Rosebud River, Serviceberry Creek and Crowfoot Creek (RSC) Watershed Land System – Census of Agriculture Database Project Report

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Executive Summary

The Rosebud River, Serviceberry Creek and Crowfoot Creek (RSC) watershed area in Alberta is significant from both agricultural and waterfowl habitat perspectives. Information that supports understanding the nature of agricultural production and possible water quality relationships is required at the local level. The integrated land resource and production databases developed from this project can provide a current reference of agricultural and soil resource data for use at the local level.

The objectives of this project are:

1. Provide 1991 and 1996 Census of Agriculture data referenced to land systems for the RSC watershed area.
2. Determine if a land use/ water quality relationship may be inferred from the Census data.
3. Apply the information at the local level to support local planning.

Land systems are biophysical units that describe the land resources at the regional or municipal level. The land systems of the RSC watershed are taken from AGRASID. Census data from 1991 and 1996 were obtained and used for this project. The Census data were linked to the land system polygons and reprocessed to produce a land system – Census of Agriculture database for each Census year (1991 and 1996).

From the databases, agricultural profiles were created using six themes: land use, land management, livestock, conservation practices, tillage practices to prepare land for seeding and weed control on summerfallow. These agricultural profile tables outline the 1991 Census data, the 1996 Census data and the change between the two Censuses. Another table of selected variables from some of the 1996 Census profiles looks at some of the more significant variables when making inferences to water quality and presents them together for comparison by land system.

From the change in the data between Census years, overall trends in the watershed are identified. Linkages or inferences are also identified that can be made between the land use – Census of Agriculture databases, and the potential risk factors to water quality in the entire watershed and in individual land systems. The risk factors can be considered as practices that improve or degrade water quality in relation to the land use.

Recommendations from this project include:

- The land system – Census of Agriculture databases are a useful tool to tie land use and land management to water quality within the RSC watershed. Additional land use data and water quality data, however, are required to further understand the association between the two.

Additional data may come from detailed surveys, on-farm visits or from Census data of the non-agricultural area of the watershed (non-farming population of the watershed).

- In order to apply the information at the local level, a project that would link the land system – Census of Agriculture databases with local water quality information should be undertaken. The local data could be useful to validate the effectiveness of the land system – Census of Agriculture databases for describing the nature of agriculture and management practices that may affect the environment. Presenting this information could be a useful tool for raising awareness and providing education to create the motivation needed for practice change at the local level. A Terms of Reference for a water quality mapping project is currently being prepared which will outline a future project of this type to provide the tools for the education and awareness of the linkages.
- Subsequent to the water quality-mapping project mentioned above, a community-based watershed planning initiative is recommended. Once awareness is raised concerning water quality issues, information regarding appropriate land use practices within the watershed can be addressed. As well, the Alberta Water Quality Index for Agriculture (Small Streams) could be calculated for the watersheds to assist with community-based planning.
- From the data presented, questions are raised concerning how to determine the basis for the trends and changes. With a thorough analysis of the data and local input, it would be possible to answer some of these questions. By posing these questions locally, the local knowledge and experience would assist in explaining the data and understanding the trends, thereby making the data even more useful.
- Work on risk factors that improve or degrade water quality in relation to land use, should continue as a vehicle to communicate the land management practices that benefit water quality and agricultural production, and in turn the agricultural community.

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1.0 Introduction

The Rosebud River, Serviceberry Creek and Crowfoot Creek (RSC) watershed area in Alberta is significant from both agricultural and waterfowl habitat perspectives. Information that supports understanding the nature of agricultural production and possible water quality relationships is required at the local level. Integrated land resource information has been useful for program planning and policy development (MCPPP 1993), as well as for feasibility analysis by the agri-business sector. The integrated land resource and production databases developed from this project can provide a current reference of agricultural and soil resource data for use at the local level. The relationships developed or inferred will assist in targeting specific actions to address resource management and environmental issues.

1.1 Objective

The objectives of this project are:

1. Provide 1991 and 1996 Census of Agriculture data referenced to land systems for the RSC watershed area.
2. Determine if a land use/ water quality relationship may be inferred from the Census data.
3. Apply the information at the local level to support local planning.

1.2 Land Systems

Land systems are biophysical units with similar climate, soils and landscape characteristics (Brierley et al. 1992). Land systems describe the land resources at the regional or municipal level and are represented at a scale of 1:250,000. At this scale, land systems can be a useful base for regional resource planning and management.

The land systems used in this project are from version 1.0 of the Agricultural Regions of Alberta Soil Inventory Database (AGRASID). AGRASID is an update and compilation of soil survey reports on CD-ROM for the White Area of Alberta (CAESA – Soil Inventory Project Working Group 1998). The database includes land systems, which are a generalized form of 1:100,000 scale soil landscape polygons. In AGRASID the soil landscape polygons are identified to the National Ecological Framework – Ecoregions and Ecodistricts (ESWG 1995). With the soil landscape polygons and land systems fitting into an ecological hierarchy, it allows for aggregation and scaling up of soil and landscape attributes and interpretations.

1.3 Census of Agriculture

The Census of Agriculture is a detailed source of farm-level production data that is conducted every five years. A variety of information about land use, land management, production and economics is collected from this required survey. Statistics Canada collects the information on a farm headquarters basis; however, research (Hiley et al. 1994) has led to reprocessing the data set by other geographical areas or boundaries for area-specific analysis of the data. This makes the Census of Agriculture data a useful source of information since it can be applied to the specific watershed of this project and repeated for more than one dataset, allowing for comparison.

Census data from 1991 and 1996 were obtained and used for this project.

2.0 Method

The study area is located in south-central Alberta (Figure 1). While the initial focus was on the area covered by the RSC watershed, the land systems whose boundaries go beyond the RSC watershed were included in their entirety, making the land system boundaries the extent of the study area. The total RSC watershed area is 122,807 acres, while the total land system area is 265,764 acres.

While the study area has three individual watersheds (Rosebud River, Serviceberry Creek and Crowfoot Creek), a fourth area at the confluence of the Rosebud River and Serviceberry Creek, which flows into the Red Deer River, is another important area that should be looked at. Since this fourth area (named Rosebud River - Severn) cannot be called a watershed on its own, the four areas are referred to as **modified water management units**. Figure 2 depicts the relief of the study area overlaid by the boundaries of the four modified water management units and the 27 land systems.

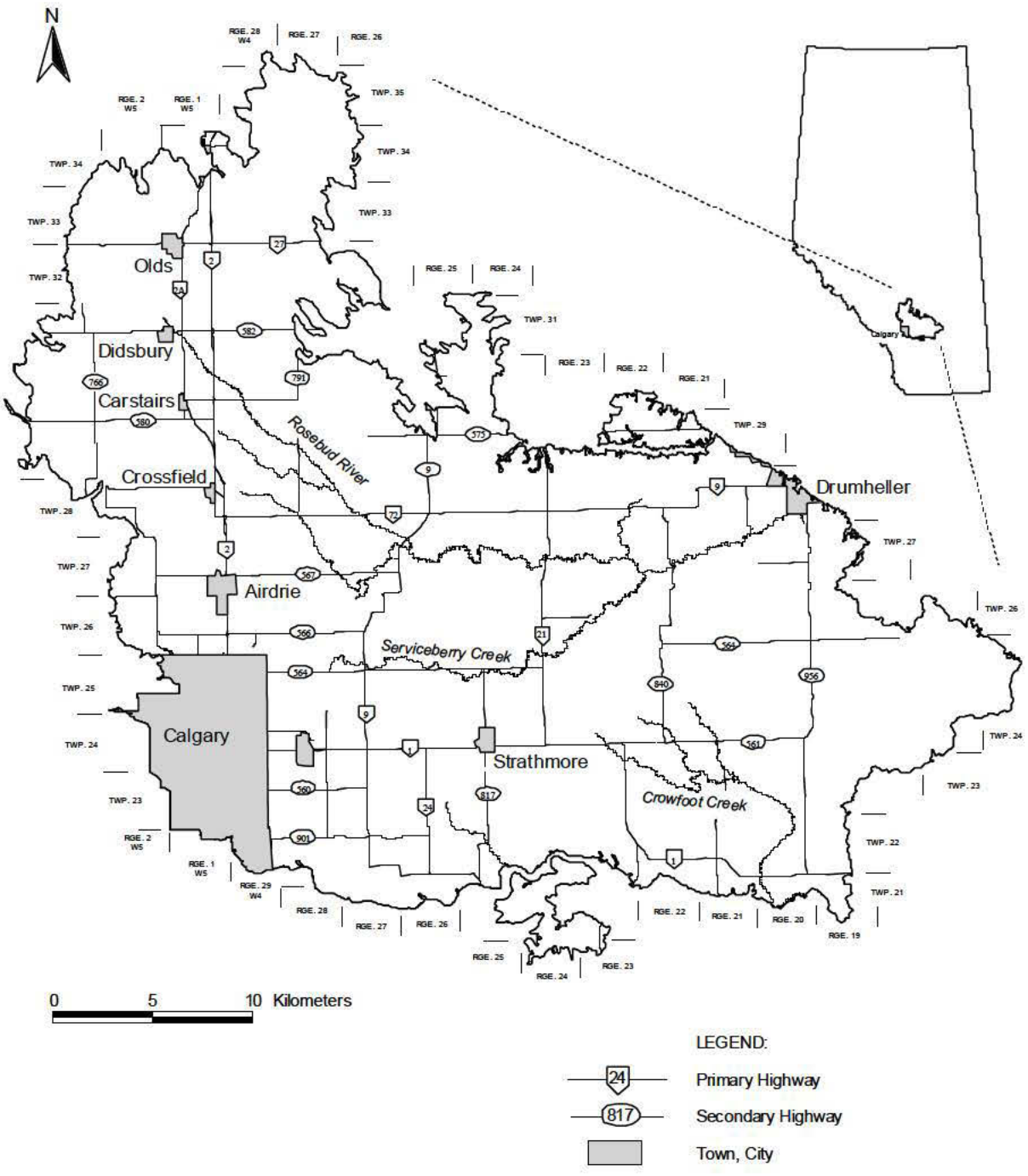
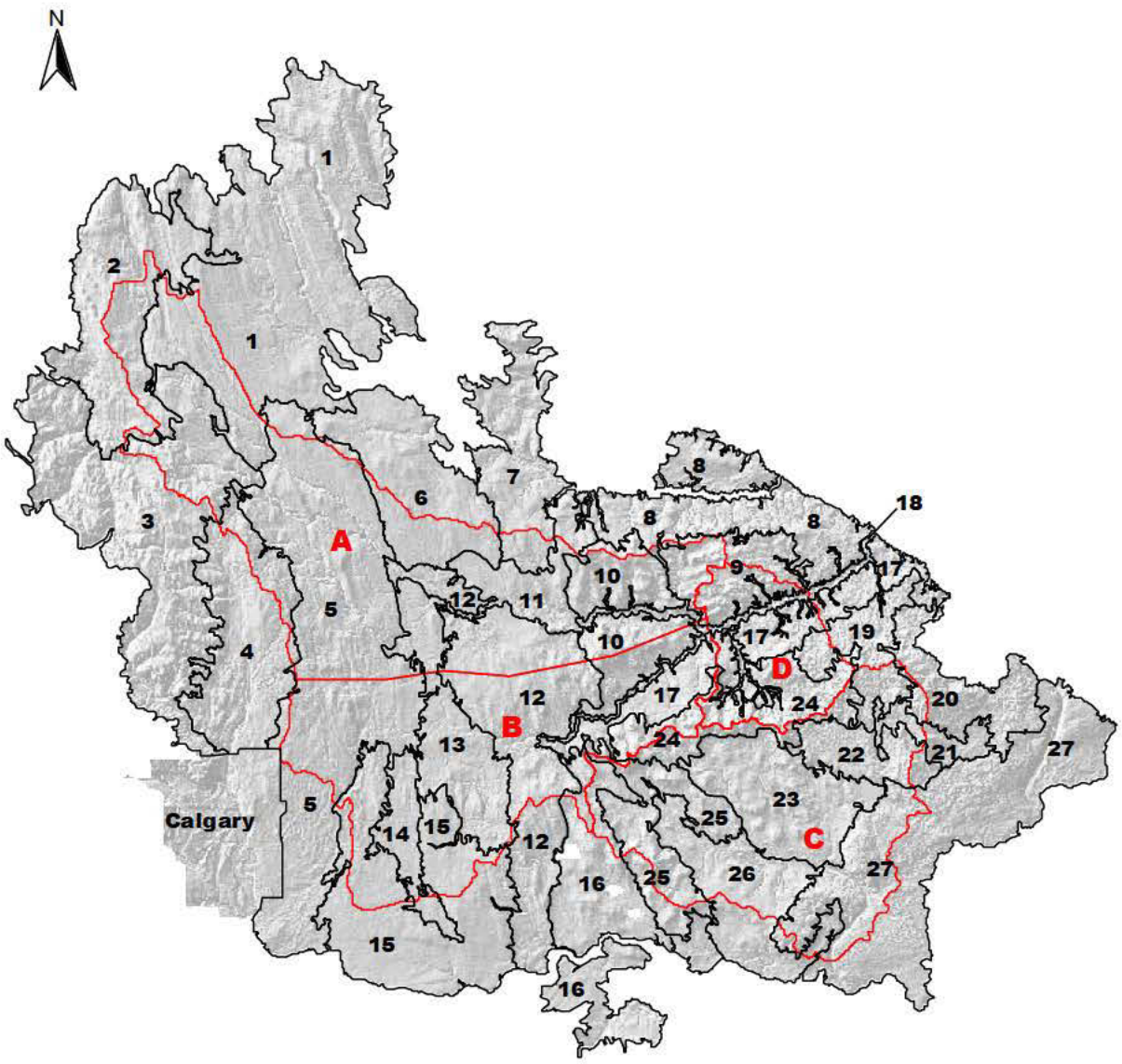


Figure 1. Location within Alberta and geographic features of the study area.



MODIFIED WATER MANAGEMENT UNITS:

- A - Rosebud River
- B - Serviceberry Creek
- C - Crowfoot Creek
- D - Rosebud River - Severn

LAND SYSTEMS:

1. Olds	10. Stahlville	19. Dalum
2. Trail Creek	11. Beiseker East	20. Indian Springs
3. Raven Creek	12. Strathmore	21. Duck Lake
4. Balzac	13. Irricana	22. Deadhorse
5. Kathryn	14. Weed Lake	23. Parflesh
6. Stirlingville	15. Dalemead	24. Tudor East
7. Grainger	16. Strangmuir	25. Hammer Hill
8. Pope Lease	17. Wayne South	26. Ouletteville
9. Beynon North	18. Rosebud River	27. Trefoil

Figure 2. Relief map of the study area with land systems and watersheds.

Tables 1 and 2 outline the areas covered by the land systems and the modified water management units, respectively.

Table 1. Land System Areas

Land system	Area (acres)	Land system	Area (acres)
Rosebud River Valley	2,829	Tudor East Upland	6,652
Strangmuir Plain	11,029	Balzac Plain	10,139
Trefoil Plain	19,208	Dalemead Plain	14,956
Parflesh Plain	7,879	Weed Lake Lowland	2,871
Hammer Hill Plain	6,164	Kathryn Plain	26,343
Ouletteville Plain	7,557	Irricana Plain	7,193
Pope Lease Plain	9,598	Strathmore Plain	15,241
Wayne South Plain	7,619	Beiseker East Plain	4,218
Beynon North Plain	4,929	Grainger Plain	7,303
Stahlville Plain	6,975	Stirlingville Plain	9,245
Indian Springs Upland	5,080	Olds Plain	30,231
Duck Lake Lowland	1,786	Trail Creek	12,074
Deadhorse Plain	3,443	Raven Creek Plain	21,033
Dalum Upland	4,169	**Total**	265,764

Table 2. Modified Water Management Unit Areas

Modified water management unit	Area (acres)
Rosebud River	48,340
Serviceberry Creek	33,568
Rosebud River - Severn	9,410
Crowfoot Creek	31,489
Total	122,807

A comparison of the land system area with the modified water management units (Table 3) reveals that there are areas which closely represent the watershed unit and areas that only account for as little as 15% of the area. There is an opportunity to explore the relationship between the area of the land systems within the modified water management units and the Census data to determine their value in planning.

Table 3. Proportion of Land System in each Modified Water Management Unit

Land system	Rosebud River	Serviceberry Creek	Rosebud River - Severn	Crowfoot Creek
Rosebud River Valley	0.21	0.22	0.36	0.00
Strangmuir Plain	0.00	0.06	0.00	0.09
Trefoil Plain	0.00	0.00	0.00	0.29
Parflesh Plain	0.00	0.00	0.00	1.00
Hammer Hill Plain	0.00	0.04	0.00	0.77
Ouletteville Plain	0.00	0.00	0.00	0.68
Pope Lease Plain	0.01	0.00	0.00	0.00
Wayne South Plain	0.00	0.37	0.34	0.00
Beynon North Plain	0.31	0.00	0.36	0.00
Stahlville Plain	0.65	0.28	0.00	0.00
Indian Springs Upland	0.00	0.00	0.00	0.07
Duck Lake Lowland	0.00	0.00	0.00	0.39
Deadhorse Plain	0.00	0.00	0.00	0.88
Dalum Upland	0.00	0.00	0.19	0.30
Tudor East Upland	0.00	0.21	0.49	0.28
Balzac Plain	0.19	0.00	0.00	0.00
Dalemead Plain	0.00	0.39	0.00	0.00
Weed Lake Lowland	0.00	0.82	0.00	0.00
Kathryn Plain	0.52	0.23	0.00	0.00
Irricana Plain	0.27	0.73	0.00	0.00
Strathmore Plain	0.34	0.42	0.00	0.00
Beiseker East Plain	0.77	0.00	0.00	0.00
Grainger Plain	0.12	0.00	0.00	0.00
Stirlingville Plain	0.30	0.00	0.00	0.00
Olds Plain	0.15	0.00	0.00	0.00
Trail Creek	0.23	0.00	0.00	0.00
Raven Creek Plain	0.23	0.00	0.00	0.00

2.1 Land Systems

The land systems of the RSC watershed are taken from AGRASID. In AGRASID a variety of data sources were interpreted and integrated in order to delineate the land systems (CAESA – Soil Inventory Project Working Group 1998). The primary criteria used to subdivide ecodistricts into land systems were type, texture and surface form of geological deposits. Bedrock geology, hydrogeology and surface drainage pattern were considered next. Regional soil patterns (soil zones), surface form and agroclimate were then applied in order to delineate the land systems. The land systems were named using local features together with a morphological descriptor. Table 4 outlines the major land resource characteristics of the 27 land systems of the RSC watershed.

2.2 Linking Census Data to Land Systems

The Census of Agriculture is conducted across Canada. The data are generally presented and described by enumeration area within each province. Statistics Canada is able to use other geographical units, as specified by their clients, to sort and present the data. Hiley et al. (1994) used the legal location of the farm headquarters to sort Census data into land systems. Land system codes were assigned to the farm headquarters records based on the legal land location. Once each farm headquarters was tied to a land system, the data were reprocessed to give the data on a land system basis.

In this project, Statistics Canada used a polygon approach that combined farm headquarters records with the land system polygons. Alberta Agriculture, Food and Rural Development (AAFRD) sent the 27 land system boundaries of the RSC watershed in a digital file using a geographic information system (GIS) to Statistics Canada. Using this geographic information together with the farm headquarters, Statistics Canada reprocessed the Census data to produce a **land system – Census of Agriculture database** for each Census (1991 and 1996). This method is unique in that it links Census data to delineated polygons based on specific soil and landscape attributes rather than enumeration areas.

Table 4. Land Resource Characteristics of the Land Systems

Land system name	Agroclimate*	Type & texture of parent material	Topography	Dominant and contrasting soils
Rosebud River Valley	2AH	Undifferentiated	Confined floodplain with some inclined >10% exposed bedrock	Dominant: Regosols (significant eroded soils present)
Strangmuir Plain	2A	Medium textured water-laid sediments and coarse textured sediments	Undulating and ridged (bedrock controlled)	Dominant: Dark Brown Chernozems (saline areas > 5% of land system)
Trefoil Plain	2A	Medium textured till	Hummocky	Dominant: Dark Brown Chernozems Minor: Solonetz
Parflesh Plain	2A	Fine textured water-laid sediments	Undulating	Dominant: Dark Brown Chernozems Minor: Solonetz
Hammer Hill Plain	2A	Medium textured material over medium textured till	Undulating	Dominant: Dark Brown Chernozems (saline areas > 5% of land system)
Ouletteville Plain	2A	Medium textured water-laid sediments	Undulating and ridged (bedrock controlled)	Dominant: Dark Brown Chernozems (saline area >5% of land system)
Pope Lease Plain	2AH	Fine textured water-laid sediments	Undulating	Dominant: Dark Brown Chernozems (significant eroded soils present)
Wayne South Plain	2AH	Medium textured water-laid sediments and fine textured water-laid sediments	Hummocky, undulating and inclined	Dominant: Dark Brown Chernozems
Beynon North Plain	2AH	Fine textured water-laid sediments	Undulating and inclined, some hummocky	Dominant: Dark Brown Chernozems Minor: Solonetz
Stahlville Plain	2AH	Medium textured material over medium textured till and medium textured water-laid sediments	Undulating	Dominant: Dark Brown Chernozems
Indian Springs Upland	2AH	Medium textured till	Hummocky	Dominant: Dark Brown Chernozems Minor: Gleysols
Duck Lake Lowland	2AH	Medium textured till, and medium textured material over medium textured till	Undulating	Dominant: Dark Brown Chernozems Minor: Solonetz, Gleysols and fine textured soils
Deadhorse Plain	2AH	Medium textured till	Hummocky with some undulating	Dominant: Dark Brown Chernozems Minor: Gleysols & fine textured soils
Dalum Upland	2AH	Medium textured till and medium textured material over medium textured till	Hummocky	Dominant: Dark Brown Chernozems Minor: Gleysols

Land system name	Agroclimate*	Type & texture of parent material	Topography	Dominant and contrasting soils
Tudor East Upland	2AH	Medium textured material over medium textured till, and medium textured till	Hummocky	Dominant: Dark Brown Chernozems
Balzac Plain	2AH	Medium textured till and medium textured material over medium textured till	Undulating with some hummocky & valleys with confined floodplain	Dominant: Thin Black Chernozems Minor: Solonetz & Gleysols
Dalemead Plain	2AH	Medium textured till, and medium textured material over medium textured till	Undulating	Dominant: Thin Black Chernozems Minor: Gleysols
Weed Lake Lowland	2AH	Medium textured material over medium textured till	Undulating	Dominant: Thin Black Chernozems Minor: Solonetz, Gleysols & fine textured soils
Kathryn Plain	2AH	Medium textured till, and medium textured material over medium textured till	Undulating	Dominant: Thin Black Chernozems Minor: Gleysols & fine textured soils
Irricana Plain	2AH	Medium textured till, and medium textured material over medium textured till	Undulating with some valley bottom	Dominant: Thin Black Chernozems Minor: Gleysols & fine textured soils
Strathmore Plain	2AH	Coarse textured sediments	Undulating with some duned	Dominant: Thin Black Chernozems Minor: Gleysols
Beiseker East Plain	2AH	Medium textured water-laid sediments and medium textured material over medium textured till	Undulating, and undulating and inclined	Dominant: Thin Black Chernozems
Grainger Plain	2AH	Medium textured material over medium textured till, and medium textured till	Undulating with some undulating and inclined	Dominant: Thin Black Chernozems Minor: coarse textured soils
Stirlingville Plain	2AH	Medium textured material over medium textured till, and medium textured till	Undulating	Dominant: Thin Black Chernozems
Olds Plain	3H	Medium textured till and medium textured material over medium textured till	Undulating with some hummocky and valleys with confined floodplain	Dominant: Black Chernozems Minor: Gleysols
Trail Creek	3H	Medium textured till, and medium textured material over medium textured till	Undulating with some hummocky and ridged	Dominant: Black Chernozems
Raven Creek Plain	3H	Medium textured till	Undulating with some valleys with confined floodplain	Dominant: Black Chernozems

* 2A = slight moisture limitation; 2AH = slight heat and moisture limitations; 3H = moderate heat limitation (ASAC 1987).

2.3 Land System - Census of Agriculture Databases

The land system – Census of Agriculture databases received from Statistics Canada reported metric values. Before data analysis could begin, the data were converted using the following conversion factors:

1 hectare (ha) = 2.471054 acres (ac.)

1 kilogram (kg) = 2.205 pounds (lb.)

1 tonne = 1.102 tons

Once the data were converted to imperial values, agricultural profiles were created using six themes:

1. **Land use –** number of farms and total farm area, which is divided into cultivated land (cropped land including total forage plus summerfallow), total pasture (tame pasture plus natural land for pasture, i.e. native pasture) and other land (land on which farm buildings and barnyards are located, as well as idle land, woodlots, windbreaks and sloughs).
2. **Land management –** irrigated land; herbicide applied land; and fertilizer applied land; manure applied acres; nitrogen in fresh manure; and total fresh manure produced.
3. **Livestock** – total cattle including dairy, beef, calves and those over 1 year; pigs; hens and chickens; sheep and lambs; horses and ponies; and other livestock.
4. **Conservation practices** – number of farms reporting conservation practices including crop rotation with a forage and windbreaks.
5. **Tillage practices to prepare land for seeding** – incorporation of residue, retention of residue and no tillage prior to seeding.
6. **Weed control on summerfallow** – chemical weed control, tillage, and a combination of tillage and chemical weed control.

In the Land Use profile, **total forage** is considered a field crop and is included with **cultivated land**. **Total forage** includes alfalfa and alfalfa mixtures cut for hay or silage, all other tame hay cut for hay or silage and other fodder crops cut for hay or silage. **Total pasture** includes **tame or seeded pasture** and **natural land for pasture**. Tame or seeded pasture refers to grazing land that has been cultivated, seeded, irrigated or fertilized and does not include land with hay or silage that was harvested by machinery. Natural land for pasture refers to native pasture and is also used only for grazing.

Two variables in the Land Management profile did not come directly from the Census data. **Nitrogen from fresh manure** and **total fresh manure produced** were calculated by Statistics Canada using livestock data from the Census and coefficients used by Culley and Barnett (1984).

