Citation

Alberta Agriculture, Food and Rural Development. 2005. *Agricultural Land Resource Atlas of Alberta, 2nd Edition.* Alberta Agriculture, Food and Rural Development, Resource Management and Irrigation Division, Conservation and Development Branch, Edmonton, Alberta. 53 pp., 25 maps.

Published by

Alberta Agriculture, Food and Rural Development
Resource Management and Irrigation Division
Conservation and Development Branch
206, 7000 - 113 Street
Edmonton, Alberta T6H 5T6

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Revised 2005

Printed in Canada

Agricultural Land Resource Atlas of Alberta

Background

Alberta and Canada jointly conducted a scan of the environmental issues facing agriculture in Alberta as a commitment under Agriculture and Agri-Food Canada's Agricultural Policy Framework (APF). The purpose was to identify areas to target Environmental Farm Planning (EFP) efforts and Beneficial Management Practice (BMP) incentive funding.

A scan refers to a geographic assessment of the location, extent and severity of environmental issues associated with primary agriculture production. Five components were considered in the environmental scan: surface water quality, groundwater quality, soil erosion risk, air quality and biodiversity. The vulnerability of each component to impacts from agriculture was considered with respect to the physical characteristics of the component and agricultural activities carried out. Various geographic-linked data sets were selected and used to form risk factors for each of the five components in each land location.

This environmental scan process resulted in a wealth of agricultural resource maps useful to producers and other agricultural professionals involved in developing environmental farm plans and in other activities related to agricultural land management in Alberta.

Introduction

The Agricultural Land Resource Atlas of Alberta is a collection of agricultural resource maps developed following completion of the *Environmental Scan for Agriculture in Alberta* by the Alberta Environmental Scan Technical Team in 2003.

The maps in the Atlas were prepared for the environmental scan process or were added to the collection because of their potential value to Alberta's agricultural community. The maps were recognized for their value to people involved in developing environmental farm plans who could use resource and environmental information on a broad scale.

Using the Atlas

The maps in the Atlas are displayed at a common scale of approximately 1:3 000 000 making comparison between themes easier. All maps also have the Alberta Township System (ATS) displayed for generalized location reference. The ATS is explained on its own map in this Atlas.

Various geographic-linked datasets were gathered and compiled in order to produce the maps. Descriptions of each map, the data used, how the map can be used and where to look for further information is provided for each resource map.

This Atlas contains generalized land resource information that was compiled for presentation at the provincial level. This scale of information is appropriate for making broad comparisons between different regions of Alberta. Between regions, comparisons can be made with respect to different characteristics or limitations, but it is not appropriate for assessing individual legal locations or for farm scale use.

The five risk maps developed for the environmental scan considered the vulnerability of surface water quality, groundwater quality, soil erosion risk, air quality and biodiversity as they relate to the impacts from agriculture. The assessment of vulnerability considers the interaction of the physical characteristics of air, water and soil landscapes and the associated agricultural management activities. The geographic datasets used to represent these characteristics and activities combined information at various levels of detail into a unit-less ranking from 0 to 1. These rankings were then assigned to classes for mapping purposes.

The intent of the risk maps is to identify potential issues at the regional level. Individual land locations may be located and the potential risks identified, but further site-specific evaluation and assessment are required to identify beneficial management practices to address or reduce the risk.

Acknowledgements

The following individuals contributed to the development and review of the Atlas: John Hermans, Tim Martin, David Neilson and David Spiess (Alberta Agriculture, Food and Rural Development), and Tony Brierley, Michael Bock and Alan Stewart (Agriculture and Agri-Food Canada).

David Spiess, Arva Traynor, Longin Pawlowski, and Gerald Stark, Conservation and Development Branch, Alberta Agriculture, Food and Rural Development (AAFRD), compiled the data, and produced the maps in the Atlas. Donna Beever served as editor and developed the accompanying map descriptions. Overall publication layout was completed by Chris Kaulbars, John Gillmore and Sherrill Strauss.

Funding for the Atlas was provided by AAFRD as part of Alberta's contribution to the Environment Chapter of the Agricultural Policy Framework (APF).

The following groups are also recognized for their contribution of the data used to produce the maps: Alberta Agriculture, Food and Rural Development, Agriculture and Agri-Food Canada, Alberta Environment, Alberta Sustainable Resource Development, AltaLIS Ltd., Committee on the Status of Endangered Wildlife in Canada, Ducks Unlimited Canada, Environment Canada, Norwest Labs, Statistics Canada and the United States National Climate Data Center.

Contents

Municipal Districts and Counties of Alberta

Description

Municipal Districts and Counties of Alberta shows the location of the rural, urban and specialized municipalities in Alberta as of 2003.

