of destroying a duck nest. However, they were often observed devouring eggs in coot nests. And no other predator was present on the study area which would destroy nests in a similar manner. So, although the evidence against the gull is circumstantial, the writer is confident that the gulls were responsible for the losses attributed to them.

Three nests, representing 5 percent of the unsuccessful nests, were deserted for no reason that was apparent. These desertions were either caused by some disturbance that left no evidence, or they were caused by the activities of the writer in making this study. The latter is the more probable of the 2 possibilities.

Two nests, or 4 percent of the unsuccessful nests, were

trampled by cattle. One was a teal nest and the other a shoveller. Both were in saltgrass that was classified as medium in height and density and moderately grazed. Such a loss can be considered minor. However, there is the question of how great the losses by trampling would have been if the gulls had not destroyed so many of the nests.

Predation by the marsh hawk involved 1 female teal which was killed on the nest.

Description of Nest Sites

Relation to Water

All of the nests found during this study were located on channel banks. None was found on the periphery of Knudson's Marsh. The banks of Knudson's Marsh were very heavily grazed, and the writer believes that for this reason the nests of the ducks which frequented the marsh were all located within the marsh. The writer explored the interior of the marsh on several occasions and found numerous nests of such species as mallard, pintail, shoveller, and teal which are normally upland-nesting species. This information lends credence to the theory.

The distances of the nests from the nearest water are shown in Table 4. All of the nests were found within 75 feet of water. Half of the nests were situated within 15 feet of water, 79 percent within 30 feet of water, and 95 percent within 50 feet of water. This distribution of nests was undoubtedly correlated with the quality of the saltgrass at varying distances from the channel banks.

Table 4. Distance of nests from the nearest water on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

Number of Feet from Water	Number of Nests			Percent of Nests	Accumulative Percent of Nests
	1948	1949	Total		
1-5	8	6	14	18	18
6-10	5	5	10	13	31
11-15	7	7	14	18	49
16-20	2	3	5	7	56
21-25	5	3	8	10	66
26-30	4	6	10	13	79
31-35	2	1	3	4	83
36-40	1	2	3	4	87
41-45	1	1	2	3	90
46-50	3	1	4	5	95
51-55	0	0	0	0	95
56-60	1	1	2	3	98
61-65	0	0	0	0	98
66-70	0	1	1	1	99
71-75	1	0	1	1	100
Totals	40	37	77	100	-

The height and density of the saltgrass decreased with increasing distance from the channel banks.

The nests were situated very little above the current and high water levels. The estimated average height of the nests above the current water level was 7½ inches and the average nest was only 1½ inches above the high water level. About half of the nests were more than 6 inches above the current water level, and only 18 percent were more than 1 foot above this level. Nineteen percent of the nests were more than 6 inches, and 10 percent were more than 1 foot above the high water level. That the nests were located so little above the current and high water levels is correlated with the topography of the area and the geographic distribution of the nests. In the first place, the maximum relief of the study area is only 4 feet, so none of the nests could have been located far above the water. And, second, only 8 percent of the nests were in Zone 1 where the channel banks in some places are 1-4 feet above the water. It is surprising that with the nests so little above the water that none was destroyed by flooding.

Relation to Topography

The topography in the vicinity of each nest was level. As for the nests themselves, all were on level ground except 4 pintail nests and the 1 redhead nest, which were on isolated clumps of turf in the channels.

Relation to Vegetation

With the one exception of the redhead nest, all of the

Table 5. Distribution of nests in relation to saltgrass height and density on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

	Low	Medium Low	Medium	Medium High	High
HEIGHT					
1948 nests	0	1	16	12	10
1949 nests	0	2	11	14	10
1948 and 1949 nests	0	3	27	26	20
Percent, 1948 and 1949	0	4	36	34	26
DENSITY					
1948 nests	0	1	21	8	9
1949 nests	0	1	22	7	7
1948 and 1949 nests	0	2	43	15	16
Percent, 1948 and 1949	0	2	57	20	21

nests were located in saltgrass. The redhead nest was in a tussock of foxtail barley. The remainder of this section on vegetation at the nest site deals only with the nests that occurred in saltgrass. There were 39 in 1948 and 37 in 1949.

That the ducks had a definite preference for the taller grass for nest sites is evident in Table 5. In this table the relative terms used to describe the height of saltgrass at the nest sites refer to the height of the saltgrass as it occurred on the study area. That is, medium refers to the average height of saltgrass on the study area, and high refers to the highest that grew on the area. In spite of the preference for taller grass, it was not the highest grass that was used the most. Apparently, grass of medium height and higher was acceptable for nesting. Only 4 percent of the nests were in grass of lower than medium height; and all of these were in medium-low grass, there being none in grass that was classified as low.

