LAND USE CHANGES IN THE MINNEDOSA POTHOLE REGION OF SOUTHWESTERN MANITOBA 1948-1970

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Introduction

Changes in land use on the Canadian prairies have long been of interest to governments, private individuals and groups, and, more recently, resource planners. Historical studies at an extensive level deal with settlement but often stop once people are on the land.[8] Changes resulting from continuous occupation of a given area, however, have become more significant as resource availability diminishes and societal values evolve.

The purpose of this paper is to delimit and assess land use changes between 1948 and 1970 on a 23 km² area of the southeastern portion of the "Minnedosa pothole country"[5] of southwestern Manitoba (Figure 1). The study area consists of sections 13, 14, 15, 22, 23, 24, 25, 26, and 27 of Township 13 North, Range 18 West of Principal Meridian, in the Rural Municipality of Odanah.

Physical Environment

The topography of the study area (which forms part of the Minnedosa-Reston till plains) is glacially derived.[4] Because of its recent glacial origin, drainage is non-integrated and poor. Elevation varies only 100 feet between 1625 feet and 1725 feet above sea level. Nevertheless there is a gentle southeastward slope of less than six feet per mile, typical of the area separating the Whitemud from the Minnedosa River drainage systems (Figure 1). The dominant water catchment areas (potholes) are derived from in-situ glacial ice-block melting and are depositional rather than erosional features.[5]

Soils of the area are black earths derived from till and have high natural fertility. Most areas are dominated by soils of the Newdale association, which have only moderate limitations regarding crop range and potential for agricultural use. Low lying areas which contain water on either a semi-permanent or a temporary basis, however, place severe restrictions on agricultural use. Natural vegetation reflects the topography by the presence of wetland meadow and shrub associations in depressions and intermingled grassland and aspen forest (parkland) on upland areas.[4]

The climate of the Minnedosa district is characterized by short, warm summers (July $\bar{x}$ 17°C) and long, cold winters (January $\bar{x}$ −28°C). Precipitation is uniform over the area over long periods, but annual totals vary greatly. Significant local differences have been recorded in some years.[5] Mean annual precipitation is 450 mm about 75 percent of which falls as rain during the warm season.