Agriculture and Agri-Food Canada provided the calculation to Statistics Canada to generate these variables. The formula for each variable is:

Total manure produced =
[(bulls + steers + horses) * 7.7] +
(milk cows * 16.6) +
[(beef cows + heifers) * 10.3] +
[(calves + goats) * 3.4] +
(boars * 2.0) +
(sows * 4.1) +
(pigs under 45 lbs. * 0.6) +
(pigs 45 lbs. and over * 1.9) +
[(ewes + wethers + rams) * 1.0] +
(lambs * 0.5) +
(pullets * 0.03) +
[(laying hens + broilers) * 0.05] +
[(turkeys + other poultry) * 0.09]

Nitrogen in manure =
[(bulls + steers) * 41.6] +
(milk cows * 63.1) +
[(beef cows + heifers) * 55.6] +
[(calves + goats) * 18.4] +
(boars * 12.6) +
(sows * 25.8) +
(pigs under 45 lbs. * 3.8) +
(pigs 45 lbs. and over * 12.0) +
[(ewes + wethers + rams) * 7.1] +
(horses * 38.5) +
(lambs * 3.6) +
(pullets * 0.3) +
[(laying hens + broilers) * 0.5] +
[(turkeys + other poultry) * 0.9]

Each calculation includes all of the main types of livestock even though some types have not been shown in the agricultural profile tables in this report. For instance, *turkeys* and *other poultry* were used in the calculation, but not presented in the agricultural profile tables due to their low numbers. The tables only showed **total pigs** and **total sheep and lambs**; however, the category breakdowns shown above were used from the original Census data for these calculations.

The formulas used unsuppressed livestock figures, or all of the “raw” livestock numbers before any suppression for confidentiality was applied.

Initially the calculations were done in tonnes for the **total fresh manure produced** and in kilograms for the **nitrogen from fresh manure**. These values were converted to tons and pounds, respectively. Also, the manure used in both calculations refers to “fresh” or “as-voided” manure. It does not take into account moisture and volatilization losses during storage, transport or spreading. It also does not account for bedding, additions from milk house washing or gutter flushing. Since these values refer to “fresh” manure, they cannot be compared to AAFRD’s Code of Practice values that calculate volume and nutrient content at the time of manure spreading.

3.0 Results by Agricultural Profiles

The key areas of interest from the land system – Census of Agriculture databases are presented in the following agricultural profile tables (Tables 6 to 24). Each of the six profiles has three separate tables showing the 1991 Census data, the 1996 Census data and a table outlining the change between the two Censuses. The Land Management profile has an additional table for the data relating to manure application methods that was unique to the 1996 Census (Table 11).

Table 5 includes selected variables from some of the 1996 Census profiles to give a brief summary by land system. This table looks at some of the more significant variables from the most recent Census and presents them together for comparison by land system. The variables were chosen as possibly being more significant when making inferences to water quality.

In the tables describing the change between Censuses, it should be noted that “0%” values may be values less than one that have been rounded to zero. There may have been a change from one Census to the next, but when the percentage was calculated it resulted in “0%” since only whole numbers have been presented.

The figures in the Appendix represent selected variables from the agricultural profiles in map form. Differences between land systems are noted by the colour variation on the maps.

Table 5. Selected Variable Summary – 1996 Census of Agriculture

Land system name	Pasture			Cultivated land*	Herbicide sprayed area as % cult. land	Commercial fertilizer applied area as % cult. land	Manure applied area as % cult. land	Total cattle and calves	Total pigs
	Tame or seeded	Natural land for pasture	Total pasture	acres				number	number
	acres	acres	acres						
Rosebud River Valley	1,991	5,635	7,626	34,236	75	88	2	4,555	4,113
Strangmuir Plain	7,903	11,571	19,474	66,423	68	75	15	9,688	6,886
Trefoil Plain	7,966	19,696	27,662	143,705	47	47	1	6,023	15,454
Parflesh Plain	2,075	3,471	5,546	68,162	58	67	1	1,802	x
Hammer Hill Plain	4,087	8,330	12,417	54,723	70	74	1	6,750	710
Oulettevile Plain	4,340	5,421	9,761	47,094	50	51	1	3,841	x
Pope Lease Plain	2,504	18,874	21,378	81,315	57	69	2	4,064	5,031
Wayne South Plain	5,280	13,411	18,691	49,857	73	72	3	3,720	1,318
Beynon North Plain	725	6,134	6,859	43,903	77	78	1	1,912	x
Stahlville Plain	3,685	6,463	10,148	55,931	69	80	2	7,403	8,127
Indian Springs Upland	2,637	7,418	10,055	40,491	70	74	1	3,058	x
Duck Lake Lowland	2,684	5,769	8,453	24,948	56	59	2	1,191	-
Deadhorse Plain	681	2,576	3,257	17,895	52	63	1	1,222	-
Dalum Upland	705	5,731	6,436	33,149	76	64	1	1,013	x
Tudor East Upland	1,461	11,083	12,544	53,950	70	78	2	2,927	3,386
Balzac Plain	8,171	18,624	26,795	76,453	67	77	7	24,628	5,109
Dalemead Plain	5,127	15,316	20,443	143,675	66	82	3	23,236	4,755
Weed Lake Lowland	1,098	4,444	5,542	14,106	53	66	9	2,726	9
Kathryn Plain	11,804	32,986	44,790	203,399	77	82	6	30,293	16,258
Irricana Plain	3,947	11,486	15,433	58,763	64	74	4	8,486	7,077
Strathmore Plain	22,963	30,209	53,172	95,614	69	74	8	57,144	4,848
Beiseker East Plain	1,546	3,554	5,100	28,676	75	79	2	2,804	1,287
Grainger Plain	5,186	18,348	23,534	78,444	71	82	5	11,891	10,309
Stirlingville Plain	5,253	10,381	15,634	78,455	76	89	6	12,282	31,955
Olds Plain	27,137	62,304	89,441	223,331	75	91	8	65,022	17,299
Trail Creek Plain	17,273	41,722	58,995	96,594	57	83	8	30,221	2,355
Raven Creek Plain	23,595	56,961	80,556	141,226	68	99	8	47,358	3,417
Total (1)	**181,824**	**437,918**	**619,742**	**2,054,517**				**375,260**	**149,703**

* - cultivated land = cropland (including total forage) + summerfallow.
x – values not included due to confidentiality.
(1) – RSC watershed total does not include land systems where confidentiality applies.

3.1 Land Use

Table 6. 1991 Census of Agriculture – Land Use

Land system name	Total number of farms	Total area of farms (acres)	Total pasture		Other land		Cultivated land*		Field crops as % of cultivated					
			acres	as % total farm area	acres	as % total farm area	acres	as % total farm area	wheat	barley	canola	total forage	summer-fallow	other crops
Rosebud River Valley	18	40,718	11,507	28	2,184	5	27,027	66	44	24	4	4	20	x
Strangmuir Plain	103	95,390	17,739	19	2,185	2	75,466	79	33	24	12	8	20	3
Trefoil Plain	60	151,112	17,689	12	924	1	132,499	88	36	12	2	0	48	1
Parflesh Plain	67	93,048	20,390	22	1,006	1	71,652	77	45	12	7	1	34	0
Hammer Hill Plain	77	71,295	11,599	16	1,576	2	58,120	82	34	24	9	6	24	3
Ouletteville Plain	79	74,469	13,315	18	2,388	3	58,766	79	33	15	6	3	39	3
Pope Lease Plain	97	96,440	15,830	16	5,266	5	75,344	78	47	13	4	1	33	x
Wayne South Plain	58	95,009	25,167	26	3,377	4	66,465	70	48	12	4	5	28	3
Beynon North Plain	38	54,981	7,990	15	1,340	2	45,651	83	52	11	2	1	33	0
Stahlville Plain	60	61,515	11,781	19	2,626	4	47,108	77	40	13	12	6	26	3
Indian Springs Upland	27	50,453	8,929	18	566	1	40,958	81	41	13	4	1	37	4
Duck Lake Lowland	14	28,411	6,535	23	x	x	20,452	72	41	11	3	x	40	x
Deadhorse Plain	14	22,309	1,459	7	975	4	19,875	89	42	7	x	3	41	5
Dalum Upland	23	30,473	3,121	10	1,079	4	26,273	86	45	11	4	3	34	2
Tudor East Upland	53	74,278	11,927	16	1,594	2	60,757	82	53	16	7	1	21	x
Balzac Plain	195	115,130	33,927	29	3,522	3	77,681	67	15	52	8	12	7	7
Dalemead Plain	204	148,183	15,510	10	2,477	2	130,196	88	31	33	19	6	9	2
Weed Lake Lowland	65	25,862	5,977	23	792	3	19,093	74	30	27	13	5	19	5
Kathryn Plain	407	261,312	53,235	20	8,729	3	199,348	76	32	33	12	7	9	6
Irricana Plain	115	79,523	17,156	22	1,988	2	60,379	76	31	31	17	6	11	2
Strathmore Plain	195	180,752	63,389	35	5,712	3	111,651	62	21	38	6	19	6	9
Beiseker East Plain	36	39,644	6,158	16	586	1	32,900	83	39	21	16	3	20	x
Grainger Plain	138	93,838	14,276	15	2,091	2	77,471	83	48	15	14	5	16	2
Stirlingville Plain	119	99,737	10,619	11	2,259	2	86,859	87	38	28	16	4	11	4
Olds Plain	559	310,162	64,198	21	11,269	4	234,695	76	16	50	15	8	3	7
Trail Creek Plain	284	144,729	42,710	30	5,047	3	96,972	67	10	47	10	20	4	9
Raven Creek Plain	411	218,748	73,564	34	7,704	4	137,480	63	7	47	11	21	3	12
Total (1)	**3,516**	**2,757,521**	**585,697**	**21**	**79,262**	**3**	**2,091,138**	**76**						

x - values not included due to confidentiality.

* - cultivated land = cropland (including total forage) + summerfallow.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 7. 1996 Census of Agriculture – Land Use

Land system name	Total number of farms	Total area of farms (acres)	Total pasture		Other land		Cultivated land*		Field crops as % of cultivated					
			acres	as % total farm area	acres	as % total farm area	acres	as % total farm area	wheat	barley	canola	total forage	summerfallow	other crops
Rosebud River Valley	18	43,774	7,626	17	1,912	4	34,236	78	40	23	19	4	12	2
Strangmuir Plain	103	88,000	19,474	22	2,103	2	66,423	75	31	28	11	10	15	5
Trefoil Plain	57	173,304	27,662	16	1,937	1	143,705	83	35	14	10	1	37	3
Parflesh Plain	61	75,772	5,546	7	2,064	3	68,162	90	46	15	14	2	22	x
Hammer Hill Plain	87	70,050	12,417	18	2,910	4	54,723	78	40	25	13	4	16	2
Ouletteville Plain	64	58,397	9,761	17	1,542	3	47,094	81	40	13	9	4	32	2
Pope Lease Plain	90	107,989	21,378	20	5,296	5	81,315	75	48	17	10	1	22	2
Wayne South Plain	58	70,383	18,691	27	1,835	3	49,857	71	45	18	10	5	20	2
Beynon North Plain	39	53,755	6,859	13	2,993	6	43,903	82	55	13	10	1	18	2
Stahlville Plain	60	68,465	10,148	15	2,386	3	55,931	82	47	19	13	6	13	x
Indian Springs Upland	27	51,986	10,055	19	1,440	3	40,491	78	38	21	16	2	19	4
Duck Lake Lowland	14	33,832	8,453	25	431	1	24,948	74	42	14	9	3	27	x
Deadhorse Plain	20	22,343	3,257	15	1,191	5	17,895	80	38	15	9	1	28	7
Dalum Upland	28	41,508	6,436	16	1,923	5	33,149	80	47	9	12	4	26	x
Tudor East Upland	51	69,307	12,544	18	2,813	4	53,950	78	51	14	16	2	14	2
Balzac Plain	223	107,947	26,795	25	4,699	4	76,453	71	11	58	9	11	4	7
Dalemead Plain	210	168,110	20,443	12	3,992	2	143,675	85	33	37	14	5	7	3
Weed Lake Lowland	57	20,198	5,542	27	550	3	14,106	70	18	33	11	20	14	4
Kathryn Plain	433	257,608	44,790	17	9,419	4	203,399	79	29	39	12	8	7	5
Irricana Plain	131	76,349	15,433	20	2,153	3	58,763	77	32	31	12	13	10	2
Strathmore Plain	216	154,092	53,172	35	5,306	3	95,614	62	17	42	8	21	6	5
Beiseker East Plain	35	34,489	5,100	15	713	2	28,676	83	46	20	16	7	9	x
Grainger Plain	146	105,450	23,534	22	3,472	3	78,444	74	47	20	13	7	10	3
Stirlingville Plain	113	96,977	15,634	16	2,888	3	78,455	81	33	32	16	4	8	6
Olds Plain	621	323,784	89,441	28	11,012	3	223,331	69	11	57	9	13	5	4
Trail Creek Plain	302	161,848	58,995	36	6,259	4	96,594	60	5	51	6	27	4	5
Raven Creek Plain	463	230,592	80,556	35	8,810	4	141,226	61	4	46	8	27	6	9
Total	**3,727**	**2,766,308**	**619,742**	**22**	**92,049**	**3**	**2,054,517**	**74**						

x – values not included due to confidentiality.

* - cultivated land = cropped (including total forage) + summerfallow.

Table 8. Change in Land Use Between 1991 and 1996 Census of Agriculture

Land system name	Change in total number of farms	Change in total area of farms (acres)	Change in total pasture		Change in other land		Change in cultivated* land		Change as percent of cultivated land					
			acres	as % total farm area	acres	as % total farm area	acres	as % total farm area	wheat	barley	canola	total forage	summerfallow	other crops
Rosebud River Valley	-	3,056	- 3,881	- 11	- 272	- 1	7,209	12	- 4	- 1	15	- 0	- 8	x
Strangmuir Plain	-	- 7,390	1,735	4	- 82	0	- 9,043	- 4	- 3	4	- 0	2	- 5	2
Trefoil Plain	- 3	22,192	9,973	4	1,013	1	11,206	- 5	- 1	2	7	1	- 11	2
Parflesh Plain	- 6	- 17,276	- 14,844	- 15	1,058	2	- 3,490	13	0	3	7	0	- 12	x
Hammer Hill Plain	10	- 1,245	818	1	1,334	2	- 3,397	- 3	6	1	4	- 2	- 8	- 0
Ouletteville Plain	- 15	- 16,072	- 3,554	- 1	- 846	- 1	- 11,672	2	6	- 2	4	0	- 7	- 1
Pope Lease Plain	- 7	11,549	5,548	3	30	- 1	5,971	- 3	0	4	5	1	- 11	x
Wayne South Plain	-	- 24,626	- 6,476	0	- 1,542	- 1	- 16,608	1	- 3	6	5	- 0	- 8	- 1
Beynon North Plain	1	- 1,226	- 1,131	- 2	1,653	3	- 1,748	- 1	3	2	8	0	- 15	1
Stahlville Plain	-	6,950	- 1,633	- 4	- 240	- 1	8,823	5	7	6	1	- 0	- 13	x
Indian Springs Upland	-	1,533	1,126	2	874	2	- 467	- 3	- 3	8	12	1	- 18	0
Duck Lake Lowland	-	5,421	1,918	2	x	x	4,496	2	1	3	6	x	- 13	x
Deadhorse Plain	6	34	1,798	8	216	1	- 1,980	- 9	- 4	8	x	- 2	- 13	3
Dalum Upland	5	11,035	3,315	5	844	1	6,876	- 6	2	- 3	8	0	- 7	x
Tudor East Upland	- 2	- 4,971	617	2	1,219	2	- 6,807	- 4	- 3	- 1	9	1	- 7	x
Balzac Plain	28	- 7,183	- 7,132	- 5	1,177	1	- 1,228	3	- 4	6	1	- 1	- 3	1
Dalemead Plain	6	19,927	4,933	2	1,515	1	13,479	- 2	2	4	- 5	- 1	- 2	2
Weed Lake Lowland	- 8	- 5,664	- 435	4	- 242	- 0	- 4,987	- 4	- 13	6	- 2	15	- 5	- 1
Kathryn Plain	26	- 3,704	- 8,445	- 3	690	0	4,051	3	- 3	6	- 1	1	- 2	- 2
Irricana Plain	16	- 3,174	- 1,723	- 1	165	0	- 1,616	1	1	0	- 5	7	- 1	- 1
Strathmore Plain	21	- 26,660	- 10,217	- 1	- 406	0	- 16,037	0	- 4	4	2	2	0	- 4
Beiseker East Plain	- 1	- 5,155	- 1,058	- 1	127	1	- 4,224	0	7	- 1	0	4	- 11	x
Grainger Plain	8	11,612	9,258	7	1,381	1	973	- 8	- 1	5	- 1	2	- 6	0
Stirlingville Plain	- 6	- 2,760	5,015	5	629	1	- 8,404	- 6	- 4	5	- 0	0	- 3	2
Olds Plain	62	13,622	25,243	7	- 257	- 0	- 11,364	- 7	- 5	7	- 6	5	2	- 3
Trail Creek Plain	18	17,119	16,285	7	1,212	0	- 378	- 7	- 5	4	- 4	8	- 0	- 3
Raven Creek Plain	52	11,844	6,992	1	1,106	0	3,746	- 2	- 2	- 1	- 3	6	3	- 3
Total (1)	**211**	**8,787**	**34,044**		**12,356**		**- 36,621**							

x – values not included due to confidentiality.

* - cultivated land = cropland (including total forage) + summerfallow.

(1) – RSC watershed total does not include land systems where confidentiality applies.

3.2 Land Management

Table 9. 1991 Census of Agriculture – Land Management

Land system name	Area irrigated	Total herbicide sprayed area	Herbicide sprayed area as % cult. land	Area commercial fertilizer applied	Area of manure spread		Nitrogen from fresh manure*	Total fresh manure produced*
	acres	acres		acres	# farms	acres	pounds	tons
Rosebud River Valley	960	17,127	63	20,815	6	656	629,323	56,641
Strangmuir Plain	11,688	48,302	64	48,857	16	903	967,275	86,757
Trefoil Plain	x	59,682	45	39,098	7	905	728,788	62,400
Parflesh Plain	435	37,534	52	36,964	5	151	161,077	14,918
Hammer Hill Plain	5,730	35,443	61	33,486	6	275	410,685	37,629
Oulettevillle Plain	2,469	28,313	48	24,966	12	265	445,090	39,657
Pope Lease Plain	x	42,304	56	42,475	15	370	303,616	27,444
Wayne South Plain	3,262	34,950	53	35,484	10	670	830,120	76,354
Beynon North Plain	-	25,460	56	28,093	3	70	258,703	22,721
Stahlville Plain	2,000	28,917	61	31,457	15	430	439,882	40,467
Indian Springs Upland	-	20,963	51	21,881	4	125	166,366	15,223
Duck Lake Lowland	-	11,175	55	8,665	3	290	75,073	6,934
Deadhorse Plain	-	9,045	46	10,005	2	x	52,929	4,893
Dalum Upland	x	16,040	61	15,276	5	130	51,764	4,660
Tudor East Upland	560	35,130	58	39,350	8	435	415,669	35,206
Balzac Plain	5,165	48,285	62	55,220	61	9,348	1,925,979	173,134
Dalemead Plain	5,929	84,119	65	92,656	45	4,528	1,584,538	139,322
Weed Lake Lowland	441	12,203	64	12,627	18	583	239,522	20,687
Kathryn Plain	2,416	140,965	71	161,444	110	8,387	2,817,721	256,054
Irricana Plain	737	41,184	68	44,725	34	1,324	761,179	69,218
Strathmore Plain	18,152	67,788	61	73,363	64	6,946	7,798,395	719,521
Beiseker East Plain	625	20,990	64	23,899	8	823	597,531	52,804
Grainger Plain	x	49,909	64	61,870	50	3,266	1,483,108	108,091
Stirlingville Plain	x	63,288	73	69,684	42	2,700	1,680,090	144,084
Olds Plain	48	168,132	72	201,182	219	16,381	5,521,782	508,872
Trail Creek Plain	48	51,725	53	75,782	117	6,100	2,725,927	255,175
Raven Creek Plain	-	84,971	62	116,950	140	6,723	3,867,166	355,214
Total (1)	**60,665**	**1,283,944**		**1,426,274**	**1,025**	**72,784**	**36,939,298**	**3,334,082**

* - derived from calculations by Agriculture and Agri-Food Canada using Census livestock numbers.

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 10. 1996 Census of Agriculture – Land Management

Land system name	Area irrigated	Total herbicide sprayed area	Herbicide sprayed area as % cult. land	Area commercial fertilizer applied	Area of manure spread		Nitrogen from fresh manure*	Total fresh manure produced*
	acres	acres		acres	# farms	acres	lbs.	tons
Rosebud River Valley	1,074	25,660	75	30,280	6	745	550,359	49,586
Strangmuir Plain	10,755	45,403	68	49,647	31	9,753	1,096,734	99,605
Trefoil Plain	2,439	67,775	47	66,847	18	2,152	993,970	86,219
Parflesh Plain	826	39,502	58	45,843	11	445	252,499	20,872
Hammer Hill Plain	5,823	38,165	70	40,715	21	819	690,822	63,692
Ouletteville Plain	2,979	23,416	50	23,845	17	497	390,694	34,167
Pope Lease Plain	x	46,462	57	56,290	21	1,248	487,715	43,917
Wayne South Plain	2,385	36,316	73	35,966	14	1,384	365,823	33,474
Beynon North Plain	x	33,876	77	34,228	8	542	324,047	28,346
Stahlville Plain	3,159	38,539	69	44,483	26	1,112	884,176	79,910
Indian Springs Upland	-	28,469	70	29,810	10	420	289,049	26,665
Duck Lake Lowland	x	13,855	56	14,742	4	390	105,176	9,735
Deadhorse Plain	x	9,375	52	11,271	4	128	106,266	9,836
Dalum Upland	x	25,165	76	21,317	8	348	99,102	9,111
Tudor East Upland	995	37,606	70	42,266	13	1,025	383,221	33,589
Balzac Plain	759	51,037	67	59,171	78	5,490	2,547,584	231,574
Dalemead Plain	7,511	94,944	66	117,290	56	4,344	2,659,429	233,135
Weed Lake Lowland	595	7,487	53	9,337	20	1,338	316,986	27,481
Kathryn Plain	2,960	156,294	77	166,644	155	11,515	3,561,264	316,015
Irricana Plain	1,906	37,356	64	43,441	52	2,551	988,147	89,702
Strathmore Plain	15,547	65,686	69	70,454	85	8,044	5,546,300	512,401
Beiseker East Plain	1,017	21,412	75	22,751	10	450	299,215	26,878
Grainger Plain	273	55,701	71	64,578	71	3,705	1,763,088	136,300
Stirlingville Plain	3,304	59,264	76	69,722	59	4,795	1,976,895	168,856
Olds Plain	38	167,028	75	202,311	255	18,057	6,763,183	628,914
Trail Creek Plain	x	55,278	57	80,079	143	7,273	2,951,481	274,806
Raven Creek Plain	73	95,499	68	139,149	196	10,784	4,533,583	418,924
Total	**64,418**	**1,376,570**		**1,592,477**	**1,392**	**99,354**	**40,926,806**	**3,693,711**

* - derived from calculations by Agriculture and Agri-Food Canada using Census livestock numbers.

