Waterfowl Production in Relation to Rest-Rotation Grazing

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Highlight: *Duck production was compared in two rest-rotation cattle grazing systems and normally grazed areas in Phillips County, Montana, from 1968 to 1970. Pair populations generally increased in pastures excluded from cattle grazing the previous year and decreased in pastures grazed in the fall of the previous year. In eleven of twelve instances, complete rest or grazing only during spring and early summer, resulted in an increase of the number of broods the following spring. In five of eight instances grazing during summer and fall resulted in a decrease of broods the following spring.*

In an attempt to improve watersheds and increase forage production for livestock on western ranges, rest-rotation grazing systems (Hormay, 1961) are becoming increasingly popular with land managers. Each of these systems requires the presence of livestock water, usually stockponds, which are valuable for waterfowl production.

The purpose of this study was to determine the effects of certain rest-rotation systems on waterfowl production.

Study Area

Two study areas were located in Phillips County in northcentral Montana; one was 12 miles south (Milk River Association Pasture) and one was 50 miles north (Liebel-Math Pasture) of the town of Malta. These areas included 20,650 and 4,320 acres, respectively. Gieseker (1926) described the physiography of the area as rolling plains dissected by deeply intrenched streams and coulees. Rough, broken land is found along most of the streams and in the more feebly glaciated areas.

The climate is semiarid and is characterized by low rainfall, great temperature extremes, and a large number of sunny days (Gieseker, 1926). The mean annual precipitation is 11.84 inches. Precipitation for 1968 and 1969 was 1.14 and 0.48 inches below average, respectively. In 1970, precipitation was 1.75 inches above normal. Average temperatures for the period April through July for 1968, 1969, and 1970 were 59.1, 57.3, and 58.7°F, respectively.

Fifty-four reservoirs were located on the two study areas—33 on the south area and 21 on the north. The reservoirs were of two types: pit type or "dugouts" (a total of 8 on the south and 10 on the north area) and retention dams (25 and 11 on the south and north areas, respectively).

The upland was mainly a grassland community. Crested wheatgrass (*Agropyron cristatum*),[1] bluestem (*Agropyron smithii*), needleleaf sedge (*Carex eleocharis*), blue grama (*Bouteloua gracilis*), Junegrass (*Koeleria cristata*), Sandberg bluegrass (*Poa secunda*), and needleandthread (*Stipa comata*) were the dominant grasses and grasslike plants. Dominant forbs included yarrow (*Achillea millefolium*), fringed sagewort (*Artemisia frigida*), saltbrush (*Atriplex nuttalii*), and plaintain (*Plantago* spp.). Dominant shrubs included silver sagebrush (*Artemesia cana*), saltbrush (*Atriplex nuttalii*), and rose (*Rosa* spp.). Shoreline vegetation consisted mainly of slender spike-sedge (*Eleocharis acicularis*), longstem spike-sedge (*Eleocharis macrostachya*), and foxtail barley (*Hordeum jubatum*). Emergent vegetation included American water plaintain (*Alisma plantago-aquatica*) and arrowleaf (*Sagittaria cuneata*). Sago pondweed (*Potamogeton pectinatus*), milfoil (*Myriophyllum exalbescens*), and aquatic buttercup (*Ranunculus aquatilis*) were the principal submergents.

Methods

The division of the south and north areas into five pastures each was completed in the fall of 1966 and 1967, respectively. Before this each area was continuously grazed for at least 6 months as were the controls throughout the study period. The general grazing plan essentially followed that of Hormay (1961), with each system being subjected to yearly grazing treatments as shown in Figures 2 and 3.

Two pits and three retention reservoirs were selected outside of each experimental study area for controls to compare waterfowl production on reservoirs in pastures under normal grazing with those under rest-rotation grazing.

Censuses of the breeding populations were made during spring and early summer each year except 1968 on the south area. Observations of pairs, lone drakes, or combinations indicating pairs, were used to estimate the breeding population (Hammond, 1959).

Brood counts were made each summer from both areas at approximately 10-day intervals from early June to September 15. All broods were recorded as to species, age class, date observed, and number of young. Broods observed only once on a specific pond were considered

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[1] Plant nomenclature follows Booth (1950) and Booth and Wright (1959).

Table 1. Estimated number of breeding pairs of waterfowl on the two study areas.