The average height of the saltgrass at the sites of the nests which were found in 1949 was estimated and then measured to the nearest one-half inch. The data thus obtained appear in Table 6. The range in average heights of saltgrass at the nest sites was from 8 inches to 13½ inches. Thus, the minimum saltgrass height which any of the ducks accepted for a nest site was 8 inches. About 1 out of 10 ducks (8%) accepted a height of 8½ inches; 1 out of 5 (19%) accepted a height of 9 inches; 1 out of 4 (24%) accepted a height of 9½ inches; 1 out of 3 (24-40%) accepted a height of 9½-10

Table 6. Average heights of saltgrass at nest sites in 1949 on the Bear River Silts Land Study Area, Box Elder County, Utah in 1949

Average Height in Inches	Number of Nests	Percent of Nests	Accumulative Percentages	
13½	1	3	3	100
13	0	0	3	97
12½	2	5	8	97
12	2	5	13	92
11½	3	8	21	87
11	6	16	37	79
10½	8	23	60	63
10	6	16	76	40
9½	2	5	81	24
9	4	11	92	19
8½	2	5	97	8
8	1	3	100	3
Total	37	100	-	-

inches, and 1 out of 2 (40-60%) accepted a height of 10-10½ inches. The average height of saltgrass at the 37 nest sites was 10½ inches.

As indicated in Table 5, the denser saltgrass contained the most nests. Only 2 percent of the nests were in grass of less than medium, or average, density. None was in grass of low density. However, as with height, the largest number of nests was not found in the densest saltgrass. Fifty-seven percent of the nests were in grass of medium density. Another 20 percent were in medium-high density grass, and only 21 percent were in the densest grass. The writer believes that saltgrass density is not a major factor in the duck's choice of a nest site. It seems logical that height is the more important factor, and that density is correlated with height.

The relationship of the height, density, and degree of grazing of saltgrass at the nest site to that of the surrounding vegetation is summarized in Table 7. Only 1 (1%) of the nest sites was in saltgrass that was shorter than the saltgrass surrounding the nest site. The saltgrass at the other nest sites was at least as tall or taller than the surrounding grass. There were only a few more nests in saltgrass that was taller than the surrounding saltgrass (53%) than there were in grass that was about the same height as that surrounding the nest site (46%).

Ninety-five percent of the nest sites consisted of grass that was as dense or denser than the surrounding grass. There were only a few more nests in grass that was

Table 7. Relation of saltgrass at the nest sites to the surrounding saltgrass on the Bear River Silts Land Study Area, Box Elder County, Utah in 1948 and 1949

	Saltgrass at the Nest Site was: Lower	Same	Higher
HEIGHT			
1948 nests	1	18	20
1949 nests	0	17	20
1948 and 1949 nests	1	35	40
Percent, 1948 and 1949	1	46	53
DENSITY			
1948 nests	1	21	17
1949 nests	3	16	18
1948 and 1949 nests	4	37	35
Percent, 1948 and 1949	5	49	46
GRAZING	Saltgrass at the Nest Site was Grazed: Less	Same	More
1948 nests	21	17	1
1949 nests	20	16	1
1948 and 1949 nests	41	33	2
Percent, 1948 and 1949	54	43	3

the same density as the surrounding grass (49%) as there were in grass of a greater density than the surrounding grass (46%).

Relation to Grazing

The distribution of nests in relation to grazing is indicated in Table 8. The relationship shown is not of the nest site to grazing. It is the relationship of the nest location to grazing. This term refers to the general vicinity of the nest that can be observed when one stands at the actual nest site. None of the nest locations was in ungrazed or in heavily grazed saltgrass. All of the nest locations were in lightly and moderately grazed grass. Two-thirds were in lightly grazed grass, and the remaining one-third was in moderately grazed saltgrass. Thus, as a result of the preference for the taller grass mentioned previously, the nest locations apparently had to be in lightly or moderately grazed areas. That none of the nest locations was in ungrazed saltgrass is undoubtedly due to the fact that few or no ungrazed areas of any size existed on the study area. It is doubtful whether one could have found a place where he could stand and see only ungrazed grass.