Land Use History

Extensive settlement of the Minnedosa region occurred between

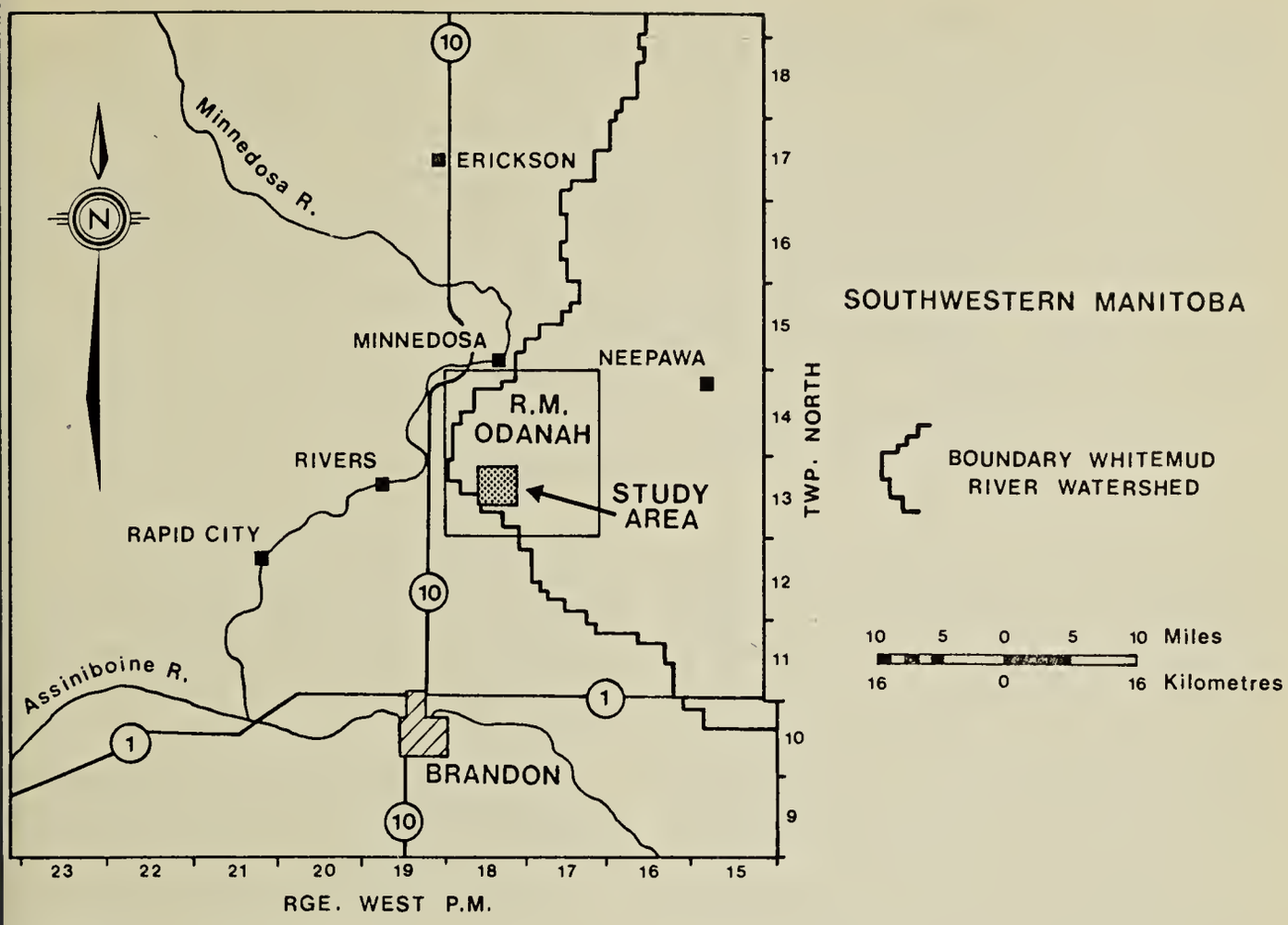


Figure 1. *Location Map*

1875 and 1885 and nearly all of the land was settled by 1895.[8] Jenkins suggests, however, that the immediate study area (Rural Municipality of Odanah) was not settled extensively until after 1882, and that the area was more forested than surrounding regions.[4] Land clearing progressed continuously from the 1880's with approximately half of the acreage in the Minnedosa region being cultivated by 1930. Clearing continued at the rate of approximately 6 percent per decade until 69 percent of the land was broken in 1964. Nearly all clearing was at the expense of forest and bushland which decreased from 39 percent to 21 percent, while wetlands decreased only from 13 to 10 percent.[5]

Methods

Air photographs of the study area were secured for 1948 and 1970. The earlier photos were taken by the Royal Canadian Air Force for the Department of Mines, Energy and Natural Resources at a scale of one inch to 1320 feet (RF = 1:15840). The 1970 photos, obtained from the Canadian Department of Agriculture, were taken at a scale of one inch to 6000 feet (RF = 1:7200). The scale difference was eliminated using a Sketchmaster and subsequent enlargement to a working scale of one inch to 750 feet (RF = 1:9000).

The system and symbols used for land use (Table 1) are modifications of the classification for present land use of the Canada Land Inventory.[3] Because the entire study area was "rural" and the CLI classification does not have a designation for farmsteads, these were placed in Category I (non-agricultural) and given the designation "F".

A major adjustment was necessary in the classification of pasture, hayland, and grazed woodlands. Because of the complexity of topography, drainage, and vegetation, improved and rough pasture were often intermingled. Similarly, grassy wetlands were often

Table 1. LAND USE CLASSIFICATION EMPLOYED

Description	*Symbol*
Non-agricultural-restricted to farmsteads	F
Agricultural land	
Land used for annual field crops, associated fallow	A
Improved and rough pasture, grazed woodland, and grassy wetland	P
Woodland	
Wooded land with 25% or more crown cover	U
Open water	Z

either cut for hay or grazed, or both, and small plots of woodland often occurred within pastures. Rather than attempt to separate these naturally overlapping uses, all were combined under the single designation "P" (Table 1). This adjustment is believed to be consistent with the original demarcating criteria.

Land use areas were traced on equal area maps from single photos of the nine study sections. Derived patterns were checked against stereopairs in order to refine questionable boundaries. Measurements of the final areas were made with an Alvin Planimeter previously calibrated to the scale of the working maps. Precautionary measures were taken to obviate errors and the means of three approximately equal readings were used for final values in delineated areas.[6] Field investigation confirmed the identification of questionable boundaries on the 1970 photos.

