Topic: The story of Palliser's Triangle, the structure of Saskatchewan soils, the reality of Saskatchewan weather
Prepared by Amy McInnis, May 2004, for the Winning the Prairie Gamble exhibit, North Battleford WDM

1. Scientific explorations, the Palliser Triangle, the agricultural potential of Saskatchewan

In "A History of Agriculture on the Prairies to 1914," Lewis H. Thomas writes: "Agricultural activity is impossible without fertile soil and favourable climatic conditions, and unless these qualities be perceived by men, the land will remain untouched." (221-22). The British Parliament and an ardent group of British-Canadian expansionists, centered in Canada West, were keen to settle the area west of Canada to the Rockies, but lacked solid information as to the climate and agricultural potential of the area, necessary to attract prospective settlers (Thompson, 33-34). In an attempt to quash the wilderness stereotype of the West, furthered by the likes of Hudson Bay Company's Governor, Sir George Simpson, and published accounts like that of William F. Butler's The Great Lone Land, scientific explorations were launched (Rees, 5-6).

1.1 Palliser and Hind Expeditions

On behalf of Britian, Captain John Palliser set out on his British North American Expedition to investigate the agricultural potential of the prairie region from 1857-60. Palliser's expedition is famous for his delineation of a triangular shaped area north of the 49th parallel, covering 200,000 square kilometers across present-day southern Saskatchewan, southeastern Alberta and southwestern Manitoba, which became known as the Palliser Triangle (Lemmen and Dale-Burnett, 41). Known as "the driest part of the Canadian prairie provinces," the Triangle is described in the Atlas of Saskatchewan by Lemmen and Dale-Burnett as follows:

> The native vegetation cover is commonly referred to as "northern mixed grass prairie", or simply "mixed prairie". The regional soils are predominantly of the Chernozemic order, although large areas of Solonetzic and Regosolic soils also occur. However, implicit in Palliser's writing is that the Triangle is a climatic region, defined by comparatively great aridity. All of the region is characterized by a significant annual moisture deficit, such that evaporation exceeds precipitation. ...The most critical climatic characteristic of the region, however, is the common occurrence of droughts. Widespread drought has occurred nearly every decade of the 20th century within the Palliser Triangle, with severe droughts in the 1920s, 1930s and 1980s, having serious social, economic and environmental consequences (41).

What has become one of the most productive agricultural areas in the world, was described as an

area incapable of supporting viable agriculture by Captain John Palliser in 1857. In fairness to Palliser, it is recognized that he visited the area during a drought year, explored mainly the periphery of the area, and that he incorrectly treated the area as having a homogeneous soil type. Much of Saskatchewan's present-day wheat growing area was included in the Palliser Triangle, which he described as a semi-arid region which was essentially an extension of the Great American Desert. James H. Gray wrote, "Thus while the Palliser Triangle included millions of acres of land which should never have been broken to the plow, it included more millions of near-perfect grain-growing soil" (15). Henry Youle Hind's 1858 expedition into the western interior painted an equally bleak picture of the southern grassland region as attested by the following entry from his journal: "A proper appreciation and use of facts will convince the most sanguine that the larger portion of this area [Palliser Triangle] is, in its present state, unfit for permanent habitation of man, on account of climate, soil, and a lack of fuel (attributed to Henry Youle Hind in The Swift Current Research Station, 10)."

Although bleak in their assessment of the southern grassland region, both Palliser and Hind agreed in the existence of a "fertile belt" which "extended in a northwest direction, all the way from Red River to the Rocky Mountains" (Hind as cited in National Library of Canada and National Archives The Canadian West). Hind confidently reported that, "no other part of North America [has] this singularly favourable disposition of soil and climate" (attributed to Hind in National Library of Canada and National Archives The Canadian West). Those in favor of western expansion seized onto the idea of a "fertile belt", despite the reports of the desert-like conditions to the south. The optimism which the "fertile belt" encouraged "...was being fanned into flames by pamphlets, resolutions of Boards of Trade, parliamentary committees, and eloquent speeches, describing the unlimited possibilities of the West," as explained in the History of Prairie Settlement by Arthur S. Morton (36).

