



Vegetative characteristics of two water areas in Teton County, Montana, in relation to waterfowl usage
by Richard R Knight

A THESIS Submitted to the Graduate Faculty in partial fulfillment Of the Requirements for the degree
of Master of Science in Fish and Wildlife Management at Montana State College

Montana State University

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Abstract:

During the summers of 1956 and 1959, information was gathered on the' vegetative characteristics and waterfowl usage of two water areas in Teton County, Montana. Maps of vegetative types were drawn and described. Data relating to occurrence of individual species were obtained from transects extending across the areas. The sum of occurrences for any plant was expressed as a percentage of the total of all occurrences.

Information on waterfowl usage was gathered from total counts of waterfowl, nest searches and brood observations. Differences in waterfowl usage for the two years were compared to the vegetative changes which occurred.

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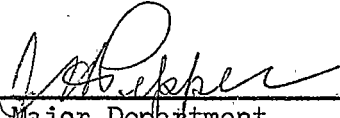
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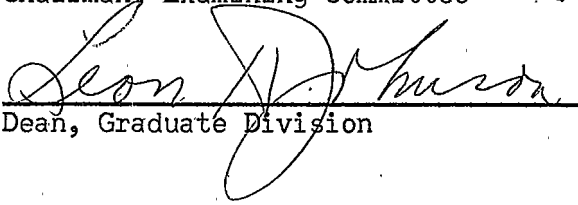
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Head, Major Department


Chairman, Examining Committee


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ABSTRACT

During the summers of 1956 and 1959, information was gathered on the vegetative characteristics and waterfowl usage of two water areas in Teton County, Montana. Maps of vegetative types were drawn and described. Data relating to occurrence of individual species were obtained from transects extending across the areas. The sum of occurrences for any plant was expressed as a percentage of the total of all occurrences.

Information on waterfowl usage was gathered from total counts of waterfowl, nest searches and brood observations. Differences in waterfowl usage for the two years were compared to the vegetative changes which occurred.

INTRODUCTION

Freezeout Lake in Teton County, Montana, is a natural sump supplied by waste water from adjacent irrigated farmland. For many years, this lake has furnished good duck hunting. From 1941 to 1952, due to unusual moisture conditions, the water area increased from 1,900 to 4,100 acres. Drainage of the area was proposed by local groups. Ellig (1955), in cooperation with the Montana Fish and Game Department, studied waterfowl relationships of the area in 1951 and 1952. In 1953, the Montana Fish and Game Department began to develop this region into a waterfowl management area. A drainage system was constructed and dikes with water control structures were planned to divide the area into several water units for management purposes.

In 1956, two water areas on the northern edge of the lake were chosen by the writer for study to determine vegetational characteristics and waterfowl usage. Information was gathered from June 15 to October 15, 1956, and from June 10 to September 24, 1959.

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DESCRIPTION OF THE AREA

Freezeout Lake lies at the western edge of the Fairfield Bench. It occupies part of a glacial lake basin, surrounded by rolling uplands. The climate of this general area is semi-arid. Upland native vegetation is mainly grassland. Soils in the area are cloddy stratified silty clays and clays with subsoils impregnated with alkali (Geiseker, 1937).

Study Area No. 1 lies north of the main body of Freezeout Lake and is connected to it by a drainage canal 0.5 mile long and a seepage region. Ellig (op. cit.) described this area as it appeared in 1952, as a 400 acre cattail marsh. In 1953, rising water expanded this pond until it was directly connected to the main lake (Fig. 1). The rise in water levels was accompanied by elimination of much of the emergent vegetation. Drainage of Freezeout Lake, beginning in 1954, reduced the area to the size shown in figure 2 by 1956. Figure 3 shows Study Area No. 1 in 1952, supporting an extensive emergent growth. Figure 4 shows this area as it was in 1959, after drainage had reduced the area to its present size (about 296 acres) and without the extensive emergent vegetation present in 1952. This area is fed by three supply ditches entering the northern edge. All receive waste water from adjacent irrigated farmland. Maximum water depth found was 25 inches but most depths varied from six to 15 inches. Water fluctuations up to four inches were common.

Study Area No. 2 lies north of Freezeout Lake and west of Study Area No. 1. In 1952, this was a pond of about 40 acres separated from Freeze-



Fig. 1. Freezeout **Lake** area in 1953. The numerals 1 and 2 designate the locations of the respective study areas.



Fig. 2. Freezeout Lake area in 1959 with numerals indicating study areas. Dotted line indicates water level on Study Area No. 2 in 1956.



Fig. 3. Study Area No. 1 in 1952 showing extensive growth of Common Cattail (Typha latifolia).



Fig. 4. Study Area No. 1 in 1959 showing extensive open water. The dark line in the background is Great Bulrush (Scirpus validus).

out Lake by a strip of grassland approximately 0.2 of a mile wide. In 1953, this strip of grassland was flooded and Study Area No. 2 became part of Freezeout Lake (Fig. 1). By 1956, the water had receded, leaving the area approximately the same size as in 1952 but with a mud flat in place of the grassland strip. The dotted line in figure 2 indicates the approximate size and position of this area. In 1958, a dike was constructed between this pond and the main lake and small islands were built to attract nesting waterfowl. In the spring of 1959, the area inside the dike was flooded and had a surface area of 263 acres leaving a large island in addition to the artificial islands. In 1956, Study Area No. 2 was fed by two ditches: one entering from the north through a culvert under U. S. Highway 89 and one entering from the east. In 1959, all water came from a marsh area north of the highway through a culvert connecting the two areas. The maximum water depth was 14 inches in 1956 and 26 inches in 1959. Water depths throughout most of the pond varied from eight to 12 inches in 1956 and from 18 to 24 inches in 1959. Fluctuations up to six inches were common in 1959 only.

METHODS

Three methods were used to study vegetation. Cover maps were made from aerial photographs and verified in the field, pictures for comparative purposes were taken at photopoints and permanent transects extending across the study areas were established.

Steel fence posts were placed on opposite sides of the ponds on high ground to serve as end points for the transects. A 200-foot cable marked

at one foot intervals was moved between the two end points to aid the sampler. A rod with a 0.75 inch diameter wire loop at the bottom was lowered each foot along the entire length of the transect. Water depths were recorded to the nearest 0.5 inch. Anything touched by the loop was recorded as an "occurrence" of a plant or bare ground. The sum of occurrences for any plant was expressed as a percentage of the total of all occurrences. If more than one species of plant was touched, an occurrence was recorded for each of them. This method neither expressed results in amount of ground cover nor vigor of growth but it is believed to have shown vegetative composition by species. Six transects were used on Area No. 1 and two on Area No. 2. A total of 45,102 occurrences was recorded for both years.