Land Use Changes 1948-1970

Land use changes in the study area are summarized in Table 2. Cropland was dominant in all sections in 1948 and increased in overall importance by 1970. The total area increase from 55 to 70 percent reflects the greatest single area gain by any land use category.

Most of the land increase in cultivation was at the expense of pasture and woodland. Pasture area decreased in all sections, but most noticeably in 15, 23, 24, and 27 where a reduction of approximately 50 percent is evident in each case. In total area, pasture decreased from 645 to 374 hectares, which represents an 11.4 percent drop (Table 2).

Proportionally, woodland showed the greatest losses. Extensive clearing of bush was evident in sections 14, 23, and 24, and by 1970, woodland constituted less than 10 percent of the surface cover of 5 of the 9 sections. By 1970, woodland accounted for only 4 percent of the surface area and was the lowest of all land use classes except farmsteads (Table 2).

The change in surface water area from approximately 4 to 8 percent is the only land use category other than cropland which showed an increase between the years. Eight of the 9 sections were consistent with the overall trend and great increases were obvious in sections 23, 25, 26, and 27.

The percentage of land covered by farmsteads is insignificant in both years, but decreased between 1948 and 1970. Noticeable decreases occurred in sections 22, 24, and 26, while a slight increase occurred in section 13 (Table 2).

Analysis

Because of the complex topography, clearing of land does not necessarily imply production of uniform fields for mechanized agriculture. The loss of pasture and woodland to cropland has, of course, produced larger fields, but

the large number of wetland areas precludes total uniformity. Figures 2 and 3 are presented to illustrate the nature of the field patterns as well as trends in land use change. Section 14 was selected because it was consistent in all major trends in land use and typifies the topography of the entire area.

Clearing of woodland is especially obvious in section 14 as the area had the greatest amount of forest (91.6 hectares) remaining in 1948 (Table 2 and Figure 2). The close association of woodland and pasture is evident and the recently cleared agricultural lands usually amount to extensions of fields existing in 1948 by including adjacent woodland and pasture. The pattern of wetlands is generally consistent between years, but water areas have become fewer and larger because of draining or filling with concommitant increase in nearby catchment areas.

Discussion

In a major study on the grain transportation system in the Brandon-Neepawa region of Manitoba, Channon and Morrison reported that 72.8 percent of the land in the Moore Park delivery region was cropped in 1970-72.[2] The 62 farms involved included, but were not restricted to those in the study area, although the percentage of land used for crops was virtually the same. In the same area, 64.3 percent of the land was cropped in 1962-63 compared with 73.5 percent in 1968-69. The slight decrease between 1968-69 (73.5%) and 1970-71 (72.8%) could easily result from weather (water) conditions, grain prices or other temporary factors.

In the entire Brandon-Neepawa agricultural region, 63 percent of the land was cropped in 1962-63, 67 percent in 1968-69, and 64 percent in 1970-71.[2] The Moore Park and the present study areas, therefore, showed not only somewhat greater amounts of clearing but also a more consistent trend toward clearing. The reasons most likely relate to the fact that the Minnedosa study area has the highest long-term grain production record and lowest number of grazing animals of the entire Whitemud River watershed region.[4] The lower percentage of land in crops in the Whitemud watershed is accounted for by increases in grassland pastures in the poorly drained areas to the north and east of Neepawa.[4]

Table 2. LAND USE CHANGES IN A 23 SQ. KM (9 SQ. MI.) AREA OF SOUTHWESTERN MANITOBA, 1948-1970.

