

Chapter 4: Land Use and Farming Systems



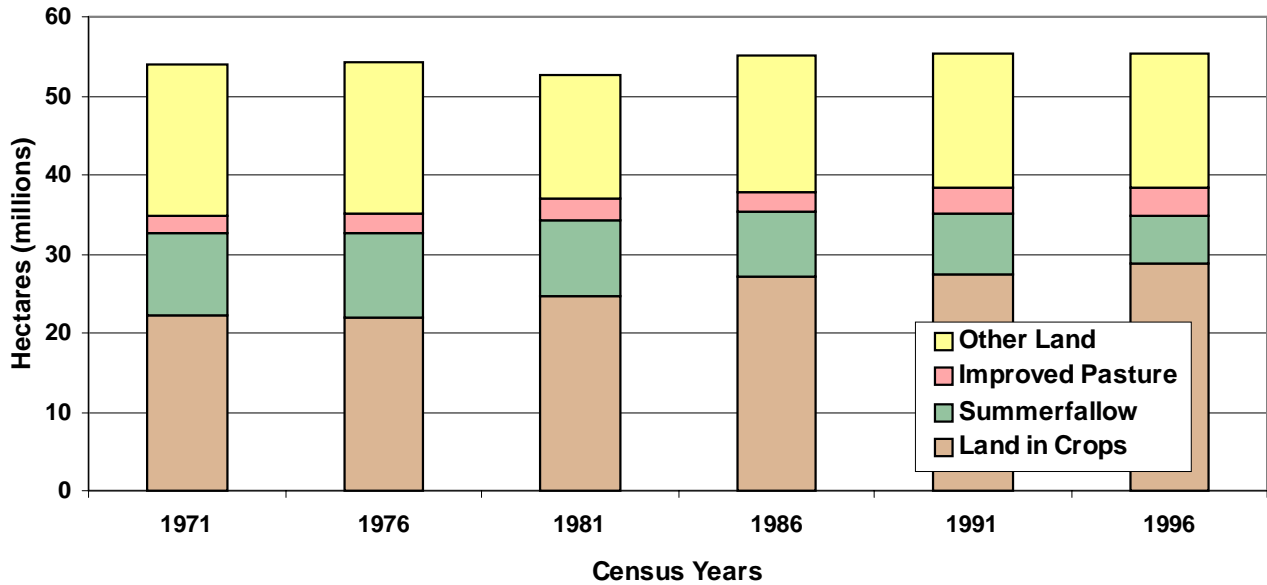
Introduction

Since the settlement of the Prairies in the 19th and early 20th centuries, land use and farming practices have evolved to match the various climates and soil types on the Prairies and adapted to changing markets, technology and transportation systems. The abandonment of farms in the Special Areas of Alberta during the early 1920s, and southwestern Saskatchewan in the 1930s, provides evidence of these adjustment processes. More recently, since the 1980s, there has been a reduction in summerfallow and an expansion of crop varieties, particularly in areas of higher moisture.

The total land reported on farms has remained relatively constant (1971-1996). However, a reduction in summerfallow area since 1981 has resulted in additional land being cropped (Figure 4.1). This reduction in summerfallow is attributed to a number of

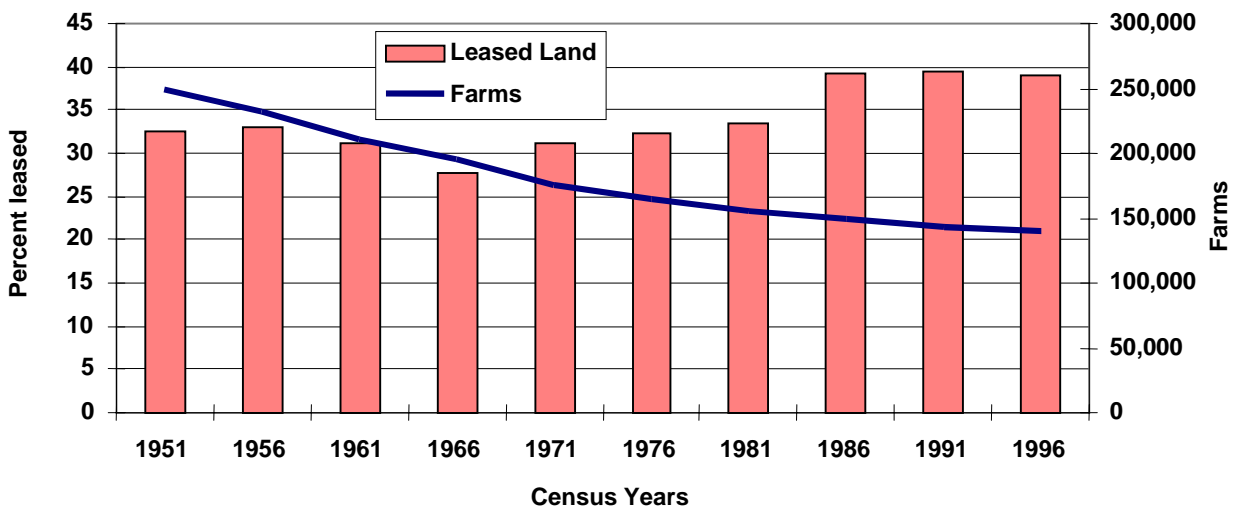
factors, including economic circumstances and technological change. Conservation programming over the past 20 years has done much to communicate and demonstrate appropriate land management techniques.

Over the past 20 years, 35-40% of farmland has been rented (Figure 4.2). This raises concerns since public programs designed to promote long term land stewardship may not be as effective on rented lands, where shorter term revenues may be the primary goal.



Source: Census of Agriculture

Figure 4.1 Prairie land use.



Source: Census of Agriculture

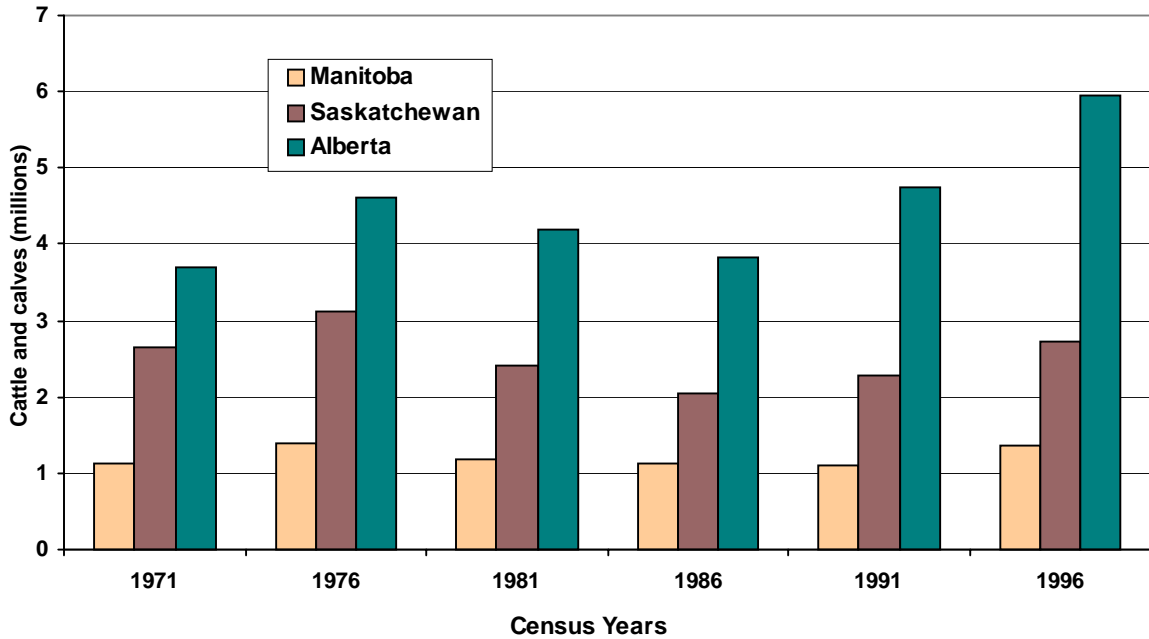
Figure 4.2 Number of farms and percent of agricultural land leased on the Prairies.

Trends and populations of livestock (cattle, hogs and poultry) since 1971 are illustrated in Figures 4.3 to 4.5. Overall, cattle numbers have been increasing since 1986, with production highest in Alberta (Figure 4.3). Cattle

populations in Manitoba and Saskatchewan in 1996 approach, but have not attained, the peaks of 1976. Land for pasture and feed grains to meet the demands for increased cattle numbers may be in short supply in some regions where

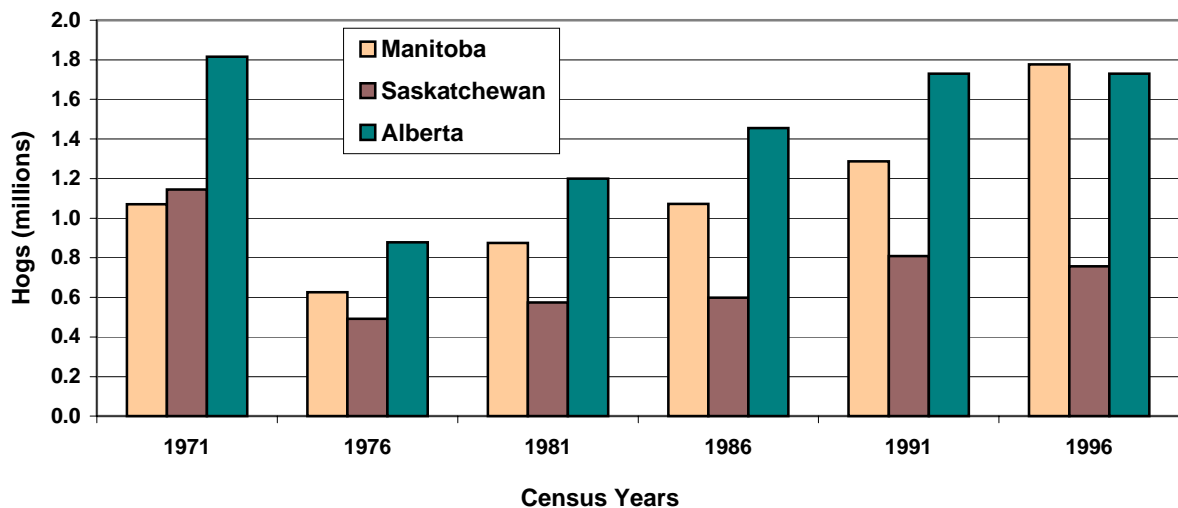
there is competition for higher valued crops.

Hog numbers have rapidly increased in Manitoba and Alberta since 1976, with Manitoba's hog population surpassing Alberta's (1996 Census of Agriculture).



Source: Census of Agriculture

Figure 4.3 Cattle and calf populations.



Source: Census of Agriculture

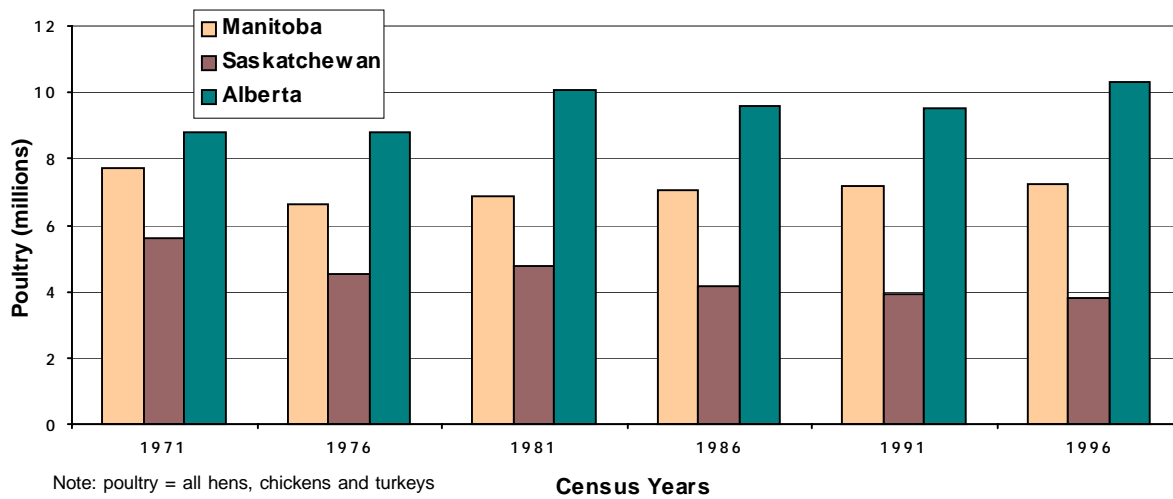
Figure 4.4 Hog populations.

Recent hog processing developments in Manitoba, coupled with changes to freight rates for export grains, bode well for continued expansion of that province's hog sector over the next few years. Despite Saskatchewan's aggressive target to increase production, a rapid decline in the number of smaller operations has resulted in little

change in hog numbers for the period presented in Figure 4.4. However, forecasts for both Saskatchewan and Alberta suggest rapid increases in intensive hog production.