Degrees of waterfowl usage was determined from the total number of waterfowl using the areas, the number of nests found and brood usage. In 1956, total waterfowl counts were made approximately once weekly from observation points on the ground. In 1959, poorer visibility caused by increased emergent vegetation made it necessary to make counts from an airplane. All nest searches were made between 8:00 and 10:00 A.M. Nest searches in 1956 were made by two men dragging a rope between them which had tin cans attached, similar to the method described by Sowls (1950). In 1959, nest searches were made by one man walking in zig-zag routes, spaced at 30 foot intervals. While using the latter method, hens flushed more readily if the searcher stopped for a moment every 20 or 30 feet. All broods observed in the course of normal daily activities on the area

were recorded.

DESCRIPTION OF VEGETATIVE TYPES

Distribution of vegetative types on Area One in 1956 and 1959 are shown in figures 5 and 6 respectively. A description of vegetative types delineated on the maps, follows:

Scpa. This type, covered 15 acres and was characterized by dominance of Alkali Bulrush (Scirpus paludosus). It was situated above the water line in 1956 (Fig. 5) but was exposed to fluctuating water levels. Other species, mainly Spike-sedge (Eleocharis macrostachya), Great Bulrush (Scirpus validus), Common Cattail (Typha latifolia) and Nuttall Alkali-grass (Puccinellia nuttalliana) were present. By 1959, total area covered by Alkali Bulrush was 54 acres. Most of this increase was around the perimeter of open water at the east end of the area. Much of the area covered in 1959 was occupied by Kochia/Chenopodium in 1956 (Figs. 5, 6). The Alkali Bulrush type shown inside the water line in figure 6 occurred as an almost pure stand with only occasional culms of Common Cattail. This water type of Alkali Bulrush normally occurred in water depths up to six inches.

Tyla. Common Cattail was the dominant plant in this vegetative type. In 1956, Rabbitfoot Polypogon (Polypogon monolepiensis) was common, but in 1959 this grass was not as prevalent in this type. Total areas covered by Tyla did not change appreciably during the study period. Water levels averaged higher in 1959. Most of this type occurred as a large stand in the northeast portion of the area. A smaller stand was situated south of

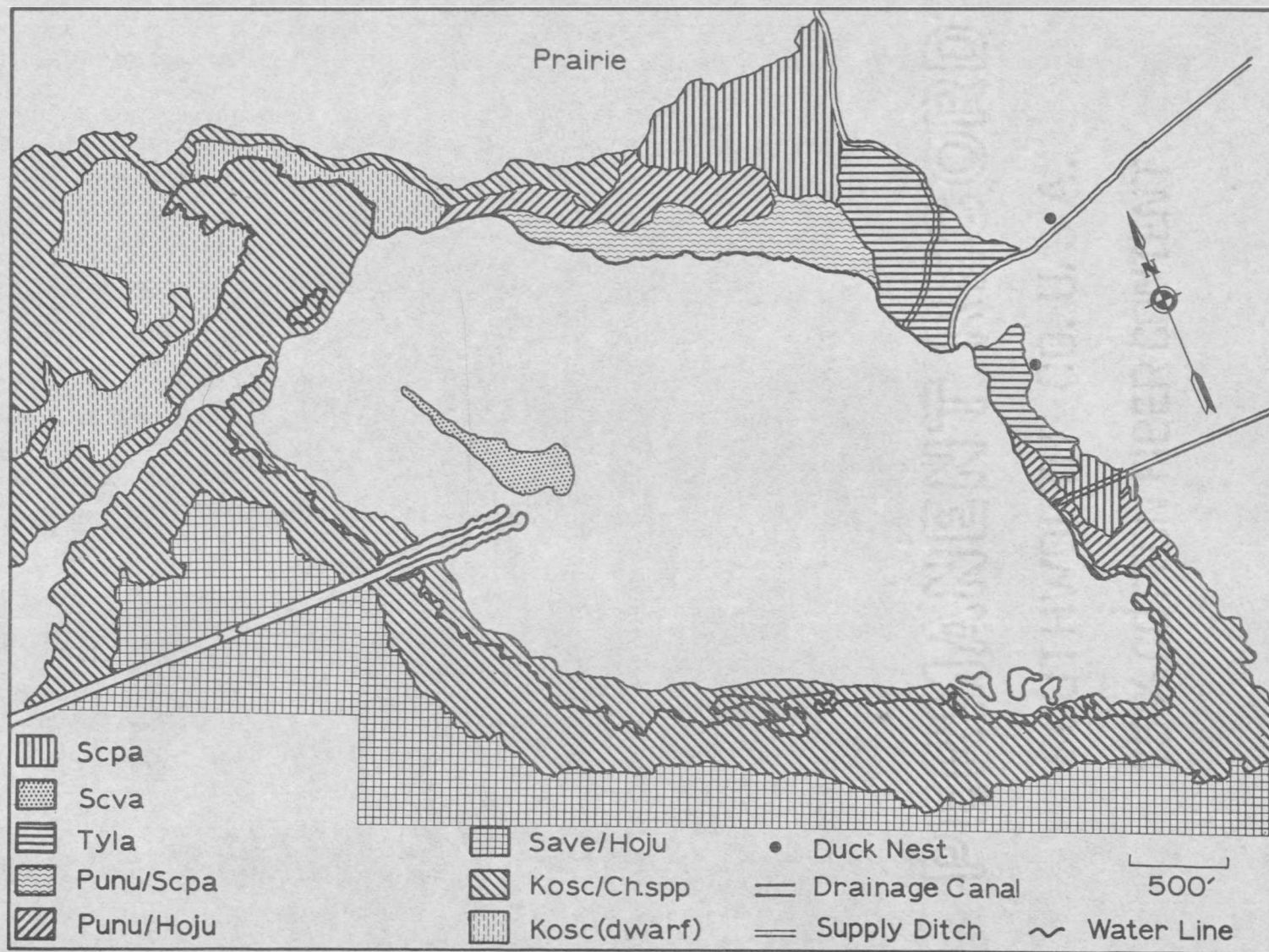


Fig. 5. Distribution of vegetative types and location of nests on Area No. 1 in 1956.