	Number of pairs		
	1968	1969	1970
South unit	–	71	93
South controls	–	18	24
North unit	39	47	49
North controls	–	16	21
Totals	39	152	187

transient (Berg, 1956). Calculation of brood production followed that of Gollop and Marshall (1954).

Time permitted evaluation of the effects of rest-rotation grazing on vegetation only on the south study area. A permanent 100-foot line transect (Canfield, 1941) was established on each of three shrub types. The numbers of individual plants of key species of shrubs and grasses in square-foot frames placed at 10-foot intervals along the line were counted in mid-May of 1968 and 1970. Canopy coverages of upland and shoreline vegetation were determined on each of the five pastures in the area. The method was a modification of Daubenmire (1959). Twenty 2- by 5-dm plots were placed along a 100-foot tape at 5-foot intervals. Within these plots, the percentage of canopy coverage of each taxon was visually estimated and recorded by classes. The vegetation occurring within the plots was also recorded in one or more of five height classes for each category of canopy coverage.

Shoreline length was obtained during the fall of 1970. A calibrated wheel was pushed around each reservoir at the high and low waterline for that year.

No intensive nest searches were made, but for nests found, the following information was recorded: distance to water, species of duck, and fate.

Results

Breeding Pair Populations

Breeding pair populations were composed principally of dabbling ducks, although redheads (*Aythya americana*), ruddy ducks (*Oxyura jamaicensis*), ringnecks (*Aythya collaris*), canvasbacks (*Aythya valisineria*), and lesser scaups (*Aythya affinis*) were seen as spring migrants. Lesser scaup and canvasback pairs comprised the diver populations after June 10.

The estimated numbers of pairs on the south and north study areas are shown in Tables 1 and 2, respectively.

Table 2. Comparison of pairs of waterfowl use on retention and dugout ponds, 1969-70.

Type	No. of ponds	Total pairs		Pairs/pond		Pairs/1000 ft of shoreline	
		1969	1970	1969	1970	1969	1970
Retention	49	141	169	2.9	3.4	2.0	2.5
Dugouts	17	11	18	0.6	1.1	0.9	1.5

Pair populations increased on both areas during the years of census. Blue-winged teal (*Anas discors*) and lesser scaup showed the greatest increase on the south, while pintail and lesser scaup showed the greatest increases on the north.

The maximum number of breeding pairs per acre of water occurred in 1970 when there were 1.2 and 1.8 pairs for the south and north areas, respectively. Comparable data for the controls for the two study areas during the same period were 3.1 and 3.3 pairs. The higher pair density occurring on the controls may have been due to selecting largely retention-type control ponds, whereas those ponds on the study areas were all inclusive within a unit area and thus included a higher percentage of dugouts.

Retention-type ponds held the highest density of breeding pairs. The average number of pairs for both years on retention-type and dugouts was 3.2

