



Avian ecology on stock ponds in two vegetational types in north-central Montana
by Vaughn Marlan Rundquist

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY in Fish and Wildlife Management

Montana State University

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Abstract:

The avian ecology on natural and artificial impoundments in two vegetational types, grassland and sagebrush-grassland, in north-central Montana was studied from 1970 to 1972. Pond dimensions, water-level fluctuations, and selected characteristics of pond water were measured. Upland vegetation was described by a canopy-coverage method. Bird censuses were conducted during about 800 pond visits. The water level of all ponds declined during the summer, with a computed weekly rainfall of 1.35 inches being required for water-level stability. Due to a greater percent of bare soil and a more abrupt contour in the sagebrush-grassland type, ponds had a greater degree of turbidity, accompanied by less plankton and submergents than in the other type. Most of the 113 bird species observed were more numerous in the grassland type. Breeding waterfowl in this type numbered 45.5 pairs per square mile and used temporary waters in the form of natural potholes and reservoir flood-plains in addition to permanent waters. Considering all types of ponds, waterfowl in grassland numbered 1.81 breeding pairs per water-surface acre. Mallards (*Anas platyrhynchos*), pintails (*A. acuta*) American widgeon (*Mareca americana*), and blue-winged teal (*A. discors*) formed 74.9 percent of the waterfowl breeding population in grassland. No temporary waters were present in the sagebrush-grassland type, where waterfowl breeding pairs numbered 19.6 per square mile and 2.84 per water-surface acre. Mallards and American widgeon comprised 50.8 percent of the breeding population in sagebrush-grassland. A low density of duck nests was associated with a 67-percent nest success, indicating that primarily nest spacing rather than vegetational cover provided security for nests. An 87-percent seasonal decrease in the water acreage of the grassland type was accompanied by a waterfowl reproductive success one-third as great as in the sagebrush-grassland type, where the seasonal water-acreage decrease was only 8 percent. Grassland had 9.8 broods per square mile, while the other type had 11.1 broods per square mile. Broods numbered 2.95 and 1.86 per water-surface acre in grassland and sagebrush-grassland, respectively. The low reproductive success in grassland may have been related to lowered water levels causing egress of breeding pairs, gonadal inhibition, or strife due to crowding. Fencing ponds was not recommended due to the initial cost involved and the maintenance required to achieve the intended effects.

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IN NORTH-CENTRAL MONTANA

by

VAUGHN MARLAN RUNDQUIST

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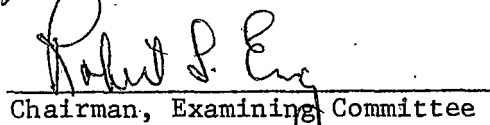
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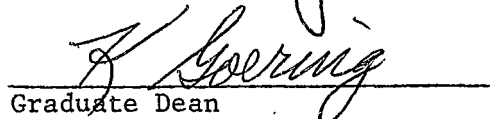
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ABSTRACT

The avian ecology on natural and artificial impoundments in two vegetational types, grassland and sagebrush-grassland, in north-central Montana was studied from 1970 to 1972. Pond dimensions, water-level fluctuations, and selected characteristics of pond water were measured. Upland vegetation was described by a canopy-coverage method. Bird censuses were conducted during about 800 pond visits. The water level of all ponds declined during the summer, with a computed weekly rainfall of 1.35 inches being required for water-level stability. Due to a greater percent of bare soil and a more abrupt contour in the sagebrush-grassland type, ponds had a greater degree of turbidity, accompanied by less plankton and submergents than in the other type. Most of the 113 bird species observed were more numerous in the grassland type. Breeding waterfowl in this type numbered 45.5 pairs per square mile and used temporary waters in the form of natural potholes and reservoir floodplains in addition to permanent waters. Considering all types of ponds, waterfowl in grassland numbered 1.81 breeding pairs per water-surface acre. Mallards (*Anas platyrhynchos*), pintails (*A. acuta*), American widgeon (*Mareca americana*), and blue-winged teal (*A. discors*) formed 74.9 percent of the waterfowl breeding population in grassland. No temporary waters were present in the sagebrush-grassland type, where waterfowl breeding pairs numbered 19.6 per square mile and 2.84 per water-surface acre. Mallards and American widgeon comprised 50.8 percent of the breeding population in sagebrush-grassland. A low density of duck nests was associated with a 67-percent nest success, indicating that primarily nest spacing rather than vegetational cover provided security for nests. An 87-percent seasonal decrease in the water acreage of the grassland type was accompanied by a waterfowl reproductive success one-third as great as in the sagebrush-grassland type, where the seasonal water-acreage decrease was only 8 percent. Grassland had 9.8 broods per square mile, while the other type had 11.1 broods per square mile. Broods numbered 2.95 and 1.86 per water-surface acre in grassland and sagebrush-grassland, respectively. The low reproductive success in grassland may have been related to lowered water levels causing egress of breeding pairs, gonadal inhibition, or strife due to crowding. Fencing ponds was not recommended due to the initial cost involved and the maintenance required to achieve the intended effects.