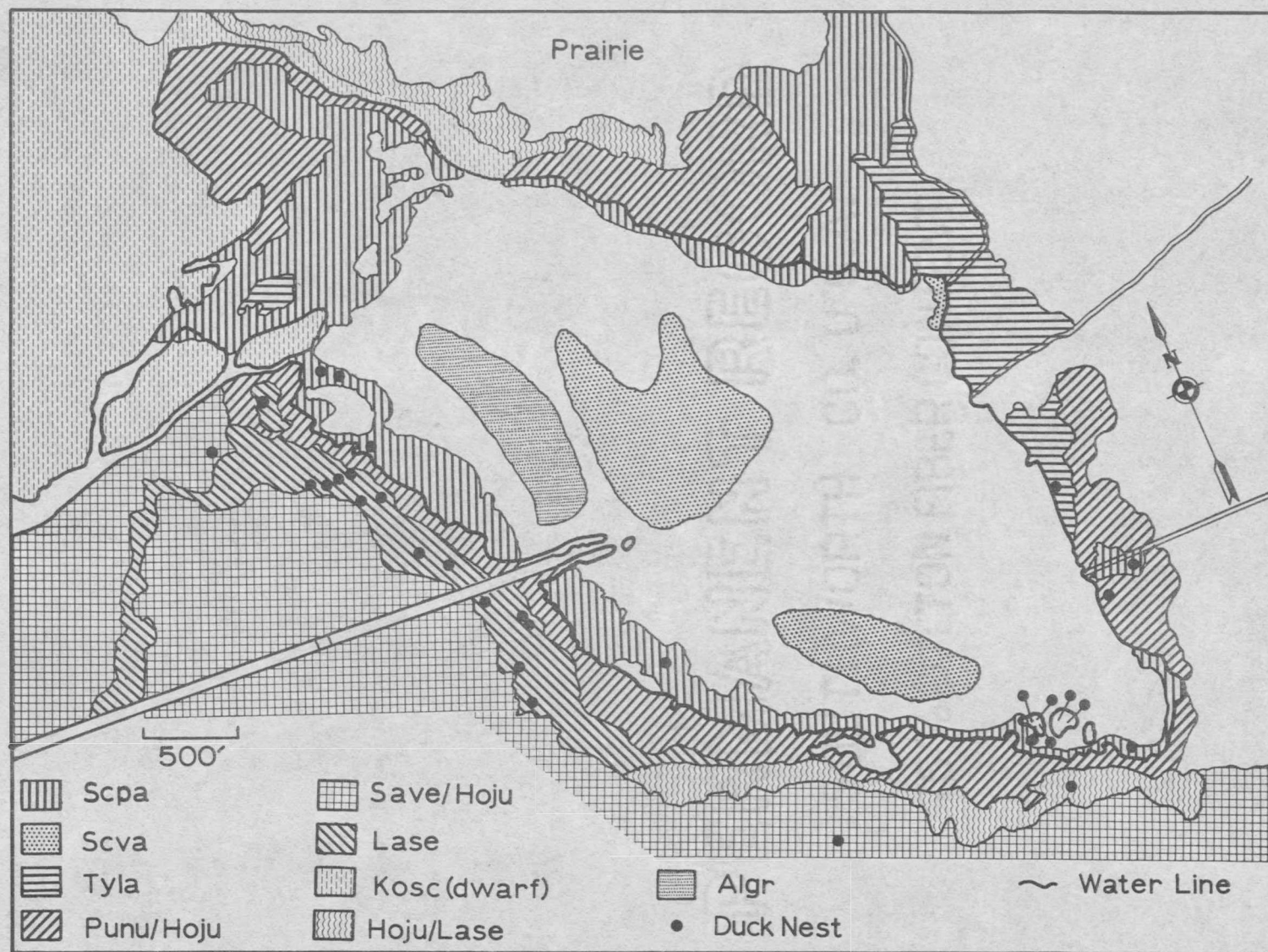


Fig. 6. Distribution of vegetative types and location of nests on Area No. 1 in 1959.

this and Common Cattail also was present at the northwestern end of the area in 1959. Water levels fluctuated from zero to three inches in the area supporting the large stand. The area occupied by the small stand was much drier. In 1959, this stand had decreased noticeably in vigor.

Scva. This type composed two acres of small clusters of Great Bulrush growing in open water, in the west central portion of the pond in 1956. In 1959, this type had expanded to 20 acres, with large vigorous clusters in the center of the pond and thinner clusters in the southeast end. No other plants were found in this type.

Punu/Hoju. This type occurred in areas with water depths up to two or three inches. Foxtail Barley (Hordeum jubatum) and Nuttall Alkali-grass were dominant with about a 30 and 60 percent occurrence respectively. In 1956, 10 acres existed and in 1959 51 acres. Most of the area taken over by this type in 1959 had been occupied by Kochia/Chenopodium in 1956 (Figs. 5, 6).

Punu/Scpa. About 8 acres of this type were present in 1956. Species composition was about 50 percent Alkali Grass and 40 percent Alkali Bulrush with some Foxtail Barley and scattered miscellaneous species. In 1959, no extensive tracts of this type were found. Sites where it had been present were occupied by pure stands of Alkali Bulrush type or Punu/Hoju type.

Algr. Only a few scattered culms of Narrow-leaved Water-plantain (Alisma gramineum) were found in 1956, but in 1959, a 7 acre stand was present near the west central edge. This plant also occurred as scattered culms throughout the pond.

Kosc/Ch. spp. This type occurred on dry or slightly damp ground. Species composition was almost equally divided between Summer Cypress (Kochia scoparia), Lamb's Quarter (Chenopodium album) and Oakleaf Goosefoot (C. glaucum). Growth was so dense (Fig. 7) that almost 100 percent occurrence was recorded. In 1956, extensive stands on the southern and western borders of the pond were flooded and killed out by August. There were 11 acres in 1956 and none in 1959.

Kosc (Dwarf). A dense growth of stunted Summer Cypress only two to three inches in height (Fig. 8) occurred on 21 and 46 acres of comparatively dry soil with numerous alkali spots at the northwestern edge of the area in 1956 and 1959 respectively (Fig. 5, 6). An expansion in 1959 covered ground formerly occupied by Kosc/Ch. spp., in 1956. Red Glasswort (Salicornia rubra) often occurred in moist areas in this type.

Lase. Prickly Lettuce (Lactuca serriola) was the dominant plant in this type, forming a very dense growth covering 25 acres between the Punu/Hoju and Save/Hoju types on the western edge of the area. Prostrate Knotweed (Polygonum aviculare), Hoary Aster (Aster canescens), Lamb's Quarter and Summer Cypress occurred commonly along the edge. This type did not occur in 1956. The area was then occupied by Kosc/Ch. spp.