			Land Use Classification (ha)									
Section	*Total Area (hectares)*		*Cropland*		*Pasture*		*Woodland*		*Water*		*Farmsteads*	
	1948	*1970*	*1948*	*1970*	*1948*	*1970*	*1948*	*1970*	*1948*	*1970*	*1948*	*1970*
13	256	249	151.4	184.6	70.0	40.1	25.8	7.4	5.6	12.2	3.1	4.9
14	277	261	120.5	198.2	59.6	34.4	91.6	14.9	6.0	10.9	3.3	2.8
15	279	271	147.5	187.8	80.1	38.7	38.2	21.2	10.1	7.4	3.1	2.3
22	256	252	155.7	162.6	53.8	44.5	23.6	15.5	14.5	27.1	6.0	2.2
23	256	258	115.1	183.3	82.8	42.3	46.7	1.0	11.8	30.2	—	—
24	260	251	118.2	176.1	81.1	43.4	44.5	15.3	7.0	13.6	7.7	2.4
25	250	251	149.8	162.4	81.3	57.4	7.7	8.7	11.1	28.7	—	—
26	251	257	179.7	177.1	51.5	39.7	2.0	0.4	14.4	37.0	2.9	0.3
27	254	263	150.1	193.7	85.4	33.2	7.8	5.9	9.4	28.1	0.9	0.8
Totals	2339	2313	1288.0	1625.8	645.6	374.1	287.9	90.3	89.9	195.2	27.0	15.7
% Total Area	100	100	55.1	70.3	27.6	16.2	12.3	3.9	3.8	8.4	1.2	0.7

Kiel *et al.* studied land use changes in the Minnedosa pothole country of the aspen parkland of Manitoba.[5] Although primarily concnered with wetlands, they noted a 21 percent increase in cultivated land between 1928-30 and 1964 (48-69 percent of total), most of which was accounted for by a 17 percent decrease in "woodlots and bushland" (39-21 percent of total). Differences in classification do not allow direct comparison, but trends are similar to this study's findings (Table 2).

Whereas increases in cropped hectarage and decreases in both woodland and pasture are evident, changes in water area (wetlands) appear to be erratic. Although noting a gradual decrease over 35 years (1930-1965) of 3 percent (13-10 percent of total area), Kiel et al. (1972:48) indicated major fluctuations in water surface area ". . . in response to wet or dry periods". Deviations of 20 percent or more in precipitation caused noticeable changes in wetland conditions, and successive wet or dry years could account for major joining of adjacent potholes or complete disappearance of some water areas.