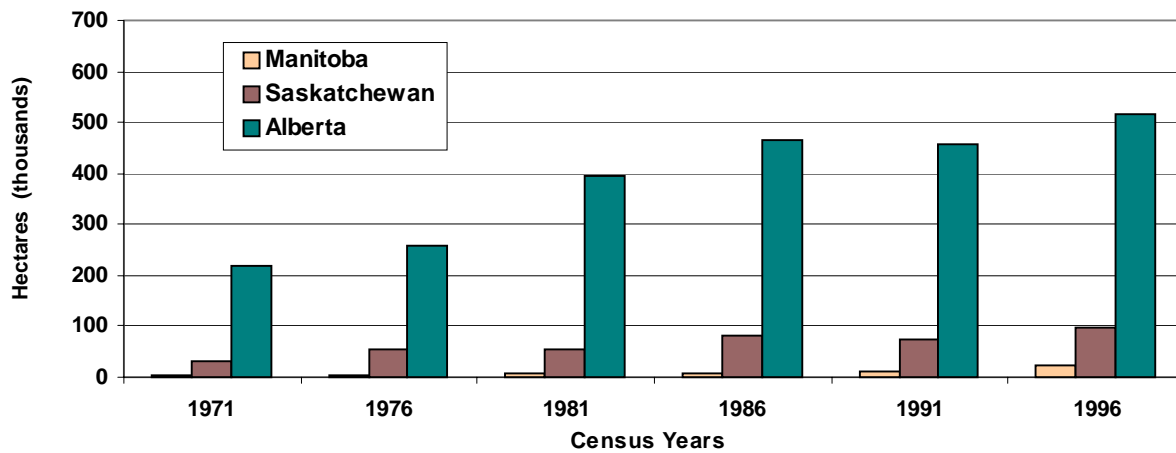
The poultry population has remained relatively constant (1971 to 1996) due to supply management (Figure 4.5). How-

ever, concentration of production has increased significantly as the number of chicken producers had declined from 69,670 to 11,617. The remaining farms show that significant intensification has occurred due to economies of scale with confined production techniques. As with the hog and beef sectors, there is renewed interest in additional poultry



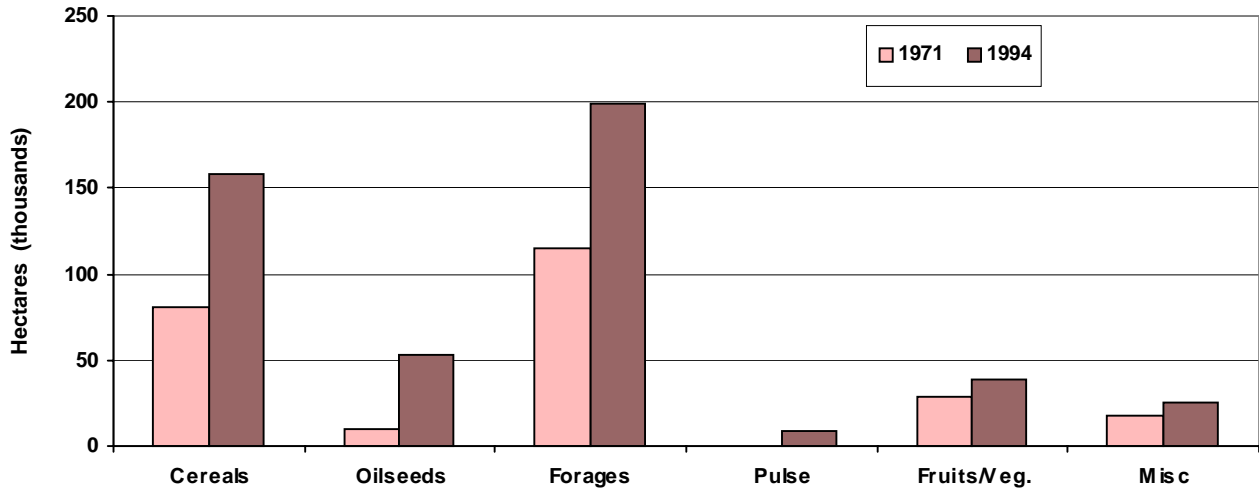
Source: Census of Agriculture

Figure 4.5 Poultry populations.



Sources: Census of Agriculture and PFRA

Figure 4.6 Prairie irrigation area.



Sources: 1971 Census of Agriculture; Alberta Agriculture Food and Rural Development 1994; Saskatchewan Agriculture and Food 1994; Manitoba Agriculture 1994.

Figure 4.7 Trends in Prairie irrigated crops.

output due to the comparative cost advantage of production in the Prairie region.

Irrigated area has nearly tripled (1971 and 1996), with Alberta having most of the growth (Figure 4.6). The 636 000 hectares of irrigated land in the Prairie provinces represents an important sub-set of agricultural land use and production activity. Although the majority of irrigated areas are cropped to cereals and forages (Figure 4.7), the output supports a diverse and vibrant processing and value-added sector. For instance, irrigation provides the consistent yields and quality necessary to support potato processing in the Prairie region.

The 1991 and 1996 Agricultural Census also solicited input from producers on the adoption of conservation tillage. In general,

there has been significant acceptance of reduced tillage technologies between 1991 and 1996 (Figure 4.8). In all provinces less conventional tillage is being reported, while no-till and minimum tillage on the cultivated land base is increasing.

Both historically and in the recent past, there have been changes in land use and land practices on the Prairies. The remainder of this chapter explores in more detail the relationship between current land use and farming practices in different landscapes across the Prairies. Information from this study can be used to identify the location of current practices and to evaluate the potential of Prairie landscapes to adapt to future economic and environmental scenarios. It may also be used to predict where future changes are most likely to occur.

Defining Land Practices Groups and Landscapes

It has long been understood that the ability and opportunity for agricultural systems to change is limited by landscape characteristics (Dumanski and Kirkwood 1988). For this discussion, landscape characteristics include soil, land form, vegetation and climate factors.

Studies that relate land use to landscape usually begin by classifying the landscape, and then describe the biological characteristics and land use of each landscape type (Huffman et al. 1993). In this study, areas with similar agricultural practices and land uses were grouped together first. Then the soil and landscape types found within each group were characterized, identifying the range of land-

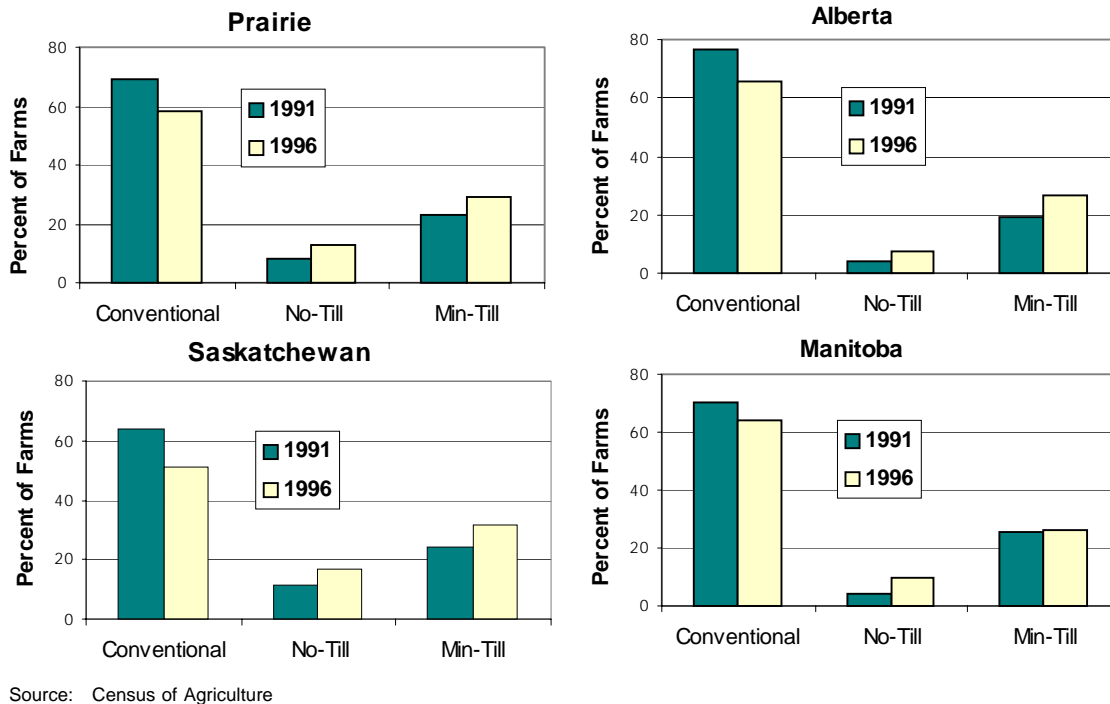


Figure 4.8 Percent of farms using conventional, no-till and min-till practices across the Prairies.

scapes that are associated with a given set of agricultural activities. Two data sets were used in this study, the Soil Landscapes of Canada (SLC) (Centre for Land and Biological Resources Research 1996) and the 1996 Census of Agriculture.

The Soil Landscapes of Canada is a series of maps and associated databases that portray soil and land characteristics, or attributes, for all provinces and territories in Canada. The maps have been compiled at a scale of 1:1,000,000. Each SLC map area, or polygon, is described in terms of a standard set of attributes that includes soil development, soil parent material, mode of deposition, texture class of parent material, local surface form, slope gradient,

kind of rock or surface material except water, and spatial occurrence of these attributes within a polygon. These attributes are factors that are important for plant growth, general land management, regional planning, terrain sensitivity and environmental sustainability. A polygon may contain one or more distinctive soil landscapes.

Statistics Canada conducts a Census of Agriculture every five years in which producers are required to report information on:

- operating arrangements and tenure
- land use and crops grown
- crop inputs and cultivation methods
- farm sales and capital value.

The standard product for the agriculture census is summarized and reported at a Consolidated Census Subdivision level, which generally corresponds with rural municipalities or counties. This level of reporting does not permit analysis on a landscape basis.

For the past four censuses (1981-1996), the Research Branch of Agriculture and Agri-Food Canada has contracted Statistics Canada to link the Census of Agriculture to SLC polygons. For the 1991 and 1996 Census data, this linkage was achieved using the *farm headquarters processing* technique (Hiley et al. 1994). The process involves spatially matching the legal location of each farm headquarters to a polygon. The

characteristics of all farms associated with each polygon have been summarized. The resulting databases allow comparison of farm management and farm practices to landscape attributes and can be analyzed and displayed using geographic information systems (GIS) technology (Hiley 1999). In this study, the individual soil components of the SLC polygons were grouped into eleven distinctive *Prairie soil landscapes* and the SLC polygons were consolidated into thirteen *Land Practices Groups* of similar land use and farming practices using the Census of Agriculture data.

PRAIRIE SOIL LANDSCAPES

To identify the relationship between land practices and soil landscapes, SLC polygons were linked to the soil component table of SLC version 2.2 for the attributes:

- DRAIN (soil drainage - e.g. well drained, poorly drained)
- DEVEL (soil profile development - e.g. Orthic Black Chernozemic, Brown Solonetzic)
- SLOPE (landscape slope - e.g. less than 4%, 10-15%)
- LOCSF (landscape surface form - e.g. undulating, rolling)
- PMDEP (soil parent material - e.g. morainal, lacustrine).

A detailed description of the attributes is provided in the Procedures Manual and User's Handbook for the SLC (Shields et al. 1991).

Each soil component in 1,245 SLC polygons was described using these five attributes and grouped into common soil landscape descriptions based on key soil attributes that affect agricultural capability. The distribution of these soil landscape descriptions is depicted in Figure 4.9.

Not all land within the SLC polygons that define the agricultural area of the prairies is used for agriculture. The agricultural area of the Prairies includes all of the land in the SLC polygons, not just the agricultural portion. It was not possible to determine which soil components were in agricultural use.

Soils in the Prairies have been classified into five major soil zones based on soil profile development and resulting soil organic matter (Figure 4.10). Within these zones, eleven Prairie soil landscapes were identified and described.

Strongly sloping to hilly

Soil landscape components that have slopes greater than 10% would be classified as Canada Land Inventory (CLI) 4T, 5T or 6T, and are marginal to unsuitable for cultivation (Brocke 1977). These soil landscapes are

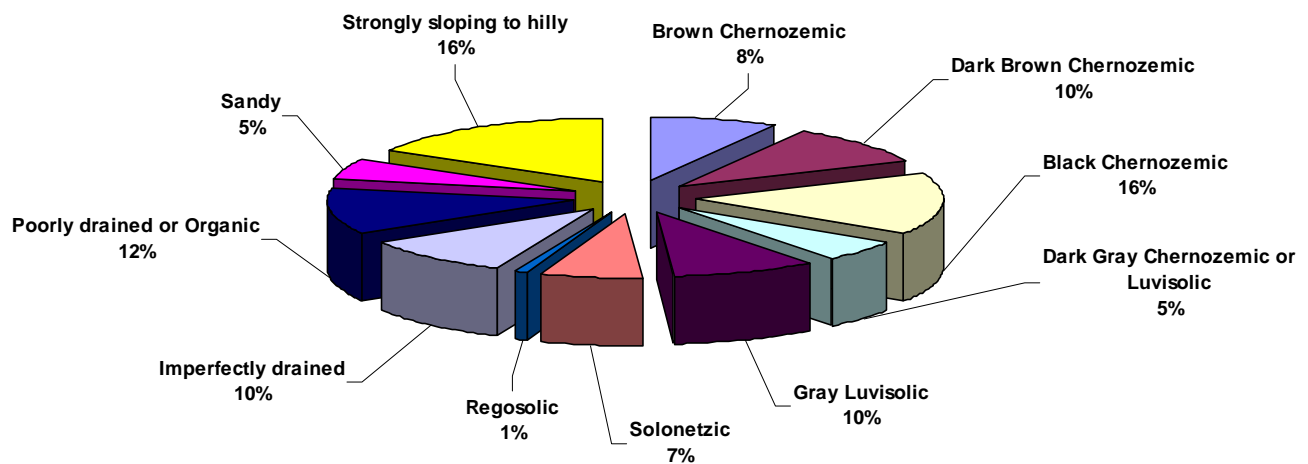


Figure 4.9 Distribution of Prairie soil landscapes in PAL SLC polygons.

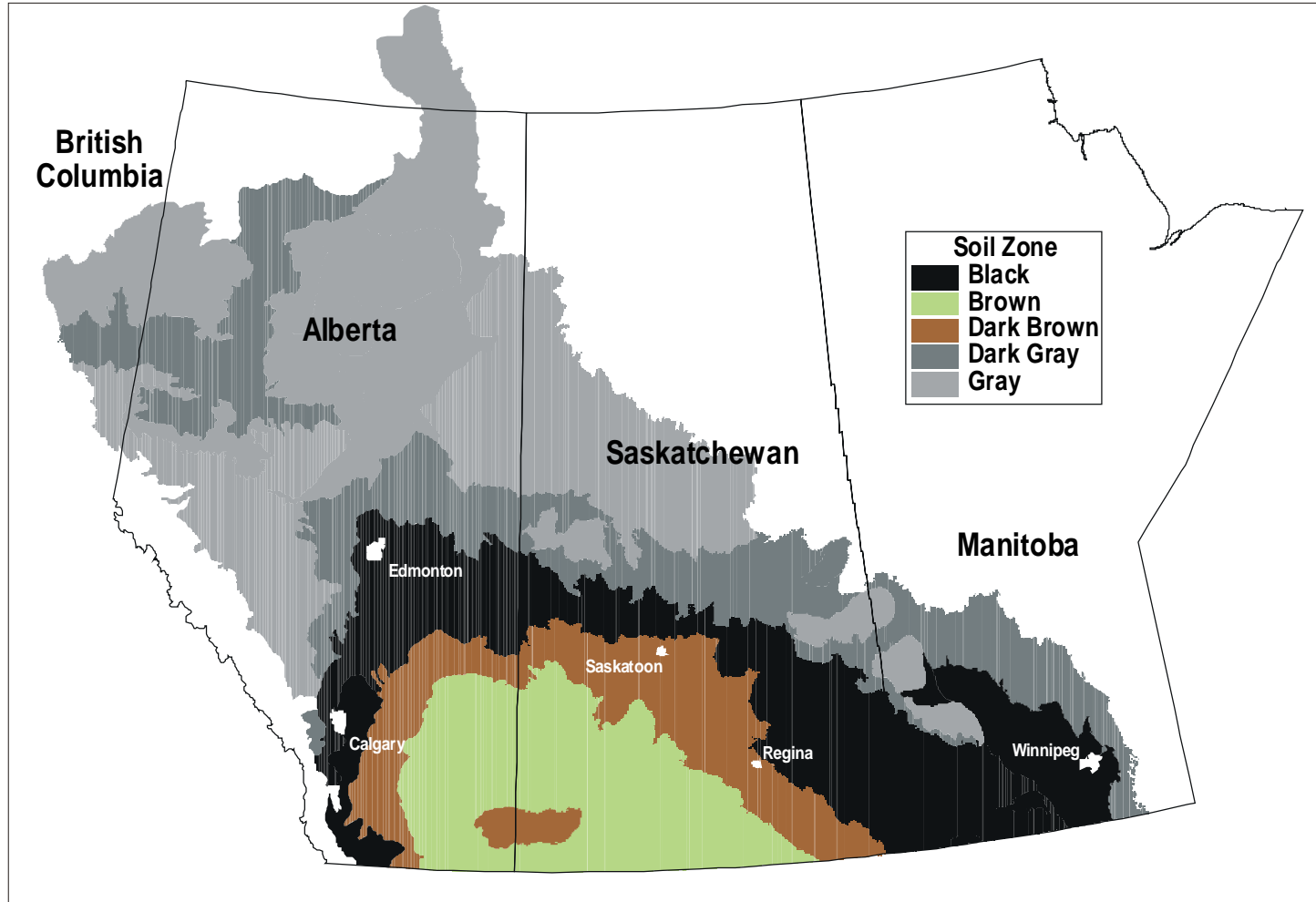


Figure 4.10 Soil zones of Western Canada

found in all soil zones and make up 16% of the land in the agricultural area of the Prairies. For this study, all soil components that had slopes greater than 10% are included in the strongly sloping to hilly landscape.