Hoju/Lase. The Foxtail Barley and Prickly Lettuce type formed a strip of 8 acres on the southern edge of the area which was continuous from the Lase type to the eastern end of the area in 1959.

Save/Hoju. Greasewood (Sarcobatus vermiculatus) and Foxtail Barley were the dominant plants in this type. Western Wheatgrass (Agropyron



Fig. 7. Dense growth of Kosc/Ch. spp. type.



Fig. 8. Kosc (Dwarf) type.

smithii) was the only other plant of common occurrence. This type was found on high ground which had not been inundated in recent years. It extended from the southern edge of the study area, south and west to Freeze-out Lake in both years.

Prairie. Prairie bordered Area No. 1 on the entire north side. The most abundant grasses were Junegrass (Koeleria cristata), Canby Bluegrass (Poa canbyi) and Western Wheatgrass. Other prevalent plants were William's Needlegrass (Stipa williamsii), Broom Snakeweed (Gutierrezia sarothrae), Curlcup Gumweed (Grindella squarrosa), Hymenoxys richardsonii, Prairie Coneflower (Ratibida columnifera), Dotted Blazingstar (Liatris punctata), Fringed Sage (Artemisia frigida), Rubber Rabbitbrush (Chrysothamnus nauseosus), Two-grooved Milkvetch (Astragalus bisulcatus), Common Salsify (Tragopogon dubius), Aster commutatus and A. hesperius. Desert Saltgrass (Distichlis stricta), Marsh Arrowgrass (Triglochin maritima) and Foxtail Barley were locally abundant.

Figure 9 shows the distribution of vegetative types on Area No. 2 in 1959. A cover map of the entire area for 1956 is not available.

Construction of dikes around Area No. 2 in 1958 resulted in increased water levels and flooding of much land in 1959 that had been dry in 1956. Data on the 82 percent of Study Area No. 2 that was dry in 1956 and inundated in 1959 are of value for describing the vegetation appearing in the summer immediately following flooding. Data on the 18 percent that was already flooded in 1956 must be interpreted as the effect of higher water levels on vegetation. The only emergent vegetation present in 1956

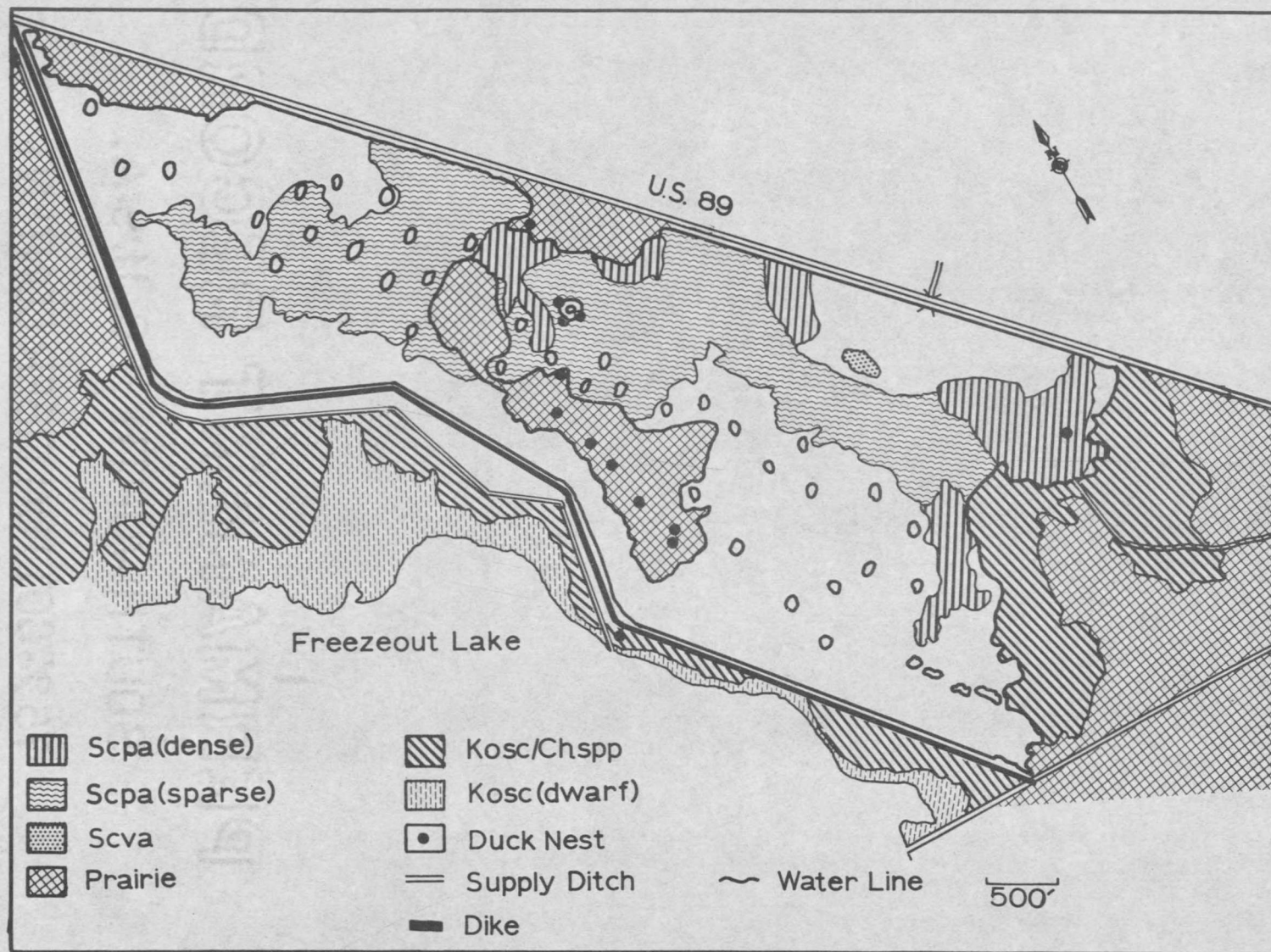


Fig. 9. Distribution of vegetative types and location of nests on Area No. 2 in 1959.

was a 2 acre stand of Alkali Bulrush at the southeast corner. The remainder of the area was occupied by the Kochia/Chenopodium type in varying densities and Prairie type at the eastern end and on the large island (Fig. 9).