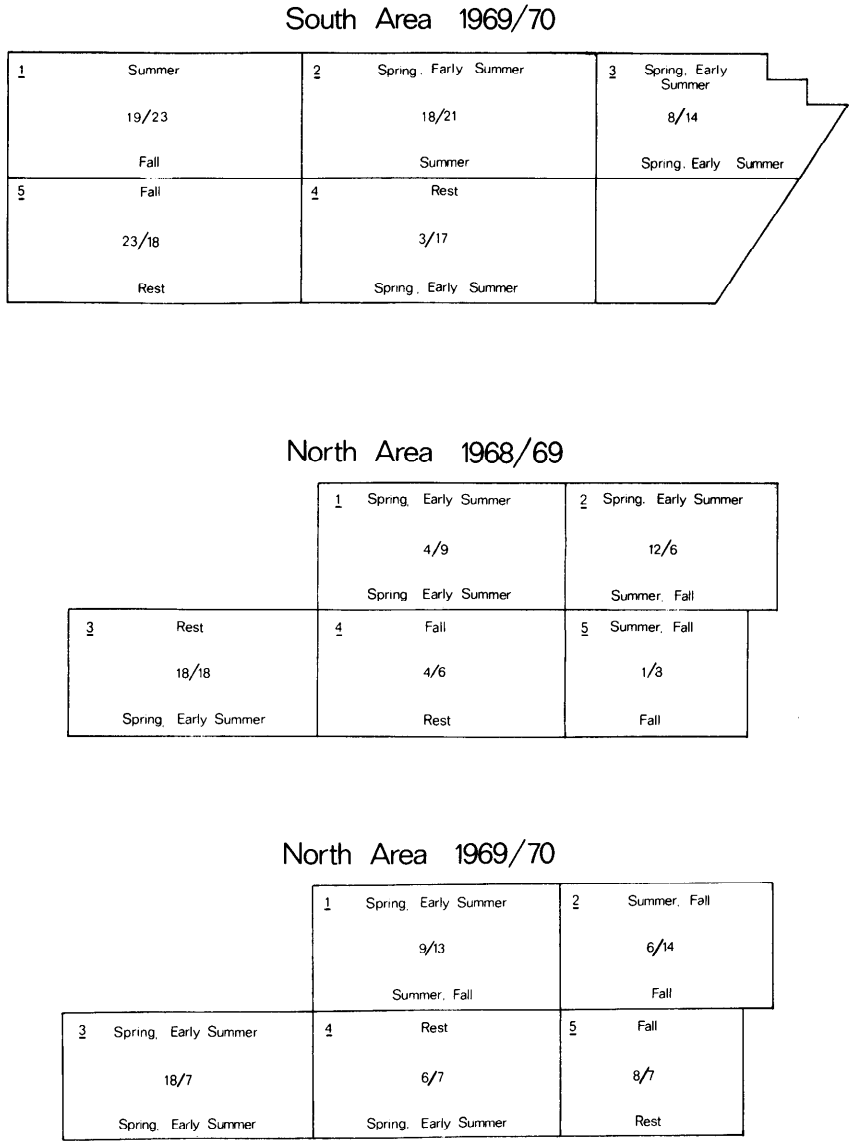

Fig. 1. *Changes in breeding-pair numbers in relation to grazing treatments. Grazing periods for the first year are listed at the top of each pasture; for the second, at the bottom.*

and 0.9, respectively. Pairs per 1,000 feet of shoreline on these same types averaged 2.3 and 1.2 (Table 3).

The greatest increase in breeding pairs in relation to grazing treatments on the south area from 1969 to 1970 occurred in pasture four (Fig. 1). This pasture was rested during 1969 and grazed from May 1 to July 20 during 1970. The only decrease on this area occurred in pasture five, which was grazed in the fall of 1969 and rested during 1970.

Differences in numbers of breeding pairs in relation to grazing on the north area were difficult to assess because the small pasture size resulted in overlap between pastures of breeding pair territories.

Table 3. Brood production on the south study area, 1968-1970.

Species	Number of broods				Average brood size[a]			
	1968	1969	1970	Avg	1968	1969	1970	Avg
Pintail	4(2)[b]	13(3)	17(2)	11	3.0	4.5	5.6	4.4
Mallard	6	13(3)	11(2)	10	5.0	6.1	5.5	5.5
Baldpate	6	9(2)	15(1)	10	5.8	6.3	5.5	5.9
Shoveler	6(1)	6(2)	11(1)	8	5.8	9.3	9.8	8.3
Blue-winged teal	4(2)	2	16(5)	7	5.3	3.0	7.1	5.1
Gadwall	9(2)	4	6	6	4.8	6.8	7.3	6.3
Lesser scaup		1	1	1		10.0	9.0	9.5
Total	35(7)	48(10)	77(11)	53	5.1	6.1	6.7	6.2
Controls	12	11	13	12	5.4	5.8	5.9	5.7

[a]Average brood size given is Class IIc - IIIa.
[b]Number of transient broods is shown in parentheses.

Table 4. Brood production on the north study area, 1968-1970.

Species	Number of broods				Average brood size[a]			
	1968	1969	1970	Avg	1968	1969	1970	Avg
Pintail	4(2)[b]	11(5)	9(1)	8	3.3	4.8	3.9	4.0
Baldpate	6(1)	7	8(2)	7	5.2	7.3	6.9	6.5
Shoveler	4	10(1)	5	6	6.3	7.4	4.4	6.0
Mallard	4	3(3)	5(1)	4	5.7	4.0	6.0	5.2
Gadwall	4(1)	1	4	3	6.0	5.0	7.3	6.1
Blue-winged teal		2	7	3		6.5	9.0	7.8
Lesser scaup		1	1	1		9.0	2.0	5.5
Total	22(4)	35(9)	39(5)	32	5.2	6.3	6.1	5.9
Controls	4	9	11	8	3.7	5.7	5.3	5.3

[a]Average brood size given is Class IIc - IIIa.
[b]Number of transient broods is shown in parentheses.