1.2 Macoun Expedition

The reports of Professor John Macoun, a Canadian botanist who explored the area during a string of wet years during the 1870s, were more encouraging in regards to the agricultural potential of the prairie region, including the area of Palliser's Triangle. Macoun reported that the Palliser Triangle, in addition to the "fertile belt" was suited to agriculture because the precipitation came during the growing season when it was needed most (Bonikowsky Drought in Palliser's Triangle). Macoun's enthusiastic and influential accounts were the impetus for the Canadian Pacific Railway to forge westward to the Rockies through the southern prairies, and led to the eventual settlement of Saskatchewan (Thomas, 227). The railways served a dual purpose; to bring settlers to the prairies and to provide a means of transporting the bounty of the wheat lands to markets in the east (Thomas, 227).

Owing to the droughts which plagued the Palliser's Triangle in the twentieth century and the rate of homestead cancellations, Macoun's zealous accounts have been met with much criticism. According to Thomas, "Macoun cannot be entirely blamed for his optimistic appraisals: he visited the plains during wet years when Manitoba farmers enjoyed large crops and the country to

the west was lush. The truth lies somewhere between the calculations of Macoun and Palliser" (227).

1.4 Early Ranching in Palliser Triangle

Large scale ranching was the dominant activity in the area of Palliser's Triangle prior to agricultural settlement (Lemmen and Dale-Burnett, 41). Deemed unsuitable for agriculture by Palliser, the area, with its "dry climate, sandy soil, and extensive grass cover," made it highly suitable for raising livestock (The Applied History Research Group Palliser's Triangle). As explained by Lemmen and Dale-Burnett in the **Atlas of Saskatchewan**, "By 1879 the buffalo were gone and the Indians confined to reserves by the treaties. In 1880-81 the Canadian government developed policies to facilitate large scale ranching, and that became the dominant agricultural activities in the area prior to extensive farm settlement. The period of large ranches lasted about 25 years until the extremely harsh winter of 1906-07, when it is estimated that up to 70 per cent of the cattle in south western Saskatchewan perished" (41). The winter of 1906-07 tipped the scales in favour of the farmers, who began to dominate in the region (Evans, 64).

2. Saskatchewan's Climate

Saskatchewan is characterized by climatic extremes, "with temperatures varying from -40 C to +40 C, moisture conditions from drought to torrential downpours, and severe storms from winter blizzards to summer tornadoes," as described in the Atlas of Saskatchewan (118). On a basic level, the province experiences hot, dry summers and cold, dry winters (University of Saskatchewan Saskatchewan Geography). However, when examined more closely, wide variations in climate and soils occur across the province affecting the practices of crop and livestock production. As reported in the Saskatchewan Wheat Pools's publication From Field To Market, "A successful crop is a product of four key variables: good soil, enough rain at proper times, plenty of heat and sunshine through the summer and a growing season of sufficient length to allow crops to ripen before frost arrives in autumn (8)."

2.1 Temperature and Growing Season

During the summer season, average temperatures of between 21° C and 29° C provide adequate heat for maturing crops (Saskatchewan Wheat Pool, 9). Southern Saskatchewan is considered a "sunshine haven" with 2500 hours of sunshine reported at Estevan (Lundqvist, 118). The Saskatchewan Wheat Pool reports a variance in frost free days, from an average of 115 in the south to less than 100 in the northern region (9). Due to the limitations imposed by geographical location, Saskatchewan farmers carefully select the appropriate varieties of crops for their regions. Wheat is predominantly grown in the southern part of the province, where the length of the growing season is longer. Whereas crops like barley and canola, which mature quicker, are more commonly grown in the northern areas (Saskatchewan Wheat Pool, 9). In the southwestern regions, moisture rather than temperature is the limiting factor to agriculture, whereas the length of the growing season between first and last frosts is a restriction in the north (Lundqvist, 118).