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 11. 1996 Census of Agriculture – Methods of Manure Application

Land system name	Total area of manure spread		Area spread with solid spreader		Area spread with irrigation system		Area spread with liquid spreader (injected)		Area spread with liquid spreader (on surface)	
	# farms	acres	# farms	acres	# farms	acres	# farms	acres	# farms	acres
Rosebud River Valley	6	745	6	505	-	-	-	-	3	240
Strangmuir Plain	31	9,753	30	1,883	1	x	1	x	2	x
Trefoil Plain	18	2,152	17	1,452	-	-	1	x	2	x
Parflesh Plain	11	445	9	315	-	-	1	x	2	x
Hammer Hill Plain	21	819	20	689	-	-	1	x	2	x
Ouletteville Plain	17	497	16	x	-	-	-	-	1	x
Pope Lease Plain	21	1,248	17	773	-	-	1	x	6	x
Wayne South Plain	14	1,384	13	x	-	-	-	-	2	x
Beynon North Plain	8	542	7	x	-	-	1	x	-	-
Stahlville Plain	26	1,112	23	742	-	-	1	x	2	x
Indian Springs Upland	10	420	10	x	-	-	-	-	1	x
Duck Lake Lowland	4	390	4	390	-	-	-	-	-	-
Deadhorse Plain	4	128	4	128	-	-	-	-	-	-
Dalum Upland	8	348	8	348	-	-	-	-	-	-
Tudor East Upland	13	1,025	9	315	-	-	-	-	4	710
Balzac Plain	78	5,490	77	4,740	-	-	-	-	4	750
Dalemead Plain	56	4,344	50	3,874	-	-	-	-	9	470
Weed Lake Lowland	20	1,338	19	x	-	-	-	-	1	x
Kathryn Plain	155	11,515	145	8,012	1	x	2	x	14	1,333
Irricana Plain	52	2,551	48	1,736	-	-	1	x	5	x
Strathmore Plain	85	8,044	81	7,279	-	-	-	-	6	765
Beiseker East Plain	10	450	9	x	-	-	-	-	1	x
Grainger Plain	71	3,705	65	3,218	-	-	2	x	12	x
Stirlingville Plain	59	4,795	45	2,412	-	-	3	241	22	2,142
Olds Plain	255	18,057	239	14,508	-	-	1	x	31	x
Trail Creek Plain	143	7,273	137	6,551	-	-	1	x	9	x
Raven Creek Plain	196	10,784	189	9,057	-	-	3	1,307	11	420
Total (1)	**1,392**	**99,354**	**1,297**	**68,927**	**2**	**x**	**20**	**1,548**	**152**	**6,830**

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 12. Change in Land Management Between 1991 and 1996 Census of Agriculture

Land system name	Change in area irrigated	Change in total herbicide sprayed area		Change in herbicide sprayed area as % cult. land	Change in area commercial fertilizer applied		Change in # of farms spreading manure	Change area of manure spread		Change nitrogen from fresh manure*		Change
	acres	acres	percent		acres	percent	# farms	acres	percent	lbs.	percent	tons
Rosebud River Valley	114	8,533	50	12	9,465	45	-	89	14	- 78,964	- 13	- 7,055
Strangmuir Plain	- 933	- 2,899	- 6	4	790	2	15	8,850	980	129,459	13	12,847
Trefoil Plain	x	8,093	14	2	27,749	71	11	1,247	138	265,182	36	23,820
Parflesh Plain	391	1,968	5	6	8,879	24	6	294	195	91,422	57	5,953
Hammer Hill Plain	93	2,722	8	9	7,229	22	15	544	198	280,137	68	26,063
Ouletteville Plain	510	- 4,897	- 17	2	- 1,121	- 4	5	232	88	- 54,397	- 12	- 5,490
Pope Lease Plain	x	4,158	10	1	13,815	33	6	878	237	184,099	61	16,473
Wayne South Plain	- 877	1,366	4	20	482	1	4	714	107	- 464,297	- 56	- 42,880
Beynon North Plain	x	8,416	33	21	6,135	22	5	472	675	65,344	25	5,625
Stahlville Plain	1,159	9,622	33	8	13,026	41	11	682	159	444,293	101	39,443
Indian Springs Upland	-	7,506	36	19	7,929	36	6	295	236	122,683	74	11,443
Duck Lake Lowland	x	2,680	24	1	6,077	70	1	100	34	30,102	40	2,801
Deadhorse Plain	x	330	4	7	1,266	13	2	x	x	53,337	101	4,942
Dalum Upland	x	9,125	57	15	6,041	40	3	218	168	47,338	91	4,452
Tudor East Upland	435	2,476	7	12	2,916	7	5	590	136	- 32,449	- 8	- 1,617
Balzac Plain	- 4,406	2,752	6	5	3,951	7	17	- 3,858	- 41	621,606	32	58,440
Dalemead Plain	1,582	10,825	13	1	24,634	27	11	- 184	- 4	1,074,891	68	93,813
Weed Lake Lowland	154	- 4,716	- 39	- 11	- 3,290	- 26	2	755	130	77,463	32	6,795
Kathryn Plain	544	15,329	11	6	5,200	3	45	3,128	37	743,543	26	59,962
Irricana Plain	1,169	- 3,828	- 9	- 5	- 1,284	- 3	18	1,227	93	226,968	30	20,483
Strathmore Plain	- 2,605	- 2,102	- 3	8	- 2,909	- 4	21	1,098	16	- 2,252,095	- 29	- 207,120
Beiseker East Plain	392	422	2	11	- 1,148	- 5	2	- 373	- 45	- 298,316	- 50	- 25,927
Grainger Plain	x	5,792	12	7	2,708	4	21	439	13	279,980	19	28,208
Stirlingville Plain	x	- 4,024	- 6	3	38	0	17	2,095	78	296,806	18	24,772
Olds Plain	- 10	- 1,104	- 1	3	1,129	1	36	1,676	10	1,241,401	22	120,042
Trail Creek Plain	x	3,553	7	4	4,297	6	26	1,173	19	225,554	8	19,631
Raven Creek Plain	73	10,528	12	6	22,199	19	56	4,061	60	666,417	17	63,710
Total (1)	**3,753**	**92,625**	**7**		**166,203**	**12**	**367**	**26,571**	**37**	**3,987,509**	**11**	**359,629**

* - derived from calculations by Agriculture and Agri-Food Canada using Census livestock numbers.

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

3.3 Livestock

Table 13. 1991 Census of Agriculture – Livestock

Land system name	Dairy cows		Beef cows		Calves		Cattle over 1 year*		Total cattle and calves		Total pigs		Total hens and chickens		Total sheep and lambs		Horses and ponies		Other livestock**	
	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.
Rosebud River Valley	3	325	16	1,542	16	1,217	15	1,406	16	4,490	5	7,115	5	17,636	2	x	5	39	5	39
Strangmuir Plain	2	x	46	2,908	46	2,615	46	x	51	7,652	7	9,321	9	8,752	4	187	33	321	35	397
Trefoil Plain	5	222	22	1,556	23	1,531	24	969	26	4,278	9	10,319	14	46,117	4	2,698	19	84	19	111
Parflesh Plain	0	0	12	771	12	710	13	294	13	1,775	1	x	2	x	2	x	13	50	13	58
Hammer Hill Plain	2	x	42	1,813	42	1,746	40	x	45	4,222	7	346	5	293	8	2,161	28	89	29	102
Ouletteville Plain	1	x	39	1,994	38	1,807	36	x	40	4,380	5	156	5	x	6	760	35	147	35	148
Pope Lease Plain	2	x	35	1,187	39	1,102	38	x	45	2,781	14	1,829	13	1,095	6	267	26	116	28	477
Wayne South Plain	2	x	28	2,343	30	2,264	31	x	33	8,309	5	1,434	6	631	3	39	20	77	20	77
Beynon North Plain	1	x	15	537	16	654	17	x	17	1,560	5	4,652	5	x	3	70	10	53	11	55
Stahlville Plain	2	x	30	1,718	33	1,557	31	x	35	4,372	8	1,454	9	1,038	4	91	20	64	20	64
Indian Springs Upland	0	0	17	755	17	680	18	272	18	1,707	3	535	2	x	1	x	12	28	12	28
Duck Lake Lowland	0	0	8	369	8	360	6	115	8	844	2	x	2	x	0	0	4	12	4	12
Deadhorse Plain	0	0	7	267	7	256	7	85	7	608	0	0	2	x	1	x	1	x	1	x
Dalum Upland	0	0	9	244	8	188	9	36	10	468	2	x	2	x	3	75	2	x	3	24
Tudor East Upland	1	x	22	1,020	23	1,042	22	x	25	2,379	7	6,812	6	x	5	724	17	59	17	65
Balzac Plain	12	445	89	5,083	103	5,037	109	5,927	122	16,492	17	11,457	23	80,244	21	1,798	83	441	89	471
Dalemead Plain	5	186	73	2,828	76	2,707	84	7,535	91	13,256	14	3,268	26	141,628	10	1,447	64	346	66	1,052
Weed Lake Lowland	0	0	24	625	25	599	25	727	28	1,951	6	644	9	813	5	698	27	135	30	291
Kathryn Plain	17	494	196	8,803	207	8,538	221	8,481	239	26,316	42	9,900	46	88,045	25	1,013	135	678	145	1,043
Irricana Plain	4	21	69	2,916	67	2,581	72	1,681	79	7,199	12	3,898	17	1,995	9	816	37	223	38	250
Strathmore Plain	7	330	113	9,729	119	9,177	125	57,826	135	77,062	19	8,958	25	15,613	16	1,249	74	363	80	742
Beiseker East Plain	2	x	17	1,504	18	1,511	15	x	19	4,349	4	7,500	3	x	1	x	9	59	10	62
Grainger Plain	6	188	37	1,764	51	1,830	47	2,136	58	5,918	24	12,612	42	557,323	5	72	31	181	32	226
Stirlingville Plain	5	476	52	2,312	56	1,911	67	3,678	74	8,377	33	30,428	18	90,691	9	200	28	125	30	144
Olds Plain	50	2,051	299	13,254	322	13,543	344	20,934	377	49,782	81	20,357	73	120,459	36	3,741	170	1,037	177	1,781
Trail Creek Plain	38	1,416	165	8,345	180	8,815	197	7,942	211	26,518	23	7,396	36	44,279	26	2,589	100	567	106	778
Raven Creek Plain	23	409	277	13,669	289	13,045	293	12,097	321	39,220	29	5,477	49	25,949	29	1,741	169	869	182	1,020
Total (1)	**190**	**6,563**	**1,759**	**89,856**	**1,871**	**87,023**	**1,952**	**132,141**	**2,143**	**326,265**	**384**	**165,868**	**454**	**1,242,601**	**244**	**22,436**	**1,172**	**6,163**	**1,237**	**9,517**

x – values not included due to confidentiality.
* - includes bulls, heifers and steers.
(1) RSC watershed does not include land systems where confidentiality applies.
** - includes goats, horses, ponies and other.

Table 14. 1996 Census of Agriculture – Livestock

Land system name	Dairy cows		Beef cows		Calves		Cattle over 1 year*		Total cattle and calves		Total pigs		Total hens and chickens		Total sheep and lambs		Horses and ponies		Other livestock**	
	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.	# farms	no.
Rosebud River Valley	3	220	12	1,625	11	1,598	12	1,112	12	4,555	4	4,113	4	17,837	3	105	5	30	6	32
Strangmuir Plain	5	199	58	3,949	58	3,563	56	1,977	60	9,688	6	6,886	10	19,237	5	374	38	382	40	434
Trefoil Plain	5	344	26	2,414	28	2,279	30	986	32	6,023	6	15,454	7	44,580	7	3,845	21	108	21	120
Parflesh Plain	0	0	16	736	16	571	16	495	17	1,802	2	x	3	x	3	139	12	55	13	106
Hammer Hill Plain	2	x	43	2,276	39	1,965	42	x	50	6,750	5	710	5	365	7	1,454	28	110	30	137
Oulette ville Plain	0	0	35	1,807	34	1,602	32	432	36	3,841	1	x	6	x	5	491	21	79	21	82
Pope Lease Plain	4	122	35	1,685	39	1,695	35	562	41	4,064	4	5,031	6	x	4	15	20	81	21	494
Wayne South Plain	0	0	23	1,588	23	1,489	20	643	24	3,720	5	1,318	2	x	1	x	14	76	14	76
Beynon North Plain	1	x	17	764	18	704	17	x	19	1,912	1	x	3	2,395	1	x	10	40	12	74
Stahlville Plain	5	197	33	2,428	37	2,406	34	2,372	39	7,403	8	8,127	8	9,614	4	45	17	71	17	83
Indian Springs Upland	0	0	17	1,314	16	1,066	18	678	19	3,058	2	x	1	x	0	0	14	56	14	57
Duck Lake Lowland	0	0	7	504	7	484	8	203	8	1,191	0	0	2	x	0	0	4	10	4	10
Deadhorse Plain	0	0	13	532	13	501	11	189	13	1,222	0	0	0	0	2	x	1	x	1	x
Dalum Upland	0	0	12	465	12	367	14	181	14	1,013	2	x	4	182	4	110	9	20	9	28
Tudor East Upland	2	x	25	1,394	24	1,063	26	x	28	2,927	5	3,386	5	27,864	7	265	17	81	18	92
Balzac Plain	6	185	114	7,518	116	6,487	120	10,438	138	24,628	9	5,109	25	68,919	26	1,787	95	562	103	882
Dalemead Plain	6	108	74	4,410	76	3,631	85	15,087	101	23,236	15	4,755	21	229,002	8	856	70	400	78	1,272
Weed Lake Lowland	0	0	23	928	24	790	22	1,008	28	2,726	4	9	6	459	3	692	13	80	16	133
Kathryn Plain	14	485	217	11,167	208	9,450	222	9,191	249	30,293	24	16,258	42	222,746	31	1,183	152	743	165	1,453
Irricana Plain	6	76	68	3,489	72	2,905	67	2,016	81	8,486	11	7,077	18	875	9	380	41	345	48	462
Strathmore Plain	7	319	135	10,674	136	12,809	140	33,342	154	57,144	18	4,848	22	18,476	21	1,309	84	538	93	1,573
Beiseker East Plain	0	0	15	1,003	17	934	16	867	18	2,804	3	1,287	2	x	1	x	9	41	10	42
Grainger Plain	5	124	57	3,160	66	6,202	66	2,405	78	11,891	19	10,309	40	529,244	1	x	39	201	44	390
Stirlingville Plain	3	153	60	4,261	66	4,443	65	3,425	73	12,282	20	31,955	12	68,101	10	332	34	171	35	200,206
Olds Plain	41	1,895	344	19,214	353	18,232	349	25,681	401	65,022	45	17,299	56	9,218	29	2,859	183	1,362	201	2,047
Trail Creek Plain	25	1,045	180	11,201	194	10,873	195	7,102	216	30,221	14	2,355	25	67,799	23	1,783	105	719	118	1,124
Raven Creek Plain	20	433	279	17,904	272	15,565	289	13,456	312	47,358	14	3,417	30	12,200	28	1,243	185	1,206	200	1,429
Total (1)	**160**	**5,905**	**1,938**	**118,410**	**1,975**	**113,674**	**2,007**	**133,848**	**2,261**	**375,260**	**247**	**149,703**	**365**	**1,349,113**	**243**	**19,267**	**1,241**	**7,567**	**1,352**	**212,838**

x – values not included due to confidentiality.

(1) RSC watershed total does not include land systems where confidentiality applies.

* - includes bulls, heifers and steers.

** - includes goats, horses, ponies, bison, deer, llamas and other.

Table 15. Change in Livestock Numbers Between 1991 and 1996 Census of Agriculture

Land system name	Dairy cows		Beef cows		Calves		Cattle over 1 year*		Total cattle & calves		Total pigs		Total hens & chickens		Total sheep and lambs		Horses and ponies		Other livestock	
	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent	no.	percent
Rosebud River Valley	-105	-32	83	5	381	31	-294	-21	65	1	-3,002	-42	201	1	x	x	-9	-23	-7	-18
Strangmuir Plain	x	x	1,041	36	948	36	x	x	2,036	27	-2,435	-26	10,485	120	187	100	61	19	37	9
Trefoil Plain	122	55	858	55	748	49	17	2	1,745	41	5,135	50	-1,537	-3	1,147	43	24	29	9	8
Parflesh Plain	0	0	-35	-5	-139	-20	201	68	27	2	x	x	x	x	x	x	5	10	48	83
Hammer Hill Plain	x	x	463	26	219	13	x	x	2,528	60	364	105	72	25	-707	-33	21	24	35	34
Ouletteville Plain	x	x	-187	-9	-205	-11	x	x	-539	-12	x	x	x	x	-269	-35	-68	-46	-66	-45
Pope Lease Plain	x	x	498	42	593	54	x	x	1,283	46	3,202	175	x	x	-252	-94	-35	-30	17	4
Wayne South Plain	x	x	-755	-32	-775	-34	x	x	-4,589	-55	-116	-8	x	x	x	x	-1	-1	-1	-1
Beynon North Plain	x	x	227	42	50	8	x	x	352	23	x	x	x	x	x	x	-13	-25	19	35
Stahlville Plain	x	x	710	41	849	55	x	x	3,031	69	6,673	459	8,576	826	-46	-51	7	11	19	30
Indian Springs Upland	0	0	559	74	386	57	406	149	1,351	79	x	x	x	x	x	x	28	100	29	104
Duck Lake Lowland	0	0	135	37	124	34	88	77	347	41	x	x	x	x	0	0	-2	-17	-2	-17
Deadhorse Plain	0	0	265	99	245	96	104	122	614	101	0	0	x	x	x	x	x	x	x	x
Dalum Upland	0	0	221	91	179	95	145	403	545	116	x	x	x	x	35	47	x	x	4	17
Tudor East Upland	x	x	374	37	21	2	x	x	548	23	-3,426	-50	x	x	-459	-63	22	37	27	42
Balzac Plain	-260	-58	2,435	48	1,450	29	4,511	76	8,136	49	-6,348	-55	-11,325	-14	-11	-1	121	27	411	87
Dalemead Plain	-78	-42	1,582	56	924	34	7,552	100	9,980	75	1,487	46	87,374	62	-591	-41	54	16	220	21
Weed Lake Lowland	0	0	303	48	191	32	281	39	775	40	-635	-99	-354	-44	-6	-1	-55	-41	-158	-54
Kathryn Plain	-9	-2	2,364	27	912	11	710	8	3,977	15	6,358	64	134,701	153	170	17	65	10	410	39
Irricana Plain	55	262	573	20	324	13	335	20	1,287	18	3,179	82	-1,120	-56	-436	-53	122	55	212	85
Strathmore Plain	-11	-3	945	10	3,632	40	-24,484	-42	-19,918	-26	-4,110	-46	2,863	18	60	5	175	48	831	112
Beiseker East Plain	x	x	-501	-33	-577	-38	x	x	-1,545	-36	-6,213	-83	x	x	x	x	-18	-31	-20	-32
Grainger Plain	-64	-34	1,396	79	4,372	239	269	13	5,973	101	-2,303	-18	-28,079	-5	x	x	20	11	164	73
Stirlingville Plain	-323	-68	1,949	84	2,532	132	-253	-7	3,905	47	1,527	5	-22,590	-25	132	66	46	37	200,062	138932
Olds Plain	-156	-8	5,960	45	4,689	35	4,747	23	15,240	31	-3,058	-15	-111,241	-92	-882	-24	325	31	266	15
Trail Creek Plain	-371	-26	2,856	34	2,058	23	-840	-11	3,703	14	-5,041	-68	23,520	53	-806	-31	152	27	346	44
Raven Creek Plain	24	6	4,235	31	2,520	19	1,359	11	8,138	21	-2,060	-38	-13,749	-53	-498	-29	337	39	409	40
Total (1)	**-658**	**-10**	**28,554**	**32**	**26,651**	**31**	**1,707**	**1**	**48,995**	**15**	**-16,165**	**-10**	**106,512**	**9**	**-3,232**	**-14**	**1,384**	**22**	**203,321**	**2136**

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

* - includes bulls, heifers and steers.

3.4 Conservation Practices

Table 16. 1991 Census of Agriculture – Farms Reporting Conservation Practices

Land system name	Total number of farms	Crop rotation using a forage	Winter cover crops	Contour cultivation	Strip-cropping	Grassed waterways	Shelterbelts planted	Other practices*
Rosebud River Valley	18	4	1	2	3	3	1	3
Strangmuir Plain	103	25	14	8	19	10	17	38
Trefoil Plain	60	3	4	7	11	5	9	25
Parflesh Plain	67	4	2	13	9	16	7	22
Hammer Hill Plain	77	18	1	8	9	12	11	29
Oulettevillle Plain	79	11	6	9	13	18	8	28
Pope Lease Plain	97	6	3	15	32	20	23	42
Wayne South Plain	58	14	5	9	6	19	9	26
Beynon North Plain	38	4	2	3	13	9	5	15
Stahlville Plain	60	15	6	7	15	19	10	21
Indian Springs Upland	27	1	3	1	3	8	9	15
Duck Lake Lowland	14	1	0	5	2	1	2	2
Deadhorse Plain	14	0	0	1	2	2	1	2
Dalum Upland	23	5	2	4	2	7	4	13
Tudor East Upland	53	8	1	8	7	11	7	22
Balzac Plain	195	28	31	19	10	15	31	67
Dalemead Plain	204	34	10	14	8	19	40	83
Weed Lake Lowland	65	8	6	7	5	3	11	24
Kathryn Plain	407	62	49	46	38	39	78	151
Irricana Plain	115	21	9	11	7	5	18	41
Strathmore Plain	195	64	22	11	13	17	39	65
Beiseker East Plain	36	8	5	4	8	8	12	16
Grainger Plain	138	17	7	13	25	24	53	73
Stirlingville Plain	119	15	7	14	17	18	42	57
Olds Plain	559	162	46	69	27	98	157	225
Trail Creek Plain	284	137	17	46	11	73	66	89
Raven Creek Plain	411	130	65	41	20	74	74	119
Total	**3,516**	**805**	**324**	**395**	**335**	**553**	**744**	**1,313**

* - only asked in 1991 Census.

Table 17. 1996 Census of Agriculture – Farms Reporting Conservation Practices

Land system name	Total number of farms	Crop rotation using a forage	Winter cover crops	Contour cultivation	Strip-cropping	Grassed waterways	Windbreaks and shelterbelts planted	Permanent grass cover*
Rosebud River Valley	18	10	0	1	4	2	1	5
Strangmuir Plain	103	55	2	3	7	13	23	44
Trefoil Plain	57	45	0	6	9	12	11	18
Parflesh Plain	61	53	0	8	4	10	4	13
Hammer Hill Plain	87	51	1	1	1	7	10	34
Oulettеville Plain	64	49	1	6	2	10	8	20
Pope Lease Plain	90	67	2	11	15	25	18	11
Wayne South Plain	58	43	1	10	2	10	9	17
Beynon North Plain	39	29	0	4	6	10	7	8
Stahlville Plain	60	46	1	5	8	13	15	20
Indian Springs Upland	27	23	2	5	2	10	8	10
Duck Lake Lowland	14	11	0	1	1	2	3	2
Deadhorse Plain	20	17	0	3	0	4	1	5
Dalum Upland	28	20	0	3	2	7	4	12
Tudor East Upland	51	38	1	5	0	11	9	18
Balzac Plain	223	84	8	11	2	13	34	97
Dalemead Plain	210	109	1	5	2	9	29	67
Weed Lake Lowland	57	16	0	5	3	0	5	19
Kathryn Plain	433	222	5	18	10	25	78	159
Irricana Plain	131	63	4	7	3	7	21	61
Strathmore Plain	216	91	5	7	2	25	48	99
Beiseker East Plain	35	24	1	3	2	5	7	11
Grainger Plain	146	77	1	7	9	14	29	41
Stirlingville Plain	113	75	0	4	6	14	29	37
Olds Plain	621	354	12	40	10	74	157	236
Trail Creek Plain	302	162	6	18	6	51	90	129
Raven Creek Plain	463	234	18	26	6	61	96	223
Total	**3,727**	**2,068**	**72**	**223**	**124**	**444**	**754**	**1,416**

* - only asked in 1996 Census.

Table 18. Change in Farms Reporting Conservation Practices Between 1991 and 1996 Census of Agriculture

Land system name	Change in total number of farms	Crop rotation using a forage	Winter cover crops	Contour cultivation	Strip-cropping	Grassed waterways	Windbreaks & shelterbelts planted
Rosebud River Valley	0	6	-1	-1	1	-1	0
Strangmuir Plain	0	30	-12	-5	-12	3	6
Trefoil Plain	-3	42	-4	-1	-2	7	2
Parflesh Plain	-6	49	-2	-5	-5	-6	-3
Hammer Hill Plain	10	33	0	-7	-8	-5	-1
Ouletteville Plain	-15	38	-5	-3	-11	-8	0
Pope Lease Plain	-7	61	-1	-4	-17	5	-5
Wayne South Plain	0	29	-4	1	-4	-9	0
Beynon North Plain	1	25	-2	1	-7	1	2
Stahlville Plain	0	31	-5	-2	-7	-6	5
Indian Springs Upland	0	22	-1	4	-1	2	-1
Duck Lake Lowland	0	10	0	-4	-1	1	1
Deadhorse Plain	6	17	0	2	-2	2	0
Dalum Upland	5	15	-2	-1	0	0	0
Tudor East Upland	-2	30	0	-3	-7	0	2
Balzac Plain	28	56	-23	-8	-8	-2	3
Dalemead Plain	6	75	-9	-9	-6	-10	-11
Weed Lake Lowland	-8	8	-6	-2	-2	-3	-6
Kathryn Plain	26	160	-44	-28	-28	-14	0
Irricana Plain	16	42	-5	-4	-4	2	3
Strathmore Plain	21	27	-17	-4	-11	8	9
Beiseker East Plain	-1	16	-4	-1	-6	-3	-5
Grainger Plain	8	60	-6	-6	-16	-10	-24
Stirlingville Plain	-6	60	-7	-10	-11	-4	-13
Olds Plain	62	192	-34	-29	-17	-24	0
Trail Creek Plain	18	25	-11	-28	-5	-22	24
Raven Creek Plain	52	104	-47	-15	-14	-13	22
Total	**211**	**1,263**	**-252**	**-172**	**-211**	**-109**	**10**

3.5 Tillage Practices to Prepare Land for Seeding

Table 19. 1991 Census of Agriculture – Tillage Practices to Prepare Land for Seeding

Land system name	Area prepared for seeding	Incorporating residue into soil		Retaining residue on the surface		No tillage	
	acres	# farms	acres	# farms	acres	# farms	acres
Rosebud River Valley	20851	13	18593	4	2258	2	x
Strangmuir Plain	55735	48	32127	35	18004	14	5604
Trefoil Plain	75234	42	47028	21	26356	8	1850
Parflesh Plain	49400	44	26739	25	17072	11	5589
Hammer Hill Plain	42922	43	20542	23	17996	7	4384
Ouletteville Plain	35192	50	21200	30	13657	4	335
Pope Lease Plain	50832	54	28176	36	18451	12	4205
Wayne South Plain	46705	37	26231	25	20124	3	350
Beynon North Plain	31225	27	20691	14	8039	6	2495
Stahlville Plain	33784	43	20893	15	9044	5	3847
Indian Springs Upland	27921	18	15886	13	10560	4	1475
Duck Lake Lowland	11813	7	4868	8	6945	0	0
Deadhorse Plain	9900	8	7530	4	2370	2	x
Dalum Upland	17964	13	10507	10	6890	3	567
Tudor East Upland	47802	35	22060	22	24612	5	1130
Balzac Plain	67222	95	37582	47	29378	4	262
Dalemead Plain	112321	96	47891	65	62522	12	1908
Weed Lake Lowland	15631	33	11383	16	3955	3	293
Kathryn Plain	174482	222	113094	105	59002	9	2386
Irricana Plain	52364	59	30124	32	21255	6	985
Strathmore Plain	91451	98	62887	41	25558	9	3006
Beiseker East Plain	26216	23	14228	10	11988	2	x
Grainger Plain	65944	65	37528	52	27635	4	781
Stirlingville Plain	77434	61	41637	38	35017	4	780
Olds Plain	216172	402	185682	79	27330	7	3160
Trail Creek Plain	79338	213	68464	36	10874	2	x
Raven Creek Plain	112727	245	85608	69	26284	12	835
Total (1)	**1,648,583**	**2,094**	**1,059,179**	**875**	**543,177**	**160**	**46,227**

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 20. 1996 Census of Agriculture – Tillage Practices to Prepare Land for Seeding

Land system name	Area prepared for seeding	Incorporating residue into soil		Retaining residue on the surface		No tillage	
	acres	# farms	acres	# farms	acres	# farms	acres
Rosebud River Valley	29058	6	14011	7	10213	6	4834
Strangmuir Plain	49696	30	17997	35	19667	11	12032
Trefoil Plain	89320	29	31546	29	46144	13	11630
Parflesh Plain	52706	23	9570	37	36555	13	6581
Hammer Hill Plain	44064	24	9572	37	25811	13	8681
Ouletteville Plain	30522	40	16454	24	8999	12	5069
Pope Lease Plain	62471	54	37820	34	14746	19	9905
Wayne South Plain	37716	27	13969	22	13930	14	9817
Beynon North Plain	35635	21	18359	16	9144	9	8132
Stahlville Plain	45794	29	21101	23	16842	10	7851
Indian Springs Upland	32345	9	6542	18	20808	6	4995
Duck Lake Lowland	17631	6	6205	8	7546	4	3880
Deadhorse Plain	12831	7	4819	9	5294	4	2718
Dalum Upland	23300	15	5844	9	6267	7	11189
Tudor East Upland	45425	16	7859	27	29861	10	7705
Balzac Plain	65213	86	39691	39	20106	11	5416
Dalemead Plain	126810	55	22023	74	92497	24	12290
Weed Lake Lowland	8532	20	6177	12	2355	1	x
Kathryn Plain	173729	181	105233	116	58630	21	9866
Irricana Plain	45109	37	13174	40	31935	2	x
Strathmore Plain	69975	72	29238	48	36483	8	4254
Beiseker East Plain	24501	16	6487	12	14846	4	3168
Grainger Plain	66193	57	27160	50	33604	11	5429
Stirlingville Plain	69683	55	30876	39	35229	7	3578
Olds Plain	184501	339	142923	99	36385	14	5193
Trail Creek Plain	66880	175	56317	37	10563	1	x
Raven Creek Plain	95798	220	64056	76	28141	9	3601
Total (1)	**1,605,439**	**1,649**	**765,023**	**977**	**672,601**	**264**	**167,814**

X – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 21. Change in Tillage Practices to Prepare Land for Seeding Between 1991 and 1996 Census of Agriculture

Land system name	Area prepared for seeding		Incorporating residue into soil		Retaining residue on the surface		No tillage	
	acres	percent	acres	percent	acres	percent	acres	percent
Rosebud River Valley	8207	39	-4582	-25	7955	352	x	x
Strangmuir Plain	-6039	-11	-14130	-44	1663	9	6428	115
Trefoil Plain	14086	19	-15482	-33	19788	75	9780	529
Parflesh Plain	3306	7	-17169	-64	19483	114	992	18
Hammer Hill Plain	1142	3	-10970	-53	7815	43	4297	98
Ouletteville Plain	-4670	-13	-4746	-22	-4658	-34	4734	1413
Pope Lease Plain	11639	23	9644	34	-3705	-20	5700	136
Wayne South Plain	-8989	-19	-12262	-47	-6194	-31	9467	2706
Beynon North Plain	4410	14	-2332	-11	1105	14	5637	226
Stahlville Plain	12010	36	208	1	7798	86	4004	104
Indian Springs Upland	4424	16	-9344	-59	10248	97	3520	239
Duck Lake Lowland	5818	49	1337	27	601	9	3880	n/a
Deadhorse Plain	2931	30	-2711	-36	2924	123	x	x
Dalum Upland	5336	30	-4663	-44	-623	-9	10622	1873
Tudor East Upland	-2377	-5	-14201	-64	5249	21	6575	582
Balzac Plain	-2009	-3	2109	6	-9272	-32	5154	1968
Dalemead Plain	14489	13	-25868	-54	29975	48	10382	544
Weed Lake Lowland	-7099	-45	-5206	-46	-1600	-40	x	x
Kathryn Plain	-753	0	-7861	-7	-372	-1	7480	313
Irricana Plain	-7255	-14	-16950	-56	10680	50	x	x
Strathmore Plain	-21476	-23	-33649	-54	10925	43	1248	42
Beiseker East Plain	-1715	-7	-7741	-54	2858	24	x	x
Grainger Plain	249	0	-10368	-28	5969	22	4648	595
Stirlingville Plain	-7751	-10	-10761	-26	212	1	2798	359
Olds Plain	-31671	-15	-42759	-23	9055	33	2033	64
Trail Creek Plain	-12458	-16	-12147	-18	-311	-3	x	x
Raven Creek Plain	-16929	-15	-21552	-25	1857	7	2766	331
Total (1)	**-43,144**	**-3**	**-294,155**	**-28**	**129,424**	**24**	**121,587**	**263**

x – values not included due to confidentiality.

n/a – percentage cannot be calculated.