INTRODUCTION

Wildlife management and agricultural practices constantly interact, producing both adverse effects and mutual benefits. A practice having adverse effects on waterfowl and some other wildlife species has been the drainage of wetlands in the Prairie Pothole Region (Burwell and Sugden 1964; Smith, Stoudt, and Gollop 1964; and Studholme and Sterling 1964). The effects of drainage have been partly offset through the construction of small impoundments. The impoundments were originally designed to supply drinking water for livestock in the arid West and to secure better distribution of grazing pressure. However, the added bonus of waterfowl production was soon apparent (Bue, Uhlig, and Smith 1964 and Edminster 1964). In eastern Montana alone, nearly 8,000 rangeland impoundments had been developed by the Bureau of Land Management before 1970, with a present annual construction rate of approximately 240 impoundments. Private and state agencies also construct many impoundments in this area (Jones 1970). Several workers have studied the value of small impoundments to waterfowl (Bue, Blankenship, and Marshall 1952; Smith 1953; Berg 1956; Shearer 1960; Keith 1961; and Gjersing 1971). Most of these studies were wholly or partly concerned with the relationship between grazing practices and waterfowl production.

The present study was designed to compare two vegetational types, grassland and sagebrush-grassland, with respect to the ecology of bird

populations using the impoundments in each type. The study units in the two vegetational types were similar in all major aspects except vegetation. Field work was conducted from June 8 to September 25, 1970; from April 1 to September 20, 1971; and from March 21 to October 7, 1972.

DESCRIPTION OF THE STUDY UNITS

Both study units were located in southern Phillips County of north-central Montana (Figure 1). Phillips County has been described as a rolling plain dissected by rather deeply entrenched streams and coulees. Most of the stream borders and the more feebly glaciated areas are the sites of rough, broken land, often approaching a badland situation (Gieseke 1926).

The grassland unit was situated about 7.5 miles directly north of the sagebrush-grassland unit. Considering home-range size of waterfowl (Sowls 1955), the separation between study units tended to eliminate any interchange of locally breeding birds. On the other hand, the proximity of the two units provided similar weather conditions. The north and south units covered 8.5 and 8.0 contiguous square miles, respectively.

The grassland unit varied from 2570 to 2870 ft in elevation; the sagebrush-grassland unit varied from 2520 to 2760 ft. The contour of the former unit was somewhat less abrupt than that of the latter. The grassland unit was drained by Beaver and Second Creeks, which empty into the Milk and Missouri Rivers, respectively. The sagebrush-grassland unit was drained by Fourchette Creek, a tributary of the Missouri River. Five soil types occurred in the study units: Phillips loams, Pierre clay loams, Scobey loam, Scobey sandy loam, and Scobey stony loam (Gieseke 1926) (Appendix Figure 18). Four of the types occurred in the grassland unit, and two were found in the other unit.