However, researchers have done much to push back the barriers imposed by Saskatchewan's climate by developing varieties adapted to local growing conditions, thereby increasing the choices available to farmers. Crops are not grown in the extreme north of the province where frost free days are minimal and subsoils remain frozen (University of Saskatchewan Saskatchewan Geography).

2.2 Precipitation

Available moisture generally increases from the extreme southwest of the province towards the northeast. The Atlas of Saskatchewan describes the precipitation received in Saskatchewan as follows:

> Average annual precipitation varies from less than 300 mm in the prairie southwest to over 500 mm in the northeastern boreal forest. Except for the extreme north, most areas receive over 70 per cent of their annual precipitation during the growing season, and because of the low temperatures evaporation losses are minimal during the winter. These characteristics of the climate are critical for agriculture since they permit extensive cultivation on the southern half of the province, providing the minimal precipitation comes at the right time of the year. In the north, low temperatures become the overriding limiting factor and farming is all but impossible. ...In comparison with other parts of Canada, snowfall in Saskatchewan is fairly light, ranging from less than 80 cm per year in the driest prairie lands to around 200 cm in the north. ...The buildup of a winter snowpack is critical to agriculture because of its insulating effects on soil temperatures as well as for replenishment of soil moisture at the time of spring melt. (118-119)

2.3 Soils

"The richest resource in grain-producing areas of Saskatchewan is the soil, which has the capacity to hold moisture and allow crops to survive during extended dry periods," wrote the Saskatchewan Wheat Pool (8). Moving from the southwest to the northeast, Saskatchewan can be divided into six distinct soil zones developed as a result of the interaction of vegetation and climate (University of Saskatchewan Soil Zones). The color of the soils described in these zones correspond to the organic matter contained in the A horizon or topsoil.

The following descriptions are adapted from the Saskatchewan Wheat Pool's From Field to Market (8-9) and the University of Saskatchewan's Soil Zones website:

1) Brown Soil Zone:
   - southwestern Saskatchewan
   - warm and dry climate

- A horizon (topsoil) has about two per cent organic matter and a depth of about 12 cm
- three-quarters of the soils are medium-textured (loam), some sandy soil unsuitable for grain production
- crop production affected by a lack of moisture
- many cattle ranches
- soil erosion a concern due to high average wind speeds
- lower yield potential

2) Dark Brown Soil Zone:

- north and east of the brown soil zone
- formed under a more productive prairie grass cover, A horizon averaging 17 cm in depth with between four and six per cent organic matter
- mostly medium-textured (loam) soils
- topsoil has the capacity to hold twice the moisture as sandy soils in the brown soil zone
- greater crop choices, excellent grain growing conditions
- lower wind erosion risk as a result of decreased wind speeds and more moisture

3. & 4. Black and Dark Gray Soil Zones

- located to the north and east of the dark brown soil zone
- richest soil on the prairies
- A horizons of 20 to 25 cm, with reports of up to 50 cm in depth
- formed under tall grass and parkland prairie, these rich soils contain around 7 per cent organic matter
- cooler temperatures and available moisture is favourable for crop production
- wind erosion less problematic than in the brown and dark brown zones

5. Gray Soil Zone

- located further north, cooler and wetter climate
- greater soil moisture due to decreased temperatures
- shallow and less fertile soils due to leaching of minerals and nutrients, low organic matter and deficient in N, P and K
- some areas affected by soil acidity
- wet land in spring and early frosts affect crop production

6. Forest Soils

- located north of the boundary where agriculture is practiced (approx. 56° parallel)
- transition zone of parkland and tall grass prairie moving into northern boreal forest
- rock of the Canadian Shield occurs further north

2.4 Drought

Saskatchewan is subject to recurrent droughts (Lundqvist, 119). The semi-arid Palliser Triangle and the "Dry Belt" located within, are particularly susceptible. The area lies in the rainshadow of the Rocky Mountains, which restrict the flow of moisture from the Pacific (Nemanishen Drought in the Palliser Triangle) . No less than twenty notable droughts occurred on the prairies during the last century, including well known dry periods like 1917 to 1926, 1929 to 1937, the 1960s, a ten year period beginning in 1977, 1992 and the list goes on (Government of Canada Prairie Land and Water Resources). In the early days of settlement, the newly-broken land and timely rains provided promising harvests, including the bumper crop of 1915. However, by 1917, the rains became few and far between. Unfortunately, in an effort to retain soil moisture, farmers adopted techniques like excessive tillage of their summerfallow which was advocated by experts. This excessive tillage pulverized the soil, leaving it susceptible to soil erosion (Nemanishen Drought in the Palliser Triangle).