Data sources

The Municipal Boundary File containing the digital map information was obtained from AltaLIS Ltd. This file contains provincial coverage of municipal boundary linework, featuring rural municipalities, cities, towns, villages, summer villages and hamlets at an accuracy of $\pm$ 3 metres. Only the cities and main towns were displayed in the final map along with the main rivers and lakes.

Potential uses

This map is useful to identify municipality location and where a municipality is located in relation to neighboring municipalities. Once the municipal jurisdiction is verified, accessibility to area-specific programs can be determined.

Limitations

The names and boundaries of municipalities may change from year to year. Up-to-date information can be obtained by contacting Alberta Municipal Affairs (website below).

Further information

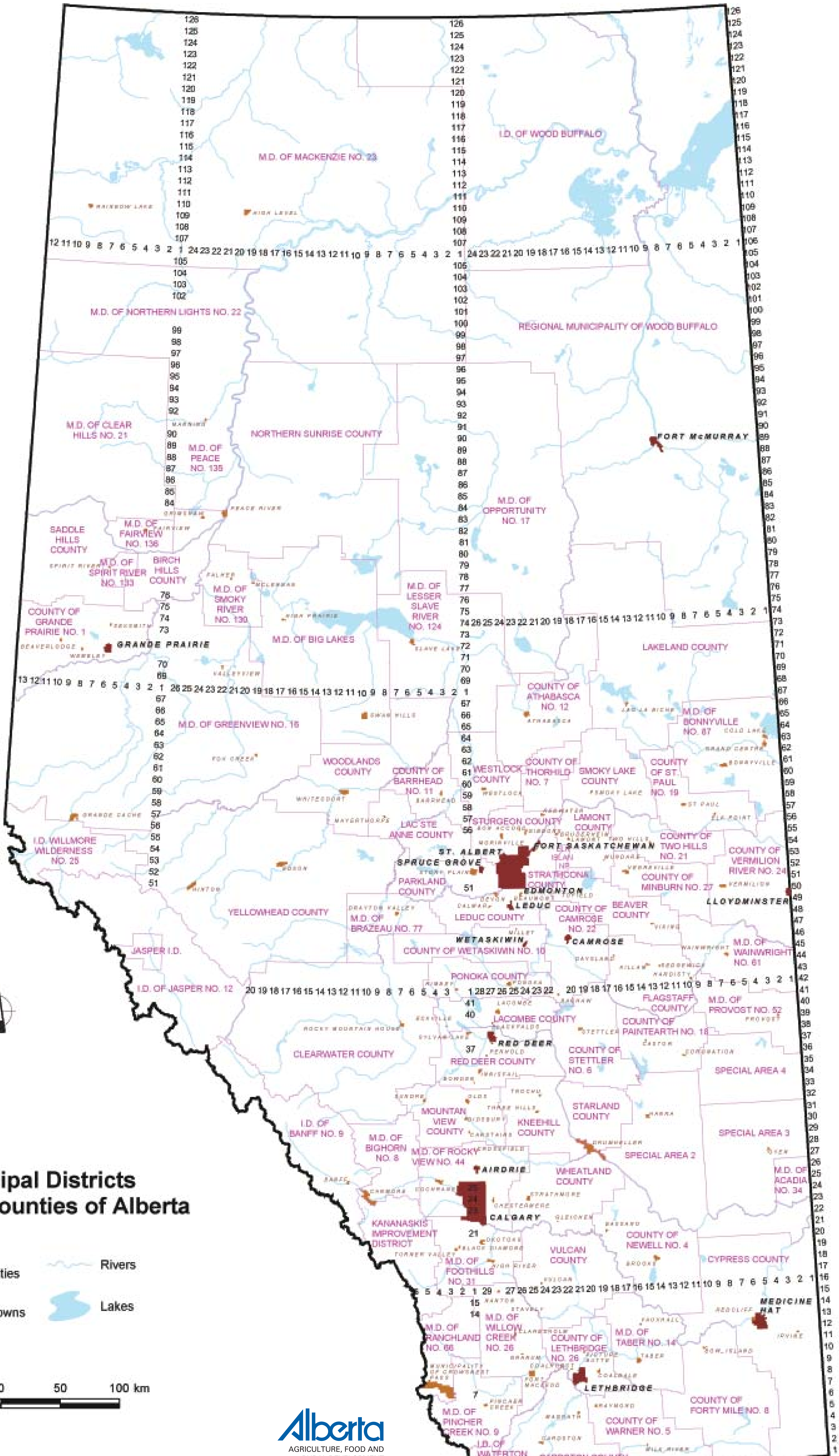
Additional information about individual municipalities can be obtained from the municipalities themselves.