Brood Populations

Brood production on the south and north study areas increased over the 3-year period, with pintails and blue-winged teal showing the greatest increase on both (Tables 4 and 5). Brood production for the same period on control areas remained fairly constant on the south area and increased on the north area.

The greatest decrease in size of broods occurred within 2 weeks after hatching. During this period, an average loss of 1.8 ducklings per brood in 1969 and 1.4 during 1970 was recorded. After this time, the loss dropped to less than 0.2 ducklings per brood. Similar findings were reported by Low (1945), Earl (1950), Keith (1961), and Miller and Collins (1954).

The maximum number of broods per acre of water (transient broods excluded) occurred in 1970, when there were 1.2 and 2.1 broods for the south and north areas, respectively. Comparable data for the controls of the two study areas during the same period were 1.9 and 2.3 broods. With an average of 6 ducks per brood, about 9 ducks per acre of water were produced to flying stage. Two new reservoirs, built in pasture five on the south area during the fall of 1968, were excluded from these figures. These reservoirs totaled 13.4 acres but produced no broods during 1970.

Brood use was much higher on retention ponds than on dugouts. Only three broods were observed on dugouts during the period of study.

Changes between years in numbers of broods produced in relation to grazing treatments are shown in Figures 2 and 3. In 11 of 12 instances, complete rest or grazing only during spring and early summer resulted in an increase of broods the following spring. Conversely, grazing during summer and fall resulted in a decrease of broods in five of eight instances. Largest fluctuations in numbers of broods between any two years consistently followed this pattern.

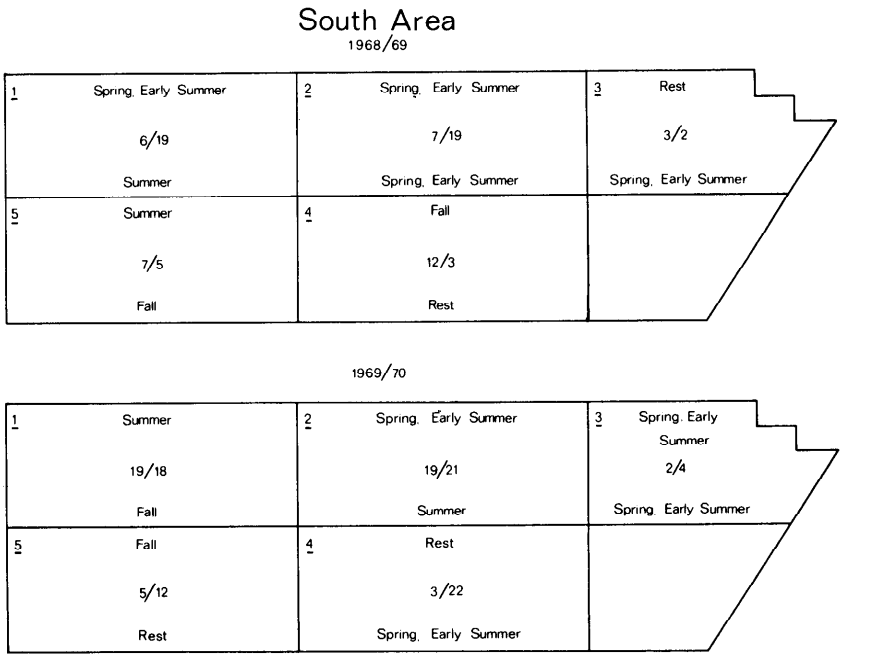

Fig. 2. *Numbers of broods in relation to grazing treatments in the south area. Grazing periods for the first year are listed at the top of each pasture; for the second, at the bottom.*

Vegetation

The line intercept data showed an increase in canopy coverage of all three shrub types from 1968 to 1970, with the greatest increase (22.6%) occurring in the silver sage type (Table 6). Counts of plants in square-foot plots in this type showed an increase in the number of mature plants from two to nine and an increase in the number of seedlings from 6 to 16. Total numbers of key grasses occurring in all square-foot plots increased from 93 to 200. This increase may have been greater, as bluestem was present in all types but was counted in only the saltbrush type.