Saskatchewan farmers are still experiencing drought today. However, the knowledge garnered through the desperate experience of the "Dirty Thirties" at the Dominion Experimental Farms and universities, the support provided by the Prairie Farm Rehabilitation Administration, the modern emphasis on conservation tillage and the increased opportunities provided through crop diversification, have all played a part in buffering the effects of drought (Bonikowsky, Drought in Palliser's Triangle). As summed up by Laura Neilson Bonikowsky, "Mother nature definitely holds the upper hand in Palliser's Triangle, but adapting to the environment and learning from experience has ensured that Macoun's prediction of a successful wheat-growing region would come true - with or without drought."

3. References

Arthur S. Morton, "History of Prairie Settlement," in W.A. Mackintosh and W.L.G. Joerg ed., Canadian Frontiers of Settlement Volume II (Toronto: The MacMillan Company of Canada Limited, 1938).

Bill Waiser, "Scientific Explorations 1870-1914," in Atlas of Saskatchewan (Saskatoon: University of Saskatchewan, 1999).

Donald Lemmen and Lisa Dale-Burnett, "The Palliser Triangle," in Atlas of Saskatchewan (Saskatoon: University of Saskatchewan, 1999).

Simon Evans, "The Saskatchewan Range in 1906 and 1921," in Atlas of Saskatchewan (Saskatoon: University of Saskatchewan, 1999).

Government of Canada, "Drought Years," Prairie Land and Water Resources website <http://collections.ic.gc.ca/soilandwater/pr5.htm>, May, 2004.

J. Baden Campbell, The Swift Current Research Station - 1920-1970 , Canada Department of Agriculture Historical Series No. 6 (Ottawa: Information Canada, 1971).

James H. Gray, Men Against the Desert 2nd ed. (Saskatoon: Fifth House Limited, 1996).

John Herd Thompson, Forging The Prairie West (Don Mills: Oxford University Press Canada, 1998).

Laura Neilson Bonikowsky, Drought in Palliser's Triangle, Historica's Canadian Encyclopedia online <http://www.thecanadianencyclopedia.com/PrinterFriendly.cfm?ArticleId=FET_E20>, May 2004.

Lewis H. Thomas, "A History of Agriculture on the Prairies to 1914," in R. Douglas Francis and Howard Palmer ed., The Prairie West - Historical Readings (Edmonton: Pica Pica Press, 1985).

National Library of Canada and National Archives of Canada, The Canadian West. <http://www.collectionscanada.ca/05/052910/05291028_e.html>, May, 2004

Olivier Lundqvist, "Climate," in Atlas of Saskatchewan (Saskatoon: University of Saskatchewan, 1999).

Ronald Rees, New and Naked Land - Making The Prairies Home (Saskatoon: Western Producer Prairie Books, 1988).

Saskatchewan Wheat Pool, From Field To Market (Canada, 1998).

The Applied History Research Group, "Palliser's Triangle," University of Calgary website <http://www.ucalgary.ca/applied_history/tutor/calgary/triangle.html>, May, 2004.

University of Saskatchewan, Soil Zones. Saskatchewan Interactive website <http://interactive.usask.ca/ski/agriculture/soils/soilform/soilform_zone.html>, November, 2003.

University of Saskatchewan, Saskatchewan Geography. Saskatchewan Interactive website <http://interactive.usask.ca/ski/factfig/geography.html>, November, 2003.

Walter Nemanishen, Drought in the Palliser Triangle. Prairie Farm Rehabilitation Administration online publication <http://www.agr.gc.ca/pfra/publications_e.htm>, May 2004.

4. Images

See attached pages.