Table 8. Location of nests in relation to the degree of grazing

	Degree of Grazing			
	None	Light	Moderate	Heavy
1948 nests	0	27	12	0
1949 nests	0	24	13	0
1948 and 1949 nests	0	51	25	0
Percent, 1948 and 1949	0	67	33	0

Ninety-seven percent of the nest sites consisted of saltgrass that was grazed to the same or a lesser degree than the surrounding saltgrass (Table 7). There were a few more nest sites that consisted of saltgrass that was more lightly grazed than the surrounding saltgrass (54%) than there were that consisted of grass grazed to about the same degree as the surrounding grass (43%).

In 1949 a notation was made as to whether the saltgrass at each nest site was grazed or ungrazed. If any portion of the saltgrass within 3 inches surrounding the nest was grazed, the nest site was considered to be grazed. Twenty-nine, or 78 percent, of the nest sites had not been grazed previous to the time they were first located. For 6 of the grazed nest sites an additional note was made as to whether the grazing appeared to be recent or old. In every case the grazing was described as being old. So it can be safely assumed that those nest sites which were grazed had been grazed before the nest was made. Thus, it appears that previously-grazed grass is acceptable as a nest site, at least to 1 bird out of 5. Undoubtedly, it is more acceptable the less it is grazed.

In 1949 a record was also kept for 22 of the nests as to whether or not the nest site was grazed from the time it was found until it was terminated. None of these nest sites was grazed during this period. This is of no immediate significance, because it seems highly improbable that due solely to chance any of the 22 nest sites on the 10-square-mile

area would be grazed during the short period each nest was being used.

Summary

The ducks preferred the taller saltgrass for nest sites, however, use was not restricted to the tallest grass. Saltgrass of medium height or more was acceptable for a nest site. The minimum height which was acceptable to all of the ducks was 8 inches. One duck out of 10 accepted a height of 8½ inches; 1 out of 5, a height of 9 inches; 1 out of 4, a height of 9½ inches; 1 out of 3, a height of 9½-10 inches; and 1 out of 2, a height of 10-10½ inches. The tallest saltgrass used as a nest site was 13½ inches, and the average height for all the nests was 10½ inches. The denser saltgrass was preferred, but the densest grass was not used exclusively. Saltgrass of a medium or greater density was accepted for nest sites. It seems logical that height is the primary factor in the choice of a nest site and that density is correlated with height. The nests were placed in the taller grass in the vicinity of the nest sites. It made little or no difference whether the grass at the nest site was the same height as the surrounding grass or taller. The nests were also placed in the denser grass in the vicinity of the nest site, but it was of little or no importance whether the saltgrass at the nest site was of the same density or denser than the surrounding grass.

Heavily grazed grass was not accepted as a nest location by any of the ducks. Moderately grazed areas were accepted

by about half of the birds, but lightly grazed areas were preferred. The nests were placed in saltgrass that was grazed less or the same as the surrounding grass. However, it made little or no difference whether the nest site was grazed less or the same as the surrounding saltgrass. Previously grazed saltgrass was acceptable as a nest site to at least 1 bird out of 5; however, it is obvious that this depends on the degree of grazing.

Range Vegetation and Utilization Survey

Range Vegetation

The survey of range vegetation and utilization was restricted to the area within 30 feet of the channel and marsh banks. Therefore, all references to vegetation in this portion of the report refer only to the vegetation within 30 feet of the channel and marsh banks.

Species Composition and Degree of Ground Cover

The basic data concerning the relative abundance of plant species and the degree of ground cover are presented in Table 9. Over the study area as a whole only 4 percent of the ground within 30 feet of the marsh and channel banks was not vegetated. The remaining 96 percent of the area was covered by 6 species. Saltgrass was by far the most abundant plant, covering 91 percent of the ground. Glasswort and Mediterranean barley each vegetated 2 percent of the area. One percent of the area consisted of foxtail barley; and less than one-half of 1 percent was spike rush.

In Zone 1 the percent of the ground that was bare (4%)

Table 9. Ground cover within thirty feet of the channel and marsh banks on the Bear River Silts Land Study Area, Box Elder County, Utah in 1949

Ground Cover	Number of Samples			
	Zone 1	Zone 2	Zone 3	Total
Saltgrass	447	141	323	911
Glasswort	3	0	15	18
Spike rush	2	0	1	3
Mediterranean barley	14	6	0	20
Foxtail barley	7	3	0	10
Bare ground	18	13	7	38
Totals	491	163	346	1,000
	Percent of Ground Cover			
Saltgrass	91	86	94	91
Glasswort	1	-	4	2
Spike rush	T	-	T	T
Mediterranean barley	3	4	-	2
Foxtail barley	1	2	-	1
Bare ground	4	8	2	4
Totals	100	100	100	100

and the percentages that consisted of saltgrass (91%) and foxtail barley (1%) were the same as those for the study area as a whole. Glasswort covered a little less ground (1%) and Mediterranean barley a little more (3%), compared with the whole of the study area.