Mean canopy coverage and frequency of occurrence of each plant species as shown by the 20- by 50-dm plots are listed in Table 7. The canopy coverage provided by grasses increased about 60% from 1969 to 1970, whereas bare ground decreased about 22%. These increases in grass canopy occurred in bluestem, blue grama, needleleaf sedge, six-weeks fescue (*Festuca octiflora*), and Sandberg bluegrass. A slight increase in percentage canopy of forbs was found over the 2-year period, with the greatest increase occurring in the dominant forb: fringed sagewort. A decrease in lichens from 21% to 5% also occurred.

Large fluctuations were found in the height of vegetation within individual pastures. The largest increase in the height of both upland and shoreline vegetation occurred in pastures which were rested for an entire year. Increases also occurred in pastures where only spring and early summer grazing occurred and regrowth was allowed in summer and fall. Largest decreases occurred in pastures which were grazed during late summer and fall.

Species composition of shoreline vegetation changed slightly from 1969 to 1970 (Table 7). Percentage canopy coverage of spike-sedge decreased while arrowleaf increased. The reason for the decrease in spike-sedge may be attributed to weather. Heavy rainfall during the summer of 1969 filled all reservoirs to capacity and stimulated a dense growth of longstem spike-sedge (*E. macrostachya*). As the waterlevels rapidly decreased through August, a dense growth of slender spike-sedge (*Eleocharis acicularis*) appeared on the exposed shoreline. These conditions did not occur during 1970.

Table 5. Canopy cover (%) and number of plants in square-foot plots on each of three shrub types of the south study area, 1968-1970.

			Number of plants					
	Canopy cover		Bluestem		Needleand-thread		Green needlegrass	
Shrub type	1968	1970	1968	1970	1968	1970	1968	1970
Silver sagebrush	16.4	20.1	–	–	29	78	–	–
Saltbush	0.5	0.8	58	77	–	–	–	–
Rose	5.1	5.6	–	–	–	–	5	45

Table 6. Mean cover (%) and frequency (%) of occurrence of vegetation on the south study area for 1969 and 1970 as determined by measurements on 40 stands in upland and 20 stands in shoreline vegetation.

	Cover		Frequency	
	1969	1970	1969	1970
Upland grasses and grass-like plants				
Bluestem	4	7	35	32
Blue grama	9	28	61	89
Needleleaf sedge	7	11	50	59
Sixweeks fescue	T	9	1	44
Sandberg bluegrass	13	24	77	91
Other grasses	6	T	33	5
Total	41	66	99	99
Forbs				
Fringed sagewort	6	12	51	64
Opuntia polycantha	2	1	15	10
Plaintain	6	6	71	74
Sphaeralcea coccinea	T	1	4	11
Other forbs	4	2	31	7
Total	16	18	99	95
Others				
Bare ground	31	24	100	100
Lichens	21	5	83	87
Shoreline				
Bechmannia Syzigachne	T	3	16	14
Slender spike-sedge	44	41	58	90
Longstem spike-sedge	95	60	100	88
Bare ground	3	29	26	63

Table 7. Number of breeding pairs, broods, and estimated breeding success on both study areas, 1968-1970.

	Number of pairs			Number of broods			Success (%)		
Area	1968	1969	1970	1968	1969	1970	1968	1969	1970
South Unit	–	71	93	35	48	77	–	68	83
South Controls	–	18	24	12	11	13	–	61	54
North Unit	39	47	49	22	35	39	56	74	80
North Controls	–	16	21	4	9	11	–	56	52
Total	–	152	187	73	103	140	–	68	74

Shoreline vegetation did not develop on most reservoirs until the fall of 1968 and then only on those ponds that were not grazed in late summer or fall. By 1970, shoreline vegetation was abundant on all retention type ponds over 3 years of age (Fig. 4) and had appeared in small amounts on some pit type reservoirs. By 1970, grazing of the shoreline by cattle seemed to result in only a slight reduction in total ground cover, but a great reduction in height of vegetation was still apparent. Within a period of 2 weeks after cattle had been turned into a pasture, grazing and trampling had reduced most of the vegetation within 15 yards of the shore to a height of 3 inches or less.