Poorly drained or Organic soils

Soil landscape components that have poor to very poor drainage, and/or are Organic or Gleysolic soils, are generally unsuitable for cultivation without drainage. Saline soils are included in this soil landscape. These soils are found on slopes of less than 10% and a variety of landforms and parent materials. Poorly drained or Organic soils occupy 12% of land in the agricultural area of the Prairies.

Solonetzic soils

Solonetzic soils have a high level of sodium that result in a B horizon which is sticky when wet, and hard when dry (Toogood and Cairns 1973), making them difficult to cultivate. These soils often have high levels of salinity and sodicity in the subsoil. Solonetzic soils are found in the Brown, Dark Brown, Black and Gray soil zones and occupy 7% of the land in the agricultural area of the Prairies.

Imperfectly drained soils

Soil landscape components with restricted drainage limit cultivation and reduce fertility. These soils are found in all soil zones and occupy 10% of the land in the agricultural area of the Prairies.

Sandy soils

Soil landscape components that have rapidly to excessively drained soils, usually on fluvial or eolian parent material, have limited water-holding capacity. These soils have moderate to severe restrictions for cropping, particularly in the drier areas. Sandy soils occur on 5% of the land in the agricultural area of the Prairies.

Brown Chernozemic soils

Brown Chernozemic soils develop in the semi-arid mixed-grass prairie in the drier areas of the Prairies (Acton et al. 1998). For this study, only well-drained or moderately well-drained soil components that have slopes less than 10% are included in this group. These soils generally have a CLI rating of 3M or 4M. Brown Chernozemic soils occur on 8% of the land in the agricultural area of the Prairies. This soil landscape has been further divided according to parent material or slope within each Land Practices Group.

Dark Brown Chernozemic soils

Dark Brown Chernozemic soils are found in moister grassland areas than the Brown Chernozemic soils, and form a transition from the Brown to the Black soils. For this study, only well-drained or moderately well-drained soil components that have slopes less than 10% are included in this group. These soils generally have a CLI rating



Since 1971, the Prairie agricultural land base has remained constant at approximately 55 million hectares.

of 3M. Dark Brown Chernozemic soils are found on 10% of the land in the agricultural area of the Prairies. This soil landscape has been further divided according to parent material or slope within each Land Practices Group.

Black Chernozemic soils

Black Chernozemic soils develop in the fescue-dominated aspen parkland, where biomass production is greater than in the Brown and Dark Brown soil zones (Acton et al. 1998). For this study, only well-drained or moderately well-drained soil components that have slopes less than 10% are included in this group. These soils are the most productive arable land and occupy 16% of the land in the agricultural area of the Prairies.

This soil landscape has been further divided according to parent material or slope within each Land Practices Group.

Dark Gray Chernozemic or Luvisolic soils

Dark Gray Chernozemic and Dark Gray Luvisolic soils are transitional between the Black Chernozems developed under grassland and the Gray Luvisols developed under aspen forest. For this study, only well-drained or moderately well-drained soil components that have slopes less than 10% are included in this group. These soils generally have a CLI rating of 2H or 3H due to lower heat units. Dark Gray Chernozemic or Luvisolic soils occur on 5% of the land in the agricultural area of the Prairies. This soil landscape has

been further divided according to parent material or slope within each Land Practices Group.

Gray Luvisolic soils (well to moderately-well drained and less than 10% slopes)

Gray Luvisolic soils are developed under the aspen forest of the Boreal Plains. These soils do not have the organic matter-rich A horizon associated with the grassland soils. For this study, only well-drained or moderately well-drained soil components that have slopes less than 10% are included in this group. These soils generally have a CLI rating of 3H due to lower heat units. Gray Luvisolic soils occur on 10% of the land in the agricultural area of the Prairies. This soil landscape has been further divided according to parent material or slope within each Land Practices Group.

Regosolic soils (well to moderately-well drained and less than 10% slopes)

Regosolic soils constitute a small, but distinctive group of Prairie agricultural soils. Regosolic soils are weakly developed and do not meet the criteria for other soil groups (Canada Soil Survey Committee 1978). These areas include alluvial flood plains and rock outcrops, and vary considerably in agricultural capability. For this study, only well-drained or moderately well-drained soil components with slopes of less than 10% are included in this



Photo by Dave Reede

The Black Chernozems are among the most productive arable soils and occupy 23% of the land in the agricultural area of the Prairies.

group. Regosolic soils are found on only 1% of the land in the agricultural area of the Prairies.

ANALYSIS OF LAND PRACTICES GROUPS

The criteria for Land Practices Groups was developed through:

- a statistical analysis of the Census of Agriculture
- expert review
- defining the criteria.

The process resulted in 13 distinct Land Practices Groups of similar land use and farming practices.

In the first step of the process, eight variables from the 1996 Census of Agriculture were initially used to group the SLC polygons. These included chemical and fertilizer inputs per cultivated hectare and the area of pasture, number of beef cows, area of cereal crops, area of summerfallow, area of oilseeds, area of flax and area of pulses per farm. Data from 1,215 SLC polygons in Alberta, Saskatchewan and Manitoba were analyzed by both k-means clustering and hierarchical clustering. Each clustering technique produced 15 separate clusters that when cross-tabulated yielded 55 distinct groups of SLC polygons. These 55 groups were manually combined into 32 groups, based on visual inspection of the eight variables. To further group similar land uses, the data were expressed as very high, high, medium, low, or very low in

terms of percentage hay and pasture, cereals, summerfallow and broadleaf crops such as oilseeds, flax and pulses. Using this approach, the 32 groups were further reduced to 15 groups based on similar general patterns of land use. At that time, data became available for 30 polygons in the B.C. Peace River region and these polygons were added to the appropriate group.

The 15 preliminary groups were mapped on a Prairie-wide basis. For the purposes of the map, 1,666 polygons were used. Of those 1,245 were grouped by land practices, 137 polygons represented water bodies and 286 had no Census of Agriculture data. The *No Data* polygons either were non-agricultural polygons in the agricultural zone (such as the Pasquia Hills in northeast Saskatchewan), or contained data that had been suppressed by Statistics Canada due to the small number of producers (less than 15 farm headquarters) within the polygon.

PFRA soil conservationists from across the Prairies reviewed the preliminary maps and identified a number of cases where the analysis and mapping did not concur with their knowledge of farming in their districts. Five issues were identified:

- the groups needed better descriptions

- specific polygons appeared to be assigned to inappropriate groups based on the key land use attributes
- two groups (5 and 11) did not represent distinct farming types because they contained too much variability in key land use attributes
- areas with suppressed census data were not being considered in this analysis
- irrigated land was not considered separately.

Although the clustering technique provided a method of reducing the total variability of all of the variables within a group, it did not minimize the variability in key variables that defined the group. Therefore, the statistical analysis was used to provide conceptual models of Land Practices Groups that were used to create specific criteria through expert opinion. For instance there were groups representing areas of extensive pasture, high amounts of summerfallow or more diversified cropping. Using the conceptual models from the preliminary groups and selecting key or defining variables, the relationships between specific groups became more apparent. The final classification resulted in 13 Land Practices Groups (Groups 5 and 11 were deleted).

These are defined by a combination of the proportion of land in pasture, summerfallow, crop mix, farm size and level of crop inputs. The criteria used to differentiate Land Practices

Groups are depicted in Table 4.1. To aid in understanding the relationships between the Land Practices Groups, they were placed into 5 major groups.

After fitting the polygons into appropriate groups, there still remained a few polygons that did not fit the criteria exactly, or could be placed within more than one group. These

polygons were generally placed into the same Group as surrounding polygons with similar characteristics. The polygons from the original Group 5 and Group 11 were placed into other appropriate groups and these groups no longer appear.

Areas of *No Data* were considered as a single group for this study. Agricultural census data for these polygons are not available to put

them into Land Practices Groups. The *No Data* group represents 3.0% of agricultural land and 1.4% of farms.

Irrigation, the total value of assets and the value of crop machinery were also examined. These factors did not correlate well to farming practices. Small irrigation projects were generally scattered across the Prairies with several located close to

Table 4.1 Criteria for determining Land Practices Groups.

Variable	Criteria/Group			
Pasture	Dominantly Pasture Pasture >70%		Majority Pasture Pasture 40-70%	Majority Cultivated Pasture < 50%
Farm Size	Group 3 Large Farms (> 540 ha)	Group 6 Small to Large Farms (< 540 ha)		
Crop Inputs			Group 12 High Inputs (> \$64/ha)	Group 9 Low Inputs (< \$64/ha)
			Majority Cultivated with Flax (Flax > 2%)	
Summer-fallow	With Flax		Group 15 Medium Summerfallow (15-30%)	Group 14 Very Low Summerfallow (< 15%)
			Group 14 Medium Pasture (20-50%)	Group 7 Very Low Pasture (<20%)
			Majority Cultivated, high summerfallow (Summerfallow > 25%)	Majority Cultivated, low summerfallow (Summerfallow < 25%)
	With Pulses		Group 13 Pulses > 4%	Group 2 Pulses > 2.6%
	With Oilseeds		Group 4 Oilseeds > 8%	Group 13 Oilseeds > 24%
	Cereals		Group 1 (not Group 4 or 13)	Group 8 (not Group 2 or 13)

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

major rivers. The amount of irrigated land is included in group data summaries (Table 4.4).

Other factors in the Census were examined to determine whether there was a relationship between the SLCs and these farming practices. Intensive livestock operations such as hogs, feedlots and poultry do not appear to be associated with any particular landscape. The location of these types of operations may be more dependent on factors such as access to markets, investment capital, infrastructure, and perhaps historic government programming and promotion. The data on large operations is often suppressed by Statistics Canada to maintain the confidentiality of respondents.

OTHER LANDSCAPE CHARACTERISTICS

By establishing the spatial relationship between the soil landscape and land use practices, a better understanding of the state of soil resources can be inferred. Although a comprehensive analysis was not completed, an attempt was made to describe the Land Practices Groups in terms of soil erosion, soil salinity, soil quality, soil organic matter, water quality and biodiversity.

The descriptions of the Land Practices Groups were used together with erosion risk maps developed by application of the Universal Soil Loss Equation and the Wind Erosion Equation to estimate overall erosion risk on annual cropland. The ranking

of erosion risk is a comparison of Land Practices Groups and is not an estimate of actual erosion rates.

The soil salinity risk was evaluated by applying the salinity risk classes for the SLC polygons (Eilers et al. 1997) to the cultivated land in each Land Practices Group.

Soil organic matter and quality is enhanced by practices that minimize disturbance and maximize perennial land cover. Loss of soil organic matter is a more serious concern in cropland than in pasture. Perennial land cover was estimated by the percentage of cropland in alfalfa, hay and forage seed production. Level of disturbance is indicated by percentage of cropland that is summerfallowed and the percentage of cropland reported in conservation tillage. In addition, the percentage of farms with cropland reporting conservation tillage, and the percentage of farms reporting summerfallow that did not report tilled fallow were determined.

The vulnerability of surface water quality to agricultural activities within the *Majority Cultivated* Land Practices Group was evaluated using a methodology modified from Cross et al. (1995). Using this method, each SLC polygon was typed according to three classes of runoff and sediment delivery potential and



Photo by Dave Reede

Irrigation produces high yields and consistent quality of crops used to support a viable processing industry.

ranked according to agricultural intensity, including fertilizer and pesticide use and animal density, to determine vulnerability classes. The proportion of cultivated land in each surface water vulnerability class was calculated for the nine Majority Cultivated Land Practices Groups.

All landscapes, including agroecosystems, provide some habitat for wildlife and contribute to the ecological balance of biodiversity. However, across Canada's prairie agricultural landscapes, various human activities, including agriculture, have reduced the area and quality of natural landscapes for wildlife. Analysis of these landscapes shows that, in general, the highest quality wildlife habitat is in areas with native vegetation.

Neave et al. (1999), show that the amount of farmland in *Natural Land for Pasture* (native vegetation) and *All Other Land* (farmstead, woodlots and wetlands) categories supports the most wildlife habitat use units, and can be used as an indicator of wildlife habitat availability and biodiversity. In the Prairie Agricultural Landscape study, this indicator was extended to each of the 13 Land Practices Groups and expressed both as a percentage of farmland in each group and as a percentage of total land in native vegetation.

Land Practices Group Descriptions

In this section, all 13 Land Practices Groups are described in terms of location, soil landscapes, agricultural capability and land practices. Brief comments are made with respect to the state of the land resources in the areas of soil quality, soil organic matter, soil erosion, soil salinity, water quality, range management and wildlife habitat availability. The information is organized by Major Land Practices Groups and is summarized in several tables and charts.

The distribution of Land Practices Groups is depicted in Map 4.1. The Agricultural Census data is summarized by Land Practices Group for land area statistics (Table 4.2), forage and cattle production (Table 4.3), and annual cropping (Table 4.4). Land use by all Land Practices Groups is depicted in Figure 4.11, while the distribution of forage and grazing for Dominantly Pasture and Majority Pasture is shown in Figure 4.12, and annual crop mix is shown in Figure 4.13. For each group, there is a table with the distribution of soil landscapes (Tables 4.9 to 4.21). There are also tables that describe, for each Land Practices Group, the salinity risk (Table 4.5), soil conservation efforts (Table 4.6), risks to surface water quality (Table 4.7), and distribution of natural vegetation (Table 4.8).