(1) – RSC watershed total does not include land systems where confidentiality applies.

3.6 Weed Control on Summerfallow

Table 22. 1991 Census of Agriculture – Forms of Weed Control on Summerfallow

Land system name	Summerfallow		Chemical only		Tillage only		Tillage and chemical combination	
	# farms	acres	# farms	acres	# farms	acres	# farms	acres
Rosebud River Valley	11	5495	2	x	4	x	7	4095
Strangmuir Plain	39	15136	4	1670	18	6028	20	7438
Trefoil Plain	56	63944	4	810	41	42888	28	20246
Parflesh Plain	54	24090	5	735	35	14643	23	8712
Hammer Hill Plain	40	14139	2	x	19	x	24	8085
Ouletteville Plain	59	23169	3	365	32	11911	33	10893
Pope Lease Plain	63	25115	3	550	32	12013	34	12552
Wayne South Plain	41	18715	2	x	22	x	27	10864
Beynon North Plain	31	15118	5	1697	15	5700	15	7721
Stahlville Plain	39	12279	3	245	18	5188	23	6846
Indian Springs Upland	24	15190	2	x	11	7754	14	x
Duck Lake Lowland	13	8231	0	0	10	6521	3	1710
Deadhorse Plain	11	8070	1	x	7	x	5	4080
Dalum Upland	19	8846	3	695	4	1115	14	7036
Tudor East Upland	31	13024	5	440	19	7741	16	4843
Balzac Plain	40	5097	0	0	13	1329	28	3768
Dalemead Plain	61	12257	3	230	29	3660	37	8367
Weed Lake Lowland	24	3717	2	x	17	2602	8	x
Kathryn Plain	131	17310	4	675	68	8283	67	8352
Irricana Plain	35	6550	1	x	18	x	20	3417
Strathmore Plain	38	6727	5	1313	16	2746	19	2668
Beiseker East Plain	23	6473	3	191	13	3222	10	3060
Grainger Plain	62	12364	4	185	33	6663	34	5516
Stirlingville Plain	56	9302	1	x	29	5213	32	x
Olds Plain	103	7635	0	0	67	4502	38	3133
Trail Creek Plain	47	3881	0	0	32	2074	17	1807
Raven Creek Plain	69	4317	3	165	45	2344	26	1808
Total (1)	**1,220**	**366,190**	**70**	**9,967**	**667**	**164,140**	**622**	**157,017**

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 23. 1996 Census of Agriculture – Forms of Weed Control on Summerfallow

Land system name	Summerfallow		Chemical only		Tillage only		Tillage and chemical combination	
	# farms	acres	# farms	acres	# farms	acres	# farms	acres
Rosebud River Valley	9	4148	3	2544	2	x	4	x
Strangmuir Plain	32	9696	3	370	10	2065	23	7261
Trefoil Plain	47	53376	7	4615	30	23912	25	24849
Parflesh Plain	45	14734	2	x	19	5446	27	x
Hammer Hill Plain	36	8849	3	431	20	4346	14	4072
Ouletteville Plain	39	15207	4	741	25	10654	17	3812
Pope Lease Plain	59	17918	2	x	30	11096	30	x
Wayne South Plain	30	9979	4	495	12	3116	19	6368
Beynon North Plain	20	8030	3	965	12	5537	5	1528
Stahlville Plain	33	7141	2	x	9	x	25	5027
Indian Springs Upland	18	7600	0	0	7	1545	12	6055
Duck Lake Lowland	9	6763	1	x	6	4146	3	x
Deadhorse Plain	15	4980	1	x	10	3400	4	x
Dalum Upland	21	8690	2	x	6	x	15	6613
Tudor East Upland	27	7576	0	0	8	1857	20	5719
Balzac Plain	37	3083	7	428	14	1281	16	1374
Dalemead Plain	61	10175	8	155	28	4256	31	5764
Weed Lake Lowland	13	1983	0	0	9	1542	4	441
Kathryn Plain	115	14021	7	880	50	4408	68	8733
Irricana Plain	33	5739	2	x	12	x	20	3197
Strathmore Plain	34	6138	4	750	15	3705	17	1683
Beiseker East Plain	12	2447	0	0	4	1028	8	1419
Grainger Plain	43	7501	0	0	19	3026	26	4475
Stirlingville Plain	41	6365	2	x	14	x	29	4674
Olds Plain	115	11298	7	1364	52	5278	65	4656
Trail Creek Plain	51	3823	6	499	16	1216	31	2108
Raven Creek Plain	79	8291	11	477	30	3390	40	4424
Total (1)	**1,074**	**265,551**	**91**	**14,713**	**469**	**106,250**	**598**	**114,252**

x – values not included due to confidentiality.

(1) – RSC watershed total does not include land systems where confidentiality applies.

Table 24. Change in Forms of Weed Control on Summerfallow Between 1991 and 1996 Census of Agriculture

Land system name	Summerfallow		Chemical only		Tillage only		Tillage and chemical combination	
	acres	percent	acres	percent	acres	percent	acres	percent
Rosebud River Valley	-1347	-25	x	x	x	x	x	x
Strangmuir Plain	-5440	-36	-1300	-78	-3963	-66	-177	-2
Trefoil Plain	-10568	-17	3805	470	-18976	-44	4603	23
Parflesh Plain	-9356	-39	x	x	-9197	-63	x	x
Hammer Hill Plain	-5290	-37	x	x	x	x	-4013	-50
Ouletteville Plain	-7962	-34	376	103	-1257	-11	-7081	-65
Pope Lease Plain	-7197	-29	x	x	-917	-8	x	x
Wayne South Plain	-8736	-47	x	x	x	x	-4496	-41
Beynon North Plain	-7088	-47	-732	-43	-163	-3	-6193	-80
Stahlville Plain	-5138	-42	x	x	x	x	-1819	-27
Indian Springs Upland	-7590	-50	x	x	-6209	-80	x	x
Duck Lake Lowland	-1468	-18	x	x	-2375	-36	x	x
Deadhorse Plain	-3090	-38	x	x	x	x	x	x
Dalum Upland	-156	-2	x	x	x	x	-423	-6
Tudor East Upland	-5448	-42	-440	-100	-5884	-76	876	18
Balzac Plain	-2014	-40	428	n/a	-48	-4	-2394	-64
Dalemead Plain	-2082	-17	-75	-33	596	16	-2603	-31
Weed Lake Lowland	-1734	-47	x	x	-1060	-41	x	x
Kathryn Plain	-3289	-19	205	30	-3875	-47	381	5
Irricana Plain	-811	-12	x	x	x	x	-220	-6
Strathmore Plain	-589	-9	-563	-43	959	35	-985	-37
Beiseker East Plain	-4026	-62	-191	-100	-2194	-68	-1641	-54
Grainger Plain	-4863	-39	-185	-100	-3637	-55	-1041	-19
Stirlingville Plain	-2937	-32	x	x	x	x	x	x
Olds Plain	3663	48	1364	n/a	776	17	1523	49
Trail Creek Plain	-58	-1	499	n/a	-858	-41	301	17
Raven Creek Plain	3974	92	312	189	1046	45	2616	145
Total (1)	**-100,640**	**-27**	**4,747**	**48**	**-57,890**	**-35**	**-42,765**	**-27**

x – values not included due to confidentiality.

n/a – percentage cannot be calculated.

(1) – RSC watershed does not include land systems where confidentiality applies.

4.0 Discussion

4.1 Trends in the Watershed

Overall trends in the watershed as noted when comparing the 1991 data with the 1996 data include:

- The **total number of farms** increased by 6% (211 farms), while the **total farm area** increased slightly by 0.3% (8787 acres) (Table 8).
- There was a decrease in the **cultivated land** by almost 2% (-36,621 acres), an increase in **total pasture** by 6% (34,044 acres) and an increase in **other land** by 16% (12,356 acres) (Table 8).
- The changes in cropped land saw the **wheat** acreage decrease by 6% (-38,171 acres), **barley** increase by 10% (60,533 acres), **canola** increase by 8% (16,613 acres), **total forage** increase by 4% (5,157 acres) and the **other crops** decrease by 16% (-14,330 acres) (Table 8).
- The number of **total cattle and calves** increased by 15% (almost 49,000 head), while **total pigs** decreased by almost 10% (-16,165 pigs), **total hens and chickens** increased by almost 9% (106,512 birds), **total sheep and lambs** decreased by 14% (-3232 animals) and **horses and ponies** increased by 22% (1384 animals) (Table 15).
- The **area sprayed with herbicides** increased 7% (92,625 acres), while the **area of commercial fertilizer applied** increased almost 12% (166,203 acres) (Table 12).
- The number of **farms that reported spreading manure** increased by almost 36% (367 farms) and the **area of manure spread** also increased by just over 36% (26,571 acres) (Table 12). Both **pounds of nitrogen from fresh manure** and **total tons of fresh manure produced** increased by almost 11% (Table 12).
- The number of farms using **crop rotation using a forage** increased 2.5 times, so that in 1996, 55% of all of the farms in the watershed reported using this practice on their farm (Table 18). The other conservation practices all showed a decrease in their use except **windbreaks and shelterbelts**, which increased slightly by 1% (10 farms) (Table 18). **Permanent grass cover** was added to the list of conservation practices in 1996 so it could not be compared to the previous Census, but 38% of the farms in the watershed in 1996 reported using this practice (Table 17).
- While the **area of land prepared for seeding** decreased slightly by 3% (-43,144 acres), the practices used to prepare the land changed significantly (Table 21). **Incorporating residue into the soil** decreased by 28% (-294,155 acres), while **retaining residue on the surface** increased by 24% (129,424 acres) and **no tillage** increased 263% or 3.6 times (121,587 acres) (Table 21).

- The **area of summerfallow** decreased by 27% (-100,640 acres) in the watershed (Table 24). The forms of weed control used on summerfallow varied from a 48% increase (4,747 acres) in **chemical only** weed control, while **tillage only** and **tillage and chemical combination** both decreased by 35% (-57,890 acres) and 27% (-42,765 acres), respectively (Table 24).

4.2 Links Between Land Management and Water Quality

Once the overall trends in the watershed are identified, the next step is to identify any linkages or inferences that can be made between the land use – Census of Agriculture databases, and the water quality in the entire watershed and on an individual land system basis. The linkages can be looked at in terms of **risk factors** or practices that improve or degrade water quality in relation to the land use. They can be described as:

1. Good practices that have a lower risk of water quality degradation, and
2. Poor practices that have a higher risk of water quality degradation.

4.2.1 Watershed

Overall in the watershed, when the data from each Census are compared, there are the following potential risk factors:

- An overall increase in the number of **total cattle and calves** in the watershed (Table 15).
- An increase in the number of **farms that spread manure**, as well as, the number of **acres on which manure is spread** (Table 12).
- An increase in the **lbs. of nitrogen from fresh manure**, as well as, the **total tons of fresh manure produced** (Table 12).
- A decrease in the **acres of summerfallow** is generally a positive risk factor because it reduces the movement of soil-attached nutrients and chemicals into streams and lakes; however, an increase in the summerfallow acres where **chemicals only** are used for weed control may be of concern for water quality (Table 24).
- An increase in the number of **acres where herbicides are sprayed**, as well as the number of **acres on which commercial fertilizers are applied** (Table 12).
- An increase in the acres of **other land** in the watershed may be explained by the wet spring in 1996, which would increase the amount of idle land (Table 8).

Other results that may reduce the risk to water quality include:

- An increase in the number of **acres where residue is retained on the surface** when preparing land for seeding, as well as, the acres of **no tillage** which reduces the risk of runoff carrying soil-attached contaminates to surface water. (Table 21).

- A significant increase in the number of farms **using a forage in crop rotation** as a conservation practice (Table 18).

Given the large proportion of agricultural land in the watershed, there is a significant opportunity to improve water quality through adoption of good land management practices.

4.2.2 Land Systems

Looking at individual land systems in the watershed may reveal possible water quality issues related to the land resources and trends from the Census data. Analysis of the data by individual land system provides the following insight in relation to possible risk factors to water quality:

- In the Rosebud River Valley with its significant eroded soils, it is positive to see the significant increase in **retaining residue on the surface** (Figure A-24) of land prepared for seeding and an increase in the farms using a **forage in crop rotation** (Figure A-22).
- The Pope Lease Plain also has significant eroded soils, and while there was an increase in the **incorporation of residue into the soil** (Figure A-23) when preparing the land for seeding, there also was a significant increase in the number of **acres of no tillage** (Figure A-25) and the number of farms using a **forage in crop rotation** (Figure A-22).
- In the Strathmore Plain while there was a slight decrease in the **acres of summerfallow** (Figure A-26), there was a large increase in the **acres where tillage only was used for weed control** (Figure A-28) on the summerfallow. This may be a concern with the coarse textured nature of the soils there.
- As would be expected, land systems with an increase in **cultivated acres** (Figure A-11) also showed an increase in the **area commercial fertilizer** (Figure A-14) was applied to. The land systems where this was seen included: Rosebud River Valley, Trefoil Plain, Duck Lake Lowland, Dalum Upland and Stahlville Plain.
- In the Beynon North Plain, the increase in the **herbicide sprayed area** (Figure A-13) may be a possible concern here due to the Solonetzic nature of the soil.
- In the Stahlville Plain, a large increase in **total cattle and calves**, **total pigs** and **total hens and chickens** shows up in an increase in **manure produced** (Figure A-18) in the land system. An increase in **cultivated land** (Figure A-11) in this land system, notably in **barley**, is consistent with the increase in pig production.
- Generally, large increases in **livestock** also showed an increase in the **area that manure was applied to** (Figure A-15). Land systems such as Strangmuir Plain, Hammer Hill Plain, Pope Lease Plain, Indian Springs Upland and Dalum Upland showed this association.
- In land systems that have saline areas such as Strangmuir Plain and Hammer Hill Plain, the increase in **acres spread with manure** (Figure A-15) and in **total fresh manure produced**

(Figure A-18) in these land systems should be noted for possible concerns related to excess salt in the manure which can affect soil structure and restrict plant growth.

4.2.3 Questioning the Results

From the data presented, questions are raised as to how to determine the basis for the trends and changes. The data may show significant changes in some areas, but the reasons for the change may not be obvious and would require local knowledge and input to fully understand what the data are showing. Examples of questions that may arise from looking at the data include:

- Was the 16% increase in the acres of **other land** in the watershed in 1996 due to the wet spring in that year? (Table 8).
- What was the cause of the large increase in **other livestock** (over 200,000 animals) in 1996 in the Stirlingville Plain due to? (Table 15).
- Many other questions that would also come out of a thorough analysis of the data with local input.

4.3 Limitations of the Data

In the agricultural profiles that were generated (Tables 6 to 24), an "x" has been inserted where the values could not be included due to confidentiality concerns. In cases where there are only a few responses to a particular question, Statistics Canada does not release that data to its clients to prevent any chance of linking responses to individual respondents. The purpose of the data is to get a general idea of agriculture in the area, not to look at specific, individual operations. In the tables where totals have been calculated, this calculation is made without including the suppressed values.

Comparison of the 1991 and 1996 data is limited where changes were made to the questions asked from one Census to the other. Changes made to the Census questions include:

- The possible responses to the question asking the ***area of land prepared or to be prepared for seeding*** in 1991 were: **conventional tillage**, **conservation tillage** and **no tillage** followed by brief descriptions of each. In 1996 the possible responses were rephrased to: **tillage that incorporates most of the crop residue into the soil**, **tillage prior to seeding that retains most of the crop residue on the surface** and **no tillage prior to seeding**. Essentially the question is being asked, with the 1996 version providing clearer statements of the three possible responses; therefore, the responses can be compared.

  This was also the case with the question regarding ***land use***. In 1991, respondents were asked for the area of **improved land for pasture or grazing** and **unimproved land for pasture,**

grazing or hay. In 1996, those were modified to **tame or seeded pasture** and **natural land for pasture**, respectively. Again, the change in the wording of the land use types is done for better clarification for the respondents and does not affect the comparability of the data.

Note that in both of these cases, the 1996 wording only has been used in this report.

- The question about the ***area of land on which manure was applied*** asked for the total area in 1991. In 1996 this question asked what the area was for each of four methods: **solid spreader**, **irrigation**, **liquid spreader – on surface** and **liquid spreader – injected**. Table 11 gives the results from the 1996 Census for this question. Evaluation by Statistics Canada (1998) determined that the four application methods could be summed to give a total area of manure application in 1996. Initial thought was that there might be double counting of land where more than one manure application method was applied on the same land. Further analysis and follow-up phone calls to a number of respondents found that usually only one method of manure application is used on a parcel of land and that the respondents understood the question and answered it correctly.
- In the 1991 questionnaire, the ***land management practices*** included **other practices** with a space left for the practice to be specified. In 1996, the **other practices** response was not given as an option, but **permanent grass cover** was. Therefore, these two responses could not be compared in the analysis and are not found in Table 12.

A factor, which may have altered some of the responses to the Census questions, is the earlier Census date in 1996. In 1991 the Census date was June 4, 1991, while in 1996 the Census date was May 14, 1996. By changing the date of the Census to three weeks earlier in 1996, some of the information given including crops seeded (or seeding intentions) and the percent of calving that had taken place may have been affected. This in turn affects the comparability of the data and could account for some of the changes.

4.4 Future Study to Compare Land System – Census of Agriculture Databases to Local Data

Analysis of the land system – Census of Agriculture databases provides information from Census data for the RSC watershed related to production and land management. The next step is to compare this information with sources of local data such as water quality measurements and other data. This local data could be useful to validate the effectiveness of the land system – Census of Agriculture databases for describing the nature of agriculture and management practices that may affect the environment. The linkage of water quality to land resource characteristics and land management practices is important for raising awareness and providing education on water quality issues at the local level.

Sampling for water quality parameters such as total phosphorus, bacteria and electrical conductivity (EC) has been conducted at specific points within the watershed. By overlaying these points on the watershed map and looking at the results of these samplings, there may be some interesting and useful linkages between the two sources of data. Presenting this information could be a useful tool for raising awareness and providing education to create the motivation needed for practice change at the local level. A Terms of Reference for a water quality mapping project is currently being prepared which will outline a future project of this type to provide the tools for the education and awareness of the linkages.

5.0 Recommendations

- The land system – Census of Agriculture databases are a useful tool to tie land use and land management to water quality within the RSC watershed. Additional land use data and water quality data, however, are required to further understand the association between the two. Additional data may come from detailed surveys, on-farm visits or from Census data of the non-agricultural area of the watershed (non-farming population of the watershed). Obtaining non-agricultural Census data is possible, but further investigation is needed to determine the appropriate methodology and level of detail for these data.
- In order to apply the information at the local level, a water quality mapping project (as described in section 4.4) that would link the land system – Census of Agriculture databases with local water quality information should be undertaken. The local data could also be useful to validate the effectiveness of the land system – Census of Agriculture databases for describing the nature of agriculture and management practices that may affect the environment. The linkage of water quality to land resource characteristics and land management practices is important for raising awareness and providing education on water quality issues at the local level.
- Subsequent to the water quality mapping project mentioned above, a community-based watershed planning initiative is recommended. Once awareness is raised concerning water quality issues, information regarding appropriate land use practices within the watershed can be addressed. As well, the Alberta Water Quality Index for Agriculture (Small Streams) could be calculated for the watersheds to assist with community-based planning.

- From the data presented, questions are raised concerning how to determine the cause of the trends and changes. Expand upon and present these questions (outlined in section 4.2.3) in presentations made at the local level. With a thorough analysis of the data and local input, it would be possible to answer some of these questions. By posing these questions locally, the local knowledge and experience would assist in explaining the data and understanding the trends, thereby making the data even more useful.
- Work on risk factors that improve or degrade water quality in relation to land use, should continue as a vehicle to communicate the land management practices that benefit water quality and agricultural production, and in turn the agricultural community.