Although no detailed vegetational measurements were taken on control ponds, visual observation indicated that height of shoreline vegetation

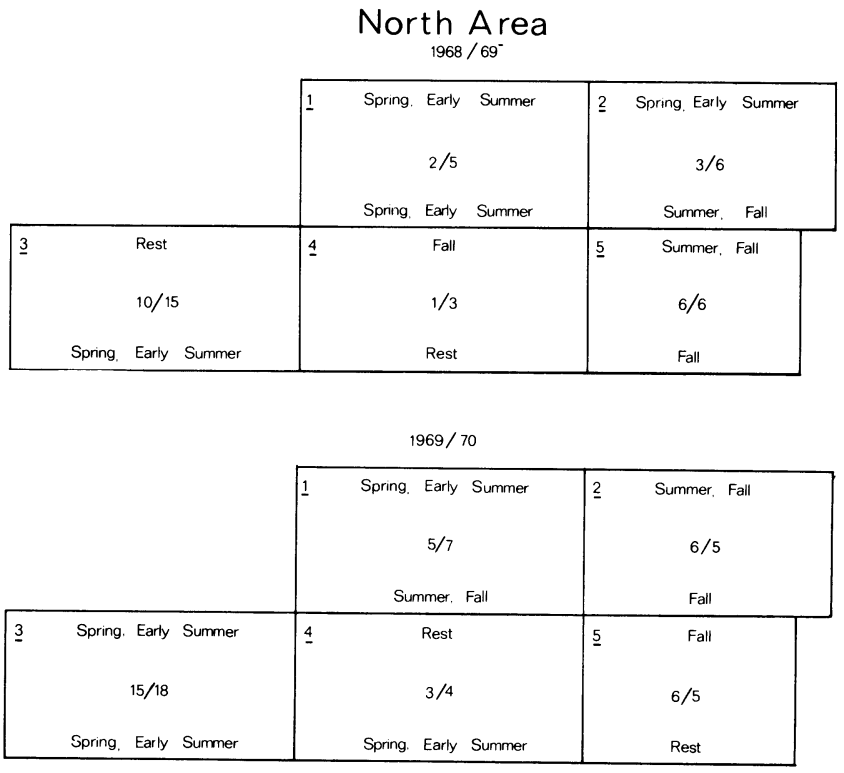

Fig. 3. *Numbers of broods in relation to grazing treatments in the north area. Grazing periods for the first year are listed at the top of each pasture; for the second, at the bottom.*

seldom exceeded three inches.

Discussion

Pair populations and brood numbers seemed to respond in a positive manner to increases in residual vegetation. Keith (1961) noted that since some species of waterfowl begin to nest before new growth provides adequate cover, the presence of residual cover from the previous year is extremely important.

Relief from grazing for a full season in 1968-1969 was accompanied by an increase of broods on the north area. This same relief in 1969-70 resulted in increases of both breeding pairs and broods on both study areas. Differences between years may have been due to the vegetation in the pastures showing a smaller response to grazing treatments from 1968-1969 than from 1969-1970. Hormay (1916), working with Idaho fescue (*Festuca idahoensis*) in California, noted that this plant will produce few, if any, flower stalks and, therefore, little or no seed the first year after close grazing, even though the plants are rested. Reasonably vigorous plants and adequate flower stalks can be expected in the second season. A similar response may be expected from the grasses found on this study area.

Some residual cover may result even from partial rest the previous year, the amount depending on the time of grazing. The upland vegetation surrounding each pond is primarily native shortgrass prairie and cattle, if permitted, will feed on grasses in this type throughout an entire grazing season. Some regrowth of vegetation, resulting in residual cover the following spring, may be expected after the end of the earliest treatment if cattle are moved out of pastures at this time. Both pastures which received this type of treatment on the south area in 1969 had increased pair populations and brood numbers in 1970. All pastures which received this type of treatment on the north area in 1969 and 1970 had increased numbers of broods the following spring.

Pastures which are grazed in late summer and fall will have the smallest amount of residual cover the following spring. The only decrease in breeding pairs on the south area in 1970 occurred in pasture five, which had been grazed in the fall of 1969. Decreases in brood production occurred in five of eight instances following late summer and fall grazing.

Similar observations on the presence of vegetative cover and breeding pairs have been made by others. Salyer (1962) observed approximately twice as many pairs on idle land as he did on moderately or lightly grazed lands. Kirsh (1969) found a higher number of pairs per 10,000 ft of shoreline on ungrazed plots than on grazed plots.