Scpa(dense). This type occupied 20 acres in 1959. The bulk of it occurred adjacent to the 2 acre stand which was present in 1956. The average density of Alkali Bulrush was 69.83 culms per square yard as determined by 18 randomly scattered square-yard quadrats. Spike-sedge also occurred in this type in the shallower areas.

Scpa(Sparse). A thin stand of Alkali Bulrush occurred over much of the area which was flooded for the first time in 1959. The average density of Alkali Bulrush was 8.73 culms per square yard as determined by 15 randomly scattered square-yard quadrats. Foxtail Barley occurred in this type in the shallower areas.

Kosc/Ch. spp. This type is essentially the same as that described for Area No. 1 in 1956, except for the added occurrence of Desert Saltgrass. In addition to the portion shown on the map, this type also occurred on all of the artificial islands in the area.

Prairie. This is similar to the type described for Area No. 1 with the exception that Western Wheatgrass was the most abundant grass with Canby Bluegrass and Junegrass occurring rarely.

OCCURRENCE OF INDIVIDUAL SPECIES

Transect data show an increase from 34.3 to 79 percent in total occurrence of aquatic species on Area No. 1 from 1956 to 1959. Table I shows

Table I. Percent occurrence of aquatic plants along transects on Area No. 1 in 1956 and 1959.

Species	Percent Occurrence	
	1956	1959
Sago Pondweed <u>Potamogeton pectinatus</u>	11.40	27.25
Stonewort <u>Chara vulgaris</u>	0.90	10.84
American Milfoil <u>Myriophyllum exalbescens</u>	0.04	7.95
Widgeongrass <u>Ruppia maritima</u>	0.10	2.04
Horned Poolmat <u>Zannichellia palustris</u>	---	1.51
Slender Pondweed <u>Potamogeton filiformis</u>	---	0.45
Alkali Bulrush <u>Scirpus paludosus</u>	2.70	5.58
Nuttall Alkali-grass <u>Puccinellia nuttalliana</u>	1.70	4.57
Foxtail Barley <u>Hordeum jubatum</u>	2.60	4.50
Common Cattail <u>Typha latifolia</u>	2.14	3.15
Water-plantain <u>Alisma gramineum</u>	0.07	1.08
Rabbitfoot Polypogon <u>Polypogon monolepiensis</u>	1.80	2.74
Spike-sedge <u>Eleocharis macrostachya</u>	0.06	0.59
Great Bulrush <u>Scirpus validus</u>	0.19	0.38
Common Duckweed <u>Lemna minor</u>	---	1.35

percent occurrence for the more commonly occurring individual species.

Six species of submerged plants showed gains in percent occurrence from 1956 to 1959. Extremes were 0.0 to 0.45 and 11.4 to 27.25 percent. Sago Pondweed (Potamogeton pectinatus) was the most frequently occurring plant and a more vigorous growth of individual plants was noted for 1959. Stonewort (Chara vulgaris) was localized in 1956 but occurred generally throughout the pond in 1959. American Milfoil (Myriophyllum exalbescens) was of rare occurrence in 1956, but in 1959, extensive beds occurred in the center of the pond and individual plants were scattered throughout. Widgeongrass (Ruppia maritima) was scattered both years. Horned Poolmat (Zannichellia palustris) did not occur in this pond in 1956 but was localized at the southeastern end in 1959. Slender Pondweed (Potamogeton filiformis) was found localized at the north central portion of the pond in 1959 only.

Eight emergent plants showed gains in percent occurrence from 1956 to 1959. Extremes were 0.19 to 0.38 and 2.70 to 5.58 percent. Alkali Bulrush was the most abundant emergent species on Area No. 1 for both years, and was found in water depths up to 14 inches. Common Cattail, which once occupied most of the pond (Fig. 2), was found only along the northern edge in 1956. In 1959, this plant was found scattered along the entire perimeter in water depths up to four inches. New growths of Common Cattail observed in 1959 were in areas already occupied by Alkali Bulrush (Fig. 10). Nuttall Alkali-grass occurred in shallow water around the perimeter of the pond. In 1956, this plant was most common as pure stands, but in



Fig. 10. Alkali Bulrush with scattered culms of Common Cattail. Light colored vegetation is Nuttall Alkali-grass.

1959, it was associated with other plants, usually Alkali Bulrush, Foxtail Barley and Prostrate Knotweed. Great Bulrush was most abundant at the center of the pond in both years. Rabbitfoot Polypogon was found only on the northern edge of the pond in close association with Common Cattail in 1956, and in 1959, it was found along the entire perimeter of the pond. Spike-sedge was confined to the southern edge of the pond in both years. Foxtail Barley occurred in water depths up to 1.5 inches along the entire perimeter of the pond in both years. Narrow-leaved Water-plantain was of rare occurrence in 1956 and was found only on the southern edge of the pond. In 1959 it was scattered uniformly throughout, with a dense stand in the southwest section (Fig. 6). Prostrate Knotweed, although not generally considered an aquatic plant, did occur in water depths up to one inch on the western and southern edges of the pond and increased from 0.07 to 2.64 percent occurrence from 1956 to 1959. Common Duckweed (Lemna minor) was the only free-floating vascular plant observed in the pond. It was present in small amounts near the edges of the pond in 1956 but did not occur on the transects. In 1959, it was abundant in stands of emergent plants and elsewhere away from the wind.

Individual occurrences of common terrestrial plants are given in Table II. Total plant occurrences increased from 67.60 to 81.92 percent from 1956 to 1959. Six species showed gains in percent of occurrence between 1956 and 1959. Extremes were 0.49 to 1.08 and 12.31 to 17.28 percent. Foxtail Barley occurred commonly around the entire area in pure stands or in association with other plants (Fig. 11, 12), on soils ranging from damp to very dry. Prickly Lettuce was locally abundant in small

Table II. Percent occurrence of common terrestrial plants along transects on Area No. 1 in 1956 and 1959.