MAJOR GROUP - DOMINANTLY PASTURE

Two Land Practices Groups, where more than 70% of total farm area was used for pasture and hay, were identified as *Dominantly Pasture*. The most significant variable to distinguish between the two groups was farm size. Farm size included both the pasture and cultivated land. On the Prairies, 25% of farms are larger than 539 hectares. A value of 540 hectares was used to distinguish between *Dominantly Pasture, very large farms* (Group 3), where the average farm size (total farm area divided by total number of farms) was greater than 540 hectares, and *Dominantly Pasture, small to large farms* (Group 6).

Dominantly Pasture, very large farms (Group 3)

Group 3 is found mainly in southeastern Alberta and southwestern Saskatchewan as well as parts of the Interlake area of Manitoba. The group comprises the most marginal of the Prairie landscapes for annual crop production (Table 4.9). The hummocky, knob and kettle and ridged moraines are too steep for successful cultivation and represent almost a third of the Group 3 area.

These areas occur in all soil zones, from the Brown Chernozems to the Gray Luvisols. A good example of this landscape is the area northwest

Table 4.2 Summary of farm land, farm numbers, farm size and crop inputs in Land Practices Groups.

Land Practices Group	SLC land Area ('000 ha)	SLC land Area (% of total)	Agricultural land (% of SLC)	Number of farms	Number of farms (% of total)	Total farm area ('000 ha)	Total farm area (% of total)	Farm size (ha)	Herbicide Fertilizer (\$/ha)
3	6 231	8.4	76.0	4 185	3.0	4 736	8.8	1 131	49
6	5 482	7.4	49.8	9 922	7.1	2 730	5.0	275	88
12	8 507	11.4	67.3	20 909	15.0	5 725	10.6	273	94
9	8 239	11.1	59.3	9 780	7.0	4 887	9.0	500	39
13	1 396	1.9	101.3	2 715	2.0	1 414	2.6	521	36
4	3 656	4.9	98.9	6 576	4.7	3 617	6.7	550	43
1	5 614	7.5	97.6	9 642	6.9	5 477	10.1	568	27
7	4 569	6.1	95.1	13 254	9.5	4 345	8.0	327	99
14	3 583	4.8	91.0	10 327	7.4	3 260	6.0	316	99
15	5 057	6.8	92.0	12 036	8.6	4 651	8.6	386	58
10	3 491	4.5	44.3	4 125	3.0	1 545	2.9	374	87
2	6 835	9.2	93.2	19 294	13.8	6 369	11.8	330	78
8	6 960	9.3	77.5	16 789	12.0	5 396	10.0	321	77
no data	4 915	6.6							
	74 536	100.0	72.7	139 554	100.0	54 154	100.0	389	68

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

Table 4.3 Summary of land use related to cattle production in Land Practices Groups.

Land Practices Group	Pasture and Hay (%) ¹	Farms with					Cattle (#/cattle farm)	Farms with	
		Unimproved pasture (%) ²	Improved pasture (%) ²	Forage seed (%) ²	Alfalfa (%) ²	Hay (%) ²		Cattle (%) ²	Beef cows (%) ²
3	81	81	47	1.7	44	21	262	75	70
6	78	78	45	0.7	40	36	132	72	64
12	56	56	46	2.6	48	26	154	66	58
9	57	57	44	1.6	40	25	138	66	61
13	19	19	30	0.6	19	10	93	39	36
4	20	55	30	0.5	21	11	115	46	42
1	21	52	28	0.3	18	9	109	41	38
7	13	13	24	4.1	31	10	75	33	28
14	30	30	34	2.1	47	18	99	57	50
15	21	21	31	0.7	30	14	96	46	42
10	28	28	35	13.0	34	23	98	38	34
2	25	51	33	2.4	30	17	105	46	41
8	30	30	36	2.4	35	18	125	53	47
Average	40	60	37	2.2	35	19	128	55	49

¹percent of farmland ²percent of farms

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

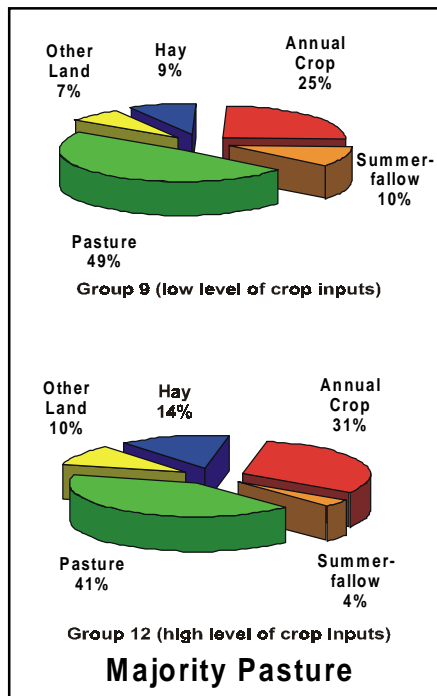
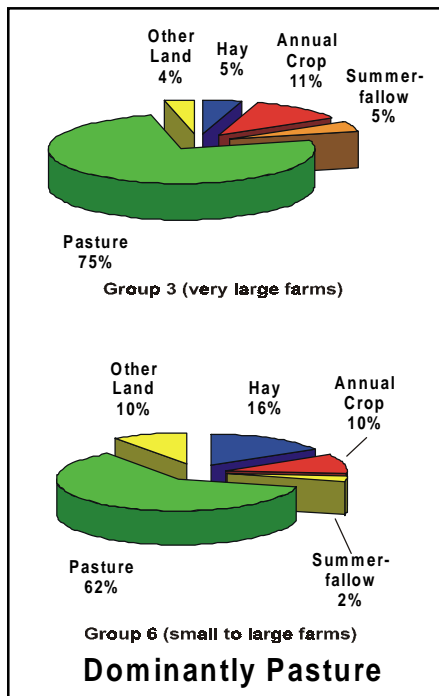
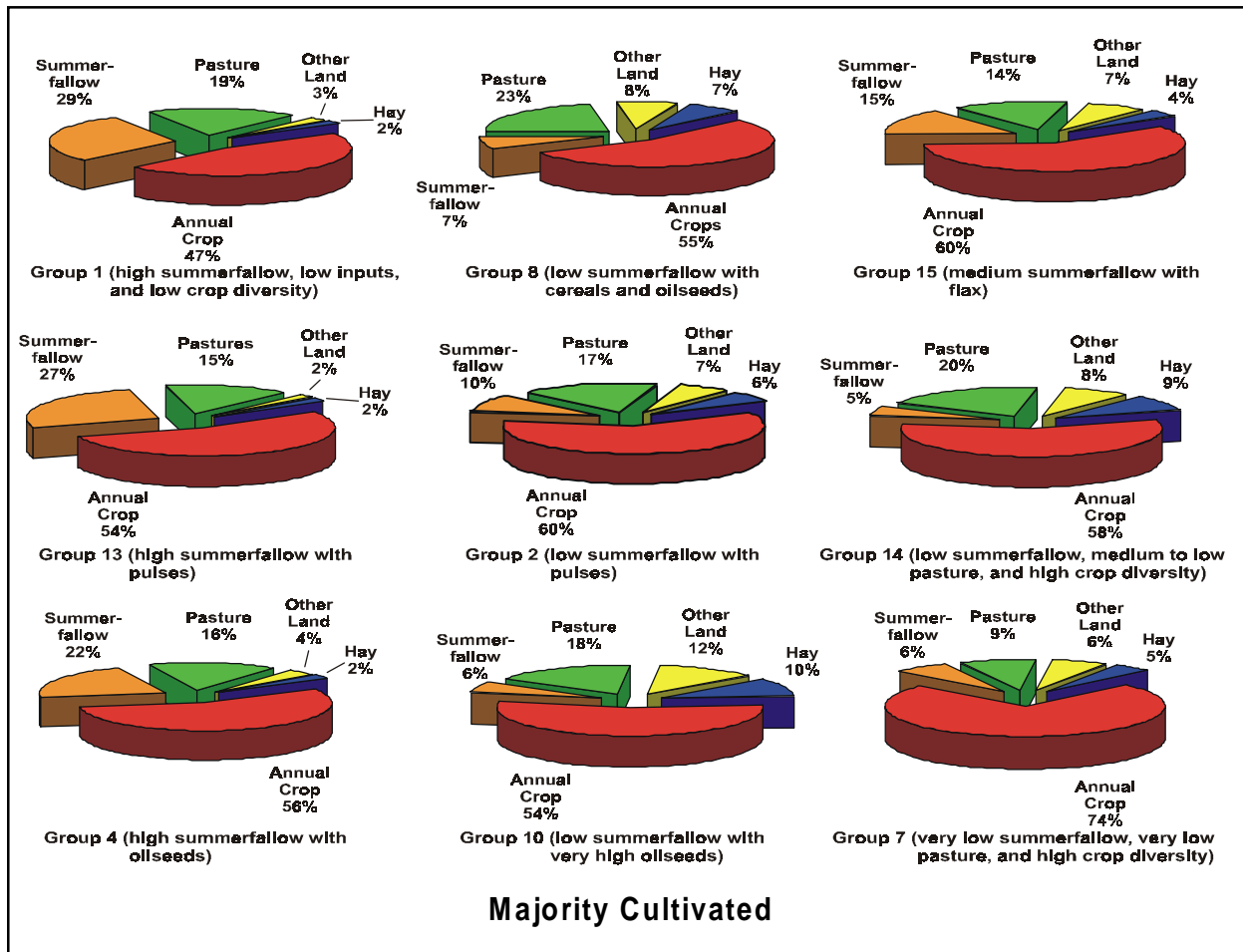


Figure 4.11 Proportion of total farmland in different land uses in each Land Practices Group.

Table 4.4 Summary of land use related to annual crop production in Land Practices Groups.

Land Practices Group	Cultivated land ('000 ha)	Cropland (%) ¹	Irrigation		Summerfallow		Cereals			Oilseeds		Flax		Pulses		
			Land (ha)	Farms (%) ²	Land (%) ³	Farms (%) ²	Land (%) ³	Wheat farms (%) ²	Barley farms (%) ²	Land (%) ³	Canola farms (%) ²	Land (%) ³	Farms (%) ²	Land (%) ³	Pea farms (%) ²	Lentil farms (%) ²
3	764	82	56 598	14.8	25	42	59	31	27	6	12	0.1	1.6	0.2	1.6	0.8
6	333	75	45 952	7.2	17	17	66	8	22	3	5	0.1	0.4	0.1	0.8	0.3
9	1 703	89	12 272	3.4	26	52	60	44	34	7	18	0.3	1.8	0.4	2.3	1.1
12	1 967	86	169 583	6.4	12	28	71	31	46	12	22	0.4	1.8	0.7	2.6	0.2
13	1 145	97	16 120	8.8	33	87	53	75	38	6	28	0.5	5.0	6.2	8.6	24.2
4	2 810	96	32 083	4.1	29	83	55	86	51	12	48	0.7	6.7	1.3	6.7	4.8
1	4 169	97	29 397	5.5	39	89	56	79	29	2	9	0.1	2.5	0.9	2.4	6.1
7	3 498	94	8 312	1.6	9	46	62	75	60	17	56	5.3	25.8	4.9	17.7	1.6
14	2 023	92	8 809	1.4	9	41	66	64	49	15	40	5.1	20.9	1.9	6.8	1.6
15	3 446	96	5 356	1.0	20	68	59	74	50	13	42	4.3	21.1	2.2	8.6	4.1
10	884	94	476	1.0	12	37	53	54	41	31	55	0.1	2.1	2.1	9.1	0.1
2	4 478	93	78 865	3.8	14	52	61	66	54	16	49	0.7	4.8	5.8	17.9	4.3
8	3 326	89	135 397	5.6	13	43	65	57	53	15	39	0.3	2.6	0.7	4.6	0.4
	30 545	90	599 227	5.1	19	50	62	54	43	11	30	1.1	5.7	1.8	6.3	2.7

¹percent of farms ²percent of farms with cultivated land ³percent of cultivated land

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

Table 4.5 Percent of total farm land in salinity risk classes by Land Practices Groups.

Land Practices Group	Salinity Risk					
	Nil (%)	Low (%)	Moderate (%)	Moderately High (%)	High (%)	Not Rated (%)
3	27	18	19	18	9	9
6	41	2	15	14	3	24
12	59	12	9	8	4	7
9	35	23	21	4	6	11
13	0	2	15	42	41	0
4	7	10	22	24	36	0
1	2	12	24	42	20	0
7	19	23	28	2	28	0
14	35	23	16	11	15	0
15	13	30	42	12	4	0
10	72	7	0	0	0	22
2	23	31	26	10	7	4
8	48	25	7	12	5	2
Average	29	19	20	15	12	5

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

Table 4.6 Permanent cover, summerfallow and conservation tillage practices in Land Practices Groups.

Land Practices Group	Land			Farms	
	Permanent cover (%) ¹	Summerfallow (%) ¹	Conservation tillage (%) ¹	Conservation tillage (%) ²	Conservation summerfallow (%) ³
3	29	29	33	26	30
6	62	18	21	11	28
12	32	11	33	20	40
9	27	29	30	26	37
13	3	33	40	35	39
4	4	28	44	45	42
1	4	39	33	36	36
7	6	8	38	32	46
14	14	9	38	29	41
15	7	20	45	40	43
10	21	11	34	25	49
2	9	14	46	31	50
8	12	12	40	30	50
Average	14	20	39	29	43

¹percent of cultivated land ²percent of farms with cultivated land ³farms not reporting tilled summerfallow as a percent of farms reporting summerfallow

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

Table 4.7 Percent of total cultivated land in surface water quality vulnerability classes in *Majority Cultivated Land Practices Groups*.

Land Practices Group	Risk to Surface Water Quality			
	Low Vulnerability (%)	Vulnerable (%)	High Vulnerability (%)	Very Highly Vulnerable (%)
13	86	10	5	0
4	60	23	13	5
1	77	15	7	0
7	69	19	10	1
14	72	2	16	9
15	83	16	0	0
10	80	6	12	1
2	56	19	23	2
8	44	26	19	11
Average	66	17	13	4

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

Table 4.8 Native vegetation in Land Practices Groups.