6.0 References

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Appendix

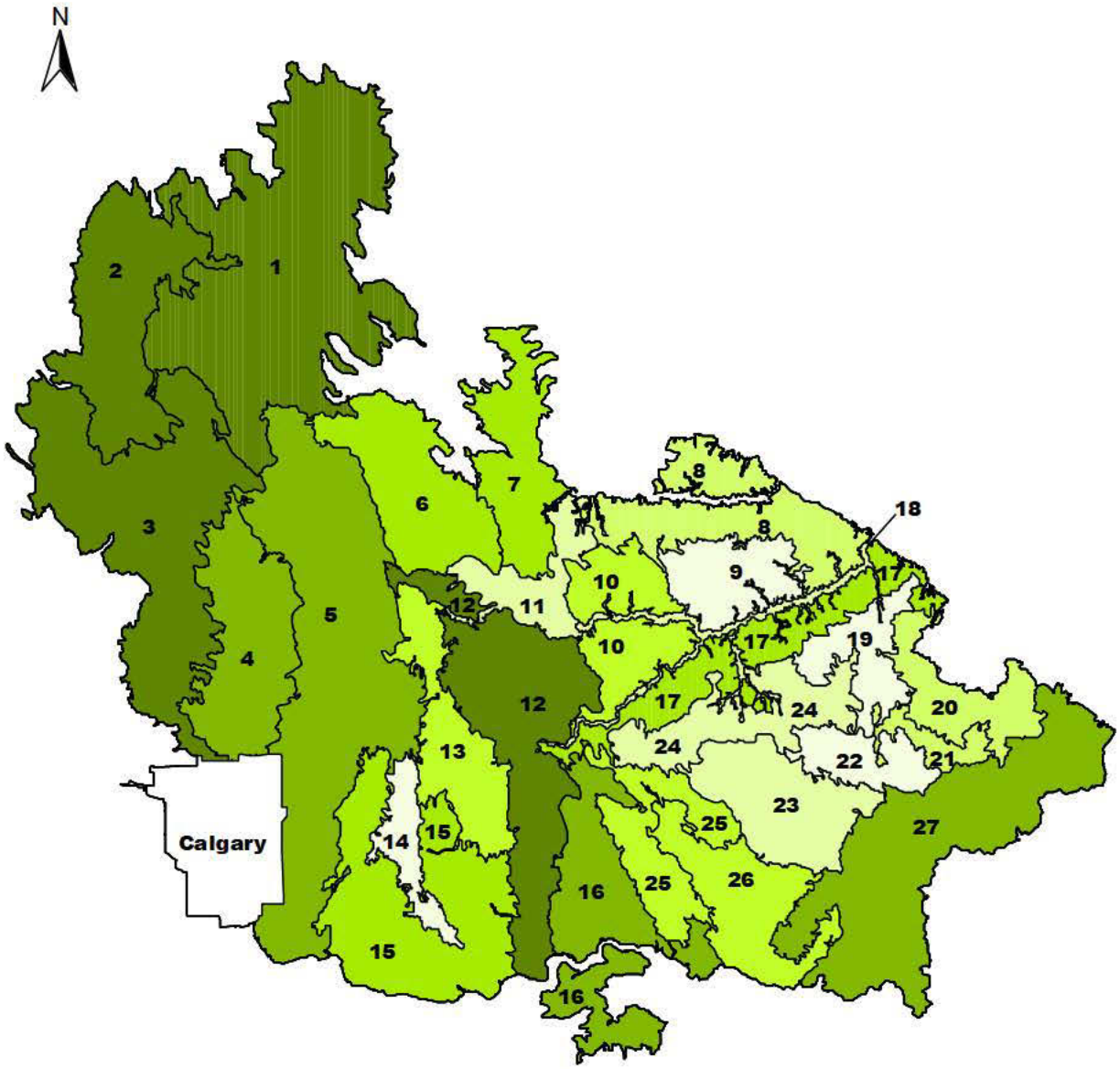

Figure A-1. Tame or seeded pasture (acres) - 1996

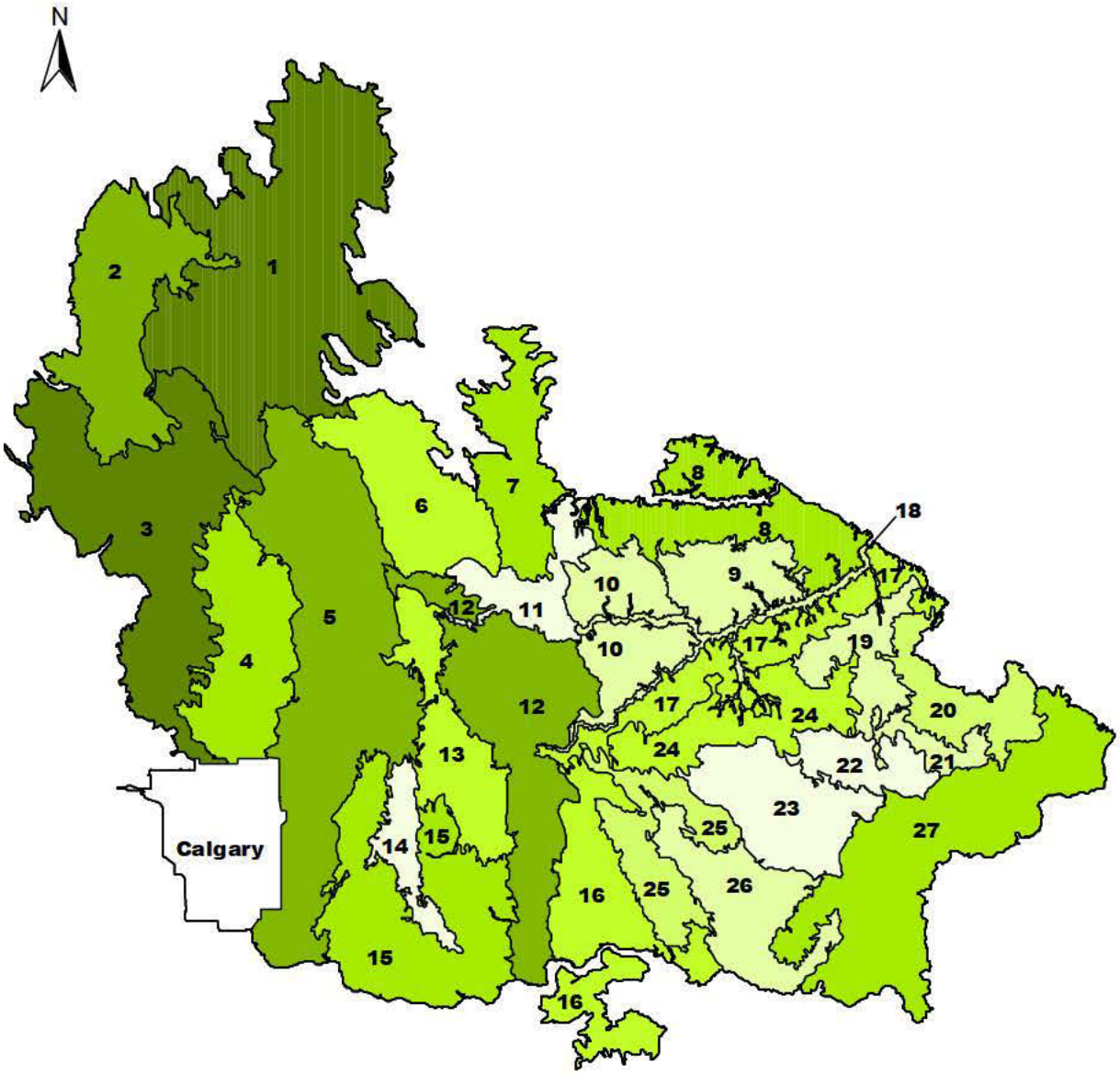

Figure A-2. Natural land for pasture (acres) - 1996

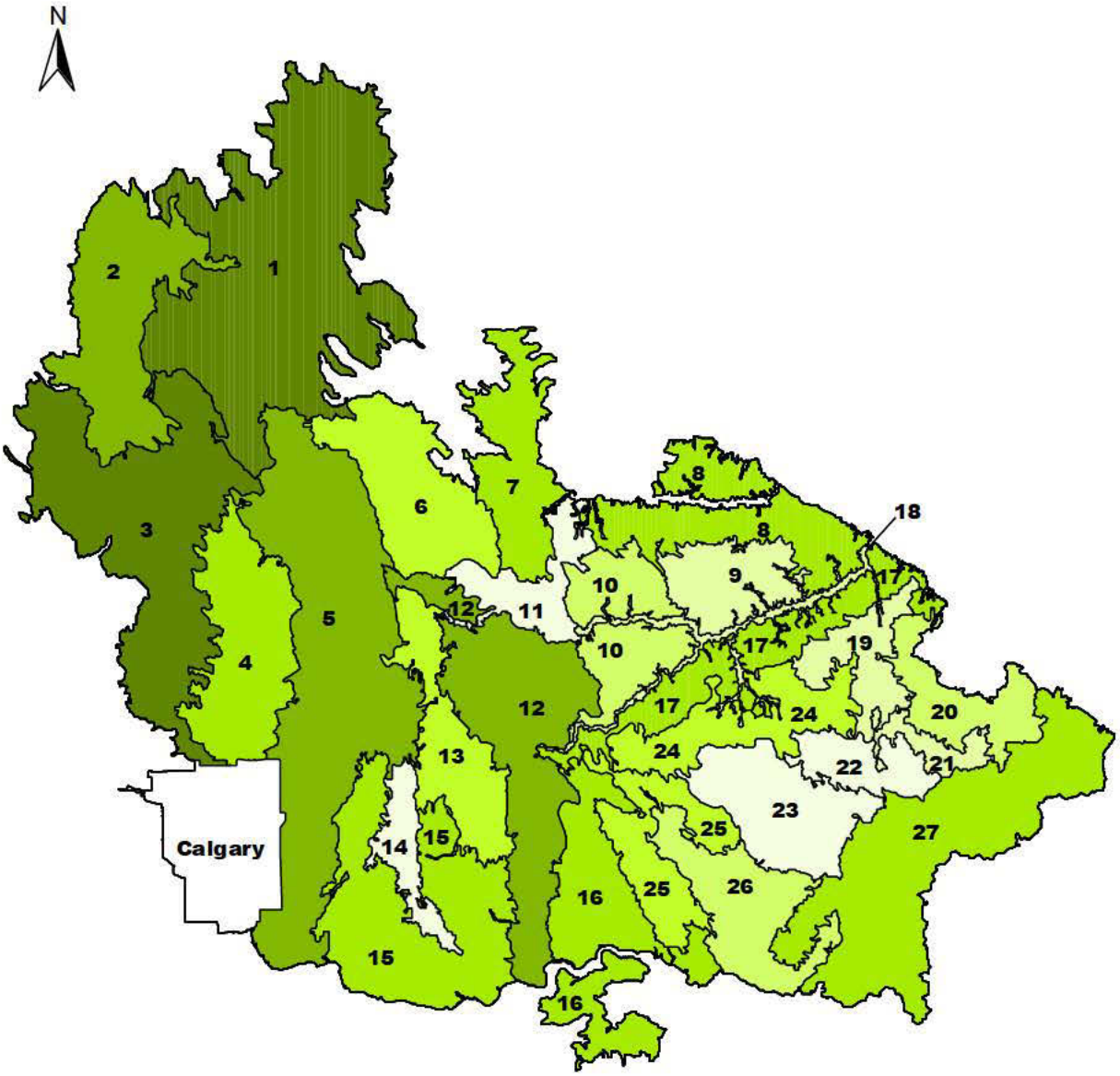

Figure A-3. Total pasture (acres) - 1996

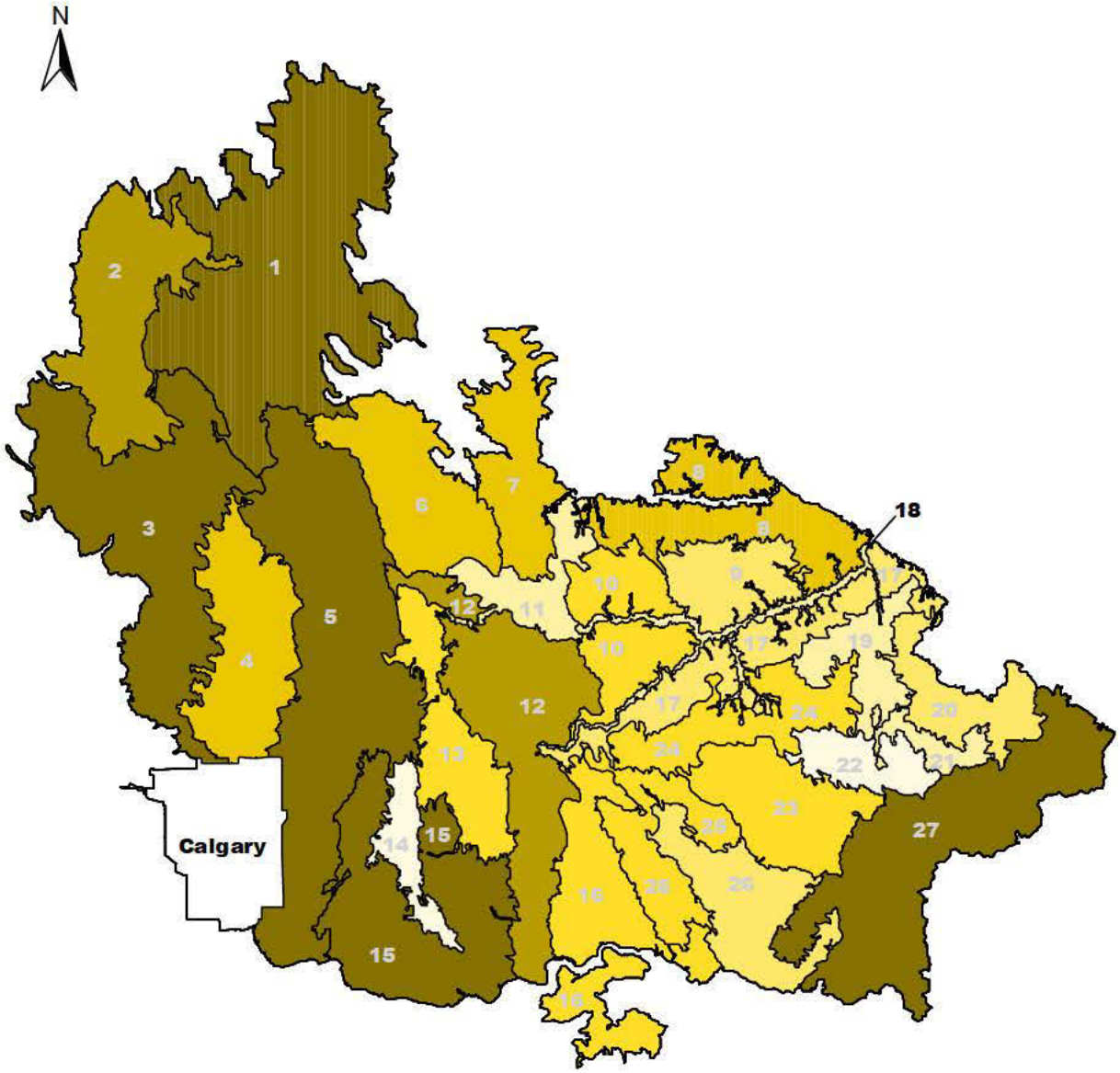

Figure A-4. Cultivated land (acres) - 1996

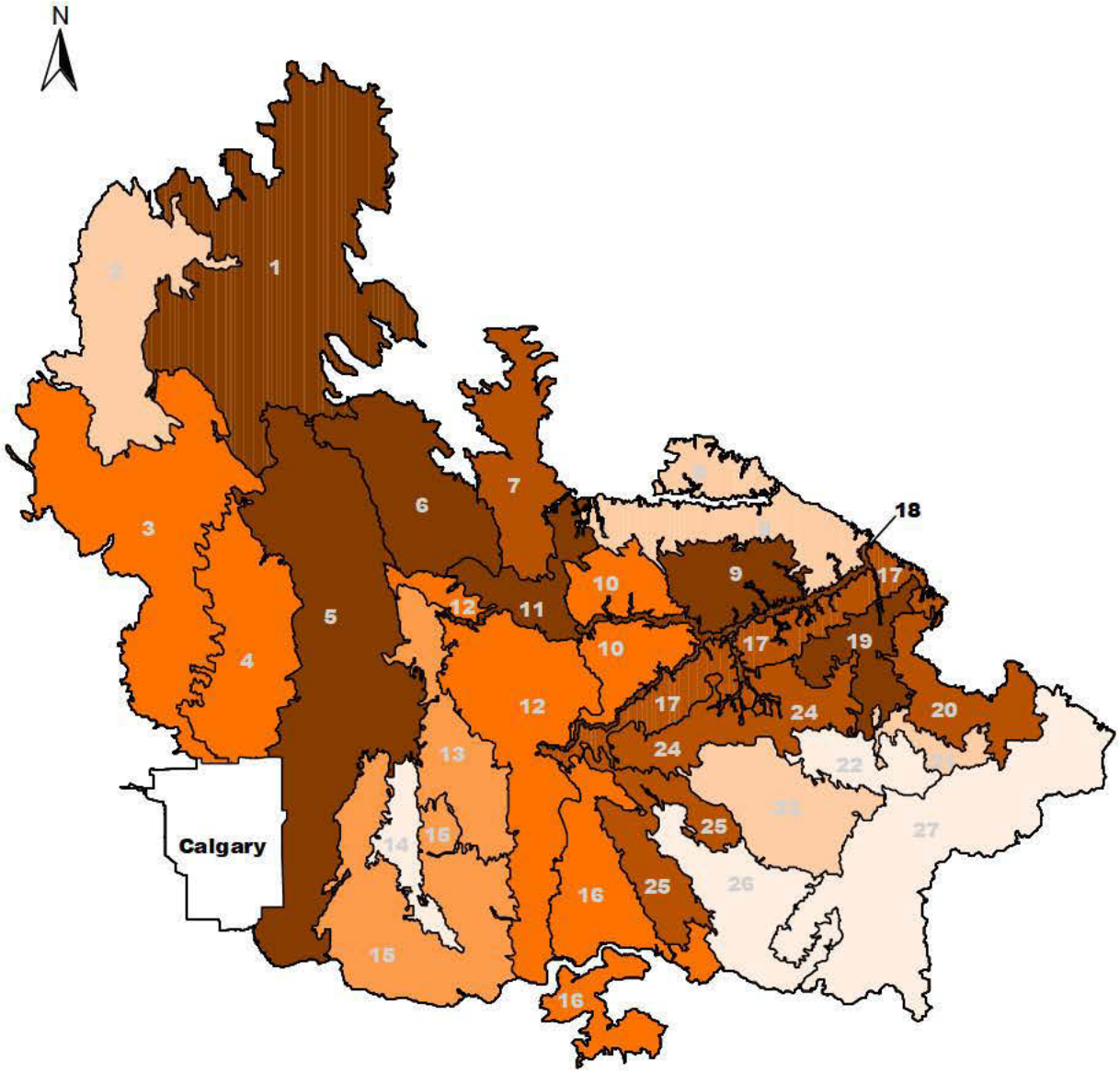

Figure A-5. Herbicide sprayed area as % cultivated land - 1996

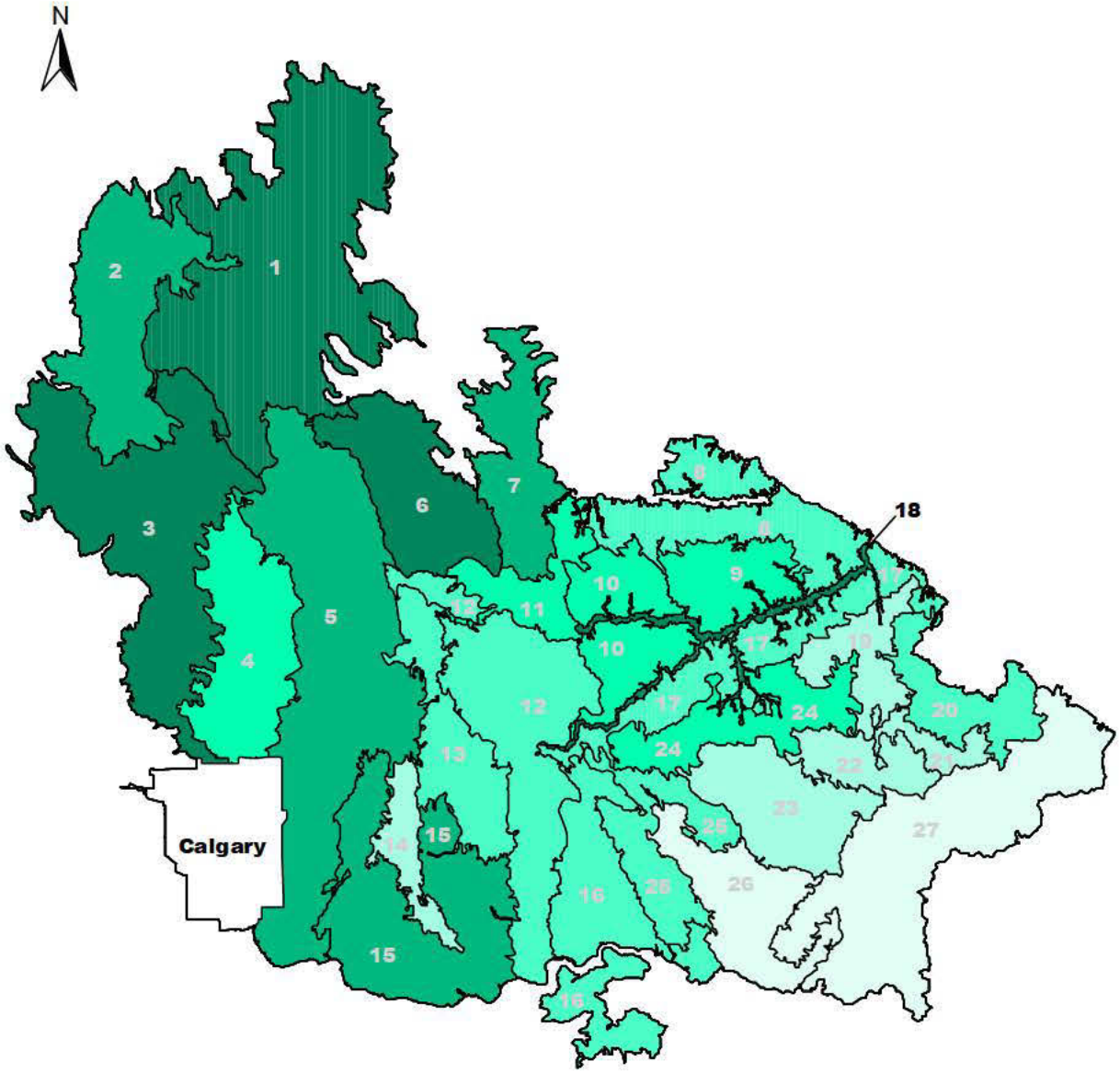

Figure A-6. Commercial fertilizer applied area as a % of cultivated land - 1996

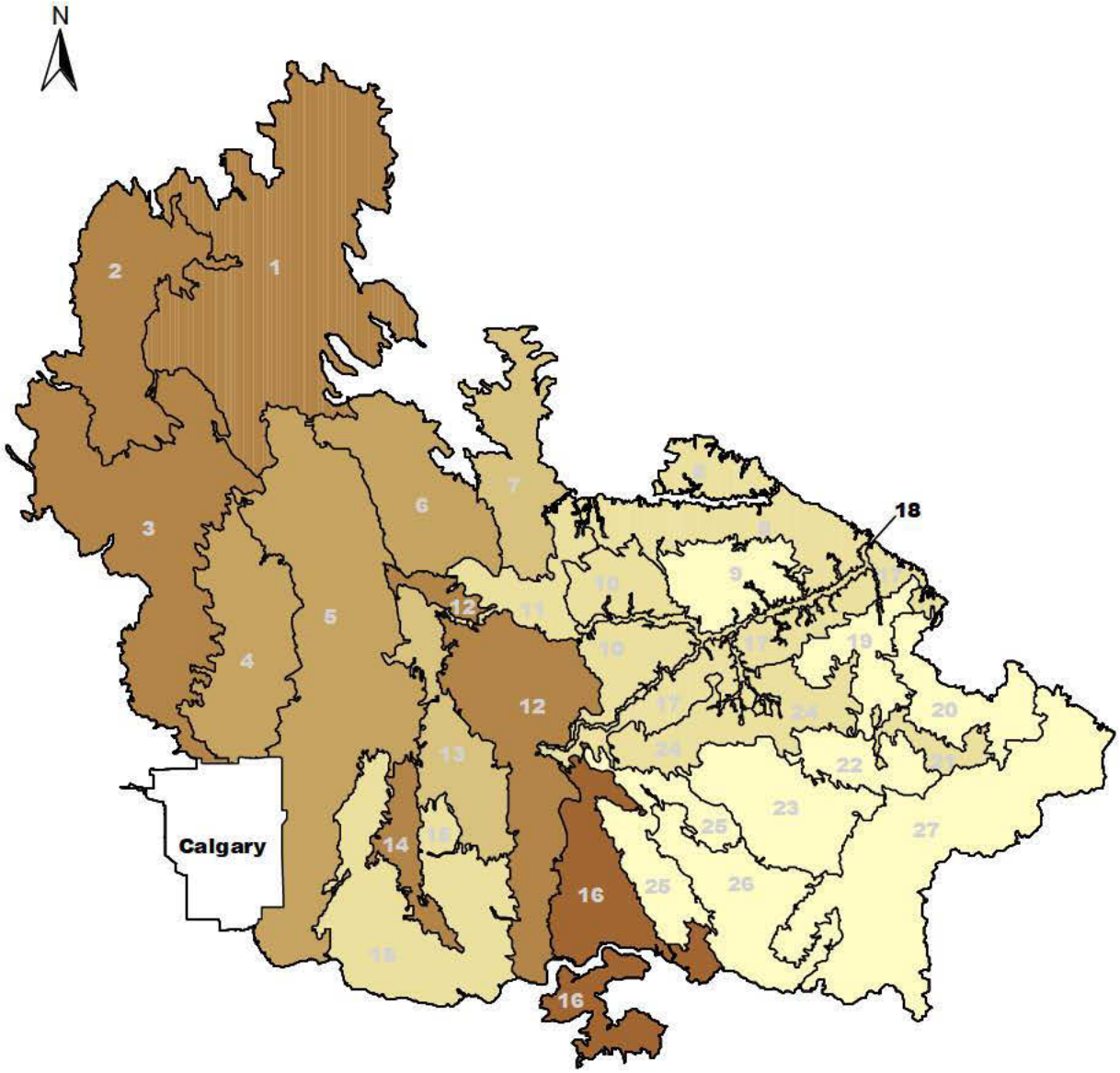

Figure A-7. Manure applied area as % cultivated land - 1996