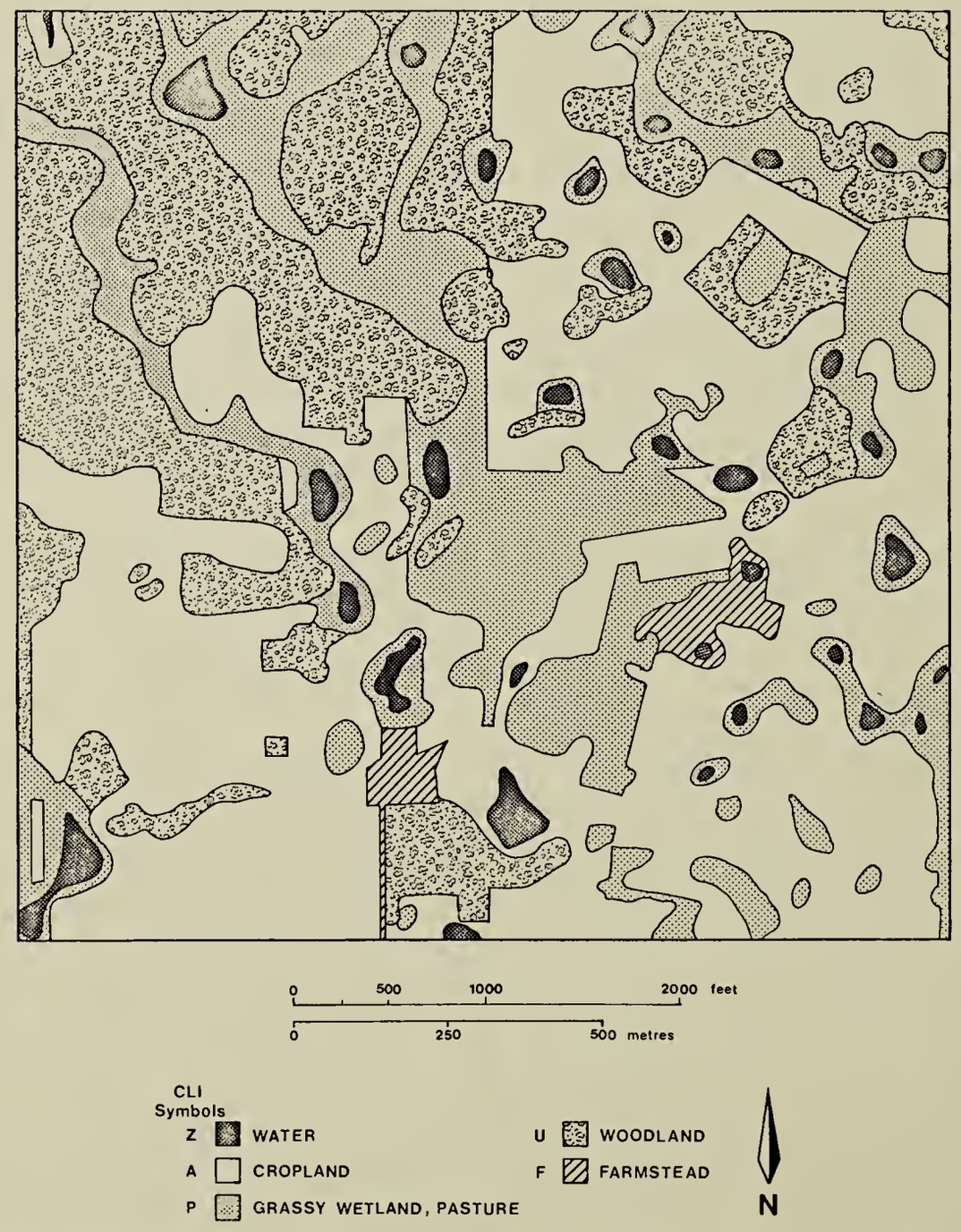


Figure 2. *Land use in 1948 in Section 14, Township 13, Range 18 West*

The increase in water hectarage in the study area, therefore, could be the result of short-term rather than consistent increases in precipitation. Although 1947-48 and 1969-70 were not unusually deviant in total precipitation, 20 percent variations in seasonal and annual precipitation have been recorded over short distances.* With no reporting station within the study area, the possibility of local precipitation variation cannot be ascertained, but a trend toward increased water area would probably be climatic as cultural practices are designed to eliminate wetlands if at all possible.[5]

Summary

Current land use trends and conditions in the study area are consistent with those found in related studies. Agricultural cropland dominates the landscape and is expanding at the expense of woodland and pastureland, while water area is slowly decreasing over long periods, but shows considerable fluctuation as climate changes periodically. The high quality of recoverable soils allows excellent crop production and will likely result in continued clearing of the small remaining areas of woodland and pasture.

Figure 3. *Land use in 1970 in Section 14, Township 13, Range 18 West*

Topographic depressions and water catchments will endure, but will slowly diminish as cultural practices integrate run-off patterns.

* Precipitation data for July 1947 to July 1948 and July 1969 to July 1970 did not deviate more than 20 percent from a normal of 452 mm for seven reporting stations near the study area.[1] Local area deviations of 50-75 mm are "frequent" and one record of 170 mm difference occurred in one growing season between Rapid City and Minnedosa, 19 km apart.[5]

Acknowledgement

Appreciation is expressed to James Andersen and Garnet Shearer for initial processing of data and to Peggy McPherson for drafting of the final maps.

[1]ATMOSPHERIC ENVIRONMENT SERVICE. 1972. 1971 Annual Meteorological Summary: Manitoba. n.p., Winnipeg. 50 pp.

[2]CHANNON, J. W. and K. J. MORRISON. 1972. "Brandon-Neepawa Region of Manitoba". Prairie Regional Studies in Economic Geography No. 8, Economics Branch, Canada Department of Agriculture. Publ. No. 71 153 pp.

[3]DEPARTMENT OF REGIONAL ECONOMIC EXPANSION. 1970. The Canada Land Inventory. Report No. 1, 2nd Ed., Objectives, Scope and Organization. Queen's Printer, Ottawa. 61 pp.