Land Practices Group	Native vegetation (%) ¹	Native vegetation (%) ²
3	71.3	20.7
6	58.7	9.8
12	39.8	14.0
9	46.6	14.0
13	14.5	1.3
4	16.4	3.6
1	18.1	6.1
7	12.8	3.4
14	23.5	4.7
15	17.9	5.1
10	23.8	2.3
2	18.5	7.3
8	23.3	7.7
	30.1	100.0

¹native pasture and other land as a percent of farm land

²native pasture and other land as a percent of column total

Note: colours in the table correspond to the Major Group colours in the legend in Map 4.1

of Loon Lake, Saskatchewan, along the Alberta border.

The large area of Solonetzic soils, particularly in southeastern Alberta and southwestern Saskatchewan, make up almost a fifth of the landscapes in Group 3. This landscape can be described as well-drained Brown Solonetzic soils developed on undulating to hummocky till plains, as well as knob and kettle moraines. Minor amounts of Brown Chernozemic and Gleysolic soils are associated with this landscape. The hard soil structure of these soils make them difficult to cultivate, particularly in the drier areas of the Prairies.

Imperfectly to poorly drained soils, ranging from saline flats to peat bogs, make up almost another fifth of this group. In most cases, these lands are not cultivated. The Great Sandhills in southwestern Saskatchewan are an example of very sandy, rapidly drained Regosols and Brown Chernozems on undulating to hummocky eolian or fluvial material. The sandy nature of the soils make them highly susceptible to wind erosion and active dunes may be present.

Less than a quarter of the land in Group 3 is moderately to well-drained Chernozemic or Luvisolic soil that could be considered arable. Almost all of the cultivated land in Group 3 is found on Brown or Gray soils that are associated with lands that are marginal for cultivation.

Three-quarters of the land in the SLC polygons that form Group 3 are used for agriculture,

primarily for cattle production. Cattle were reported on 75% of farms, with an average of 262 cattle per farm with cattle. More than 80% of the farmland is in pasture or hay, and a relatively high proportion grew alfalfa (44%) and tame hay (21%). Average farm size is almost three times the average for the Prairies.

Less than one-fifth of the land within this group is used for annual crop production. Annual cropping in Group 3 is characterized by low crop diversity. The area has a low percentage of land in oilseeds, pulses or flax and has a high amount of summerfallow. A summerfallow-cereal-cereal rotation is common on cultivated Group 3 soils. Oilseeds and other crops replace the first wheat crop in this rotation on about one-tenth of the land.

Overall wind erosion risk for annually cropped soils in

Group 3 is moderate, due in part to the large proportion of summerfallow. Sandy soils adjoining the Great Sand Hills are at extreme risk to wind erosion, while Solonetzic soils, which form a large portion of this group, are at low risk.

Overall water erosion risk is low due to the infrequent erosive storms and lower volumes of snowmelt in the Brown Soil Zone. Solonetzic soils on morainal topography will be at moderate risk to water erosion due to poor drainage.

The risk of tillage erosion is low. Considering the proportion of forage, overall risk of erosion in Group 3 drops to low.

Although Group 3 contains many areas of Solonetzic soils, the proportion of farmland in each salinity risk class is close to the Prairie average. Twenty-seven percent of the land faces a moderately high to high salinity risk.

Table 4.9 Landscapes of Group 3

Dominantly pasture, very large farms		
Landscape	Area (ha)	Percent of Group
Strongly sloping to hilly	1 939 660	31
Moderately to well-drained Chernozemic or Luvisolic soils	1 381 123	22
Solonetzic soils	1 169 828	19
Imperfectly to poorly drained or Organic soils	1 125 309	18
Sandy soils	614 881	10
Total	6 230 802	100

Table 4.10 Landscapes of Group 6

Dominantly pasture, small to large farms

Landscape	Area (ha)	Percent of Group
Strongly sloping to hilly	1 631 402	30
Well-drained Luvisolic or Chernozemic soils	1 600 141	29
Poorly drained or Organic soils	1 192 263	22
Imperfectly drained soils	824 703	15
Sandy soils	233 592	4
Total	5 482 103	100

The farmlands in Group 3 are dominated by permanent cover. The relatively small area of cropland in Group 3 has nearly one-third summerfallow, and conservation tillage has been adopted on less than one-third of the land. The cultivated portions of this group may be losing soil organic matter.

Group 3 is a very important area of natural biological diversity. Nearly three-quarters (71%) of farmland in Group 3 was in native vegetation in 1996, representing one-fifth of all the native vegetation in the agricultural lands of the Prairies.

Dominantly pasture, small to large farms (Group 6)

Group 6 landscapes are found along the foothills of Alberta and in the Interlake area of Manitoba. These areas are marginal for cultivation, mainly due to topography or drainage (Table 4.10). A third of the group is on hummocky, knob and kettle, rolling or dissected lands

that are too steep to cultivate. This limitation can be found in all soil zones, from the dry Browns to the moist Grays. Another area in this group includes imperfectly to poorly drained soils such as the highly calcareous soils of the northern Interlake in Manitoba.

Over one-fifth of the land in Group 6 is moderately to well-drained Gray Luvisolic soils that could be considered arable, while another 7% is Brown to Dark Gray soils that are associated with lands marginal for cultivation. Almost all of the cultivated land in Group 6 is found on these two soil landscapes.

Because Group 6 is found mostly along the fringes or limits of the agricultural area, less than half of the land in the SLC polygons that form this group is used for agricultural production, and is primarily devoted to cattle production. Cattle were reported on 72% of

farms, but the number of cattle per farm (132 cattle per farm with cattle) is significantly less than Group 3, and close to the Prairie average. The percentage of land in pasture and hay is similar to Group 3, but Group 6 has three times the proportion of land in hay as Group 3. Group 6 also has a higher proportion of farms with tame hay (36%) compared to Group 3.

As in Group 3, less than one-quarter of farmland is used for annual crop production. Annual cropping is primarily cereals with summerfallow. The main cereals are barley and oats, due to the limited growing season. Only 8% of Group 6 farms grew wheat. This group has a low percentage of land in oilseeds, pulses or flax. It has less summerfallow and higher input costs than Group 3. Approximately two-thirds of the annually cropped land is in a summerfallow-cereal-cereal rotation. The remainder is in a cereal-cereal-oilseed/pulse rotation.

Wind erosion risk on annual cropland in Group 6 is moderate to high in southwest Alberta due to the dry and windy climate and the high proportion of summerfallow. Wind erosion risk is low on the imperfectly drained soils of the Interlake and Westlake regions of Manitoba. Annually cropped sandy soils in Group 6 may be at high risk to wind erosion.

Tillage and water erosion risk are moderate due to the hummocky topography in much of the area. The overall erosion risk for this group is low because a high proportion of the land is in forage production.

The land in Group 6 is at low to negligible risk to salinity. Group 6 is in an area that receives relatively high rainfall and low evaporation, reducing the potential for salinization.

The farmland in Group 6 is dominated by permanent cover. The relatively small area of cropland in Group 6 has less than one-fifth summerfallow, but the adoption of conservation tillage has occurred on less than one-quarter of the land. The cultivated portions of this group may be losing soil organic matter, although the Gray Luvisolic soils have low organic matter levels initially. Group 6 is an important area of natural diversity. Nearly three-fifths (59%) of farmland is in native vegetation, representing one-tenth of the native vegetation in the agricultural lands of the Prairies.

MAJOR GROUP - MAJORITY PASTURE

Two Land Practices Groups, where between 50% and 70% of total farm area was used for pasture and hay, were identified as *Majority Pasture*. Several polygons, which did not fit the criteria for *Majority Cultivated* groups and had more than 40% pasture and hay, were added to *Majority Pasture* groups. The intensity of cropping on the cultivated land was the variable which distinguished the two groups. The intensity of cropping was measured by the dollar value of inputs per cultivated hectare. The median value for crop inputs on the Prairies is \$65/ha. A value of \$64/ha was used to distinguish between the *Majority Pasture, high level of crop inputs (Group 12)*, where the average inputs per cultivated hectare was greater than \$64/ha, and *Majority Pasture, low level of crop inputs (Group 9)*.

Majority pasture, high level of crop inputs (Group 12)

The landscapes of Group 12 represents a wide range of limitations to crop production, resulting in higher forage production than surrounding areas. Hilly landscapes are the dominant limitation for cultivation (Table 4.11). The large area of hummocky till near Stettler, Alberta is typical of this group. The edge of the foothills west of Calgary, and the Riding and Duck Mountains in Manitoba are also in this group. More than one-quarter of this group consists of imperfectly and poorly drained soils typical of

the Interlake area in Manitoba. Excessive moisture and lack of heat units make annual cropping difficult.

Parts of the Eastern Irrigation District and Bow River Irrigation Districts near Vauxhall, Alberta are also represented in this group. These are Solonchic and sandy areas that are managed as large grazing reserves, or have a high proportion of irrigated forage.

Over one-third of the land in Group 12 is moderately to well-drained Chernozemic or Luvisolic arable soils. These are mostly Black or Gray soils that are associated with marginal lands. Almost all of the cultivated land in Group 12 is found on these soils.

Two-thirds of the land in Group 12 is devoted to agriculture, including both cattle and annual crop production. More than half of the farmland is used for pasture and hay, while two-thirds of farms reported an average of 154 cattle. A relatively high proportion of farms grew alfalfa (48%) and tame hay (26%). Group 12 has 15% of all Prairie farms but only 10% of farmland, resulting in an average farm size (273 ha) that is less than three-quarters the average size for the Prairies. More than one-third (35%) of agricultural land in the group was used for annual crop production. Annual cropping is characterized by high cereals, low summerfallow and significant (12%) oilseeds. The area has a low percentage of land in

pulses or flax. About one-quarter of the farms with cropland reported summerfallow. More farms reported barley than wheat, and chemical and fertilizer costs on cultivated land were high at \$94/ha. Hay and alfalfa are often grown in rotation with cereals and oilseeds.

Wind erosion risk on annual cropland in Group 12 is moderate overall. The risk is less for more northerly polygons and for those in Manitoba due to low intensity winds and moist conditions. Sandy soils and annually cropped fields in the windy areas of Pincher Creek and the Blood First Nations land in Alberta are at high risk to wind erosion when exposed.

Overall, water erosion risk on annual cropland is low. The southern portion of the Foothills and north of the Swan Hills in Alberta have a high water erosion risk due to steeper slopes and the volume of snowmelt. Annual cropland



The extensive forage and rangeland areas across the Prairies reduce erosion and increase biological diversity.

adjoining the Duck and Riding Mountains in Manitoba is also at high risk to water erosion. Tillage erosion risk is moderate on cropland in hummocky till areas, but is offset to a degree by the predominance of cereals in the rotation. Overall erosion ratings for this group are low due to the high percentage of land in forage production.

The land in Group 12 is at low risk to salinity. Group 12 is in an area that receives higher rainfall and has lower evaporation, reducing the potential for salinization. Irrigated areas of Group 12 in Alberta have a significantly higher risk for salinity.

The farmland in Group 12 is dominated by permanent cover.

Table 4.11 Landscapes of Group 12

Majority pasture, high level of crop inputs		
Landscape	Area (ha)	Percent of Group
Strongly sloping to hilly	2 192 524	26
Well to moderately drained Dark Gray or Luvisolic soils	1 651 222	19
Well to moderately drained Brown, Dark Brown or Black soils	1 636 663	19
Imperfectly drained Black, Dark Gray or Luvisolic soils	1 365 620	16
Poorly drained or Organic soils	1 034 455	12
Sandy soils	626 633	7
Total	8 507 117	100

The cropland has about one-tenth summerfallow, but the adoption of conservation tillage has occurred on less than one-third of the land and farms. The cultivated portions of this group may not be losing soil organic matter.

Group 12 is an important area of natural diversity. Two-fifths of farmland is in native vegetation, representing almost one-sixth (14%) of the native vegetation in the agricultural lands of the Prairies.

Majority pasture, low level of crop inputs (Group 9)

The lands in Group 9 are found mainly in areas of steep topography, or in the Brown or Dark Brown soil zone, or along the margins of annually cropped land in Alberta and northwestern Saskatchewan. More than a quarter of this group consists of lands in knob and kettle moraines, typical of the Missouri Coteau (Table 4.12). These are generally too steep for

cultivation, but fields will be developed in gently sloping areas within these landscapes. Associated with these landscapes are imperfectly to poorly drained depressions.

Another landscape in Group 9 is the sandy soil of the Brown and Dark Brown soil zone. In these areas, fall rye is often grown and used for pasture or cut for feed. The sandy land near Mortlach, Saskatchewan is typical of this landscape. The area has well-drained to rapidly drained Regosolic soils with the associated Brown or Dark Brown Chernozems developed on undulating to hummocky fluvial and eolian material. Stabilized sand dunes are common.

A significant portion of Group 9 occurs on well to imperfectly drained soils along the margin of cultivation in the Peace River area, northeastern Alberta and northwestern Saskatchewan. These areas have short growing

seasons and limited heat units for a variety of crops. The area is suited to pasture, hay and feed grains.

Sixty percent of the land in Group 9 polygons is used for agriculture, including both cattle and annual crop production. Over half of the farmland is used for pasture and hay, while two-thirds of the farms reported an average of 138 cattle. A higher proportion of the pasture and hay was in native pasture compared to land in Group 12.

Over one-third (35%) of the agricultural land is used for annual crop production. Annual cropping in this group is characterized by high cereals, high summerfallow and significant (7%) oilseeds. The area has a low percentage of land in pulses or flax. Nearly half of the farms with cropland reported summerfallow. More farms reported wheat than barley. Chemical and fertilizer costs were low at \$39/ha. Hay and

Table 4.12 Landscapes of Group 9

Majority pasture, low level of crop inputs

Landscape	Area (ha)	Percent of Group
Strongly sloping to hilly	2 206 826	27
Well to imperfectly drained Dark Gray or Luvisolic soils	2 167 009	26
Poorly drained or Organic soils	1 356 864	16
Well-drained Brown or Dark Brown soils	1 149 317	14
Sandy soils	789 247	10
Solonetzic soils	570 177	7
Total	8 239 440	100

alfalfa were often grown in rotation with cereals and oilseeds.