In Zone 2 there was twice as much bare ground (8%) and considerably less saltgrass than the study area average. There was less glasswort and spike rush, neither of which occurred in the 163 square-foot samples. Mediterranean barley was twice as abundant as the average for the whole of the study area, and covered 2 percent of the ground.

In Zone 3 there was less bare ground and more saltgrass than the average for the study area. Only 2 percent of the ground was bare, and 91 percent was covered with saltgrass. Glasswort was twice as abundant as the study area average, and covered 4 percent of the terrain. In respect to average abundance for the study area spike rush was the same (T), while foxtail barley and Mediterranean barley were less abundant. Neither of the latter species occurred in the 346 square-foot samples.

Saltgrass Height

Data pertaining to the height of saltgrass on the study area are summarized in Table 10. The average height of saltgrass in all 3 zones was 5.2 inches. Zone 3 had the highest average saltgrass height of 6.3 inches. The average height of saltgrass in Zones 1 and 2 was the same, averaging 4.6 and 4.7 inches, respectively.

Table 10. Height distribution of saltgrass in the range survey samples taken on the Bear River Silts Land Study Area, Box Elder County, Utah in 1949

Average Height of Saltgrass in Inches	Zone 1		Zone 2		Zone 3		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	9	2.0	2	1.4	1	0.3	12	1.3
1½	7	1.5	1	0.7	3	1.0	11	1.2
2	26	5.7	5	3.6	4	1.2	35	3.9
2½	28	6.2	6	4.3	7	2.2	41	4.5
3	35	7.7	1	0.7	20	6.2	56	6.2
3½	54	12.0	23	16.3	18	5.6	95	10.4
4	50	11.1	16	11.4	12	3.7	78	8.6
4½	33	7.4	14	9.9	20	6.2	67	7.4
5	39	8.7	20	14.2	22	6.8	81	8.8
5½	51	11.3	15	10.7	25	7.7	91	10.0
6	43	9.6	19	13.5	35	10.8	97	10.6
6½	29	6.4	14	9.9	28	8.6	71	7.7
7	17	3.7	3	2.1	28	8.6	48	5.3
7½	10	2.2			16	5.0	26	2.9
8	5	1.1			18	5.6	23	2.5
8½	7	1.5	2	1.4	17	5.3	26	2.9
9	3	0.7			16	5.0	19	2.1
9½					8	2.5	8	0.9
10	1	0.2			8	2.5	9	1.0
10½					5	1.6	5	0.6
11					2	0.6	2	0.2
11½					1	0.6	1	0.1
12					2	0.3	2	0.2
12½					1	0.3	1	0.1
13					1	0.3	1	0.1
13½					1	0.3	1	0.1
14					1	0.3	1	0.1
14½					1	0.3	1	0.1
15					1	0.3	1	0.1
15½								
16					1	0.3	1	0.1
Totals	447	100.0	141	100.0	323	100.0	911	100.0

The range in saltgrass height for the study area was from 1 inch to 16 inches. In Zone 1 the grass ranged from 1 to 10 inches; in Zone 2, from 1 to 8½ inches; and in Zone 3, from 1 to 16 inches.

The height distribution of saltgrass for the study area as a whole and for each of the zones is indicated in Table 10. Height distribution is discussed in detail in a later section.

Saltgrass Density

Over the study area as a whole the average density of saltgrass was 44 percent of that which occurs in a luxuriant stand of ungrazed grass. Average densities for each of the zones were: Zone 1, 43 percent; Zone 2, 37 percent; and Zone 3, 48 percent of the density found in luxuriant stands of ungrazed saltgrass. Thus, saltgrass was densest in Zone 3, intermediate in Zone 1, and sparsest in Zone 2.

Range Utilization

The data used to calculate height-volume distribution of forage in saltgrass are presented in Table 11. The tallest plants in the sample of ungrazed saltgrass were 26 inches in height. Therefore, the range in height over which the distribution of volume was calculated was from 1 inch to 26 inches above ground level.

The height-volume distribution revealed by these data is apparently close to a linear relationship between heights of 4 to 15 inches. That is, between these limits the amount of forage is relatively constant for each interval of height.