Species	Percent Occurrence	
	1956	1959
Foxtail Barley <u>Hordeum jubatum</u>	12.31	29.59
Prickly Lettuce <u>Lactuca serriola</u>	2.31	12.02
Western Wheatgrass <u>Agropyron smithii</u>	0.38	5.07
Nuttall Alkali-grass <u>Puccinellia nuttalliana</u>	2.84	6.67
Canby's Bluegrass <u>Poa canbyi</u>	1.09	2.47
Prostrate Knotweed <u>Polygonum aviculare</u>	0.49	1.08
Lamb's Quarter <u>Chenopodium album</u>	15.80	1.83
Oakleaf Goosefoot <u>Chenopodium glaucum</u>	4.31	1.32
Summer Cypress <u>Kochia scoparia</u>	13.91	10.68
Red Glasswort <u>Salicornia rubra</u>	1.23	0.86
Greasewood <u>Sarcobatus vermiculatus</u>	2.89	2.84

scattered patches in 1956, and in 1959 was present as a large dense stand (Fig. 13), on the southwest side of the area. Western Wheatgrass occurred in scattered stands with Foxtail Barley and Greasewood on the southern side of the area. Nuttall Alkali-grass occurred along the edge of the pond in

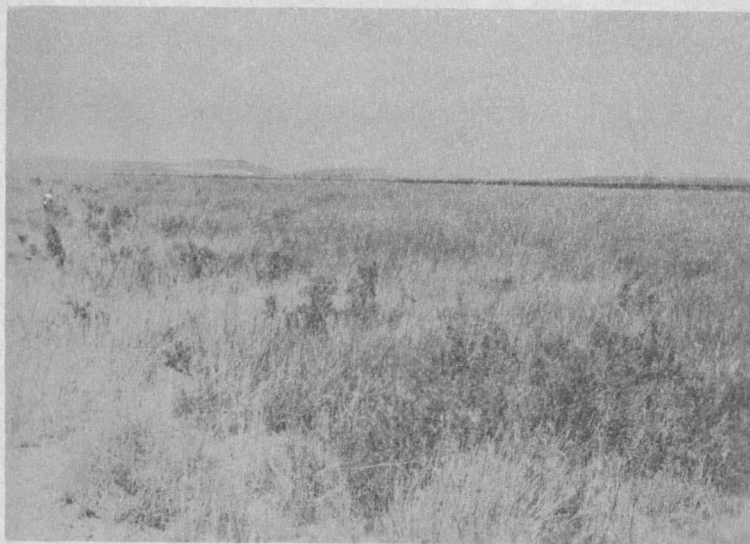


Fig. 11. Greasewood and Foxtail Barley.



Fig. 12. Pure stand of Foxtail Barley.



Fig. 13. Dense stand of Prickly Lettuce.



Fig. 14. Nuttall Alkali-grass forming a stand extending from dry ground into water. Dark vegetation is Alkali Bulrush.

both years. This plant, along with Foxtail Barley and Prostrate Knotweed, appeared to grow well both in shallow water and on dry ground. Sometimes dense stands were partly in water and on dry ground (Fig. 14). Canby's Bluegrass was the most commonly occurring plant in the Prairie type on the northern side of the area. Prostrate Knotweed was normally found on damp ground close to the water as well as in shallow water.

Five species decreased in percent occurrence from 1956 to 1959. Extremes were 2.89 to 0.05 and 15.80 to 1.83 percent. In 1956, Lamb's Quarter occurred in association with Summer Cypress and Oakleaf Goosefoot in a dense stand on the southern side of the area and as scattered culms. In 1959, only scattered plants mixed with other species were found. Oakleaf Goosefoot occurred with Lamb's Quarter and Summer Cypress in 1956 but was scattered in 1959. This plant grew better on damp soils than those associated with it; often occurring in shallow water. Summer Cypress was present in 1956 in association with the two preceding species and as a pure stand in dwarf form (Fig. 8), on the north side of the area. In 1959, this plant was found in the latter form and as scattered culms. Red Glasswort was normally found on damp soils and sometimes in shallow water. In 1956, it was the first to appear on otherwise barren mudflats left by receding water. By 1959, other plants had established themselves on the mudflats and Red Glasswort decreased. Greasewood was found in both years on dry ground well away from the pond on the southern edge of the area; it was usually closely associated with Foxtail Barley.

Total occurrence of aquatic vegetation in that part of Area No. 2

which was flooded in 1956 and 1959, increased from 13.47 percent in 1956 to 58.01 percent in 1959. Percent occurrence for common species is given in Table III.

Table III. Percent occurrence of common aquatic plants along transects on Area No. 2 in 1956 and 1959.

Species	Percent Occurrence	
	1956	1959
Sago Pondweed <u>Potamogeton pectinatus</u>	2.45	21.59
Stonewort <u>Chara vulgaris</u>	---	12.34
Alkali Bulrush <u>Scirpus paludosus</u>	0.80	12.46
Spike-sedge <u>Eleocharis macrostachya</u>	0.10	7.20
Common Cattail <u>Typha latifolia</u>	---	0.09
Great Bulrush <u>Scirpus validus</u>	---	0.02
Foxtail Barley <u>Hordeum jubatum</u>	2.53	0.53
Nuttall Alkali-grass <u>Puccinellia nuttalliana</u>	1.05	0.59

Two submerged species increased in percent occurrence. Sago Pondweed was the most common submerged plant for both years. Stonewort was not found in this pond in 1956 but was found in dense beds in 1959. The only other submerged plant found in this pond was Horned Poolmat which had a 0.04 percent occurrence in 1959 only.

Four emergent species increased in percent occurrence from 1956 to 1959. Extremes were 0.10 to 7.20 and 2.45 to 21.59 percent. Alkali Bulrush was found only as a small stand on the eastern end of the pond in 1956 but in 1959, it had increased in size and density, and other stands were present in the center and on the western edges of the pond. Spike-sedge was associated with Alkali Bulrush at the eastern end of the pond. This plant was scattered in 1956 but formed a dense stand in 1959. Common Cattail was not found in this pond in 1956 but occurred as scattered culms in stands of Alkali Bulrush in 1959. Great Bulrush was observed as scattered culms throughout the pond in 1956 but did not occur on any of the transects. In 1959, scattered culms were found with the Alkali Bulrush and four large clumps were present in the north central portion of the pond.

Two grasses showed a decrease in percent occurrence. Foxtail Barley was present in shallow water at the edges of the pond and Nuttall Alkali-grass was found in shallow water at the eastern edge of the pond. The only other plant of common occurrence was Prostrate Knotweed which was abundant in shallow water in 1956 (12.42 percent) but decreased in 1959 (0.10 percent).

Total occurrence of terrestrial vegetation on Area No. 2 increased from 77.06 to 77.96 percent from 1956 to 1959. Percent occurrence for common species is given in Table IV. Five species increased in percent occurrence from 1956 to 1959. Extremes were 0.0 to 1.89 and 0.04 to 11.70 percent. Nuttall Alkali-grass was of scattered occurrence on dry ground

Table IV. Percent occurrence of common terrestrial plants along transects on Area No. 2 in 1956 and 1959.