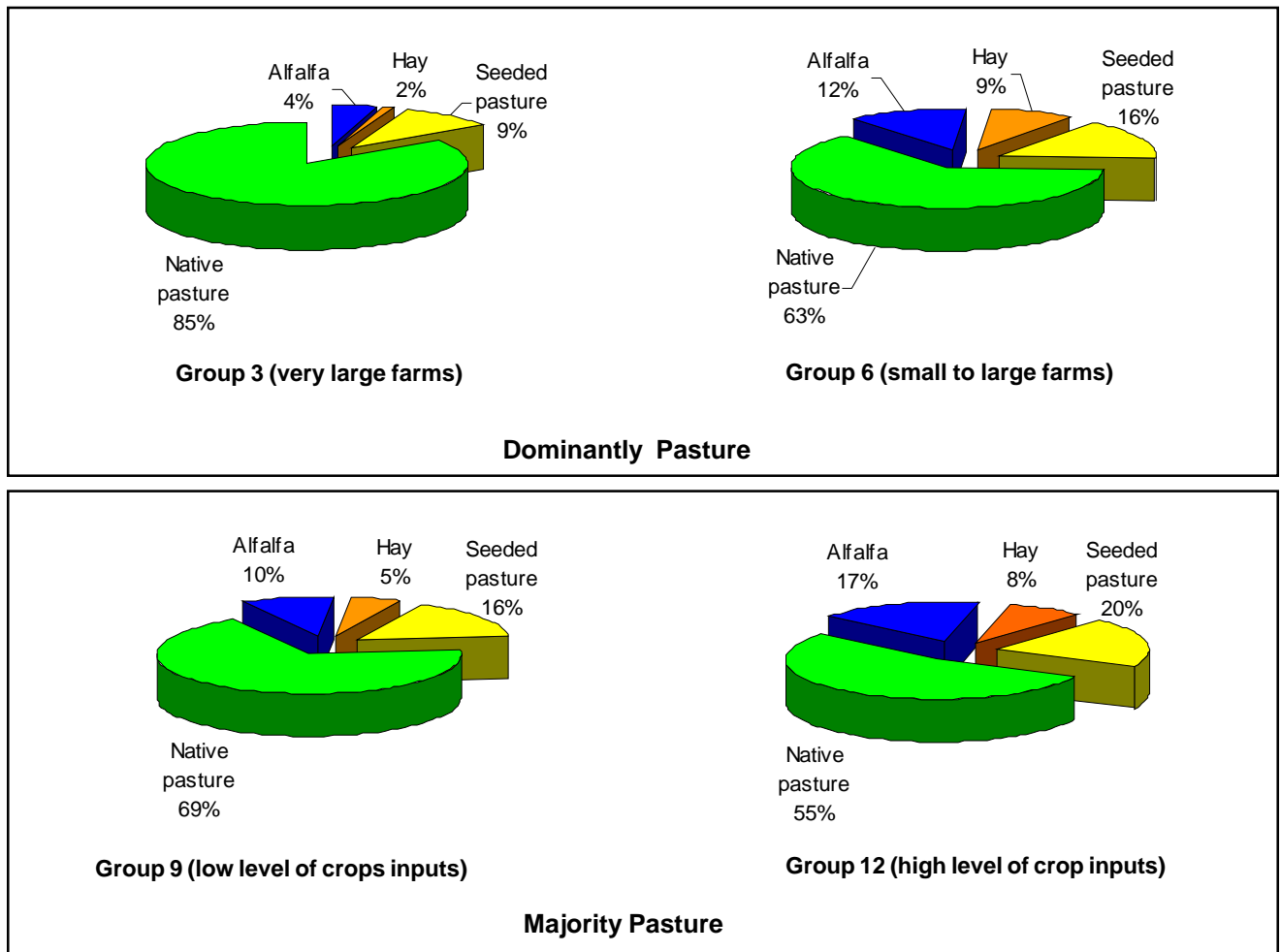
Cropland in Group 9 has a moderate wind erosion risk due to climatic factors and the large proportion of summerfallow. This is offset by the less erodible solonchic and till soils over much of the area. Sandy soils near Mortlach and Old Wives Lake in Saskatchewan are at high risk to wind erosion.

Water erosion risk on cropland is generally low. However, areas on the edge of the Missouri Coteau are especially prone to gully erosion.

Tillage erosion risk on annually cropped land is moderate due to the high proportion of summerfallow. Considering the proportion of forage, overall risk of erosion in Group 9 drops to low. Group 9 soils have a low to moderate risk to salinity.

The farmland in Group 9 is dominated by permanent cover. The cropland has about one-third summerfallow and the adoption of conservation tillage has occurred on less than one-third of the land. The cultivated portions of this group may be losing soil organic matter.

Group 9 is an important area of natural diversity. Nearly half (47%) of farmland is in native vegetation, representing nearly



Note: values are expressed as percent of hay and pasture land

Figure 4.12 Land used for pasture/forage production in Dominantly and Majority Pasture Land Practices Groups.

Table 4.13 Landscapes of Group 13

Majority cultivated, high summerfallow with pulses

Landscape	Area (ha)	Percent of Group
Well-drained Dark Brown soils (<4% slopes)	452 720	32
Well-drained Brown soils	431 979	31
Well-drained Dark Brown soils (5-9% slopes)	282 786	20
Brown or Dark Brown Solonetzic soils	126 574	9
Strongly sloping to hilly or poorly drained soils	101 901	7
Total	1 395 960	100

one-sixth (14%) of the native vegetation in the agricultural lands of the Prairies.

MAJOR GROUP - MAJORITY CULTIVATED, HIGH SUMMERFALLOW

Three Land Practices Groups were identified as *Majority Cultivated, high summerfallow* (Figure 4.13) where the summerfallow area exceeded 25% of the cultivated land. Crop diversity distinguishes the groups. The high summerfallow areas where pulses were a significant component of the cultivated land (pulses greater than 4%) were grouped as *Majority Cultivated, high summerfallow with pulses (Group 13)*. The polygons where crop diversity included canola and mustard (oilseed greater than 8%) with low levels of pulses, were called *Majority Cultivated, high summerfallow with oilseeds (Group 4)*.

The remainder of the *Majority Cultivated, high summerfallow* polygons had low pulses (less

than 4%), low oilseeds (less than 8%), and low level of crop inputs (less than \$45/ha). Of all polygons on the Prairies, 75% had crop inputs that were greater than \$40/ha, while 90% of Group 1 polygons had crop inputs of less than \$40/ha. This group was described as *Majority Cultivated, high summerfallow, low crop inputs, and low crop diversity (Group 1)*.

Majority cultivated, high summerfallow with pulses (Group 13)

Group 13 is almost exclusively in the Brown and Dark Brown soil zone and is concentrated between Rosetown and Saskatoon, Saskatchewan. These are some of the more productive of the Dark Brown soils and are generally well-drained on gently undulating lacustrine or morainal deposits (Table 4.13). One-third of this group includes the more productive Brown soils like those near Swift Current, Saskatchewan.

Some areas of steep topography and Solonetzic soils are associated with this group.

In Group 13, all of the land is used for agriculture, with almost all (81%) devoted to annual crop production. Annual cropping in this group is characterized by high summerfallow and significant pulses (6%) and oilseeds (6%). The area has a low percentage of land in flax. Nearly nine-tenths (87%) of the farms with cropland reported summerfallow, while more than one-quarter of farms reported canola (28%) and one-quarter had lentils (24%). Chemical and fertilizer costs were low at \$36/ha, but were a third higher than Group 1.

Group 13 had the highest percentage of pulses in rotation and is the major lentil growing group. Common rotations in this group include summerfallow-cereal-cereal and summerfallow-oilseed/pulse-cereal. This group

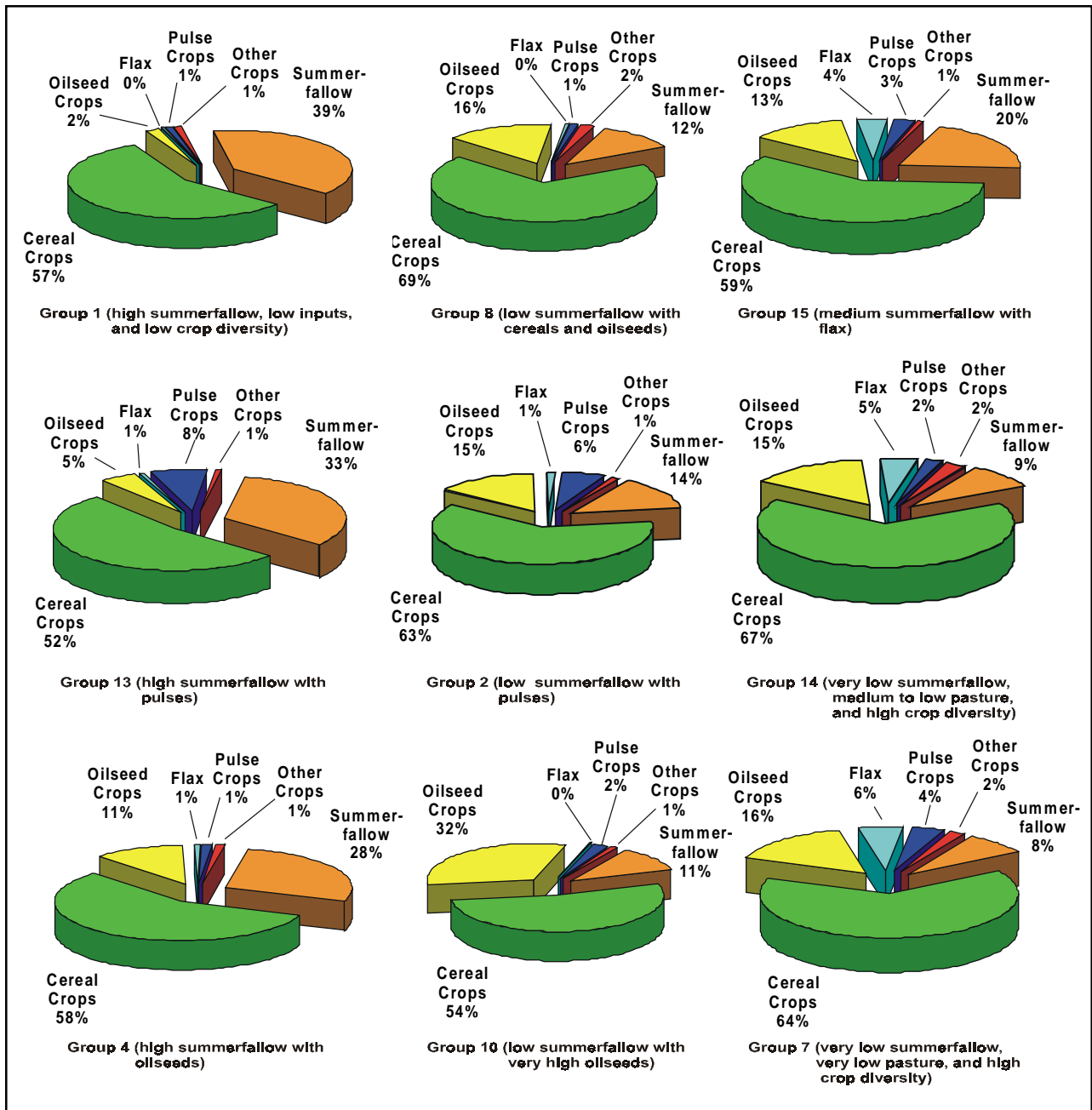


Figure 4.13 Proportions of cultivated (annual crops plus summerfallow) land in various crop in the Majority Cultivated Land Practices Groups.

had the most diversified cropping of the High Summerfallow groups.

Although only one-fifth of the agricultural land is used for hay and pasture, 39% of the farms reported cattle, resulting in a low average number of cattle per farm (93 cattle per farm with cattle). Just one-fifth (19%) of the farms reported unimproved pasture, and a relatively low proportion of farms grew alfalfa (19%) and tame hay (10%).

The proportion of oilseeds, pulses and summerfallow in the rotation combined with a relatively dry and windy climate result in a moderate wind erosion risk on annually cropped land in Group 13. Infrequent intensive rainfall and gentle slopes result in a low risk of water erosion. The risk of tillage erosion is also low.

Farmland in Group 13 is dominated by annual cropping. Permanent cover was reported

on only 3% of all cropland. Agricultural land in Group 13 has about one-third summerfallow and the adoption of conservation tillage has occurred on less than two-fifths of the land and farms. The cultivated portions of this group may be losing soil organic matter.

Almost all of Group 13 has a low vulnerability class for surface water quality, mainly due to the low level of crop inputs and low runoff potential.

Less than one-fifth (15%) of farmland in this group has native vegetation and contains only 1% of the native vegetation for the agricultural lands of the Prairies. The contribution of Group 13 to wildlife habitat and biodiversity is limited by the high levels of annual cropping.

Majority cultivated, high summerfallow with oilseeds (Group 4)

Group 4 is comprised almost exclusively of Dark Brown soils

in Alberta near Drumheller, Vulcan and Warner, and in Saskatchewan near Unity, Davidson and Estevan. These are mainly undulating morainal plains, or lake basins (Table 4.14). Associated with these soils are significant areas of Solonetzic soils. Minor areas of hilly or poorly drained landscapes are associated with the more productive lands of Group 4.

In this group, agricultural land is used mainly for annual crop production (78%). Annual cropping in this group is characterized by high summerfallow (29%) and high oilseeds (12%). The area has a low percentage of land in flax. Over four-fifths (83%) of farms with cropland reported summerfallow, while nearly half of farms reported canola (48%). Chemical and fertilizer costs were low at \$43/ha, but were significantly higher than Group 1 at \$27/ha.

Table 4.14 Landscapes of Group 4

Majority Cultivated, high summerfallow with oilseeds		
Landscape	Area (ha)	Percent of Group
Well-drained Dark Brown soils (5-9% slopes)	1 183 103	32
Well-drained Dark Brown soils (<4% slopes)	856 017	23
Brown or Dark Brown Solonetzic soils	680 478	19
Well-drained Brown soils	411 208	11
Strongly sloping to hilly	388 393	11
Poorly drained soils	136 729	4
Total	3 655 928	100

Table 4.15 Landscapes of Group 1

Majority cultivated, high summerfallow, low crop inputs, and low crop diversity

Landscape	Area (ha)	Percent of Group
Well-drained Brown soils	3 209 957	57
Strongly sloping to hilly	720 739	13
Brown or Dark Brown Solonetzic soils	703 477	13
Well-drained Dark Brown soils	656 976	12
Poorly drained or saline soils	323 277	6
Total	5 614 426	100

Like Group 10, most of the non-cereal annual crop was oilseed. However, fallow was an important part of the crop rotation on most farms. Typical rotations include summerfallow-cereal-cereal and summerfallow-oilseed-cereal-cereal. This area is a slightly moister and more diversified version of Group 1. Only one-fifth (20%) of the agricultural land was used for cattle (115 cattle per farm with cattle). Cattle were reported on nearly half (46%) of the farms, and just over half (55%) of the farms reported unimproved pasture. Fewer farms reported cattle than had pasture. A relatively low proportion of farms grew alfalfa (21%) and tame hay (11%).

Group 4 falls mainly in the Dark Brown Soil Zone. Winds and evapotranspiration are less extreme than in the Brown Soil Zone resulting in annual cropland having a low to moderate risk of wind erosion. One polygon west of Last Mountain Lake is at high risk due to the

interactions of hummocky topography with the wind.

Water erosion risk is low over most of the area due to infrequent rain storms and lower volumes of snowmelt. Solonetzic soils may occasionally be subject to gully erosion where water flow concentrates.