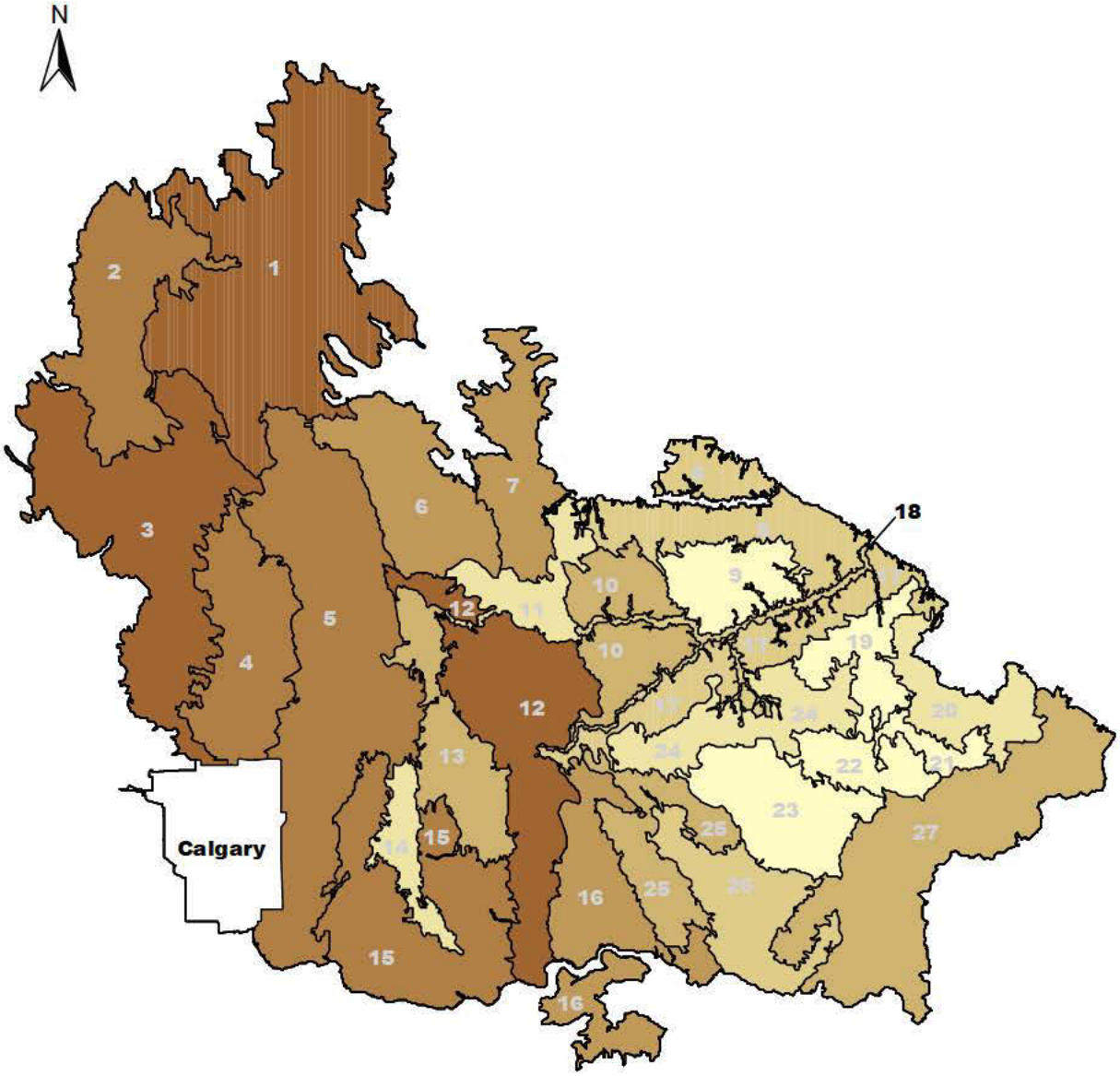

Figure A-8. Total cattle and calves - 1996

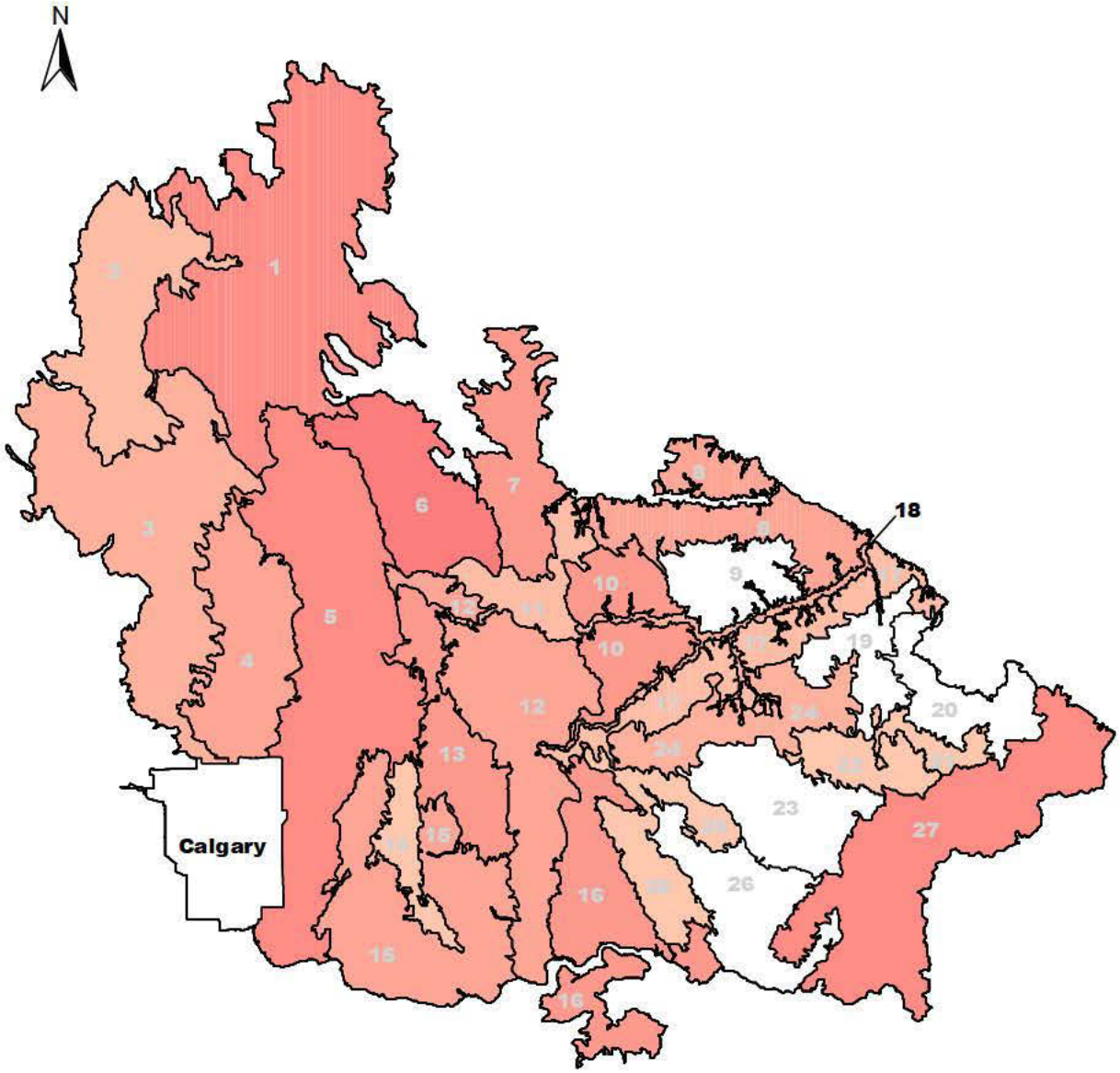

Figure A-9. Total pigs - 1996

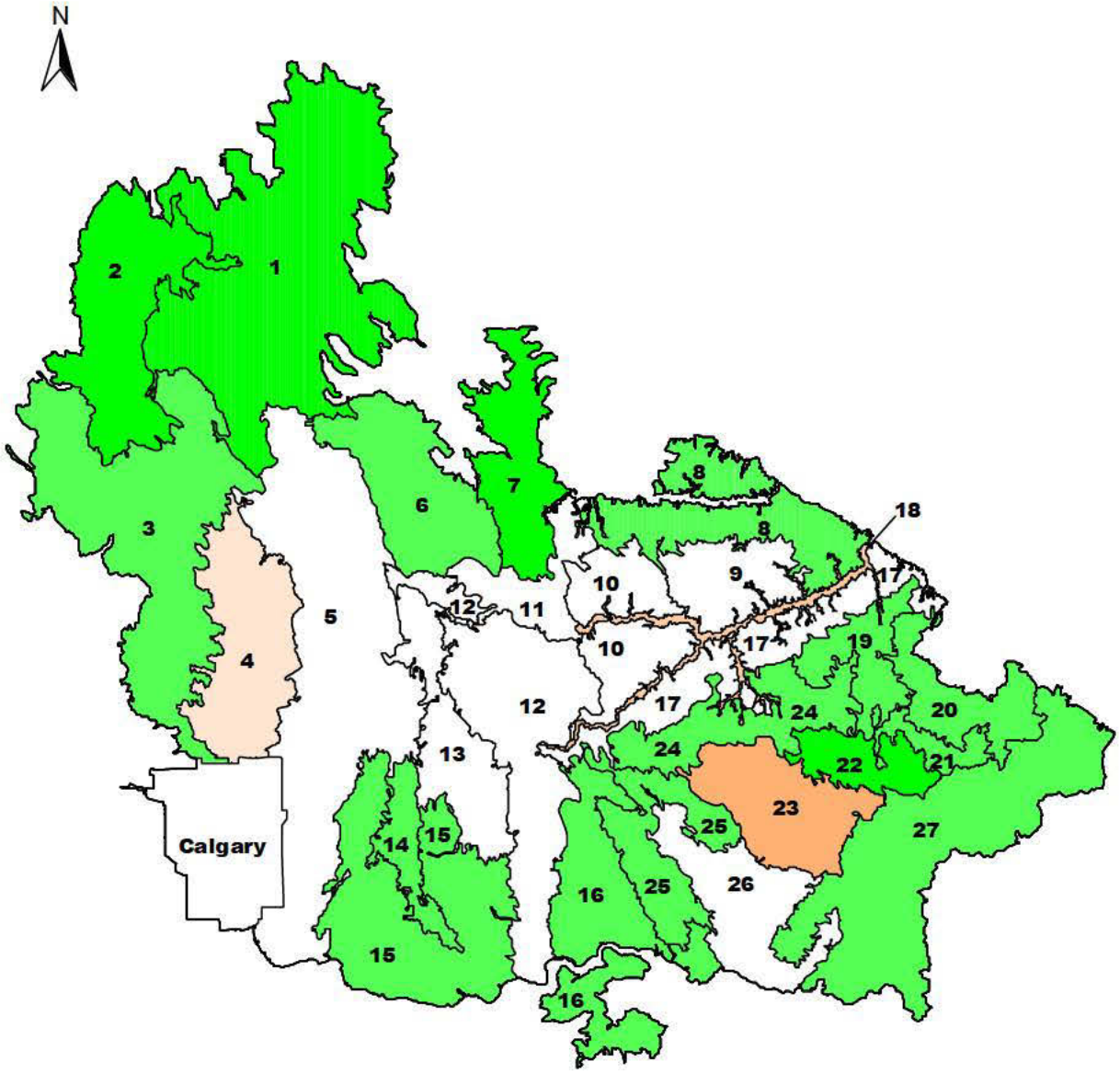

Figure A-10. Change in total pasture 1991-1996

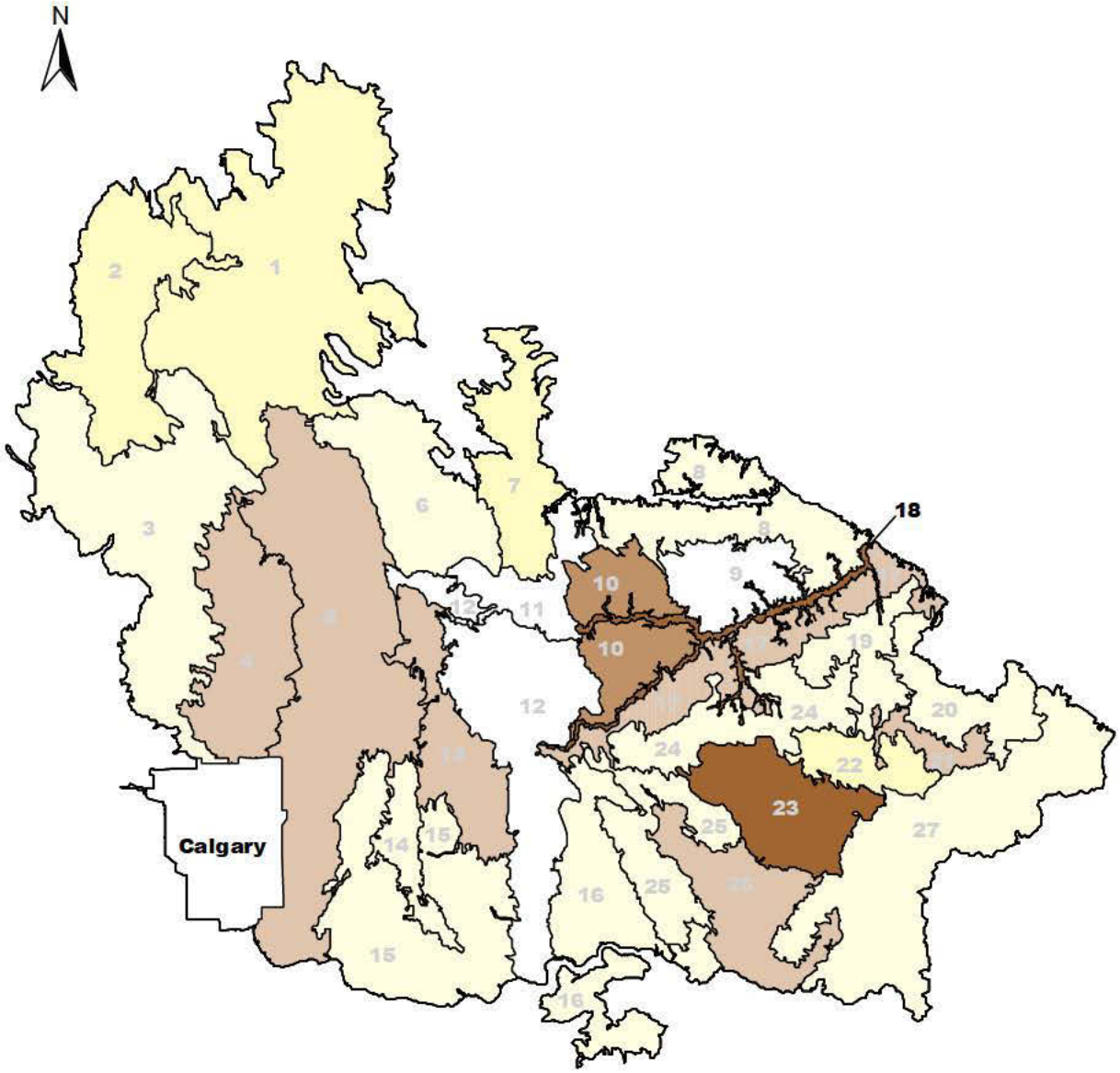

Figure A-11. Change in cultivated land 1991-1996

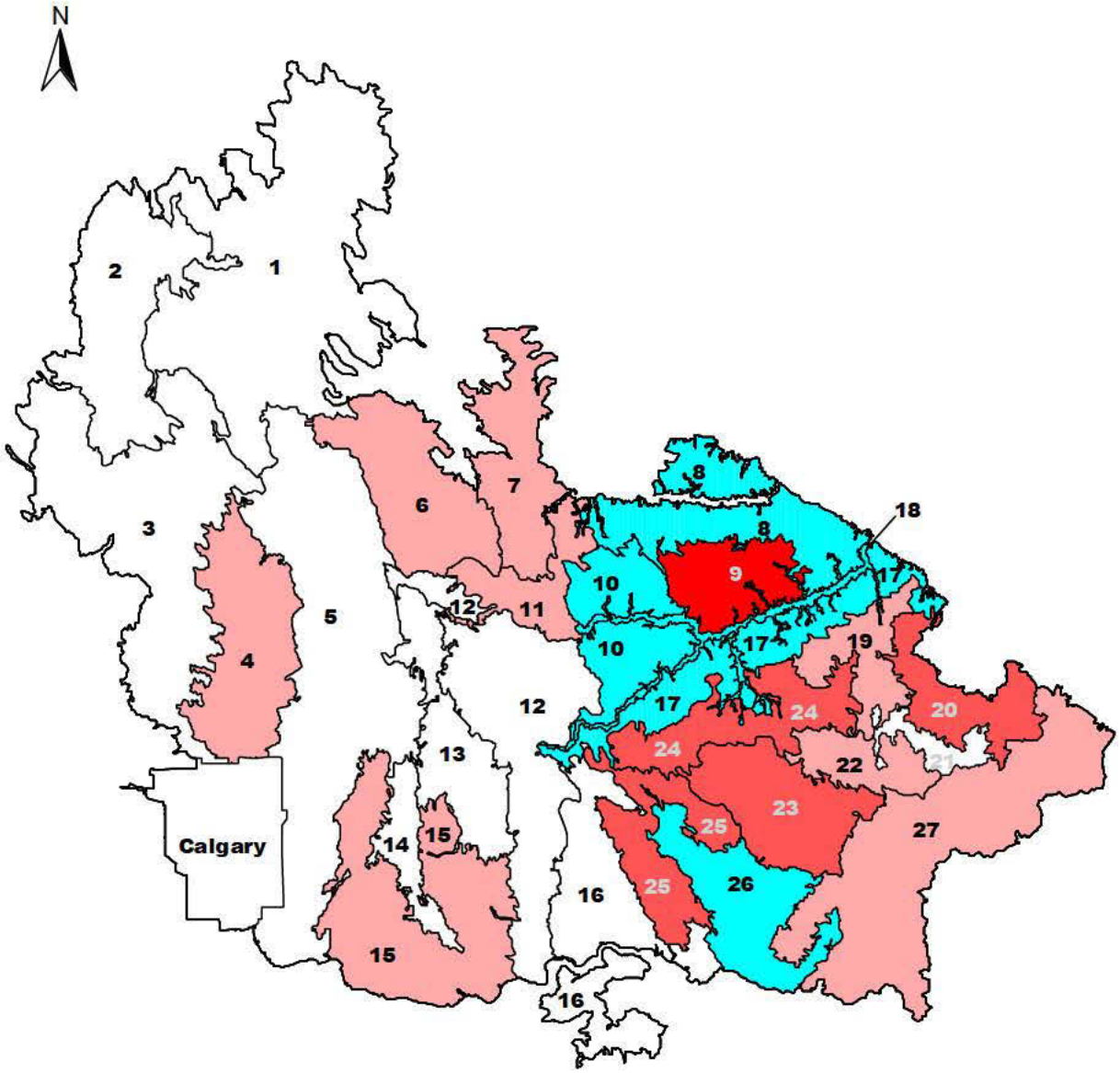

Figure A-12. Change in other land 1991-1996

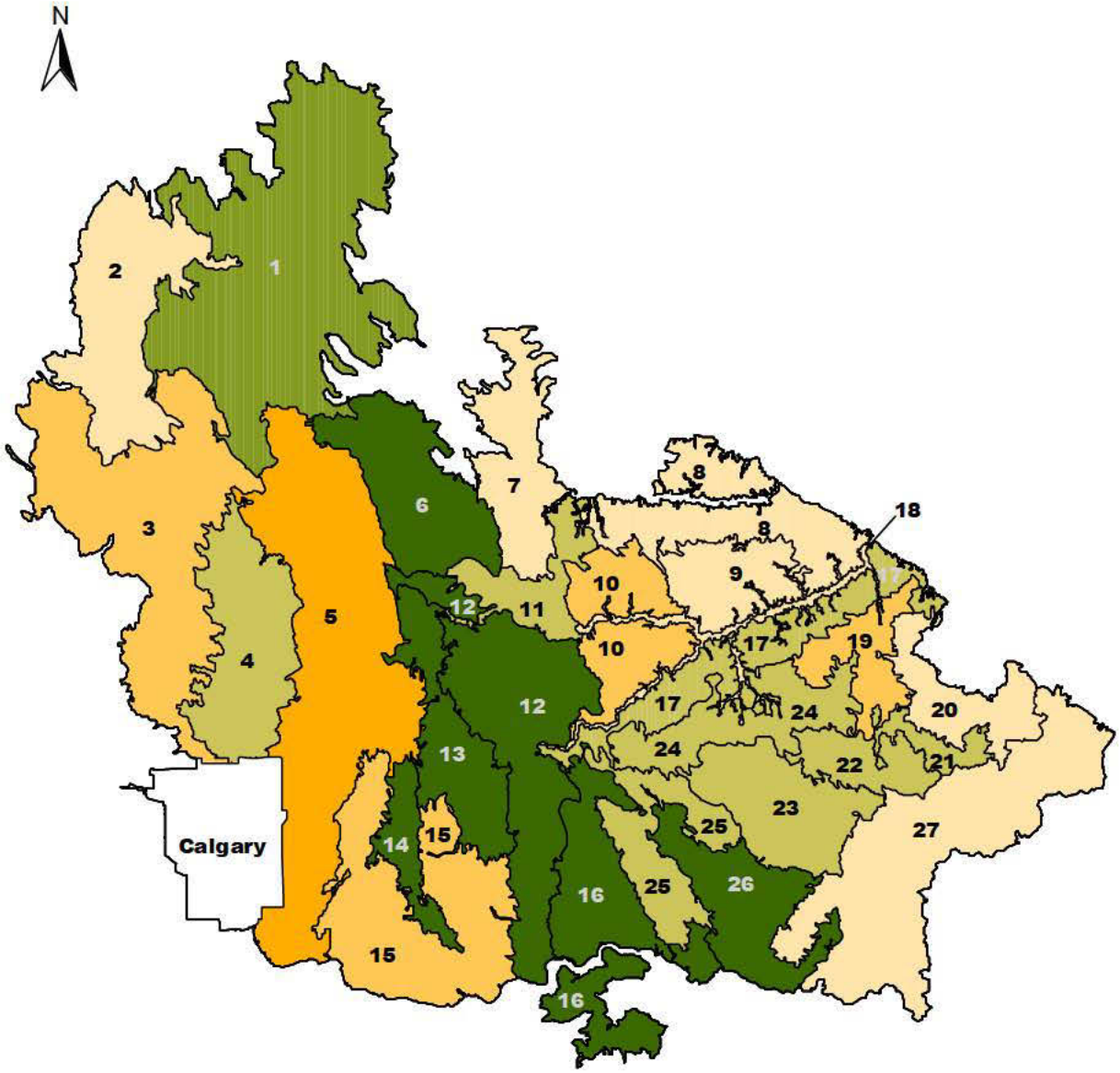

Figure A-13. Change in herbicide sprayed acres 1991-1996

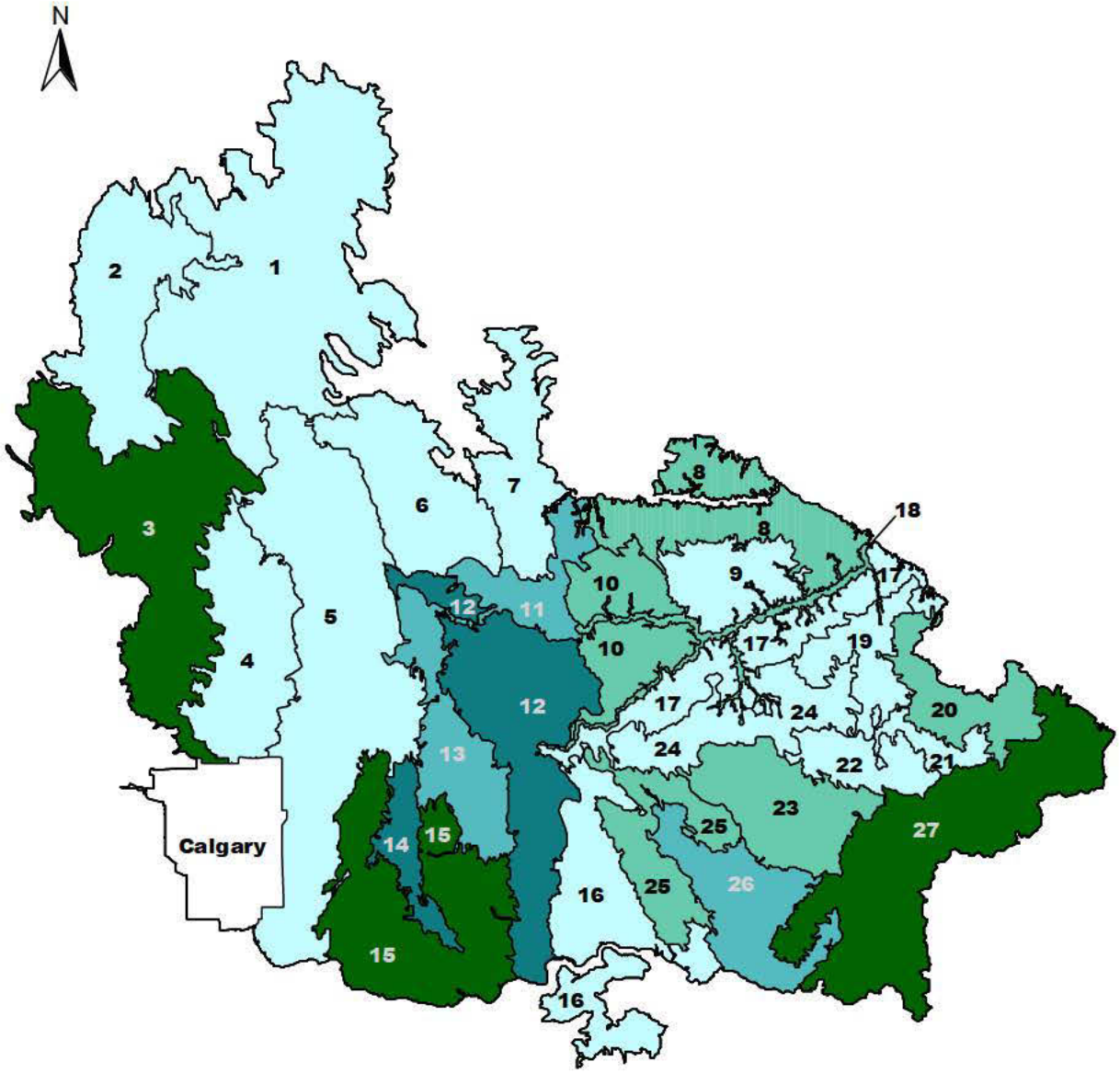

Figure A-14. Change in commercial fertilizer applied acres 1991-1996

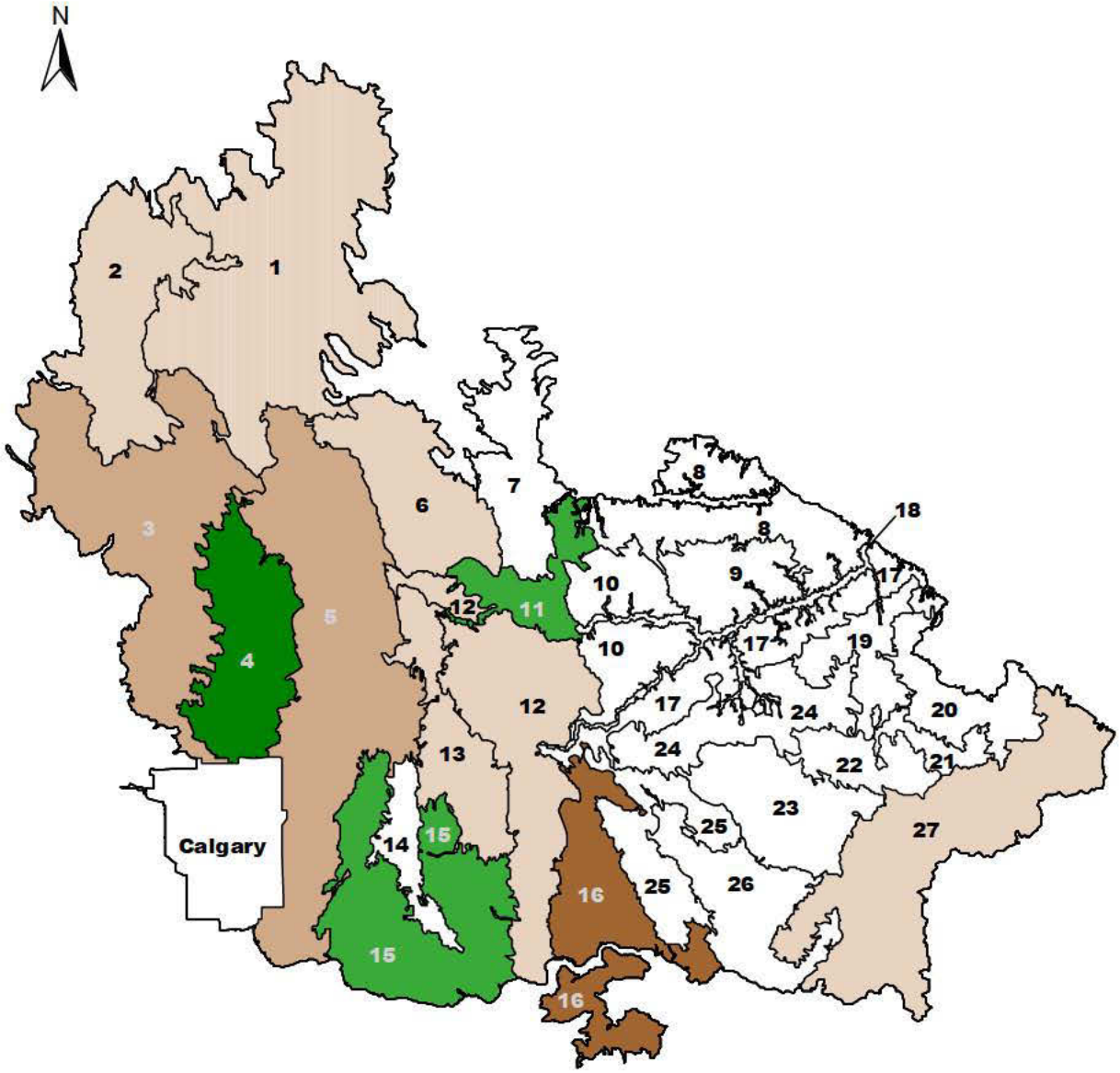

Figure A-15. Change in acres spread with manure 1991-1996