Table 11. Calculation of height-volume distribution for saltgrass

Interval of Plant Height*	Weight of Forage in Grams for Each Interval of Plant Height						Percents of Forage	Accumulative Percent
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total		
25-26					T	T	T	T
24-25					0.2	0.2	0.6	1
23-24	T				0.3	0.3	1.0	2
22-23	T	T			0.2	0.2	0.6	2
21-22	T	T	T	T	0.3	0.3	1.0	3
20-21	0.1	0.1	T	0.1	0.3	0.6	1.9	5
19-20	0.2	0.1	0.2	0.1	0.5	1.1	3.5	9
18-19	0.2	0.2	0.3	0.1	0.5	1.3	4.3	13
17-18	0.2	0.3	0.3	0.1	0.4	1.3	4.3	17
16-17	0.2	0.2	0.2	0.2	0.3	1.1	3.5	21
15-16	0.2	0.2	0.3	0.2	0.4	1.3	4.3	25
14-15	0.3	0.3	0.2	0.2	0.4	1.4	4.5	30
13-14	0.2	0.3	0.3	0.2	0.6	1.6	5.1	35
12-13	0.3	0.3	0.2	0.3	0.4	1.5	4.8	39
11-12	0.2	0.3	0.3	0.3	0.6	1.7	5.4	45
10-11	0.1	0.3	0.3	0.3	0.4	1.4	4.5	49
9-10	0.1	0.3	0.2	0.2	0.6	1.4	4.5	53
8-9	0.2	0.2	0.3	0.3	0.5	1.5	4.8	59
7-8	0.3	0.3	0.3	0.3	0.9	2.1	6.7	65
6-7	0.1	0.3	0.3	0.3	0.4	1.5	4.8	70
5-6	0.3	0.3	0.3	0.2	0.6	1.7	5.5	75
4-5	0.3	0.3	0.3	0.3	0.5	1.7	5.5	81
3-4	0.3	0.4	0.3	0.3	0.7	2.0	6.4	87
2-3	0.2	0.4	0.3	0.3	0.4	1.6	5.1	92
1-2	0.4	0.5	0.4	0.4	0.6	2.3	7.4	100
Total	4.4	5.7	5.3	4.7	11.0	31.1	100.0	-

* Expressed in inches, and excluding the first inch above ground level.

Above 15 inches there is gradually less forage per interval of height and below 4 inches there is an increasing amount of forage for each interval of height.

The survey of range vegetation in 1949 indicated an average saltgrass height for the study area as a whole of 5.2 inches. Application of this average height to Table 11 indicates that the Percent Utilization of the study area by cattle was approximately 75 percent.

Zones 1 and 2 had average saltgrass heights of 4.6 and 4.7 and are estimated to have been utilized approximately 80 percent by cattle. In Zone 3 the average saltgrass height was 6.3 inches which suggests that utilization of the saltgrass in this zone by cattle was approximately 68 percent.

Relation of Saltgrass Height to Nesting

This section compares the height of saltgrass over the study area, as revealed by the range survey, with the height requirements for nesting indicated by the nesting study. The pertinent data are presented in Table 12 for comparison purposes.

The number of duck nests per linear mile of channel and marsh banks is considered to be a more useful index to nest density than the number of nests per square mile. The reason is that the amount of channel and marsh banks varied considerably throughout the study area. The nesting study showed that in 1949 the study area as a whole had an average density of 1.2 nests per mile of banks. The average densities were 0.1 nests per mile in Zone 1; 0.2 nests per mile

Table 12. Relationships between nest density, saltgrass height, saltgrass utilization, and the percent of saltgrass of sufficient height for nesting on the Bear River Silts Land Study Area, Box Elder County, Utah in 1949

	Zone 1	Zone 2	Zone 3	Total
Nests per mile of channel and marsh banks	0.1	0.2	4.2	1.2
Average height of saltgrass, in inches	4.6	4.7	6.3	5.2
Percent Utilization	80	80	68	75
Percent of Saltgrass of sufficient height for nesting	3.5	1.4	26.1	11.2

in Zone 2; and 4.2 nests per mile in Zone 3. Thus, the nest density in Zone 3 was 40 times the density in Zone 1 and 20 times the density in Zone 2.

The range survey indicated that for the study area as a whole the saltgrass averaged about 75 percent utilized by cattle and averaged 5.2 inches in height. The saltgrass in Zones 1 and 2, which had the lowest nest densities, was approximately 80 percent utilized by cattle and averaged 4.6 inches and 4.7 inches in height, respectively. In Zone 3, where nest density was the highest, the saltgrass was only about 68 percent utilized by cattle and averaged 6.3 inches in height. Thus, there is a direct relationship between nest density and saltgrass height and an inverse relationship between nest density and the degree of utilization by cattle.