Tillage erosion risk is moderate on morainal soils due to the complexity of the surface topography.

Risk of salinity in Group 4 is higher than for the rest of the Prairies, but lower than the other high summerfallow areas (Groups 1 and 13). The more level landscapes of Group 4 present less potential for the salinization process. The vulnerability of surface water quality in Group 4 is similar to the vulnerability for all of the Prairies.

Farmland in Group 4 is dominated by annual cropping. Permanent cover was reported on only 4% of all cropland. The

cropland in Group 4 has more than one-quarter summerfallow, and the adoption of conservation tillage has occurred on nearly half of the land and farms. The cultivated portions of this group may not be losing soil organic matter.

One-sixth (16%) of farmland is in native vegetation, and it contains only 4% of the native vegetation for the agricultural lands of the Prairies. The contribution of Group 4 to wildlife habitat and biodiversity is limited by its high levels of annual cropping.

Majority cultivated, high summerfallow, low crop inputs and low crop diversity (Group 1)

The soil landscapes of Group 1 are similar to Group 4 and represent the drier areas of cultivation on the Prairies. These are mainly (80%) in the Brown soil zone and have traditionally been the wheat-fallow land of southern Saskatchewan and southeastern Alberta.

The soils are well-drained on gently sloping hummocky moraines, or a complex of level to gently undulating lacustrine and morainal deposits (Table 4.15). One-third of the land is more marginal for cultivation due to strongly sloping topography and Solonchic, poorly drained or saline soils.

In this group, agricultural land is used mainly for annual crop production (76%) which is characterized by high summerfallow (39%) and high cereals (56%). The area has a low percentage of land in oilseeds, pulses or flax. Nearly nine-tenths (89%) of farms with cropland reported summerfallow, while less than one-tenth of farms reported canola (9%), lentils (6%) or flax (3%). Chemical and fertilizer costs were low at \$27/ha.

Little crop diversification, from cereals to oilseeds and pulses, has occurred. Fallow is an important part of the crop rotation. This area is a blend of summerfallow-wheat and summerfallow-wheat-wheat rotations.

Only one-fifth (21%) of the agricultural land is used for cattle (109 cattle per farm with cattle), with cattle reported on two-fifths (41%) of the farms. Half (52%) of the farms reported unimproved pasture and fewer farms reported cattle than had pasture. A relatively low proportion of farms grew alfalfa (18%) and tame hay (9%).

Most annual cropland within Group 1 has a moderate to high risk of wind erosion due to the dry, windy climate and the high proportion of summerfallow.

The overall risk of water erosion is moderate to low due to loss of winter snowcover from Chinooks. However, steeply sloping polygons on the Missouri Coteau are at high risk to water erosion, particularly gully erosion due to snowmelt. There is a high to moderate risk of tillage erosion on hummocky cropland due to the extent of summerfallow.

Over 60% of farmland in Group 1 is at a moderately high to high risk for salinity. The relatively high salt content of the soil parent material and the high evaporation rate in the Brown soil zone contributes to this high level of risk.

Group 1 has a lower vulnerability for surface water quality than the rest of the Prairies due to the low runoff potential and low level of crop inputs.

Farmland in Group 1 is dominated by annual cropping. Permanent cover was reported on only 4% of all cropland. Group 1 has about two-fifths summerfallow and conservation tillage has been adopted on about one-third of the farmland. The cultivated portions of this group may be losing soil organic matter.

Less than one-fifth (18%) of farmland was in native vegetation, accounting for 6% of total native vegetation in the agricultural lands of the Prairies. The contribution of Group 1 to wildlife habitat and biodiversity is limited by its high levels of annual cropping, but is much greater than the other high summerfallow groups.

MAJOR GROUP - MAJORITY CULTIVATED, WITH FLAX

Three Majority Cultivated groups had a significant component of flax in the crop mix. The *Majority Cultivated, with flax* polygons with very low pasture and very low summerfallow generally had a wide range of crop diversity that included flax, pulses and oilseeds. Where these polygons had pasture and hay on less than 20% of total farm area, summerfallow less than 15% of cultivated land and flax greater than 2% of cultivated land, they were placed in *Majority cultivated, very low summerfallow, very low pasture and high crop diversity* (Group 7).

The *Majority Cultivated, with flax* polygons that had a similar cropping pattern to Group 7, but had higher pasture (pasture and hay 20-50%) were considered as *Majority cultivated, very low summerfallow, medium to low pasture, and high crop diversity* (Group 14).

A related group of polygons had higher summerfallow, but similar

pasture and flax as Group 14. Where the summerfallow exceeded 15% and flax was greater than 2%, the polygons were placed into *Majority Cultivated, medium summerfallow with flax* (Group 15).

Majority cultivated, very low summerfallow, very low pasture, and high crop diversity (Group 7)

Group 7 contains some of the most productive land on the Prairies, including the Red River Valley, Brandon area and parts of southwestern Manitoba and the Carrot River Valley of Saskatchewan. These lands are mainly well-drained, level lacustrine or till plains in the Black soil zone. Almost all of the land (87%) has less than 4% slopes, while less than 1% of the land is strongly sloping (greater than 10% slope) (Table 4.16). Poorly and imperfectly drained soils are typically associated with the level clays found in this group. The high productivity and uniformity of

the soil landscape results in a high degree of crop diversity.

In this group, agricultural land is used mainly for annual crop production (80%). Annual cropping in this group is characterized by low summerfallow (9%), high oilseeds (17%), and significant pulses (5%) and flax (5%). Nearly half (46%) of the farms with cropland reported summerfallow, while over half (56%) of farms reported canola. One-quarter (26%) of farms reported flax and one-fifth (18%) peas. Chemical and fertilizer costs were high at \$99/ha.

Group 7 has the lowest percentage of land in forages and the lowest number of cattle per farm on the Prairies. Crop production is the most intensified and diversified on the Prairies, with a mix of oilseeds, flax and pulses. No other group has a higher proportion of farms reporting canola, peas and flax. Other groups have a higher proportion of land seeded to one

of these crops (e.g. Group 10 - canola, Groups 2 and 13 - pulses), but none have high values in all three. Cereal crops make up two-thirds of the seeded area. The basic rotation is cereal-cereal-canola/flax/pulse. Occasionally, summerfallow is inserted into the rotation, usually before canola. This group has a high frequency of small areas of summerfallow.

Just one-eighth (13%) of agricultural land is used for cattle (75 cattle per farm with cattle), with cattle reported on one-third (33%) of farms. One-eighth (13%) of the farms reported unimproved pasture. An intermediate proportion of farms grew alfalfa (31%) and tame hay (10%).

Overall wind erosion risk on annual cropland within this group is low. Clay soils may occasionally be at high risk to wind erosion when crop cover is depleted by excessive tillage, drought or low residue-product-

Table 4.16 Landscapes of Group 7

Majority cultivated, very low summerfallow, very low pasture, and high crop diversity		
Landscape	Area (ha)	Percent of Group
Well-drained Black till soils	1 908 990	42
Well to imperfectly drained lacustrine Black soils (<4% slopes)	1 545 264	34
Poorly drained soils	669 555	15
Well to imperfectly drained lacustrine Dark Gray or Luvisolic soils	444 922	10
Total	4 568 731	100



Photo Courtesy of Hoppe Farms

Innovative and appropriate management practices allow producers to successfully diversify and intensify crop production.

ing crops. Soils on the till plain are quite resistant to both wind and water erosion except for areas of steeper slopes and where large contributing areas result in gully erosion. In southern Manitoba, annual cropland within this group is at moderate risk to water erosion due to the frequent occurrence of high-intensity rainfall. The overall risk of tillage erosion is low except on steeper slopes.

Although over half of the farmland in Group 7 is at low or moderate salinity risk, a significant portion is at high risk. These higher risk lands are located at the edge of the lacustrine basins that typically have a higher incidence of salinity.

Despite the high level of crop inputs, the vulnerability of surface water quality is on a par with the Prairie average. The lower runoff potential due to level land and low cattle numbers offset the higher crop inputs.

The farmland in Group 7 is dominated by annual cropping. Permanent cover was reported on only 6% of all cropland. Group 7 has less than one-tenth summerfallow and conservation tillage has been adopted on about two-fifths of the land. The cultivated portions of this group may be gaining soil organic matter.

Less than one-fifth (13%) of farmland in this group is in

native vegetation, and it contains 3% of the native vegetation in the agricultural lands of the Prairies. The contribution of Group 7 to wildlife habitat and biodiversity is very limited because of its high levels of annual cropping. Group 7 had the lowest percentage of farmland in native vegetation of all groups.

Majority cultivated, very low summerfallow, medium to low pasture, and high crop diversity (Group 14)

Group 14 is mainly found in Manitoba, surrounding the Group 7 lands. The soils are more variable and contain a greater proportion of marginal land (Table 4.17). Thirty percent of the land is sandy, poorly drained or strongly sloping, thus limiting cultivation and providing a higher proportion of grazing and forage land. The remainder of the lands in Groups 14 are generally highly productive Black lacustrine and till soils similar to those in Group 7.

In this group, agricultural land is used mainly for annual crop production (63%) which is characterized by low summerfallow (9%), high oilseeds (15%) and significant flax (5%). Two-fifths (41%) of farms with cropland reported summerfallow, another two-fifths (40%) reported canola. One-fifth (21%) of farms reported flax. Chemical

and fertilizer costs were high at \$99/ha.

Group 14 has nearly twice the proportion of farms reporting cattle and pasture than Group 7, and a very high proportion of farms had alfalfa and hay. Group 14 has slightly less diverse cropping than Group 7. A smaller proportion of farms grew canola, flax and peas, but continuous cropping is common. Rotations included cereal-cereal-canola/flax/pea, or cereal-cereal-cereal-canola/flax/pea. Occasionally, summerfallow is inserted into the rotation, usually before canola. This group has a high frequency of small areas of summerfallow.

Less than one-third (30%) of the agricultural land is used for cattle (99 cattle per farm with cattle), with cattle reported on over half (57%) of the farms. Nearly one-third (30%) of the

farms reported unimproved pasture, while a high proportion grew alfalfa (47%) and tame hay (18%).

Overall wind erosion risk in Group 14 is low because much of this area has lower wind-speeds than other parts of the Prairies. Water erosion and tillage erosion risk is also low over much of the area due to the subdued topography. Risk of water erosion is high in the Pelican Lake and Rock Lake areas due to the combination of steeply sloping morainal topography and higher rainfall intensities in this part of Manitoba.

The salinity risk for Group 14 is average, with less than a quarter of farmland rated moderately high to high risk. Although three-quarters of the cultivated land in Group 14 has low vulnerability for surface water quality, the areas of high and

very high vulnerability are greater than the Prairie average. The greater risk is due to high crop inputs and cattle on land that has a high runoff potential.

The farmland in Group 14 is dominated by annual cropping. Permanent cover was reported on only 14% of all cropland. The group has less than one-tenth summerfallow and adoption of conservation tillage has occurred on more than one-third of the land. The cultivated portions of this group may be gaining soil organic matter. Nearly one-quarter (24%) of farmland is in native vegetation, and it contains 5% of the native vegetation in the agricultural lands of the Prairies. The contribution of Group 14 to wildlife habitat and biodiversity is limited by its high levels of annual cropping. Groups 14, 10 and 8 have the highest levels of native vegetation in the low summerfallow groups.

Table 4.17 Landscapes of Group 14

Majority cultivated, very low summerfallow, medium to low pasture, and high crop diversity

Landscape	Area (ha)	Percent of Group
Imperfectly drained Black or Dark Gray soils (<4% slopes)	987 133	28
Well-drained Black soils (<4% slopes)	791 768	22
Well-drained Black soils (5-9% slopes)	425 513	12
Strongly sloping to hilly	423 822	12
Poorly drained soils	357 501	10
Well-drained Dark Gray or Luvisolic soils	318 332	9
Sandy soils	279 090	8
Total	3 583 158	100

Table 4.18 Landscapes of Group 15

Majority cultivated, medium summerfallow with flax		
Landscape	Area (ha)	Percent of Group
Well-drained Black till soils	1 898 903	38
Well-drained Dark Brown till soils	937 475	19
Well-drained lacustrine or fluvial soils	819 261	16
Poorly drained or Organic soils	612 522	12
Well-drained Dark Gray or Luvisolic till soils	455 535	9
Dark Brown Solonetzic soils	229 619	5
Strongly sloping to hilly	104 055	2
Total	5 057 370	100

Majority cultivated, medium summerfallow with flax (Group 15)

Group 15 is the Black till plain of east-central Saskatchewan. The Indian Head area is a good example of this group (Table 4.18). Two-thirds of the soils are fairly uniform well-drained Black Chernozems developed on an undulating till plain that extends into the Dark Brown and Dark Gray soil zones. Sandy soils of the associated fluvial or lacustrine materials will likely be the sites for cattle grazing in this landscape, as would be the minor amounts of poorly drained, Solonetzic or strongly sloping topography.

In this group, agricultural land is used mainly for annual crop production (75%). Annual cropping is characterized by medium summerfallow (20%) and high oilseeds (13%). The area has a significant percentage of land in flax (4%). Two-

thirds (68%) of the farms with cropland reported summerfallow, with nearly two-fifths (42%) reporting canola and one-fifth (21%) reporting flax. Chemical and fertilizer costs were slightly lower than average for the Prairies at \$58/ha.

Group 15 is very similar to Groups 7 and 14, but has more summerfallow and less crop diversification. Summerfallow levels were similar to that in more arid regions, with the practice utilized as a risk management and cost reduction practice on Group 15 soils. The cropping pattern on two-thirds of the farms appears to be one year summerfallow followed by two years of crop. The remainder of the farms are continuously cropped. Broadleaf crops account for approximately one-quarter of the seeded land.

Pasture and cattle amounts were between the values for

Groups 7 and 14. Only one-fifth (21%) of the agricultural land was used for cattle (96 cattle per farm with cattle), but cattle were reported on nearly half (46%) of farms. One-fifth (21%) of the farms reported unimproved pasture. A significant proportion of farms grew alfalfa (30%) and tame hay (14%).

The combination of less erodible till soils and a humid climate result in a low wind erosion risk on annual cropland in Group 15. Nevertheless, pockets of sandy soils such as those near Good Spirit Lake in east central Saskatchewan are prone to wind erosion.

Water erosion risk is generally low, rising to moderate in areas of steeper topography. Intensive tillage of some fields may lead to severe ephemeral gully erosion due to snowmelt. Tillage erosion is moderate due to the complexity of the morainal landscape.

Group 15 has a moderate to low risk of salinity. Although the group is dominated by a till landscape, the higher rainfall and lower evaporation reduces the potential for salinization.