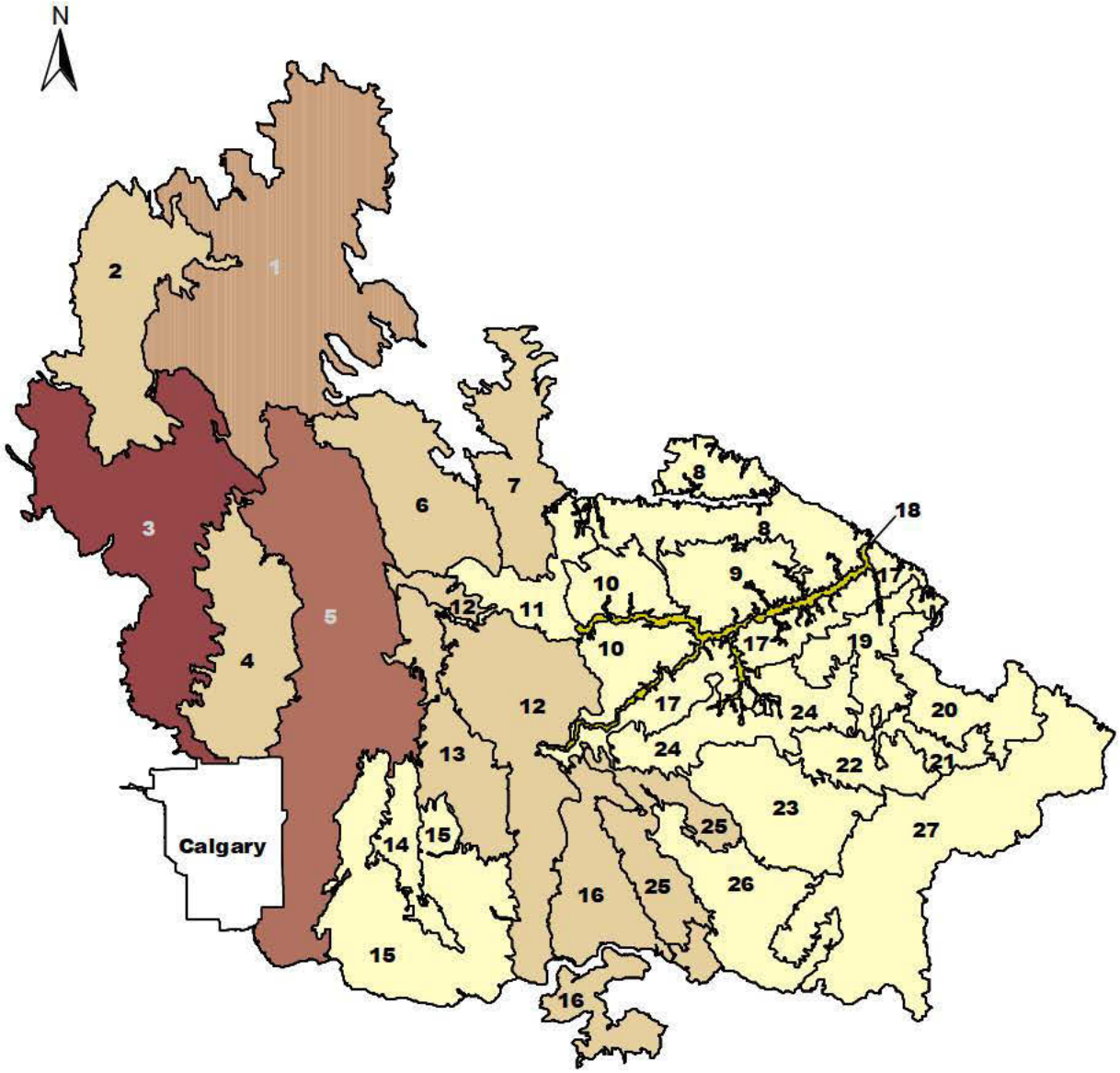

Figure A-16. Change in number of farms spreading manure 1991-1996

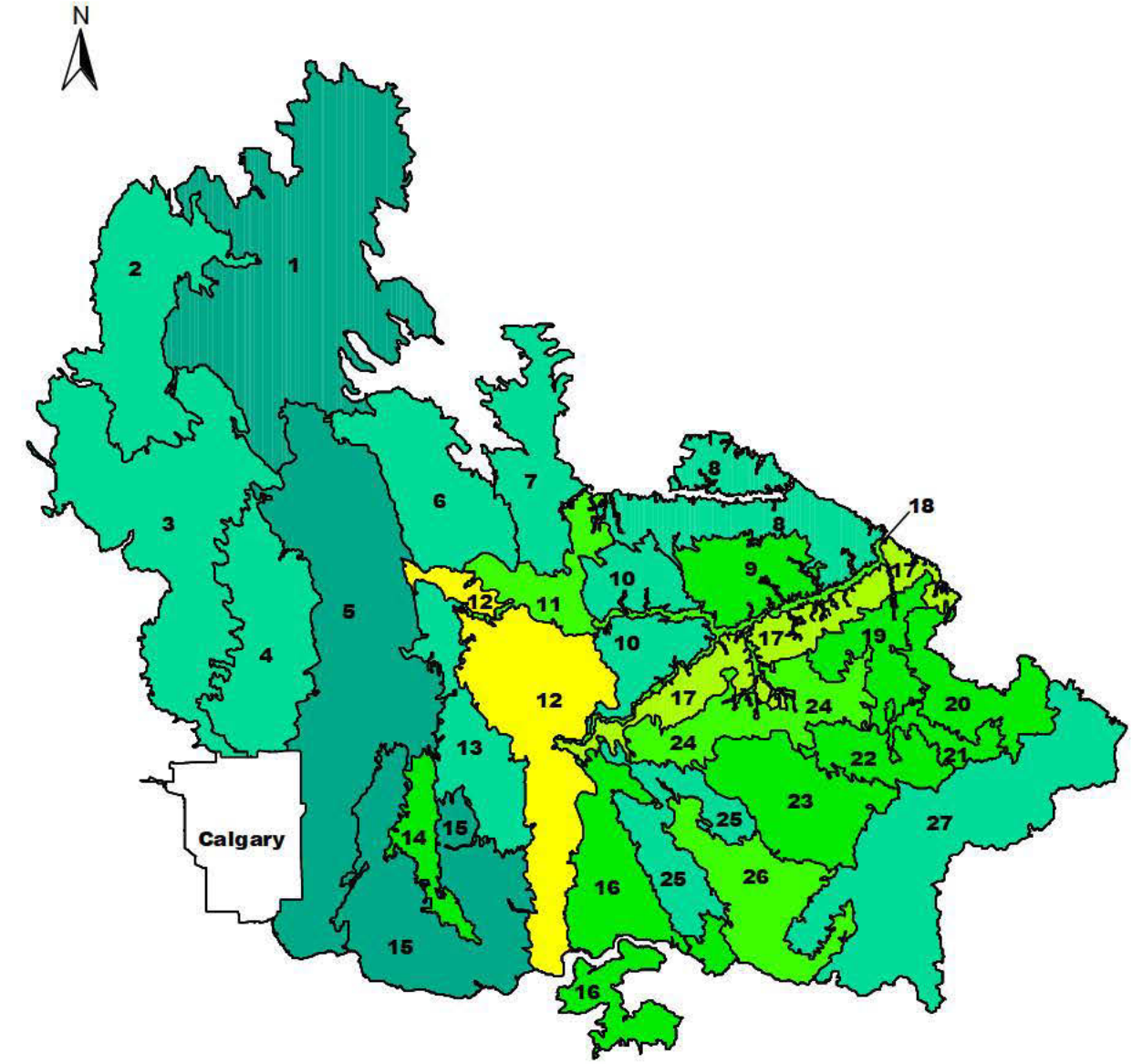

Figure A-17. Change in lbs. nitrogen from fresh manure 1991-1996

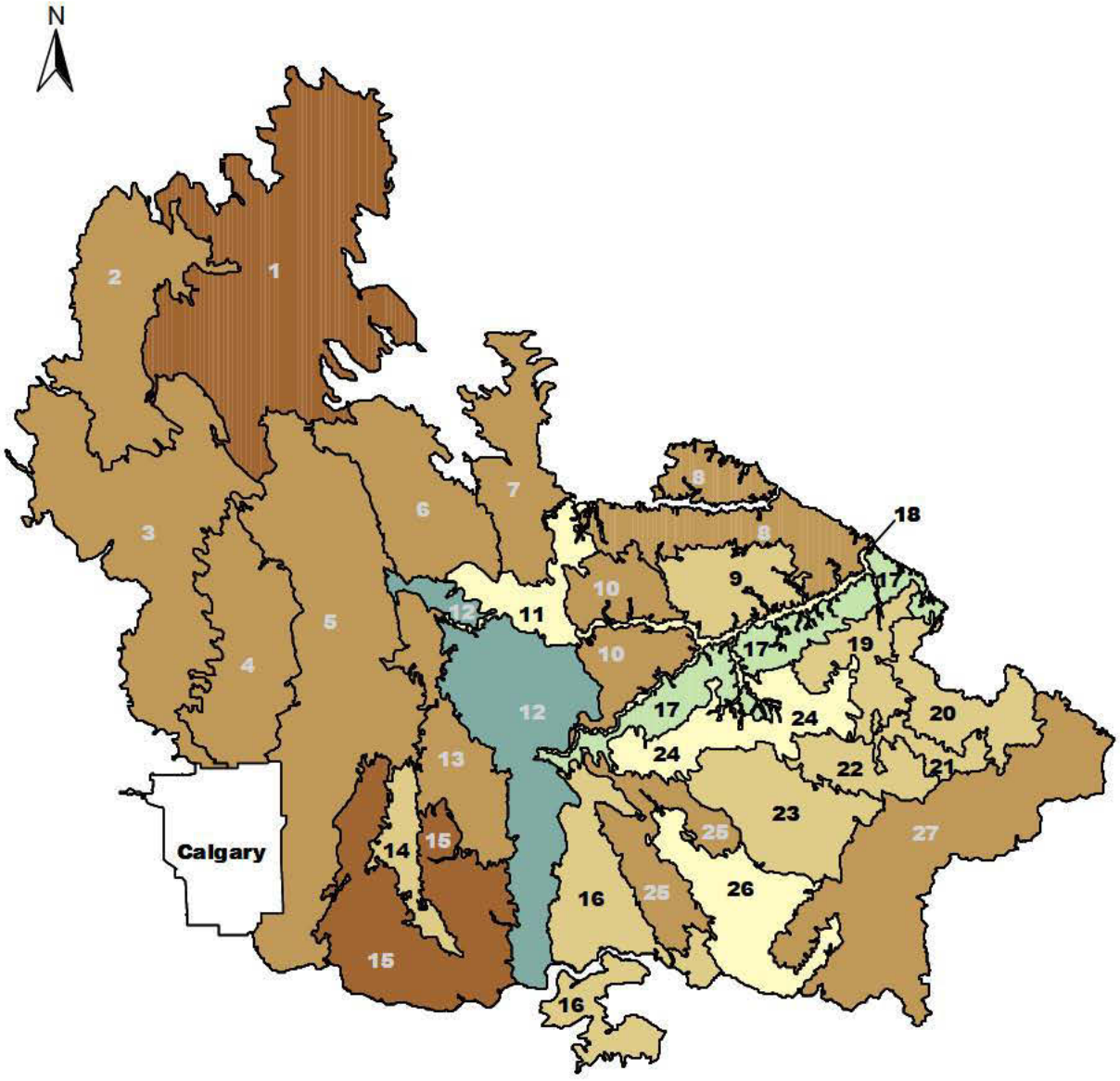

Figure A-18. Change in tons total fresh manure produced 1991-1996

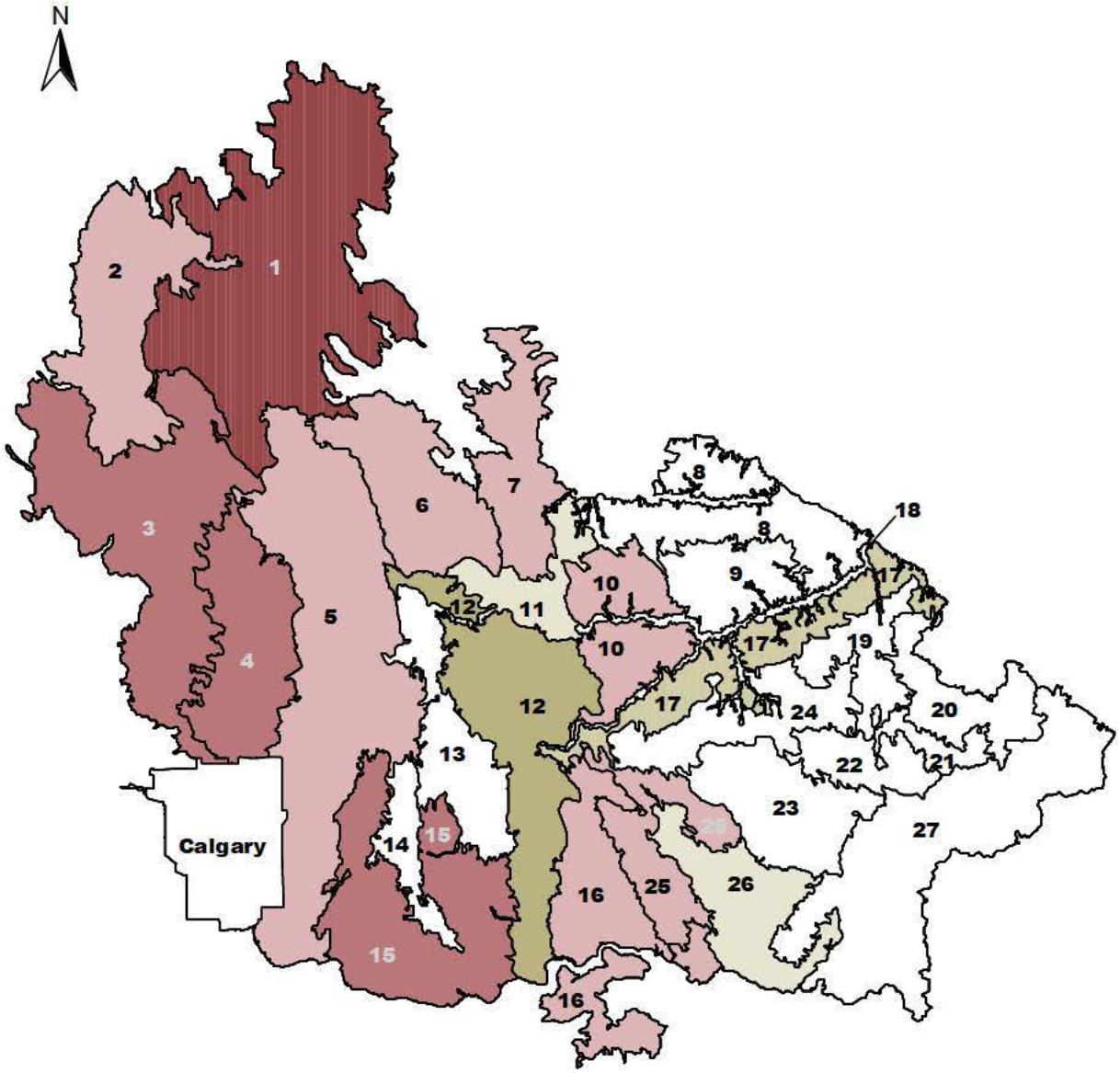

Figure A-19. Change in total cattle and calves 1991-1996

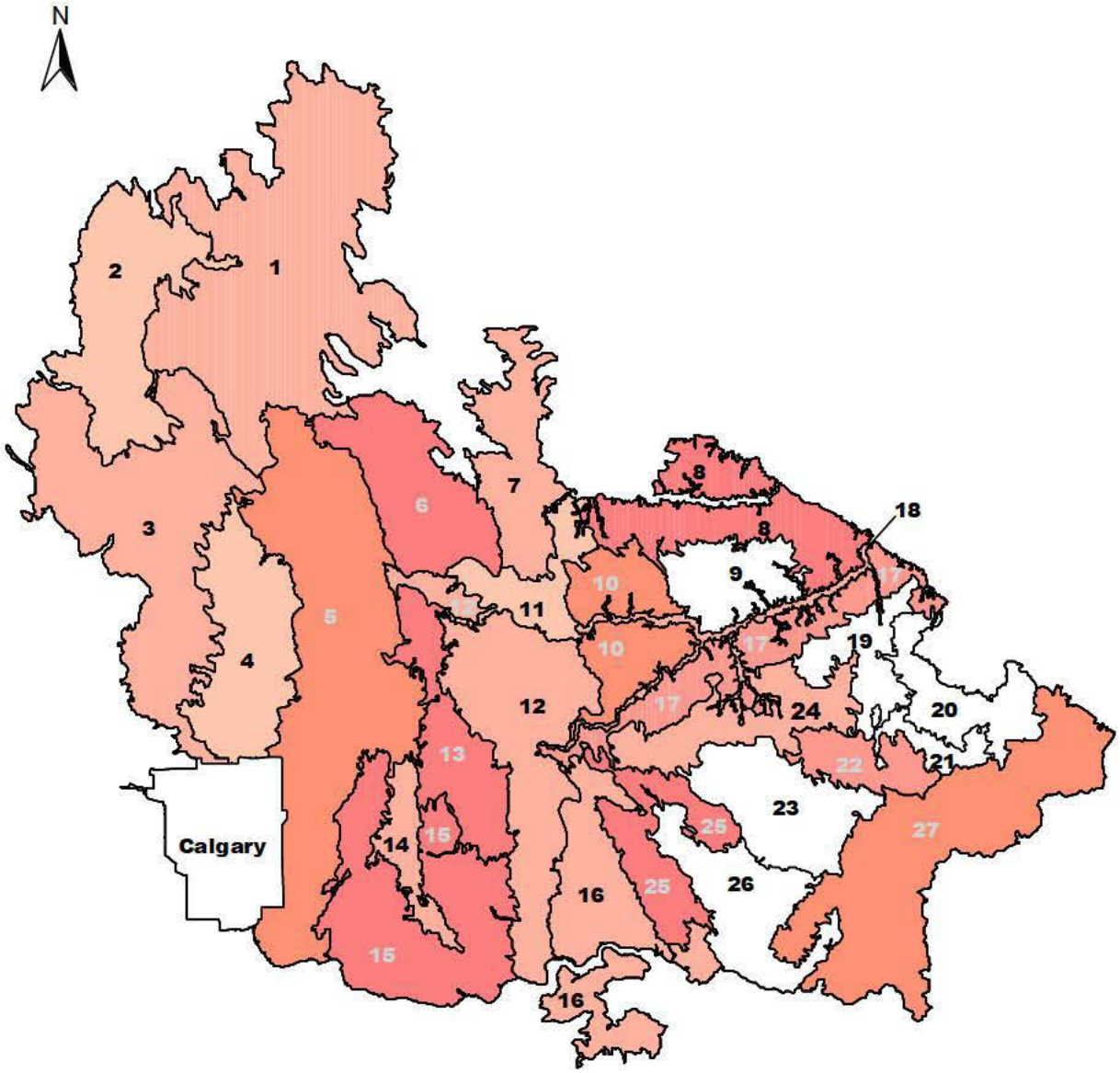

Figure A-20. Change in total pigs 1991-1996

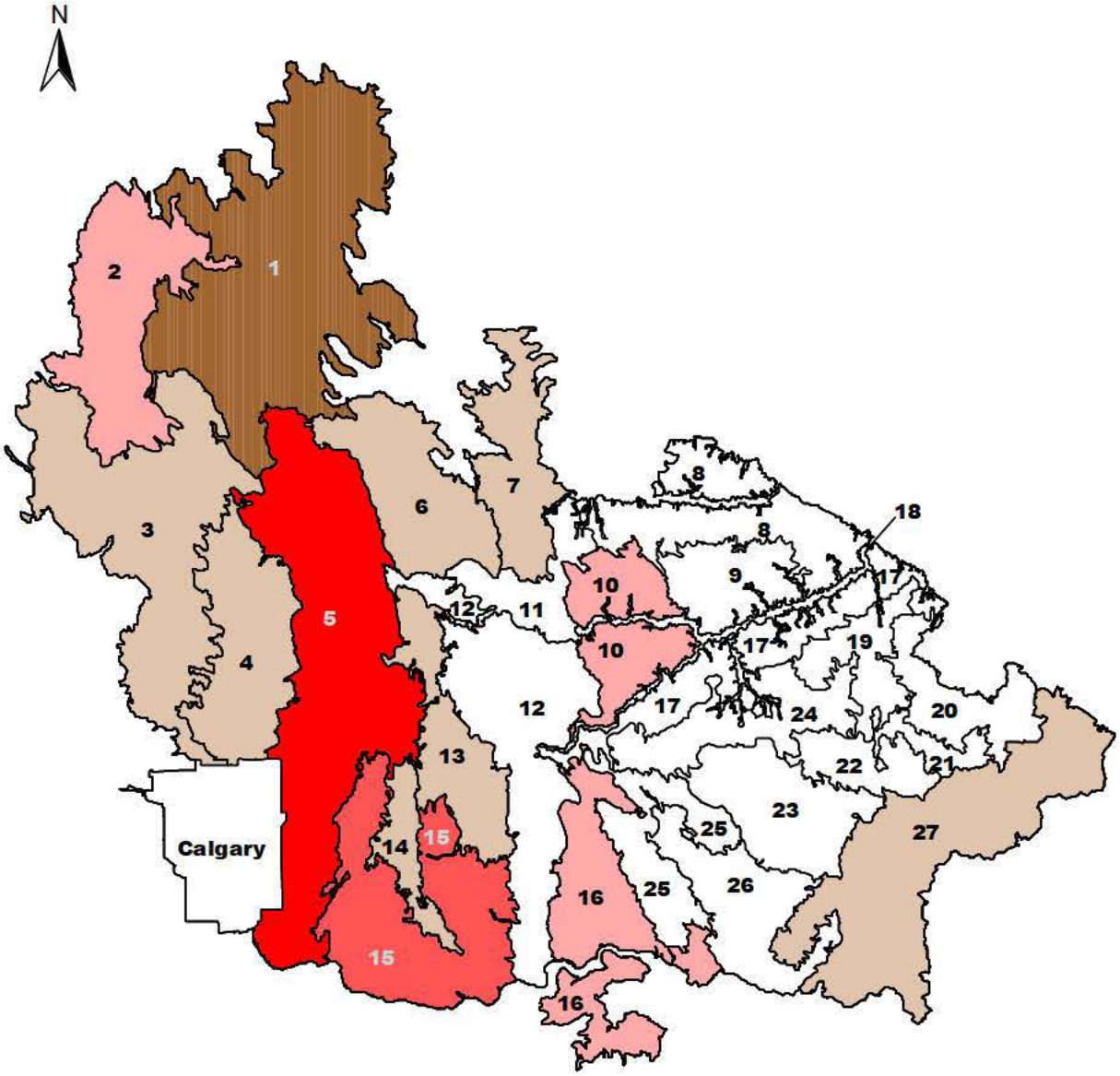

Figure A-21. Change in total hens and chickens 1991-1996

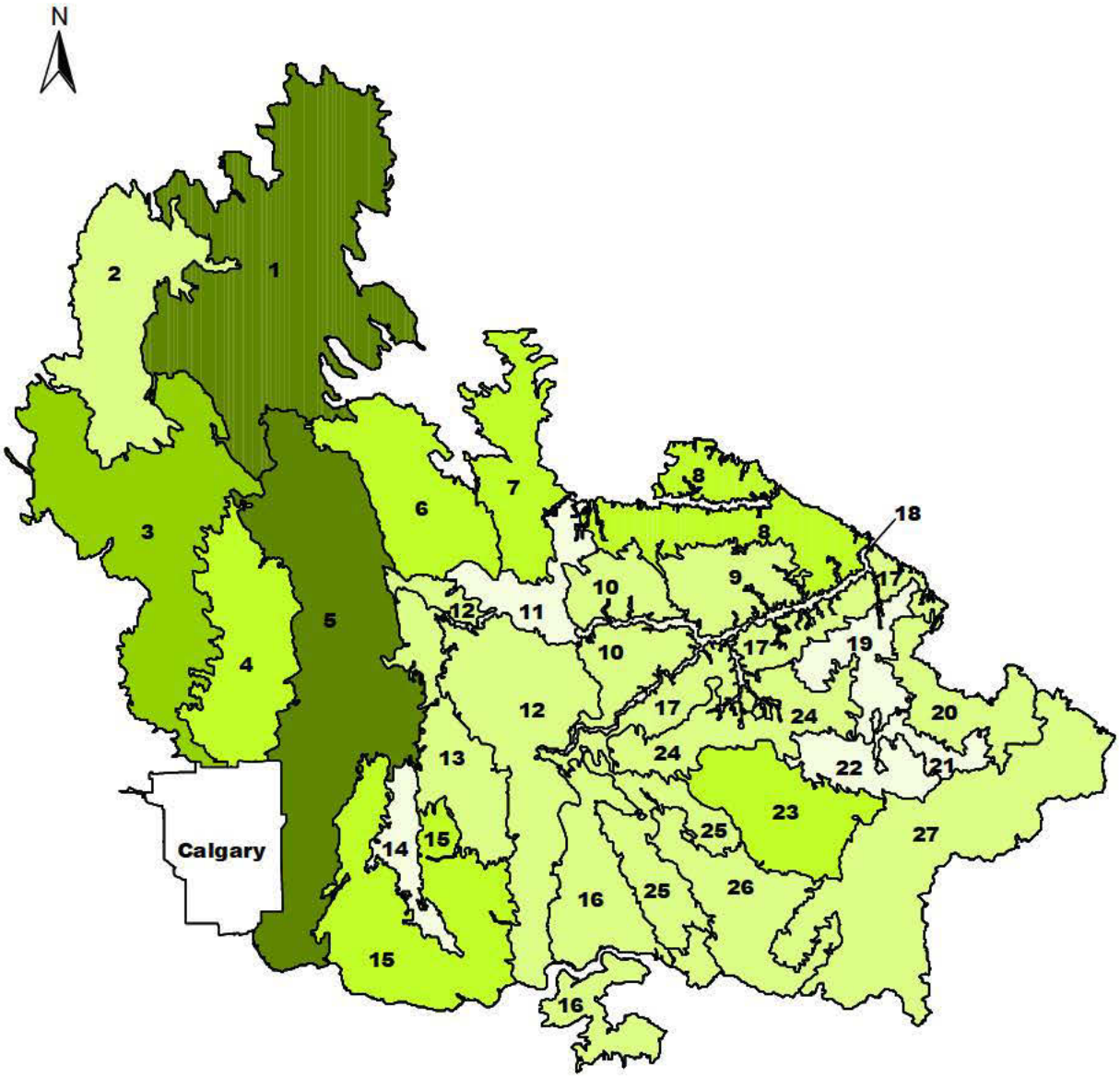

Figure A-22. Change in number of farms using crop rotation with a forage 1991-1996