However, average saltgrass height was not directly responsible for variations in nest density, because average heights ranged from 4.6 to 6.3 inches, while the nesting study showed that the minimum height accepted by the ducks for nesting was 8 inches. Instead, average saltgrass height reflected the amount of saltgrass in the higher height classes of 8 inches or more. Other factors being equal, it is the amount of grass 8 inches or more in height that determines the amount of nesting.

Zones 1 and 2 had the least saltgrass that was 8 inches or more in height, 3.5 percent for Zone 1 and 1.4 percent for Zone 2. These zones also had the lowest nest densities.

The study area as a whole was intermediate in the percent of saltgrass 8 inches or more in height (11.2%) and in nest density. Zone 3 had both the highest percent of saltgrass 8 inches or more in height (26.1%) and the highest nest density.

Degree of Utilization Compatible with Nesting

The degree of saltgrass utilization by cattle that is compatible with duck nesting depends on the amount of duck nesting that is desired. On lands devoted to the production of ducks, a maximum amount of duck nesting is desired. The objective for these areas is to determine the maximum utilization by livestock that would not result in a reduction in duck nesting.

This study has shown that, other factors being equal, it is the amount of saltgrass 8 inches or more in height that determines the amount of duck nesting. However, this relationship undoubtedly functions according to the law of diminishing returns and there is a point beyond which additional amounts of acceptable nesting cover would not result in additional nesting. This critical point in the amount of acceptable cover is associated with a critical point in the degree of utilization by cattle. Both would be expected to vary from one area to another because in different areas other factors would not be equal. Thus, if 1 area had little in the way of territorial sites, the number of ducks that could nest on the area would be low. On such an area less acceptable nesting cover would be needed and a greater degree

of utilization by livestock would be desirable.

In 1949 Zones 1 and 2 were utilized an estimated 80 percent which resulted in a nest density of 0.1-0.2 nests per mile of channel and marsh banks. The study area as a whole was utilized an estimated 75 percent by cattle, and supported 1.2 nests per linear mile. Thus, 5 percent less utilization by cattle was accompanied by a 700 percent higher nest density. Zone 3 was utilized an estimated 68 percent by cattle and had a nest density of 4.2 nests per mile of channel and marsh banks. A comparison of Zone 3 with the study area as a whole indicates that the 7 percent less utilization by cattle of Zone 3 was accompanied by a 250 percent greater nest density.

Thus, on the study area 75 percent to 80 percent utilization by cattle did not permit maximum nesting by ducks. Sixty-eight percent utilization permitted much greater nest densities; however, it is not possible to determine from this study whether 68 percent utilization is above or below the critical point where less utilization by cattle would not result in increases in nest density. Since the difference between 75 percent and 68 percent utilization was associated with such a large difference in nest density (an increase of 250%), the writer believes that the increases in nesting which accompany decreases in utilization had not leveled off materially. Therefore, it was concluded that on this area the highest degree of utilization by cattle that would permit maximum nesting is somewhere below 68 percent.

CONCLUSIONS

The conclusions derived from this study fall into 3 categories: (1) those that deal with the amount and success of nesting on a grazed saltgrass area, (2) those that are concerned with the saltgrass requirements of ducks for nesting, and (3) those that pertain to the degree of utilization of saltgrass by cattle that is compatible with duck nesting.

Amount and Success of Nesting on a Grazed Saltgrass Area

Amount of Nesting

The densities of nests per square mile which occurred on the study area during the years of this study were low. This was due, in part, to the large areas of unproductive glasswort flats and mud flats between the channels. The linear densities of nests per mile of channel and marsh banks and the densities of nests per 100 habitat acres were also low. These low densities were caused, at least in part, by the degree of grazing on the area. Apparently the study area did not realize its full potential for duck nesting due to the reduction in saltgrass height by grazing. The actual nest density on the study area in 1949 was estimated to be only 30 percent of the potential nest density at 68 percent utilization by cattle.

Success of Nesting

The success of duck nests on the study area was one of the lowest on record. However, the only apparent effect of

grazing on nest success was a slight loss of nests due to trampling by cattle.

Saltgrass Requirements for Nesting

Height

The taller saltgrass was preferred by the ducks for nest sites. However, the tallest grass available was not required. The minimum saltgrass height accepted by ducks for nest sites was 8 inches.

