Effects of road construction on wetlands in a dead-ice moraine
by Carl Raymond Surrendi

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
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Abstract:
A study of the effects of road construction on wetlands in the dead-ice moraine of south-central. Alberta was conducted during the summer and autumn of 1971. The study area consisted of 27 treated ponds along rights-of-way on which roads had been constructed and 32 control ponds located away from the treated areas. Measurements of basins before and after road construction were taken from air photos by outlining the original basin, measuring its area and shoreline, then measuring the area and shoreline of the basin, including road alterations. A 5.6 percent loss in area and an 11.5 percent gain in shoreline were found to have occurred due to the presence of the road. Aerial surveys by helicopter were made to determine if differences existed in duck use between ponds near the road and those away from the road. No difference in total duck use was detected, but some differences in preference by species was indicated.

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Signature Carl R. Swandal

Date March 10 1972

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by

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ABSTRACT

A study of the effects of road construction on wetlands in the dead-ice moraine of south-central Alberta was conducted during the summer and autumn of 1971. The study area consisted of 27 treated ponds along rights-of-way on which roads had been constructed and 32 control ponds located away from the treated areas. Measurements of basins before and after road construction were taken from air photos by outlining the original basin, measuring its area and shoreline, then measuring the area and shoreline of the basin, including road alterations. A 5.6 percent loss in area and an 11.5 percent gain in shoreline were found to have occurred due to the presence of the road. Aerial surveys by helicopter were made to determine if differences existed in duck use between ponds near the road and those away from the road. No difference in total duck use was detected, but some differences in preference by species was indicated.

INTRODUCTION

Personnel of the Canada Land Inventory, mapped approximately 45,000 square miles of moraine areas in Alberta and rated them as good to excellent waterfowl habitat. According to the Public Lands Act of Alberta, every quarter section of land which has been legally surveyed must be accessible. This has resulted in a grid system whereby east-west road allowances are located two miles apart, and north-south allowances are located one mile apart. These allowances range in width from 132 to 150 feet with an equal portion taken from each section. As settlement increases, the need for roads also increases and the road allowance, with a small construction input then becomes a trail. As traffic trends develop, heavily used trails are then upgraded and become secondary or "market roads".

Every year, personnel of the U. S. Fish and Wildlife Service conduct aerial breeding pair and production surveys in sample areas of North America. In southern Alberta (and the other prairie provinces) these surveys are conducted along the grid roads which are used as navigation aids. Because of this, there is a need to determine whether the roads have significantly altered the habitat and if duck use in the wetlands along the road is different from that in habitat unaltered by roads.

Flooding of road allowances occurs periodically, which provides no problem as long as no roads have been developed. However, as soon as a

road achieves the status of a market road and drainage of a low area is possible, a wetland may be eliminated. One typical case is well documented in central Alberta where drainage of a flooded road allowance resulted in a loss of one hundred acres of excellent waterfowl habitat (C. Surrendi 1967).

To date, little work has been done regarding the effects of grid road construction and reconstruction on wetlands in morainic areas. The purpose of this study was to investigate the effects of road construction on the morphology of ponds in dead-ice moraine located in the aspen parklands of south-central Alberta.

DESCRIPTION OF THE STUDY AREA

The study area, a strip eight miles long and one mile wide, was located 12 miles northeast of the town of Stettler, Alberta (Fig. 1). Land use in the area is primarily agricultural with emphasis on livestock production and dry land grain farming. For the past 30 years, annual precipitation has averaged 16.06 inches (Ministry of Transport Climatological Division, Edmonton International Airport, 1971). The area has been described as "... a poorly drained region situated on relatively young glacial drift, comprising mostly ground and end moraine. The till of which the moraines are formed was deposited in a rolling topography consisting of low hills and undrained depressions. The low bodies of water known locally as sloughs ... may range in number from a few to 120 or more per square mile" (Bird 1961).