Farmland in Group 15 is dominated by annual cropping. Permanent cover was reported on only 7% of all cropland. Group 15 reported one-fifth summerfallow, while the adoption of conservation tillage has occurred on more than two-fifths of the land. The cultivated portions of this group may not be losing soil organic matter.

Less than one-fifth (18%) of the farmland is in native vegetation, and it contains 5% of the native vegetation in the agricultural lands of the Prairies. The contribution of Group 15 to wildlife habitat and biodiversity is limited by its high levels of annual cropping.

MAJOR GROUP - MAJORITY CULTIVATED, LOW SUMMERFALLOW

The *Majority Cultivated, low summerfallow* polygons had summerfallow less than 25% and formed three groups, based on the crop mix. The first and most obvious was the significantly high oilseeds in the Peace River area. The amount of oilseeds in all of the polygons in *Majority cultivated, low summerfallow with very high oilseeds (Group 10)* is greater than 24%, and exceeds the one in four cropping year recommendations. Group 10 is also identified by a low component of flax (flax less than 2% of cultivated land).

The *Majority Cultivated, low summerfallow* polygons that have pulses but low flax formed another group. On the Prairies, 25% of the SLC polygons have more than 2.7% pulses in the rotation. Where the pulses exceeded 2.6% of the cultivated land, pulses exceeded flax and

summerfallow was less than 25%, the category was *Majority Cultivated, low summerfallow with pulses (Group 2)*.

The last group was the *Majority Cultivated, low summerfallow with cereals and oilseeds (Group 8)*. These polygons had summerfallow less than 25%, oilseeds less than 24%, pulses less than 2.6% and flax less than 2%.

Majority cultivated, low summerfallow with very high oilseeds (Group 10)

Group 10 is almost exclusively located in the Peace River district. Half of the area consists of level or nearly level lacustrine deposits on Dark Gray and Gray soils, while only 19% is found on more sloping land (Table 4.19). There is no strongly sloping land in this group. Also in this group are Black and Gray Solonetzic soils, which are likely cultivated and poorly drained, and Organic soils that are not likely used for agricultural production.

Table 4.19 Landscapes of Group 10

Majority cultivated, low summerfallow with very high oilseeds

Landscape	Area (ha)	Percent of Group
Well to imperfectly drained Luvisolic or Dark Gray soils (<4% slopes)	1 685 361	48
Poorly drained or Organic soils	780 415	22
Well to imperfectly drained Luvisolic or Dark Gray soils (5-9%	649 515	19
Black or Gray Solonetzic soils	375 796	11
Total	3 491 088	100

Diversification into oilseeds and pulses has become profitable in several areas across the Prairies, however, producers must be aware of the increased erosion risk that accompanies these low residue crops.



Overall, Group 10 has the lowest amount of land that is used for agriculture (44%). Some of the land is devoted to forestry, while a high percentage is in unsettled areas of bogs and bush. Cleared agricultural land in this group is used mainly for annual crop production (60%).

Annual cropping is characterized by low summerfallow (12%) and high oilseeds (32%). Nearly two-fifths (37%) of farms with cropland reported summerfallow. More than half (55%) of farms also reported canola, but less than one-tenth reported flax (2%) or peas (9%). Chemical and fertilizer costs were high at \$87/ha.

Group 10 soils have the lowest percentage of cereals and the highest percentage of oilseeds on the Prairies. Guidelines for rotation of canola for disease control include the recommendation that “canola should not be grown on the same land more than once every four years ...” (Saskatchewan Agriculture and Food 1999). Furthermore, “a three or four-year rotation is recommended to prevent or reduce the build-up of diseased crop residues” (Alberta Agriculture, Food and Rural Development 1999). The amount of land in oilseeds in 1996 (31%) exceeded the recommended rotation guidelines. This could

be a unique response to growing conditions or canola prices during the census year, but expert advice from the area suggests that large canola acreage is common. Summer-fallow was not a common practice in this group.

Less than three-tenths (28%) of the agricultural land is used for cattle (98 cattle per farm with cattle), and cattle were reported on less than two-fifths (38%) of farms. About one-quarter (28%) of farms reported unimproved pasture, and a high proportion grew alfalfa (34%) and tame hay (23%).

Overall wind erosion risk in Group 10 is low on annual cropland due to the lower windspeeds in the Peace River District. However, an area of sandy soils south of High Level is at moderate risk to wind erosion when inadequately protected by crop residue. Annual cropland in some areas of Group 10 is at high risk to tillage and gully erosion due to the long steep slopes and the high proportion of oilseeds grown on this land.

The farmland in Group 10 is dominated by annual cropping. Permanent cover was reported on 21% of all cropland. Approximately one-tenth of the group is summerfallowed, with conservation tillage adopted on about one-third of the land. The cultivated portions of this group may be gaining soil organic matter.

Nearly one-quarter (24%) of the farmland is in native vegetation, and it contains 2% of the native vegetation in the agricultural lands of the Prairies. The contribution of the agricultural portion of Group 10 to wildlife habitat and biodiversity is limited by its high levels of annual cropping. However, much of the non-agricultural portion of this group in native vegetation. Groups 14, 10 and 8 had the highest levels of native vegetation in the Low Summerfallow Groups.

Majority cultivated, low summerfallow with pulses (Group 2)

Group 2 is one of the largest groups and is found in the moister areas of the Prairies (Table 4.20). Although more than half of it is found in the Black soil zone, it extends from the Dark Brown to the Dark Gray soil zones, from southeastern Saskatchewan to the Peace River District. The majority of the group is located on the finer textured soils of mainly undulating landscapes. In contrast, marginal soils make up 20% of this group due to strongly sloping topography, sandy texture or poor drainage.

Agricultural land in this group is generally used for annual crop production (70%). Annual cropping is characterized by low summerfallow (14%), high oilseeds (16%) and significant pulses (6%). Half (52%) of farms with cropland reported

summerfallow, while half reported canola. Close to one-fifth (18%) of farms reported peas. Chemical and fertilizer costs were high at \$78/ha.

Group 2 reported highly diversified annual cropping. Oilseeds and pulses, and to a lesser extent than in Groups 7 and 14, flax, are significant components of the cropping system. Half of the farms reported summerfallow, but less than one-sixth of the land is fallowed. This suggests that half of the land is in a one-third fallow/two-thirds crop rotation, while the other half is continuous cropping with canola/pea/flax once in three or four years. The diversified rotations and higher moisture received in the area contribute to relatively high input costs for chemicals and fertilizers.

Half of the farms reported pasture and cattle, while one-third grow alfalfa. One-quarter

Table 4.20 Landscapes of Group 2

Majority cultivated, low summerfallow with pulses

Landscape	Area (ha)	Percent of Group
Well to moderately well drained Black soils (<4% slopes)	1 879 073	27
Well to imperfectly drained Dark Gray or Luvisolic soils	1 414 245	21
Well-drained Dark Brown soils	1 222 112	18
Sandy, Alluvial, poorly drained or Organic soils	888 700	13
Well-drained Black soils (5-9% slopes)	885 720	13
Strongly sloping to hilly	545 162	8
Total	6 835 012	100

(25%) of the agricultural land is used for cattle (105 cattle per farm with cattle), with cattle reported on nearly half (46%) of farms. Over one-half (51%) of farms reported unimproved pasture and a high proportion of farms grow alfalfa (30%) and tame hay (17%).

The high proportion of oilseeds and pulses which are characteristic to Group 2 increase overall wind and water erosion risk compared to cereals. Lower wind intensities than in the warmer and drier areas of the Prairies result in a moderate risk of wind erosion on morainal soils within the group. However, the Regina clays under heavy tillage regimes are exposed to freeze-thaw conditions resulting in them being highly erodible in the spring. Lacustrine soils adjacent to the South Saskatchewan River downstream of Lake Diefenbaker, and adjacent to the North Saskatchewan River in Saskatchewan are also quite susceptible to wind erosion.

Water erosion risk is low in Group 2 due to the gently sloping topography over much of the area, but may be greater in areas of hummocky topography. Snowmelt erosion may be a problem where water concentrates to form gullies. Tillage erosion risk is moderate to low due to the subdued topography over much of the area and also due to the low proportion of summerfallow.

The salinity risk in Group 2 is low to moderate. Although the soil parent material in this group may have higher salt content than some of the other low summerfallow groups, higher rainfall and a lower evapotranspiration rate reduces the salinization potential. A quarter of Group 2 cultivated land has a high vulnerability for surface water quality. This is the result of higher than average crop inputs and the higher runoff potential of the landscape.

Farmland in Group 2 is dominated by annual cropping. Permanent cover was reported on only 9% of all cropland. Cropland has less than one-fifth summerfallow and conservation tillage has been adopted on more than two-fifths of the land and one-third of the farms. The cultivated portions of this group may not be losing soil organic matter.

Nearly one-fifth (18%) of farmland is in native vegetation, representing 7% of the native vegetation in the agricultural lands of the Prairies. The contribution of Group 2 to wildlife habitat and biodiversity is limited by its high levels of annual cropping.

Majority cultivated, low summerfallow with cereals and oilseeds (Group 8)

Group 8 soils are dominantly in

the Black soil zone and represent the typical Prairie farmland found near Red Deer and Lloydminster, Alberta and similar areas in Saskatchewan (Table 4.21). The presence in this group of Black Solonchic soils near Vegreville may explain the higher proportion of forage compared to Group 2, which has somewhat similar soils. The soils of this group extend into the Dark Brown and Dark Gray soil zones. Strongly sloping topography or poor drainage result in 20% of this group's soils being rated as marginal.

In Group 8, agricultural land is mainly devoted to annual crop production (62%) which is characterized by low summerfallow (13%) and high oilseeds (15%). Two-fifths (43%) of farms with cropland report summerfallow. Another two-fifths (39%) of the farms reported canola, while less than one-tenth reported peas (5%) or flax (3%). Chemical and fertilizer costs were high at \$77/ha.

Annual cropping in Group 8 is primarily cereals and oilseeds. As in Group 10, very little diversification into flax and pulses has occurred.

This group had the highest cattle numbers per farm of all the *Majority Cultivated* Groups, suggesting that diversification to livestock has been more

Table 4.21 Landscapes of Group 8

Majority cultivated, low summerfallow with cereals and oilseeds

Landscape	Area (ha)	Percent of Group
Well to imperfectly drained Dark Gray or Luvisolic soils	1 819 068	26
Well to imperfectly drained Black soils (<4% slopes)	1 440 192	21
Well-drained Black soils (5-9% slopes)	1 230 870	18
Well-drained Dark Brown soils	943 709	14
Poorly drained or Organic soils	865 067	12
Strongly sloping to hilly	661 569	10
Total	6 960 475	100

common than diversification of cropping. Over one-quarter (30%) of the agricultural land is used for cattle (125 cattle per farm with cattle), and cattle were reported on more than half (53%) of farms. Unimproved pasture was reported on over one-quarter (30%) of farms, and a high proportion grew alfalfa (35%) and tame hay (18%).

Wind erosion risk of annually cropped land in Group 8 is low due to the loam and clay loam textures of the soils, the low amount of summerfallow in the rotation, and the combined action of low windspeeds and smaller moisture deficits characteristic of this group. Overall water erosion risk is also low, but moderate sheet, rill and gully erosion may occur in areas with hummocky topography such as east of Viking, Alberta. Tillage erosion risk is moderate

in areas of hummocky topography.

Group 8 has a low risk of salinity, although some areas such as the Solonetzic soils near Vegreville have a moderately high risk. Group 8 has a significantly higher proportion of land rated as vulnerable, high and very high vulnerability for surface water quality relative to the rest of the Prairies. Higher than average crop inputs, large cattle numbers and the strong potential for runoff all contribute to the higher vulnerability. The area has more rainfall and generally has better natural drainage than other landscapes.

The farmland in Group 8 is dominated by annual cropping. Permanent cover was reported on 12% of all cropland. Group 8 has slightly over one-tenth summerfallow and the adoption

of conservation tillage has occurred on about two-fifths of the land, and one-third of the farms. The cultivated portions of this group may be gaining soil organic matter.

Nearly one-fifth (18%) of the group's farmland is in native vegetation, comprising 8% of the native vegetation in the agricultural lands of the Prairies. The contribution of Group 8 to wildlife habitat and biodiversity is limited by its high levels of annual cropping.

Groups 14, 10 and 8 had the highest levels of native vegetation in the low summerfallow groups. Together, Groups 2 and 8 represent as much of the land in native vegetation as either Group 9 or 12, the two *Majority Pasture* Groups.

Relationships between Land Practices Groups

As anticipated, the Land Practices Groups indicate the adaptation of western Canadian agricultural producers to land capability. In general, the major areas of pasture land are found on the lands marginal for cultivation, summerfallow is concentrated in drier areas and there is more diversity of crops on the more productive land. Although this makes sense intuitively, this exercise has provided a spatial or visual representation of these relationships.

In addition to adapting to the landscape, producers have adjusted to marketing, transportation and policy conditions that exist in each province. The very high oilseed group (Group 10) for instance, has appeared to take advantage of high commodity

prices and lower shipping costs to the West Coast by seeding almost a third of the land to canola and other oilseeds.

Producers in western Alberta have used the cattle industry to process and market their grain production. Manitoba producers grow a wide variety of crops including flax and pulses, as well as oilseeds and grains. Some areas of Saskatchewan have retained higher levels of summerfallow than areas of comparable soils in Alberta and Manitoba. This response to the landscape may be due to an adherence to traditional farming methods.

In the drier areas, oilseeds have made significant gains in the Dark Brown soils, while in certain areas, pulses, and in particular lentils, have significantly increased. Lentils, that grow well in dry conditions, provide an opportunity for

diversification and higher valued cropping in the Dark Brown and Brown soil zones. Common opinion is that the oilseeds and pulses will continue to increase, reducing both

the acreage of wheat and summerfallow in southern Saskatchewan. The low input, high summerfallow area (Group 1) will be smaller.

Most of the high pasture areas will likely see little change. Group 3 (very large farms) is dominantly native grasses, while the cropping pattern on cultivated land is similar to Group 1 (low input, high summerfallow). The land is for the most part only suited to perennial forage production and there will be resistance from environmental concerns to extensive breaking and re-seeding. Increased productivity can only be achieved through management of the native grasses to improve range condition. On the other hand, the other dominantly pasture group (Group 6) could see significant increases in forage productivity through more intensive management of tame pasture and hay.

The identification of Land Practices Groups provides a basis to predict changes in cropping, grazing and hay production across the Prairies. Each of the groups will behave differently to changing pressures due to commodity prices, market opportunities, transportation changes, technological advances, government policy and environmental concerns. The Land Practices Groups can then be used to identify where changing agricultural practices may present conditions that threaten the agricultural land resource. ■



Demands for pasture, forage and feed grains to support cattle herds will compete for land currently used to grow export crops.