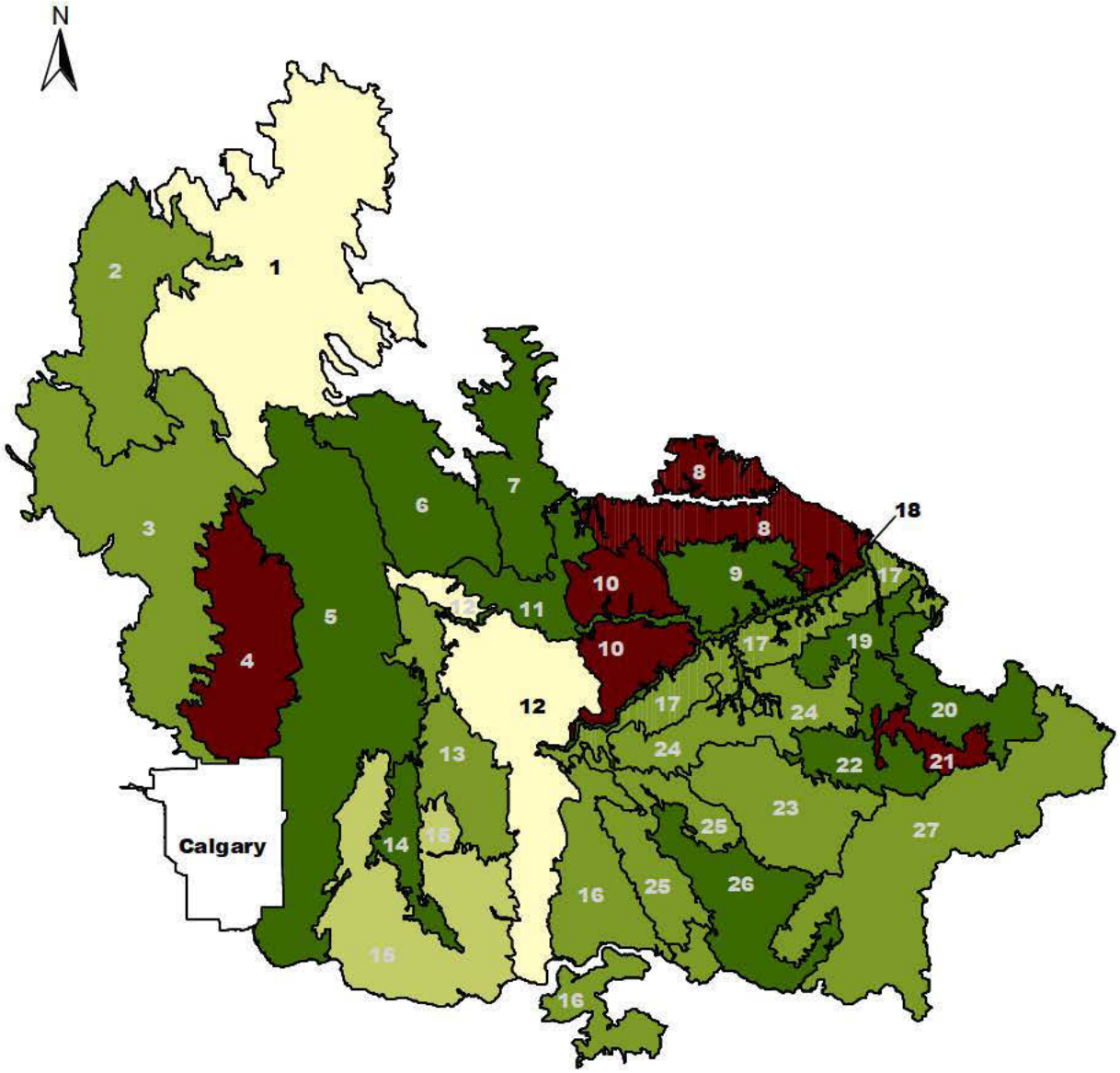

Figure A-23. Change in acres of tillage practices incorporating residue into the soil 1991-1996

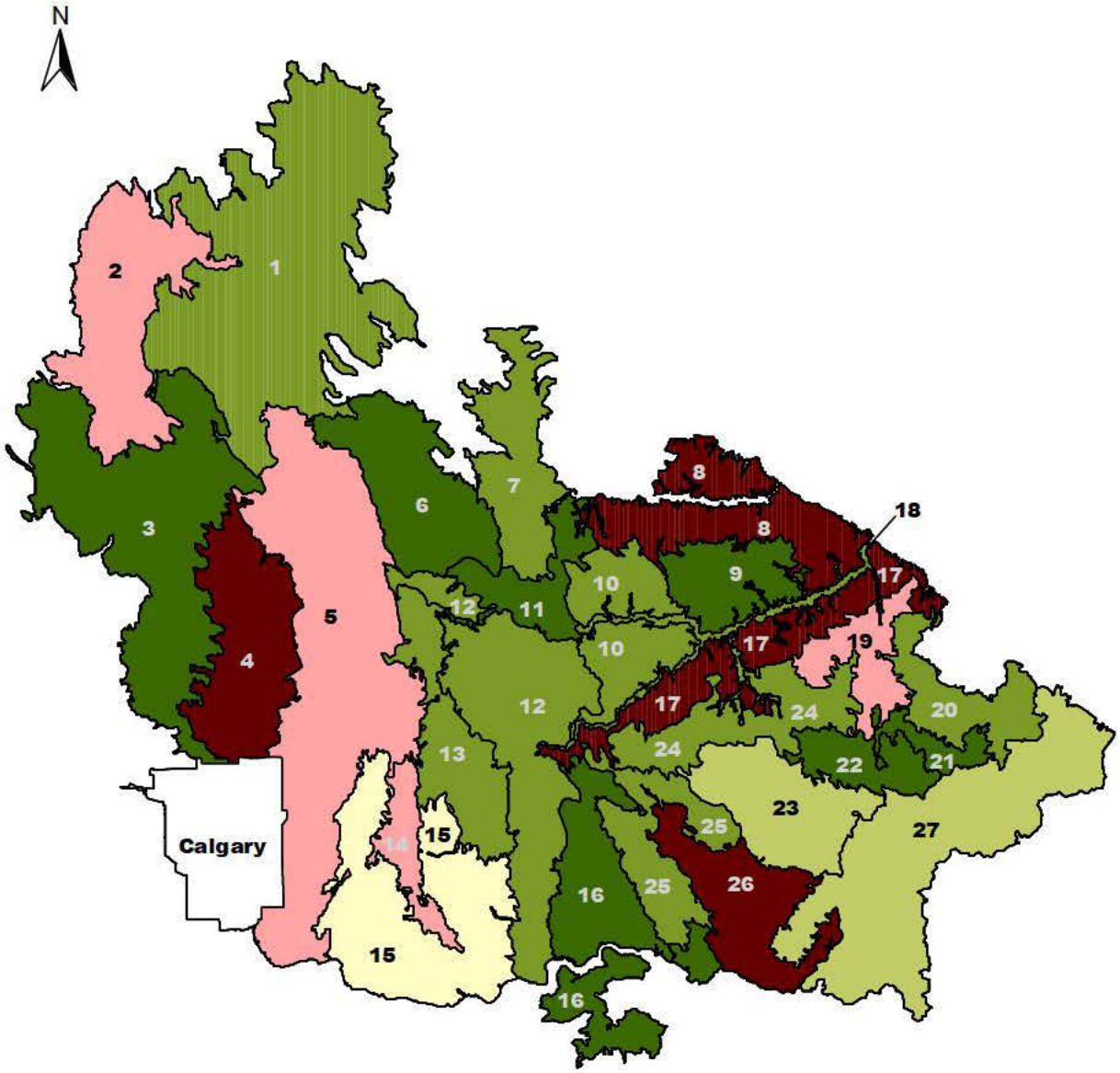

Figure A-24. Change in acres of tillage practices retaining residue on the surface 1991-1996

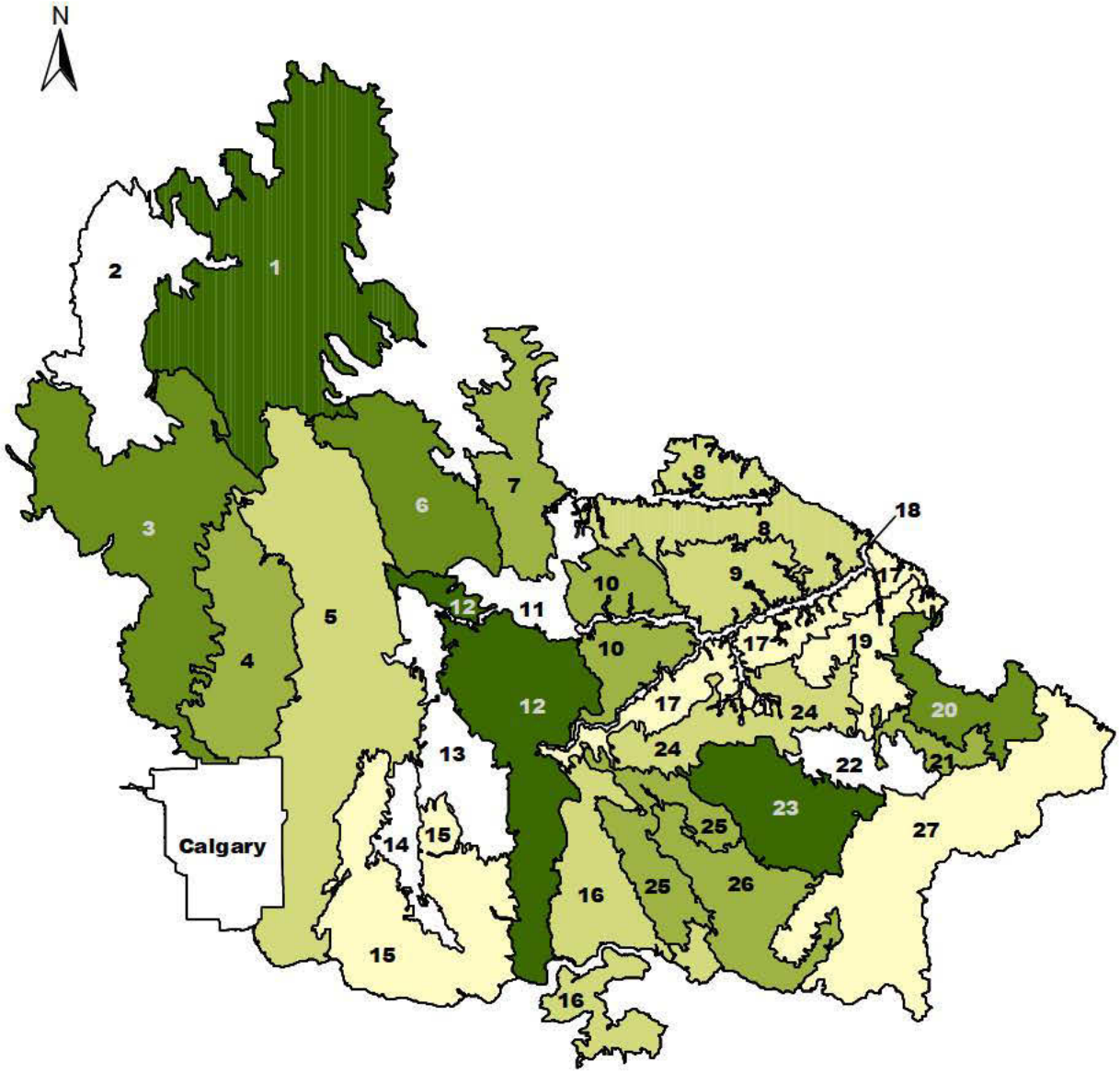

Figure A-25. Change in acres of no tillage 1991-1996

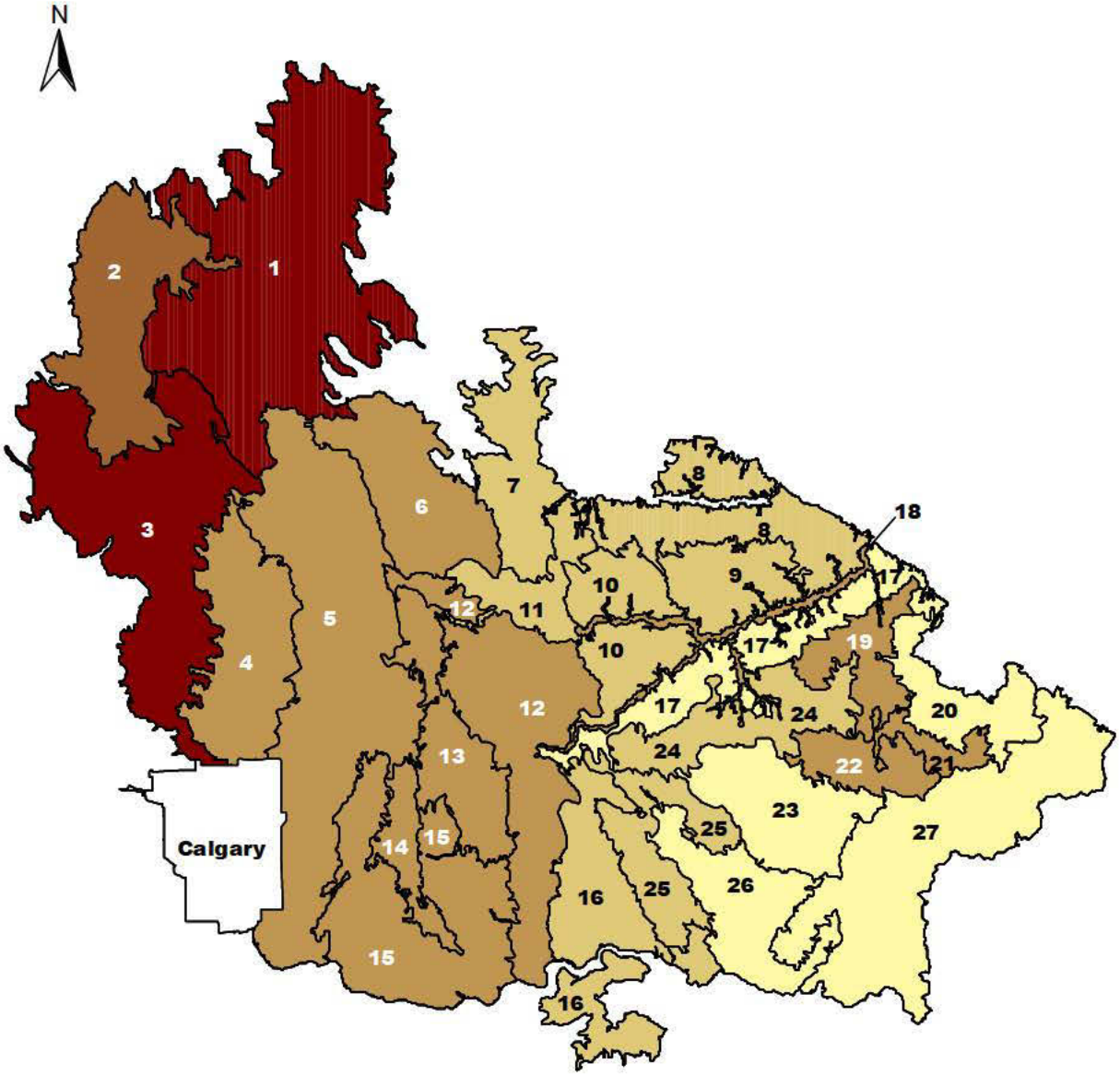

Figure A-26. Change in summerfallow acres 1991-1996

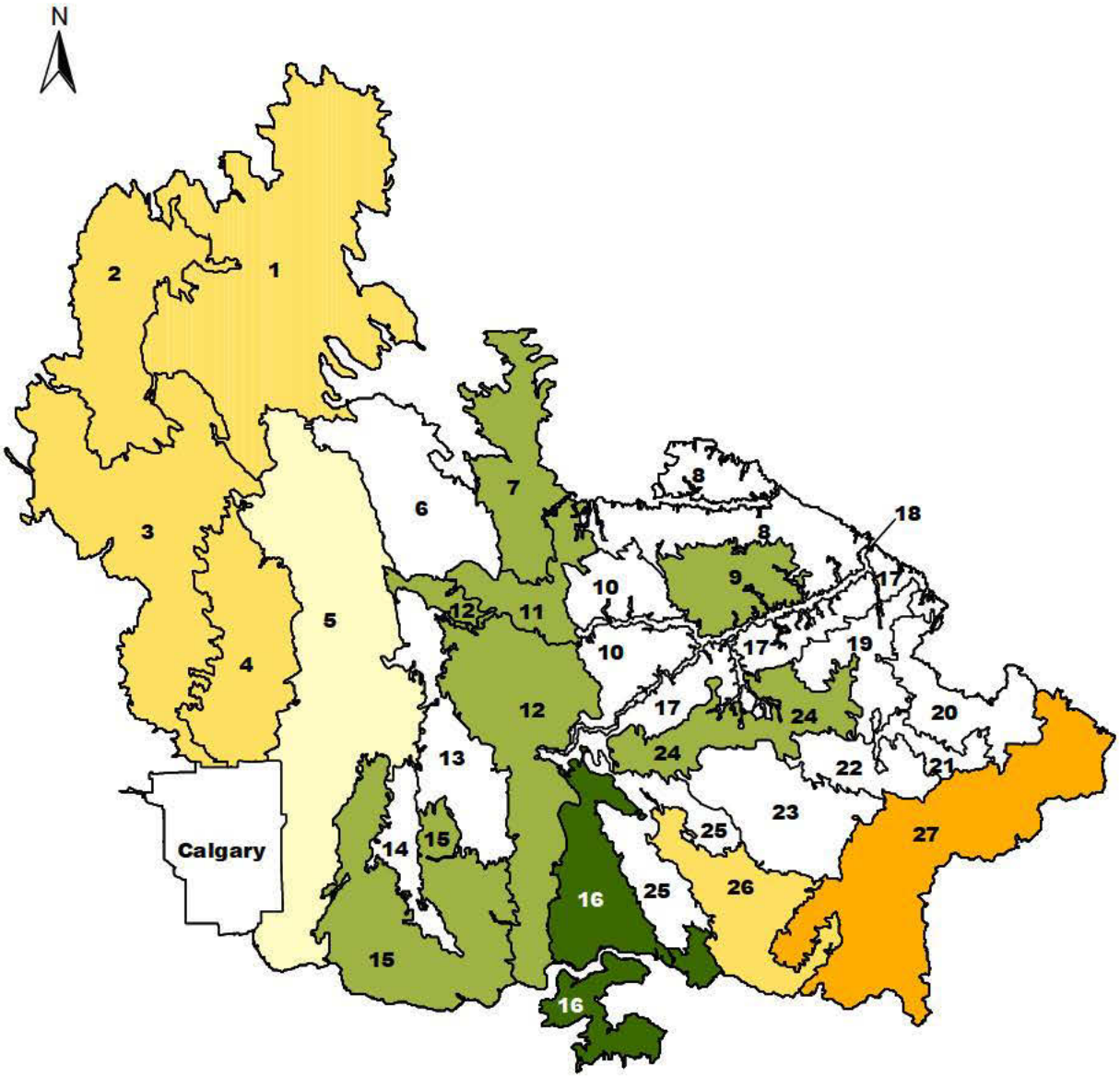

Figure A-27. Change in acres of chemical only weed control on summerfallow 1991-1996

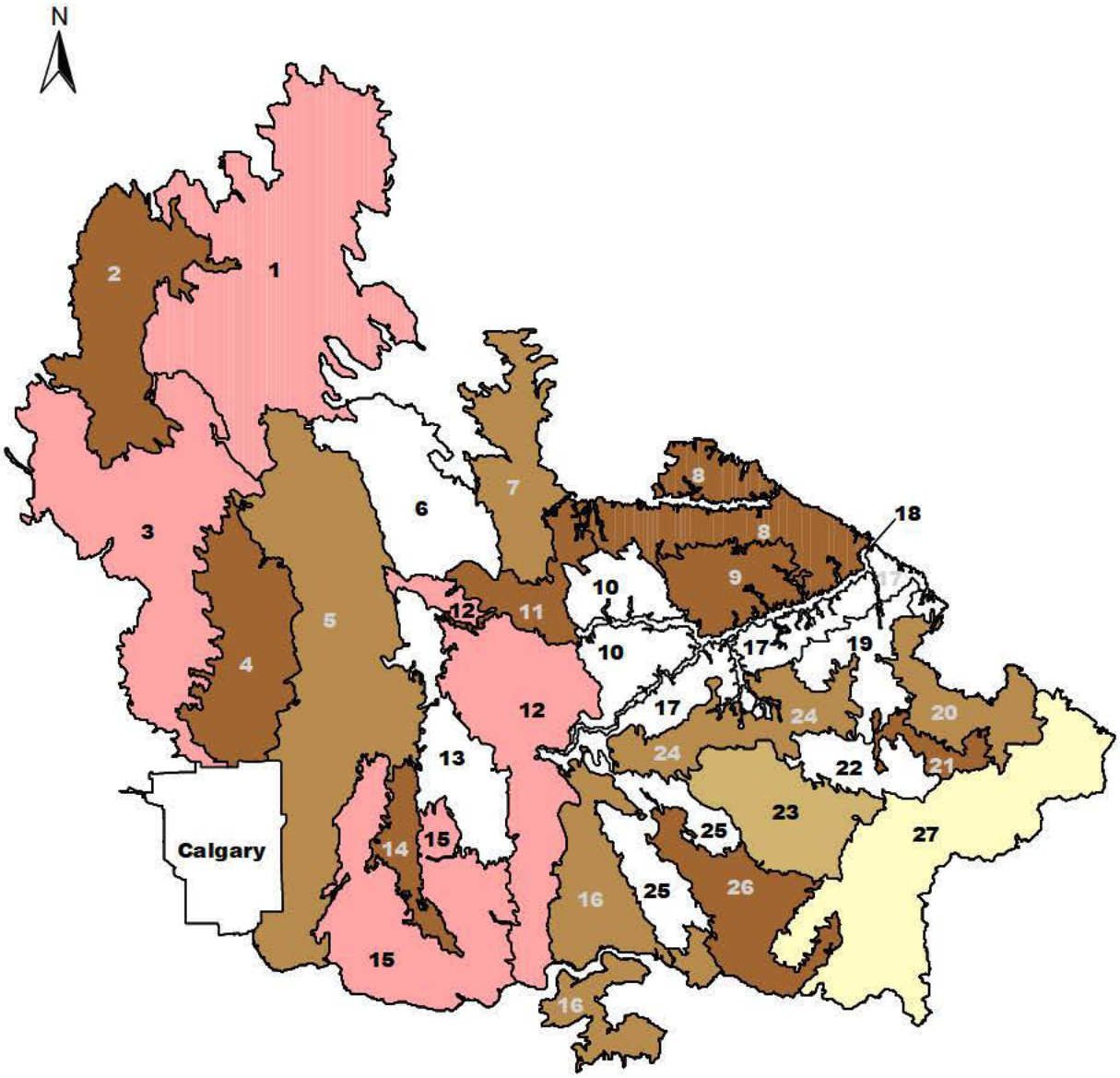

Figure A-28. Change in acres of tillage only weed control on summerfallow 1991-1996