Density

The denser saltgrass was used the most for nest sites. The writer believes that saltgrass height was the primary factor in the choice of a nest site and that greater density was associated with greater height.

Grazing

There was a definite preference by the ducks for the ungrazed or slightly grazed saltgrass for nest sites. This was associated with the preference for taller grass. Previously-grazed saltgrass was acceptable as a nest site to at least 20 percent of the birds.

Degree of Utilization Compatible with Nesting

The degree of saltgrass utilization that is compatible with duck nesting depends on the amount of duck nesting that is desired. Other factors being equal it is the amount of saltgrass of 8 inches or more in height that determines the amount of duck nesting. The amount of saltgrass of 8 inches or more in height that is needed for maximum duck

nesting varies from one area to another because of other factors which limit nesting, such as the number of available territories. It is concluded that on the study area the highest degree of utilization by cattle that would permit maximum nesting is somewhere below 68 percent.

SUMMARY

1. During the nesting seasons of 1948 and 1949 a study was made of the relationships between livestock grazing and duck nesting in the saltgrass vegetation type in Utah. The purpose of the study was to obtain information on some of the relationships between these phenomena for use in evaluating duck production on grazed lands and for using in setting up grazing policies for land devoted primarily to the production of ducks.

2. All of the field work was done on a 10.5 square mile area in Box Elder County. The area was extremely flat and contained 21.3 miles of slow, shallow, intermingling river channels and oxbows and 8.9 miles of marsh edge. Vegetation consisted of saltgrass, glasswort, Mediterranean barley, foxtail barley, spike rush, and bulrush. Saltgrass was confined to a strip of varying width along the channel and marsh banks. The California gull was the only predator present in numbers. Land use was restricted to year-round grazing. Coverage of the area for study was restricted to the saltgrass type within the area and excluded entirely the interior of the one marsh.

3. Methods of study consisted of a duck nesting study and a range vegetation and utilization survey. The purpose of the nesting study was to determine the amount and success of nesting on the area and the saltgrass requirements of

ducks for nesting. The purpose of the range survey was to determine the amount and distribution of saltgrass for comparison with nesting requirements and nest distribution and to estimate utilization by livestock.

4. The duck nesting study was made during both 1948 and 1949. Nests were located by systematically cruising the saltgrass on foot. Nests were marked and revisited about once a week until they terminated. When each nest was first located data were recorded on the species, relative height, density and degree of grazing of vegetation at the nest site; distance to, nature of and height of nest above nearest water; topography; and fate of nest. In 1949 the height of saltgrass at the nest site and the degree of grazing were recorded.

5. The range vegetation and utilization survey was restricted to the previous year's growth of saltgrass within a distance of 30 feet from the channel and marsh banks. The sampling method consisted of 1,000 one-square-foot samples located randomly. Data recorded for each square foot sample consisted of the species, height and density of vegetation. Estimates of utilization were obtained by comparing the average saltgrass height (obtained by this survey) with a height-volume distribution curve for saltgrass.

6. Nest densities on an area basis were 4.3 nests per square mile in 1948, 4.0 in 1949, and averaged 4.2 for the 2 years. Linear densities were 1.3 nests per mile of channel and marsh banks in 1948, 1.2 in 1949, and averaged 1.3 for the 2 years. Habitat densities were 8.7 nests per 100

habitat acres in 1948, 7.9 nests per 100 habitat acres in 1949 and averaged 8.3 nests per 100 habitat acres for both years.

7. Species composition of nests was relatively constant for the 2 years. Forty-six percent of the nests were those of cinnamon teal, 17 percent mallard, 16 percent pintail, 10 percent shoveller, 10 percent gadwall, and 1 percent redhead.

8. The nests were not uniformly distributed over the area, but were concentrated in the southern portion. The study area was divided into 3 zones, with Zone 3 embracing the area of highest duck density. Zone 1, in the north, included the whole of Knudson's Marsh, and Zone 2 was intermediate. Average nest densities by area for the 2 years varied from 0.4 nests per square mile in Zone 1 to 3.4 in Zone 2, and 13.1 in Zone 3. Linear densities varied from 0.2 nests per mile of channel and marsh banks in Zones 1 and 2 to 4.2 nests per mile in Zone 3.

9. All of the nests were located on channel banks; none, on marsh banks. All of the nests were within 75 feet of water; 50 percent within 15 feet, 79 percent within 30 feet, and 95 percent within 50 feet.

10. The average nest was located only 7½ inches above the current water level and only 1½ inches above high water level.

11. All of the nests were located in level areas, and the nests themselves were on level ground, except for 4

nests which were on isolated clods of turf in channels.