The Alberta Municipal Affairs website contains numerous types of information including:

- Information about the types of municipalities in Alberta. From the homepage, click on *For Albertans* along the top, then *About Municipalities* under Resources. Or, toll free call 310-0000, then dial (780) 427-8862.
- Rural Municipal Boundary Map is available online and connects to basic municipality profile information such as location description, list of urban municipalities and hamlets within the municipal boundary and incorporation history. From the homepage, click on *For Albertans* along the top, then *Municipal Boundary Map* under Resources.
- *Communities within Specialized and Rural Municipalities*, published in January 2004, lists all of the communities in Alberta and the municipality in which they are located. From the homepage, click on *For Albertans* along the top, then *Communities within Rural Municipal Boundaries* under Resources. www.municipalaffairs.gov.ab.ca

Maps of individual municipalities are available from Map Town. www. maptown.com
Municipal maps are also available at www.mapstore.ca

AltaLIS Ltd. is the joint venture company that maintains and distributes Alberta's base mapping data sets. www.altalis.com



Municipal Districts and Counties of Alberta

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT
Resource Management and Irrigation Division
Conservation and Development Branch

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Township Grid System of Alberta

Description

This map represents the province with the Alberta Township System (ATS) overlaid for referencing legal land descriptions in the province. The ATS is a grid network dividing the province into equal-sized square parcels of land, for purposes of administering legal land title. All maps in this Atlas have the ATS overlaid on them.

Data sources

The ATS is a variant of the Dominion Land Survey (DLS) system as implemented in Canada. The digital files containing the provincial coverage of legal subdivision and quarter section linework depicting road allowances, quarter section descriptors and combined scale factors were obtained from AltaLIS Ltd. These two linework products were derived from survey co-ordinates. Further work using these files was done to allow for spatial analysis to be carried out.

Potential uses

Any section of land in Alberta can be located by its legal land description. Producers and all landowners rely on this system for legal land descriptions.

The ATS designates land as being west of the 4th Meridian (110 degrees west longitude), 5th Meridian (114 degrees west longitude) or 6th Meridian (118 degrees west longitude). Between *meridians* are a series of columns, each six miles wide, called *ranges*. They are numbered consecutively from east to west, beginning west of the meridian. *Townships* are also six miles wide and are numbered from south to north. The southern Alberta border with Montana is township 1, up to the northern border with the Northwest Territories at township 126.

"Township" also describes the six mile by six mile square formed when the range and township lines intersect. These townships are further divided into 36 sections, each measuring one mile by one mile (one square mile). One section contains 640 acres. A section can be further divided into quarters (NE, NW, SE, SW) of 160 acres each or into 16 legal subdivisions (LSDs).

Legal land descriptions are written as in the following example:

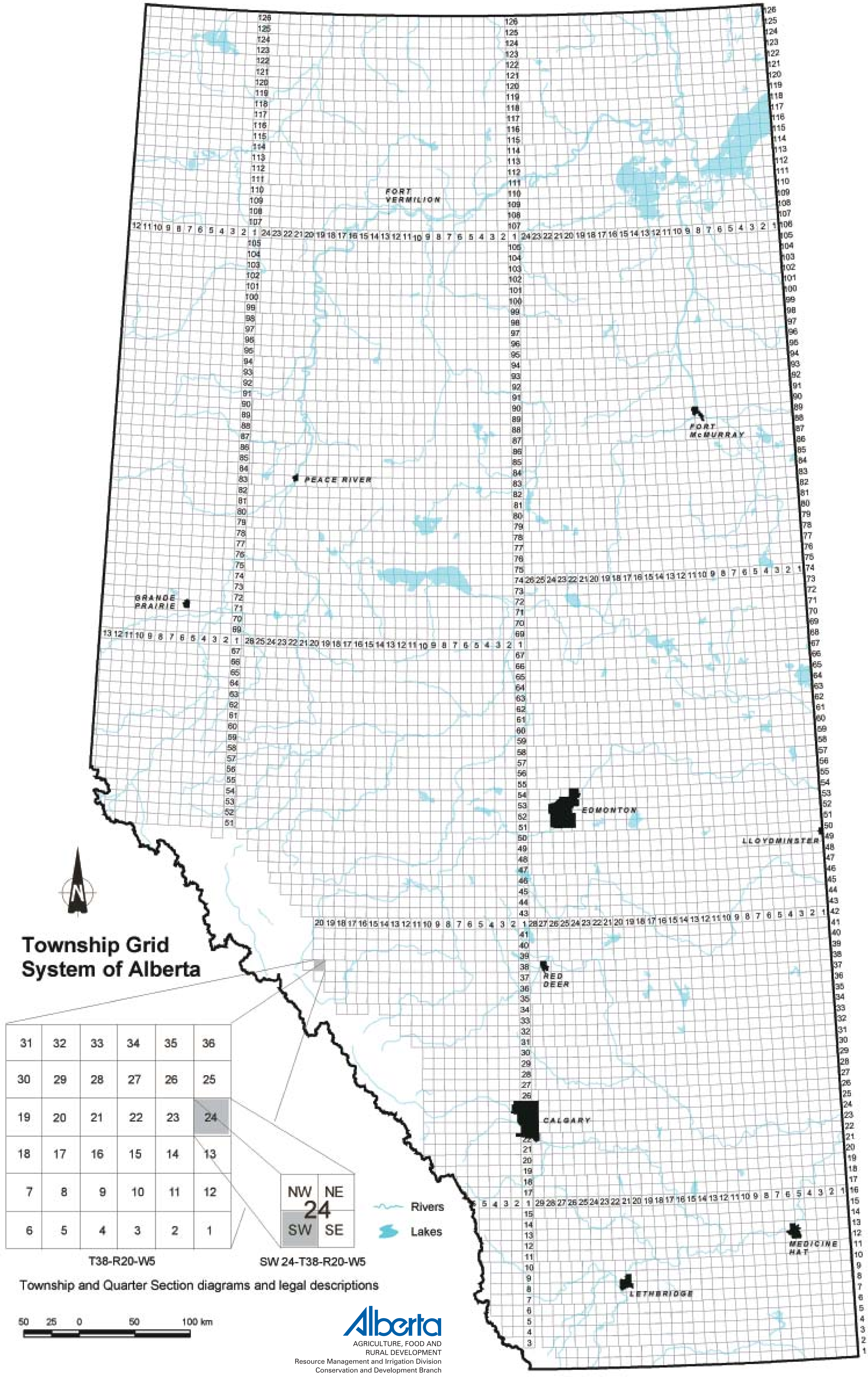
SW 24-38-20-W5 – southwest quarter of section 24, township 38, range 20, west of the 5th Meridian.