Species	Percent Occurrence	
	1956	1959
Nuttall Alkali-grass <u>Puccinellia nuttalliana</u>	0.04	11.70
Foxtail Barley <u>Hordeum jubatum</u>	2.29	10.46
Canby's Bluegrass <u>Poa canbyi</u>	---	4.14
Western Wheatgrass <u>Agropyron smithii</u>	14.50	17.32
Prickly Lettuce <u>Lactuca serriola</u>	---	1.89
Oakleaf Goosefoot <u>Chenopodium glaucum</u>	8.17	---
Lamb's Quarter <u>Chenopodium album</u>	8.21	0.59
Red Glasswort <u>Salicornia rubra</u>	4.49	3.60

in 1956 but was common in 1959. Foxtail Barley was scattered uniformly throughout the area in both years. Canby's Bluegrass was not found on this area in 1956 but was present near the edge of the Prairie type at the eastern end of the area in 1959. Western Wheatgrass was the most common plant in the Prairie type both years. Prickly Lettuce was not found on this area in 1956 but occurred on the eastern end of the area in 1959.

Four species decreased in percent occurrence from 1956 to 1959. Extremes were 4.49 to 3.60 and 36.22 to 25.00 percent. Summer Cypress was the most abundant plant on the area in both years. In 1956, this plant

was found in normal growth form and closely associated with Lamb's Quarter and Oakleaf Goosefoot, but in 1959, the dwarfed form of this plant in almost pure stands was the most prevalent. Lamb's Quarter and Oakleaf Goosefoot which were closely associated with Summer Cypress in 1956 decreased in 1959, and Oakleaf Goosefoot although present on the area did not occur on the transects. Red Glasswort was found on damp soil near the water in both years.

One 100-foot transect was used to sample open water on the newly flooded portion of Area No. 2 in 1959. Dead culms of Summer Cypress, Lamb's Quarter and Oakleaf Goosefoot were abundant but were not recorded. Total occurrence of vegetation was 28 percent with Sago Pondweed and Alkali Bulrush making up 27 and one percent respectively. The only other plant observed to be common in this portion was Foxtail Barley which formed extensive growths in the shallower areas at times.

WATERFOWL USAGE

Eleven observations on total numbers of waterfowl using Area No. 1 were made each year; two in June, four each in July and August and one in September. Results of these observations are given in Table V.

Increased numbers of waterfowl beginning in August were due to influx of early migrants, mostly Pintails (Anas acuta) and American Widgeon (Mareca americana). Table V shows an increase in waterfowl using the area from 1956 to 1959; however, data taken from Crissey (1956, 1959) show the waterfowl populations for the general area in the respective years as 32,292 and 91,962, an increase of 184.9 percent.

Table V. Average numbers of waterfowl using Area No. 1 each month.

Month	1956	1959	Percent Increase
June	68.5	183.5	168.6
July	303.5	452.5	49.9
August	1285.8	1830.8	42.4
September	3613.0	3150.0	-12.9
Average percent increase			62.0

In late June and early July, observations were made to determine the composition of the waterfowl population by species (Table VI).

Three species, Ruddy, Lesser Scaup and Canvasback, were present in 1959 but not in 1956. One species, Green-winged Teal, was present in 1956 but not in 1959; however, it was present on other marsh areas on the project in 1959. Of the species present both years, three (Mallard, American Widgeon and Redhead) increased in percent composition, while five species (Pintail, Gadwall, Blue-winged Teal, Shoveler and Cinnamon Teal) decreased. Coot (Fulica americana) and Eared Grebe (Colymbus caspicus) were present on the area both years. Approximately 200 coots remained for both years but Eared Grebes increased from four in 1956 to approximately 250 in 1959.

There was a definite increase of nests on Area No. 1 from 1956 to 1959 (Figs. 5, 6). In 1956, two nests, both Pintail, were found but in 1959, 31 nests were found as follows: Teal, 10; Gadwall, 6; Redhead, 6; Pintail, 5; Lesser Scaup, 3; and Shoveler, 1.

Five of the 10 Teal nests were located in Prickly Lettuce, two in

Table VI. Composition by species of duck population on Area No. 1.

Species	Percent of Population	
	1956	1959
Mallard <u>Anas platyrhynchos</u>	3.02	12.31
Pintail <u>Anas acuta</u>	23.16	4.34
Gadwall <u>Anas strepera</u>	28.48	13.04
Blue-winged Teal <u>Anas discors</u>	23.73	17.37
Green-winged Teal <u>Anas carolinensis</u>	0.35	---
Shoveler <u>Spatula clypeata</u>	15.98	11.99
Cinnamon Teal <u>Anas cyanoptera</u>	1.15	0.72
American Widgeon <u>Mareca americana</u>	1.95	6.15
Redhead <u>Aythya americana</u>	0.18	13.40
Canvasback <u>Aythya valisineria</u>	---	0.72
Lesser Scaup <u>Aythya affinis</u>	---	6.92
Ruddy <u>Oxyura jamaicensis</u>	---	13.04

Foxtail Barley, one in Foxtail Barley and Greasewood, one in Foxtail Barley and Prickly Lettuce and one in dry Cattails. Five of the six Gadwall nests were located in Prickly Lettuce and one was located in

Foxtail Barley and Greasewood. The six Redhead nests found in 1959 were located in Alkali Bulrush at the edges of the pond and none were found in large dense stands (Fig. 6). This absence of nests in large stands of otherwise suitable cover agrees with the findings of Low (1945). The two Pintail nests found in 1956 were located in Foxtail Barley at the edge of the Prairie type. Three of the nests found in 1959 were in Prickly Lettuce, with one each in Foxtail Barley and Nuttall Alkali-grass. The three Lesser Scaup nests found in 1959 were located on two of the three small islands at the southeast edge of the pond with Foxtail Barley as cover. The one Shoveler nest found in 1959, was located in Prickly Lettuce.

In 1956, 20 broods totaling 103 ducklings were observed on Area No. 1 as follows: Five Pintail; five Gadwall; three Mallard; three Teal; and four of unidentified species. Most broods were observed in the flooded weeds on the southern and western sides of the pond (Fig. 5).

In 1959, 15 broods totaling 49 ducklings, were observed on Area No. 1 as follows: Nine Pintail; three Teal; one Shoveler; one Mallard and one American Widgeon. All broods were observed in Alkali Bulrush either at the edges of the pond or in extensive stands at the western end and on the northern side (Fig. 6). Lower brood counts in 1959 may have been due to the denser type of cover provided by Alkali Bulrush.