Increases in brood production in pastures with residual cover might have been greater if cattle had not been permitted to graze these pastures

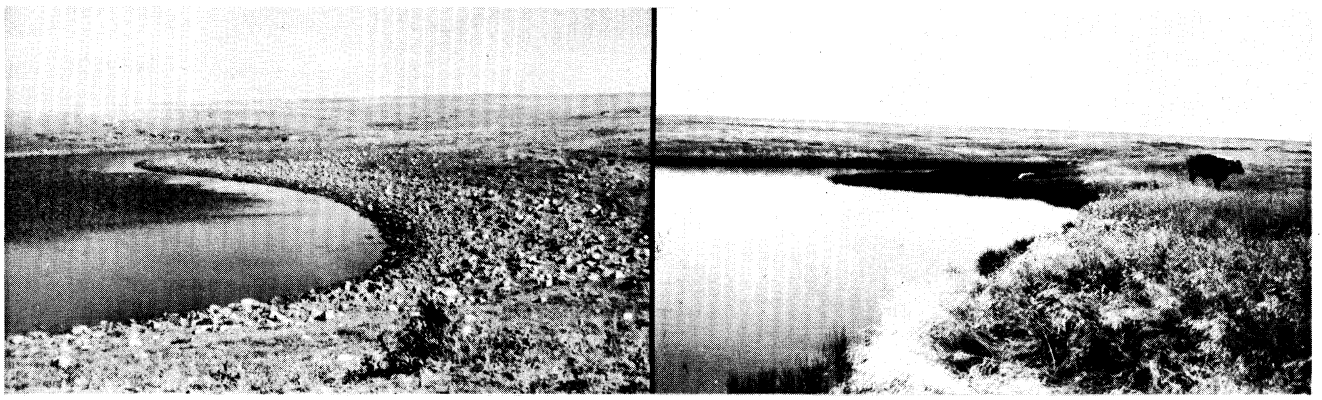

Fig. 4. *Response in shoreline vegetation from 1968 (summer and fall grazing) (left) to 1970 (right).*

until incubation was complete on most nests. Kirsh (1969) found that nest success on ungrazed areas was twice as high as on grazed areas. Anderson (1957) reported that 42.2% of 116 nests on idle land in California hatched, whereas none of seven nests on grazed land hatched. Glover (1956) found 24.4% nesting success on idle land and lightly grazed areas in Iowa, compared with only 10.5% success on heavily and moderately grazed areas.

Eight nests were found during the period of study, three of which had been trampled by cattle. When residual shoreline vegetation is present, certain species of ducks, preferring to nest close to water, may be subjected to nest loss by trampling. When such areas are opened to grazing in late spring or early summer and temporary waters are nonexistent, cattle use is concentrated around existing reservoirs. A flexible grazing system which could delay grazing on such areas until after the peak of hatching may further increase the nesting success.

Waterfowl breeding habitat must first attract breeding pairs but must also be of sufficient quality to permit successful reproduction. Table 7 compares the number of breeding pairs and resulting production in 1969 and 1970 on both study units and their controls. An increase in breeding pairs was indicated from 1969 to 1970 on both study areas and their controls. However, productivity was decidedly higher on the study areas than on their controls in 1969. In 1970, although all areas had an increase in breeding pairs, the study areas showed a further increase in breeding success, while the controls showed a slight decrease.

These data suggest that the increased vegetation being provided by the rotational grazing system is providing additional nesting and/or brood-rearing security. In contrast, the controls with no visual increase in vegetation may be showing a negative response to an increase in breeding pairs. Bellrose et al. (1961) discussed the relationship between ponds and breeding pair productivity and suggested that an inverse relationship existed between population density and production of young ducks (Errington's inversity principle).

Management Suggestions

In the establishment and management of rest-rotation systems, the range manager can increase benefits to waterfowl if the following guidelines are applied:

1) Construct retention type ponds instead of dugouts whenever possible.

2) After the end of the earliest treatment (spring and early summer grazing) move cattle out of the pasture and close the gates behind them. This will allow for regrowth of the vegetation and provide residual cover for nesting the following spring.

3) Delay grazing of pastures with residual cover (those rested or those grazed only during spring and early summer the previous year) until incubation is completed on most nests—approximately July 1 in this area.

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