As may be inferred by the name, "aspen parkland", the dominant vegetation type is quaking aspen *(Populus tremuloides)*. Balsam poplar *(Populus balsamifera)* and several species of willow *(Salix* spp.) are in lesser abundance. The trees listed above are found throughout the region in mesic and hydric sites with the willows frequently found within the pond edges.

The understory of the aspen-poplar groves is comprised of shrubs and forbs. The shrub layer is comprised of choke cherry *(Prunus virginiana)*, Saskatoon berry *(Amelanchier alnifolia)*, beaked hazel *(Corylus cornuta)*, red-osier dogwood *(Cornus stolonifera)*, and rose

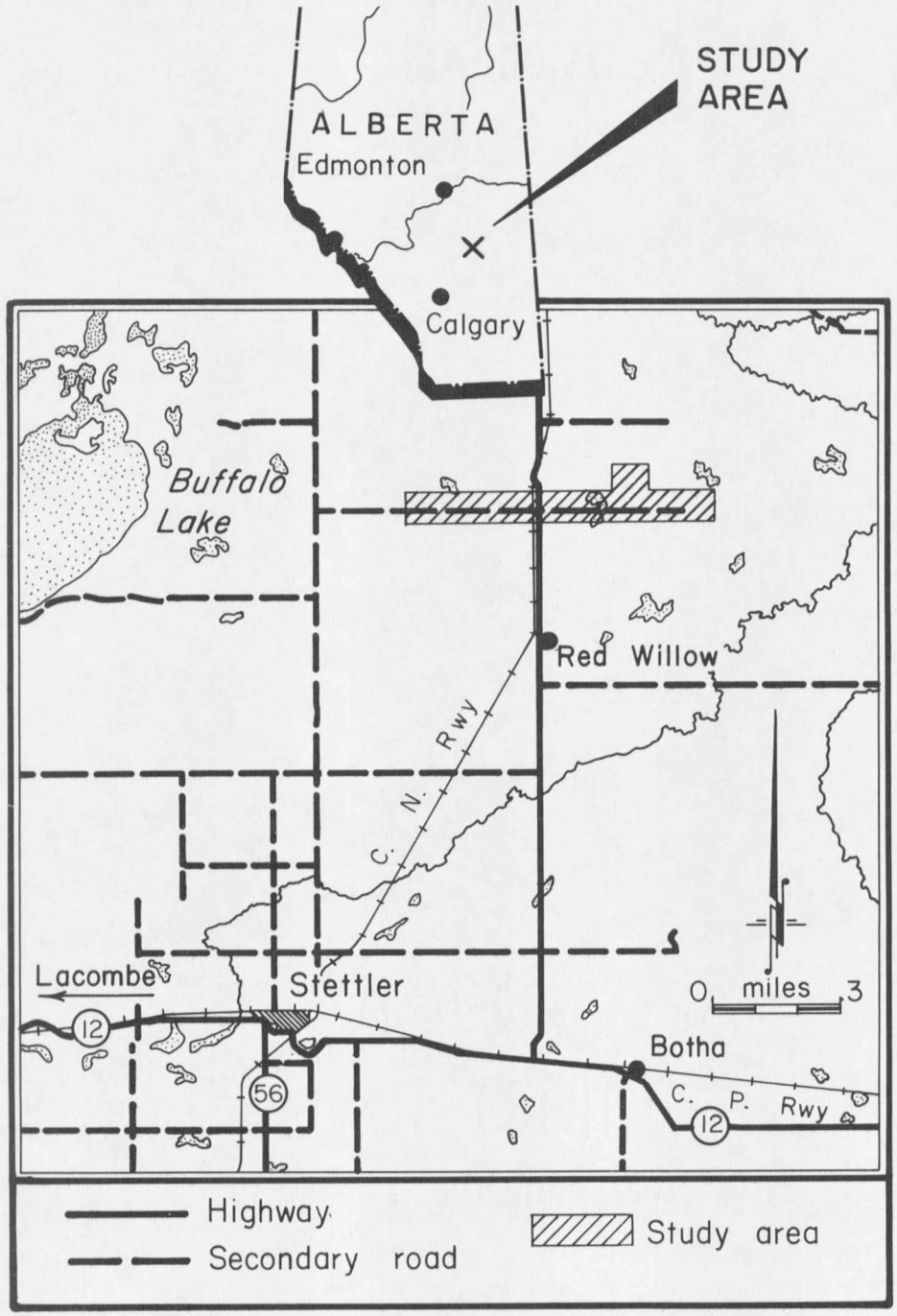

Figure 1. Map showing location of study area.