Comparisons of waterfowl usage on Area No. 2 between 1956 and 1959 are complicated by the increase in water area. Total numbers of ducks for 1956 averaged 115 for June and July and 346 for August. No counts

were made in September of 1956. In 1959, total numbers of ducks averaged 474 for June and July and 1334 for August and September.

Composition of duck population in 1956 was as follows: Pintail, 48 percent; Gadwall, 23 percent; Shoveler, 16 percent; Blue-winged Teal, six percent; Mallard, three percent; Green-winged Teal, two percent and Shoveler, one percent. Approximately 100 Coot used the area in 1959.

One Pintail nest was found on Area No. 2 in 1956. It was situated in sparse vegetation of the Kosc/Ch. spp. type. This was the only use of this type for nesting found during the study. In 1959, 13 nests were found in this area as follows: Gadwall, four; Blue-winged Teal, three; Mallard and Shoveler, two each and Pintail and Redhead, one each. With the exception of the Pintail and one Mallard, all land nests were located on areas surrounded by water (Fig. 9) and all land nests were located in Prairie type with the exception of the Pintail nest which was located in a small patch of Foxtail Barley within the Kosc/Ch. spp. type. The Redhead nest was located in Alkali Bulrush at the eastern end of the pond. No nests were found on artificial islands.

Three broods were observed on Area No. 2 in 1956, one each of Mallard, Pintail and Shoveler with a total of nine ducklings. In 1959, 12 broods totaling 84 ducklings were observed on this area as follows: Blue-winged Teal, four; Mallard and Shoveler, two each; and one each for American Widgeon, Gadwall, Redhead and Canvasback. All broods observed in 1959 were found in open water with dead weeds as cover or in sparse Alkali Bulrush.

In 1959, total counts of waterfowl were made for both areas on the same day. Changes in relative numbers of waterfowl using the two areas were noted. Numbers of waterfowl counted on the two areas from June to September are given in Table VII. Between the dates, June 17 and August

Table VII. Total numbers of waterfowl observed on Areas No. 1 and No. 2 in 1959.

Date	Area No. 1	Area No. 2
June 17	162	262
June 24	205	380
July 1	360	480
July 8	200	475
July 17	428	478
July 21	823	770
August 5	719	1152
August 12	1679	1291
August 24	1775	852
August 31	3150	1460
September 7	3150	2250
September 23	3800	1000

5, Area No. 2 had consistently more waterfowl than Area No. 1 except for July 21. From August 12 to September 23, Area No. 1 consistently had more birds than Area No. 2. This may indicate that the latter area was relatively more attractive than the former to birds summering on the project and that Area No. 1 was relatively more attractive to migrants.

DISCUSSION

General changes in vegetation on both areas apparently increased their attractiveness to waterfowl. Large increases of Sago Pondweed and Stonewort in both areas were important from a food standpoint. Both plants are rated as excellent duck foods by Martin and Uhler (1939). American Milfoil which had a moderate increase in Area No. 1 in 1959 has some importance as a duck food. It was also used by Eared Grebes for nest building. Increase of Alkali Bulrush on both areas provided more brood cover for all species and apparently increased the attractiveness for species nesting in emergent vegetation, since Redhead and Ruddy increased on both areas from 1956 to 1959. Alkali Bulrush is also listed as an excellent duck food-plant by Martin and Uhler (op. cit.). Common Cattail, although a good cover plant, is not as valuable as Bulrush and future increases of this plant could crowd out more desirable species. The most noticeable change in terrestrial vegetation on Area No. 1 was the replacement of the Kosc/Ch. spp. type with the Lase type and the data indicate this as a favorable change. The absence of nests on the Kosc/Ch. spp. type in 1956 indicates it as unattractive to nesting waterfowl. The Kosc/Ch. spp. type occupied the artificial islands on Area No. 2 in 1959 and no nests were found there although the density of nests on islands with different types of vegetation (Figs. 6, 9) indicates that islands are attractive to nesting waterfowl. The replacement of Kosc/Ch. spp. type with Lase type was accompanied by a substantial increase of nests on Area No. 1, and if the same type of replacement takes place on the islands in

Area No. 2, nesting should increase on that area in the future.

SUMMARY

During the summers of 1956 and 1959, a study was conducted to determine characteristics of vegetation and waterfowl usage on two pond areas in Teton County, Montana. Information on both aquatic vegetation and adjacent terrestrial vegetation was gathered by means of transects extending across the pond area, photopoints and maps of vegetative types. Waterfowl usage was determined from information gathered on numbers and kinds of waterfowl using the area, nesting and brood usage.

Total occurrences of aquatic vegetation on Areas No. 1 and No. 2 were found to have increased from 34.30 to 79.00 percent and from 13.47 to 58.01 percent respectively between 1956 and 1959. Increases of Sago Pondweed, Stonewort and Alkali Bulrush were the most significant changes on both areas.

Total occurrence of terrestrial vegetation increased from 67.60 to 81.92 percent and from 77.06 to 77.96 percent on Areas Nos. 1 and 2 respectively from 1956 to 1959. Foxtail Barley and Prickly Lettuce made up the greatest volumes of increase on Area No. 1. Nuttall Alkali-grass and Foxtail Barley made up the greatest volumes of increase on Area No. 2. Summer Cypress, Lamb's Quarter and Oakleaf Goosefoot occurred to a large extent on both areas in 1956 but decreased in 1959.

Total numbers of waterfowl increased on Area No. 1 in 1959 but not in proportion to the population increase of the general area. Total numbers also increased on Area No. 2, but flooding in the spring of 1959 had in-

creased the size of the water area to approximately five times that of 1956. Number of species increased on both areas. Two nests were found on Area No. 1 in 1956. Most of the 31 nests found in 1959 were in Prickly Lettuce, a plant that had replaced Summer Cypress, Lamb's Quarter and Oakleaf Goosefoot over a large section of the area. One nest was found on Area No. 2 in 1956 and 13 in 1959. Numbers of broods observed using Area No. 1 decreased 25 percent from 1956 to 1959 but this may have been due to poorer visibility caused by denser emergent cover. Numbers of broods increased from three to 12 on Area No. 2 between 1956 and 1959. It was concluded that both areas were more attractive to waterfowl in 1959 than in 1956.

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Vegetative characteristics of
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2-21-69	Joe Mathies
FEB 19 1970	Don Hoole
MAR 6 1971	N 378
2 weeks use	K 747v
SEP 19 1971	cop. 2

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