12. Except for 1 nest in a tussock of foxtail barley, all of the nests were in saltgrass.

13. None of the nests was in low saltgrass, and only 4 percent were in medium-low grass. Thirty-six percent were in grass of medium height, 34 percent in medium-high grass, and 26 percent in high grass. All of the 1949 nests were in saltgrass between 8 and 13½ inches. Only 1 percent of the nests was in grass that was lower than the surrounding grass. Forty-six percent were in saltgrass of the same height as the surrounding, and 53 percent were in saltgrass that was higher than the surrounding saltgrass.

14. None of the nests was in grass of low density, and only 2 percent were in medium-low density grass. Fifty-seven percent were in medium density grass, 20 percent in medium-high density grass, and 21 percent in grass of high density. Only 5 percent of the nests were in grass of lower density than the surrounding grass. Forty-nine percent were in grass of the same density as the surrounding, and 46 percent were in grass that was denser than the surrounding.

15. None of the nests was located in ungrazed or heavily grazed areas. Sixty-seven percent were in lightly grazed areas and 33 percent in moderately grazed areas. Only 3 percent of the nest sites were in grass grazed more than the surrounding grass. Fifty-four percent were in grass grazed less and 43 percent in grass grazed to the same degree as the surrounding grass.

16. The range vegetation survey showed that over the study area only 4 percent of the ground within 30 feet of the banks was not vegetated. Ninety-one percent was saltgrass; 2 percent, glasswort; 2 percent, Mediterranean barley; 1 percent, foxtail barley; and less than one-half of 1 percent was spike rush.

17. Average saltgrass heights were 5.2 inches for the entire study area, 4.6 inches in Zone 1, 4.7 in Zone 2, and 6.3 in Zone 3. Average saltgrass densities compared with the density in a luxuriant stand of ungrazed saltgrass were 44 percent for the entire study area, 43 percent in Zone 1, 37 percent in Zone 2, and 48 percent in Zone 3.

18. To estimate Percent Utilization of saltgrass by cattle, the height-volume distribution of forage in saltgrass was calculated from a sample of 50 plants. The distribution of forage was close to a linear relationship between heights of 4-15 inches. Above 15 inches there was gradually less forage per interval of height, and below 4 inches there was an increase in the amount of forage per interval of height. Estimates of the Percent Utilization by livestock were 75 percent for the study area, 80 percent for Zones 1 and 2, and 68 percent for Zone 3.

19. There was a direct relationship between nest density and saltgrass height and an inverse relationship between nest density and utilization of saltgrass by cattle. Zones 1 and 2 had the lowest average saltgrass height, the highest Percent Utilization, and the lowest nest densities.

Zone 3 had the highest average saltgrass height, the lowest Percent Utilization, and the highest nest density. The entire study area was intermediate in every respect.

20. In respect to the amount of nesting on a grazed saltgrass area, it was concluded: The density of nests per square mile on the study area was low, but would be expected to be low owing to the large areas of unproductive mud and glasswort flats between the channels. The linear density of nests per mile of channel and marsh banks was considered to be low. Because of the reduction of saltgrass height by grazing, the area did not realize its full potential for duck nesting. The actual density of nests in 1949 was estimated to be only 30 percent of the potential nest density at 68 percent utilization by cattle.

21. Regarding the success of nests on a grazed saltgrass area, it was concluded: 'The degree of nesting success on the study area was one of the lowest on record. The only apparent effect of grazing on nest success was the loss of 3 percent of the nests by trampling.

22. In regard to the saltgrass requirements of ducks for nesting it was concluded: There was a definite preference for the taller grass as nest sites. However, the tallest grass was not required, and medium to high grass was accepted. The minimum height acceptable to ducks for nesting was about 8 inches. There was definitely a greater use of the saltgrass of medium to high density. Because of the preference for the taller grass, there was also a preference

for grass that was grazed the least. Previously grazed saltgrass was acceptable to at least 1 duck out of 5, providing the grazing was moderate.

23. In respect to the degree of utilization of saltgrass that is compatible with duck nesting, it was concluded: Other factors being equal, it is the amount of saltgrass 8 inches or more in height that determines nest density. This relationship functions according to the law of diminishing returns. Therefore, there is a point where additional amounts of acceptable nesting cover would not result in increases in nest density. This point would vary from one area to another due to variations in other factors such as the amount of available territories. On the study area this point is somewhere below 68 percent utilization by livestock.

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