(Rosa spp.*)*. The margins of the aspen groves are comprised of smaller shrubs such as snow berry *(Symphoricarpos* spp.*)*, silver willow *(Elaeagnus commutata)* and red raspberry *(Rubus strigosus)*. The forb layer consists primarily of northern bed straw *(Galium boreale)*, Solomon's seal *(Smilacina stellata)*, and wintergreen *(Pyrola aserifolia)*.

A short grass prairie community present on the elevated, more xeric sites is characterized by spear grass *(Stipa comata)*, fringed sage *(Artemisia frigida)* a half shrub, and forbs such as three-flowered avens *(Geum triflorum)*, purple prairie clover *(Petalostemon purpureum)* and pussy toes *(Antennaria* spp.*)*. Gumweed *(Grindelia* spp.*)* occurs in disturbed areas along with several species of thistles *(Cirsium* sp.*)* and asters *(Aster* spp.*)*.

In the ponds, emergent vegetation is characterized by sedges with *Carex rostrata* and *C. atherodes* being the most abundant species. Associated with the sedge communities are varying amounts of other emergents such as cattail *(Typha latifolia)*, slough grass *(Beckmania syzigachne)*, baltic rush *(Juncus balticus)*, arrow grass *(Triglochin maritima)*, bladder wort *(Utricularia vulgaris)*, persicaria *(Polygonum* spp.*)*, and bulrush *(Scirpus* spp.*)*. Pond weeds *(Potamogeton* spp.*)* are the most abundant submergents while coontail *(Ceratophyllum* spp.*)*, water milfoil *(Myriophyllum exalbescens)* and duck weed *(Lemna* spp.*)* are present in lesser amounts. A graphic description of the fauna in this region exists in Bird (1961).

The road surfaces in the study area are gravel and vary from 24 to 30 feet wide with back slopes varying from a 2 to 1 to a 1 to 1 ratio, (James Bussard, Alberta Department of Highways, personal communication) both of which form deep ditches. The roads are raised above the general ground level to facilitate snow removal during the winter.

The road in the area of study was typical of those in the dead-ice moraine region as it touched or passed through numerous wetlands. It had been in existence for 23 years. This time interval was sufficient to allow for establishment of vegetation following disturbance. Air photos of the area were available for periods both before and after road construction.

METHODS

Twenty-seven ponds along eight miles of road were designated as "treated" because all had been modified by road construction. Thirty-two ponds occurring along lines one-fourth mile on either side of, and parallel to the road were selected as controls. None of the control ponds touched a road allowance.

Comparison of air photos taken before and after construction of the road indicated that while water levels and quality of photos varied, the general configuration of the basins remained the same. Therefore, all measurements were made on air photos (scale 1 inch = 704 feet) taken in September 1948, to avoid errors caused by photo quality or parallax distortion (Agriculture Handbook 294, Soil Conservation Service, U. S. Department of Agriculture, pp. 11). As can be seen on a photo of pond No. Ex. 8-3 (Fig. 2a), the road allowance is well defined. The original basin was outlined and total shoreline and area measured (Fig. 2b). The road allowance was outlined and measurements were again taken to assess any changes in total shoreline and area (Fig. 2c). Shoreline was measured with a map wheel and area with a planimeter. All measurements were made three times and the average used.

Ground counts of broods were only made on the treated ponds. They were conducted on July 16 and August 10. Counts from a helicopter, covering both treated and control ponds, were made on July 17 and August 7. Ground and air counts were made as close together in time as