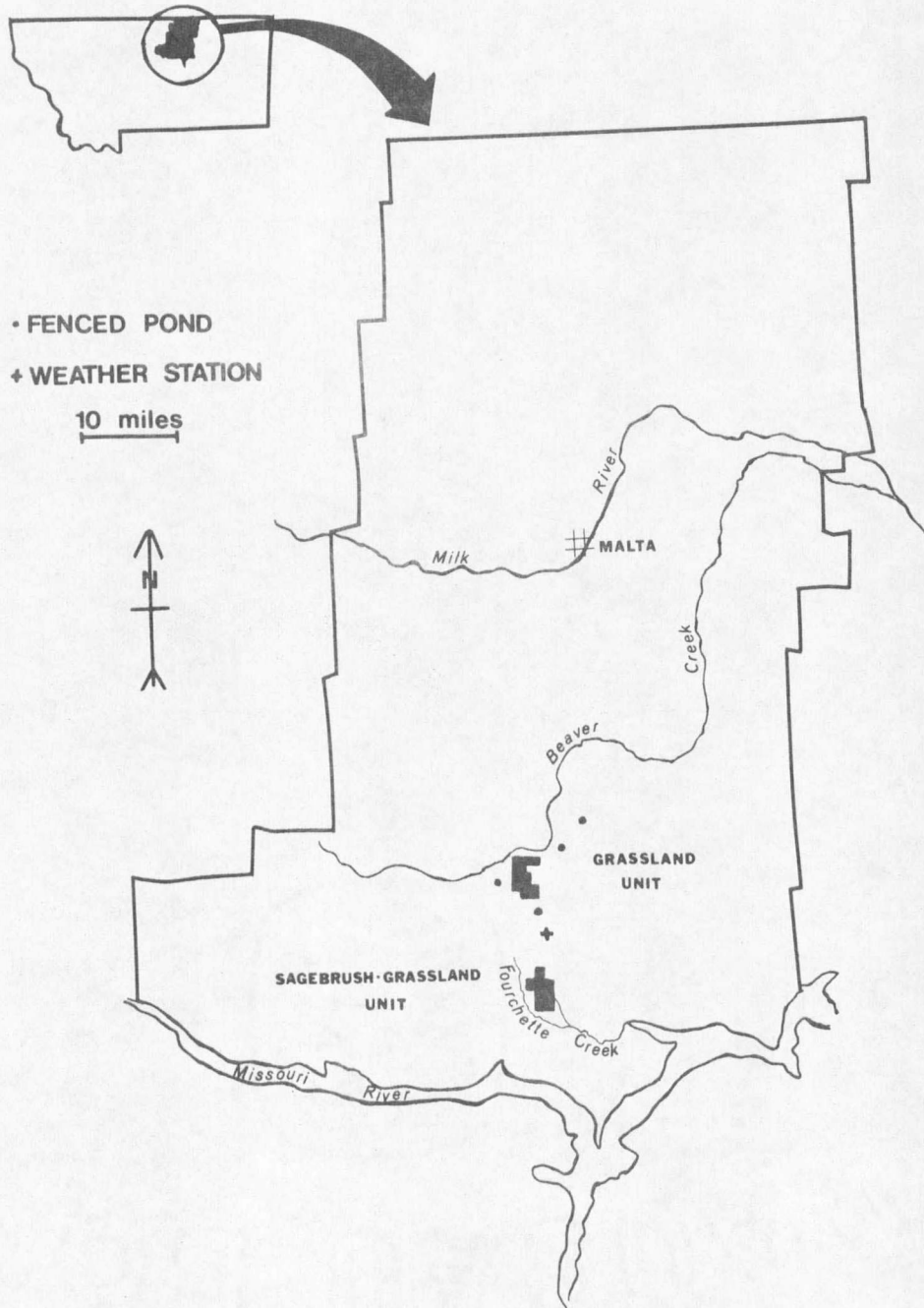


Figure 1. Location of the study units in southern Phillips County, Montana.

Annual temperatures on the study units averaged 41.9 F from 1970 to 1972. The frost-free period extended from mid-May to mid-September. Annual precipitation averaged 12.47 inches from 1960 to 1972. The study units received 3.29 and 1.95 inches above the average in 1970 and 1972, respectively, and 2.41 inches below the average in 1971. Over half of the precipitation falls in the period April through July. Winter snowfall is light. Strong westerlies are common to the area, with chinooks occurring occasionally during the winter (Gieseke 1926 and U. S. Department of Commerce 1960-1972).

The study included 31 unfenced ponds in the grassland unit, 17 unfenced ponds in the sagebrush-grassland unit, and 4 fenced ponds outside the units. The ponds were of three types: natural pothole, dugout, and retention reservoir (Appendix Table 11 and Figures 2 and 3). The natural potholes resembled the temporary and seasonal ponds described by Stewart and Kantrud (1971), while most of the artificial impoundments (dugouts and retention reservoirs) were much more permanent. In the grassland unit, natural potholes and artificial impoundments averaged 1.5 and 2.1 per square mile, respectively, for a total of 3.6 ponds per square mile. The other unit had only retention reservoirs, with an average of 2.1 per square mile. Half of the artificial impoundments in the grassland type had a floodplain in the upper end varying from 2.1 to 16.6 acres and averaging 7.8 acres (Figure 4). The floodplains were vegetated predominantly by spike-edge (*Eleocharis macrostachya*)