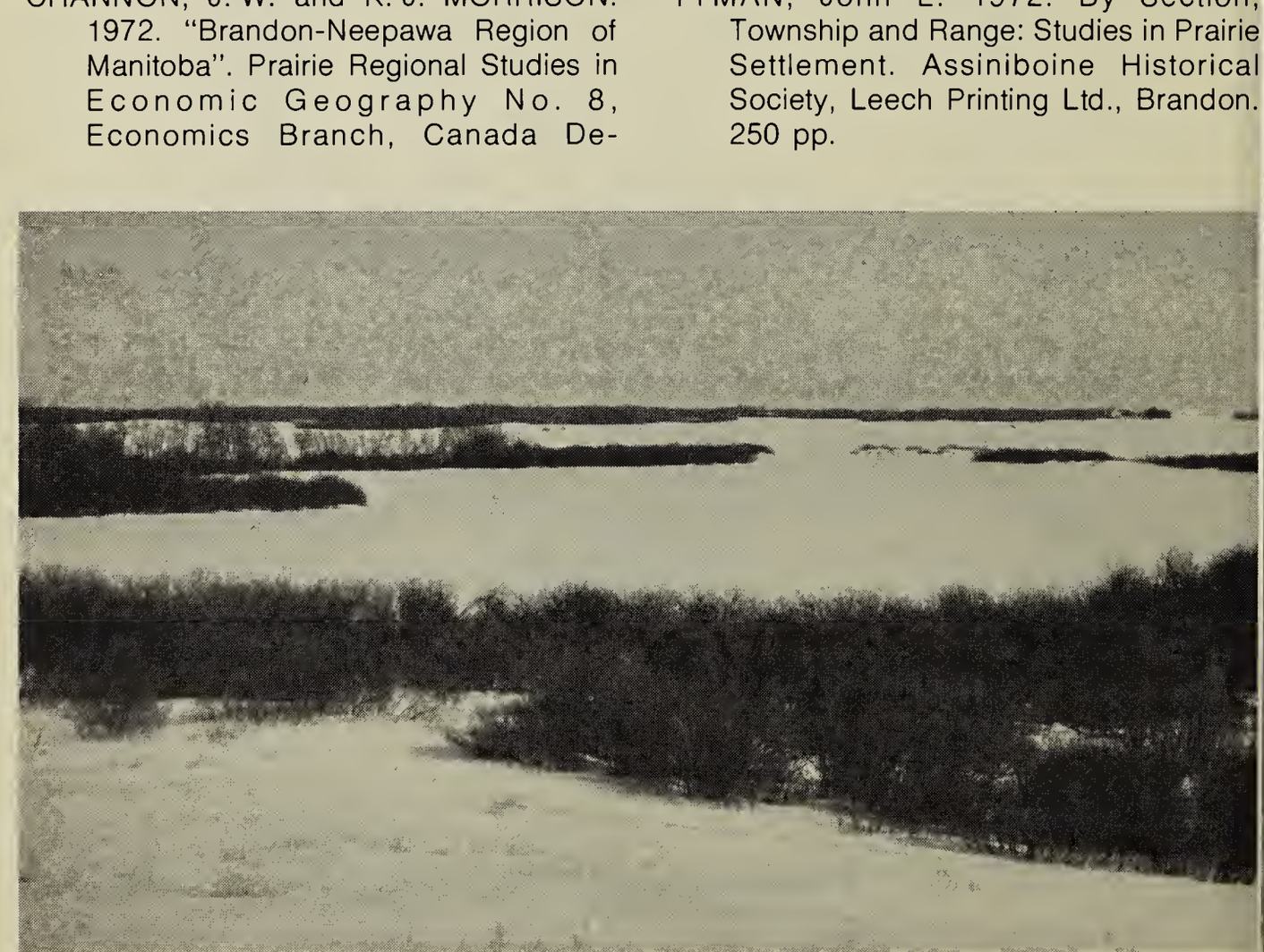
[4]JENKINS, G. C. 1974. Whitemud River Watershed Resource Study. Manitoba Department of Mines, Resources and Environmental Management. Winnipeg 99 pp.

[5]KIEL, W. H. Jr., A. HAWKINS, and N. PERRET. 1972. Waterfowl habitat trends in the aspen parkland of Manitoba. Canadian Wildlife Service, Report Series, No. 18, Ottawa. 61 pp.

[6]LAWRENCE, G. R. P. 1971. Cartographic Methods. Methuen & Co. Ltd., London. 162 pp.

[7]SHAYKEWICH, C. F. 1974. Climate of Southern Manitoba as it Relates to Agriculture. Publ. No. 546, Manitoba Department of Agriculture, Queen's Printer, Winnipeg. 24 pp.

[8]TYMAN, John L. 1972. By Section, Township and Range: Studies in Prairie Settlement. Assiniboine Historical Society, Leech Printing Ltd., Brandon. 250 pp.



Saskatchewan scenery *Lorne Scott*