Further information

The Alberta Geological Survey website gives further explanation about the ATS. From the homepage, click on *GIS Maps*, then *ATS Conversion Tools* in the bar at the right, then *Information on the ATS system*. www.ags.gov.ab.ca

AltaLIS Ltd. is the joint venture company that maintains and distributes Alberta's base mapping data sets. www.altalis.com

Range and township road maps for southern and central Alberta are available for sale from Map Town. From the homepage, click on *Maps of Canada* along the left side, then on *Alberta* on the map. www.maptown.com



FORT VERMILION
FORT McMURRAY
PEACE RIVER
GRANDE PRAIRIE
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
N
Township Grid System of Alberta
T38-R20-W5
SW 24-T38-R20-W5
NW NE 24 SW SE
Rivers
Lakes
Township and Quarter Section diagrams and legal descriptions
50 25 0 50 100 km
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Resource Management and Irrigation Division
Conservation and Development Branch

Annual Total Precipitation of Alberta, 1971 to 2000

Description

This map describes the annual total precipitation in Alberta for the 30-year period 1971 to 2000. A 30-year period is used to describe the present climate since it is enough time to filter out short-term fluctuations but is not dominated by any long-term trend in the climate.

Annual total precipitation refers to rain, snow and other forms of moisture such as hail. Annual precipitation in Alberta is greatest in the mountains and decreases at lower elevations. In the agricultural areas of the province, 50 to 60 percent of annual precipitation generally occurs during the growing season, mostly as rain.

The map shows precipitation in mm according to the following classes: less than 350, 350 to 400, 400 to 450, 450 to 500, 500 to 550, 550 to 600 and greater than 600.

Data sources

Annual Total Precipitation of Alberta, 1971 to 2000, is found in the *Agroclimatic Atlas of Alberta, 1971 to 2000* (Chetner and the Agroclimatic Atlas Working Group, 2003). This map was based on 1971 to 2000 data from Environment Canada, Alberta Environment and the United States National Climate Data Center. These agencies collect data from over 1200 climate stations in Alberta and 1400 stations in neighboring provinces, territories and states. The stations collect daily temperature and precipitation information. Environment Canada receives the majority of the data from the federal and provincial networks and performs quality control on the data. Data from the United States stations is provided by the U.S. National Climate Data Center.

Precipitation data collected at climate stations was interpolated between stations and rolled up to a township. In order to avoid the blocky appearance of townships on the map, a township generalization was produced using smoothing procedures of computer graphics software for final presentation on the map.

Potential uses

Precipitation in any month can be extremely variable with the variability of precipitation being greater in southern Alberta than in the Peace River Region and central Alberta. However, long-term (30-year) data provides a reliable indication of what to expect in any given location.

Climate information is used as a long-term planning tool, for example, in selecting a location for a farm or planning a cropping program. Crop producers generally look at the most likely weather conditions rather than the extremes because the key inputs and decisions are made well in advance of achieving results. By combining knowledge of the agricultural operation with knowledge of what is likely to happen, the producer can then decide on the acceptable level of risk due to adverse conditions.

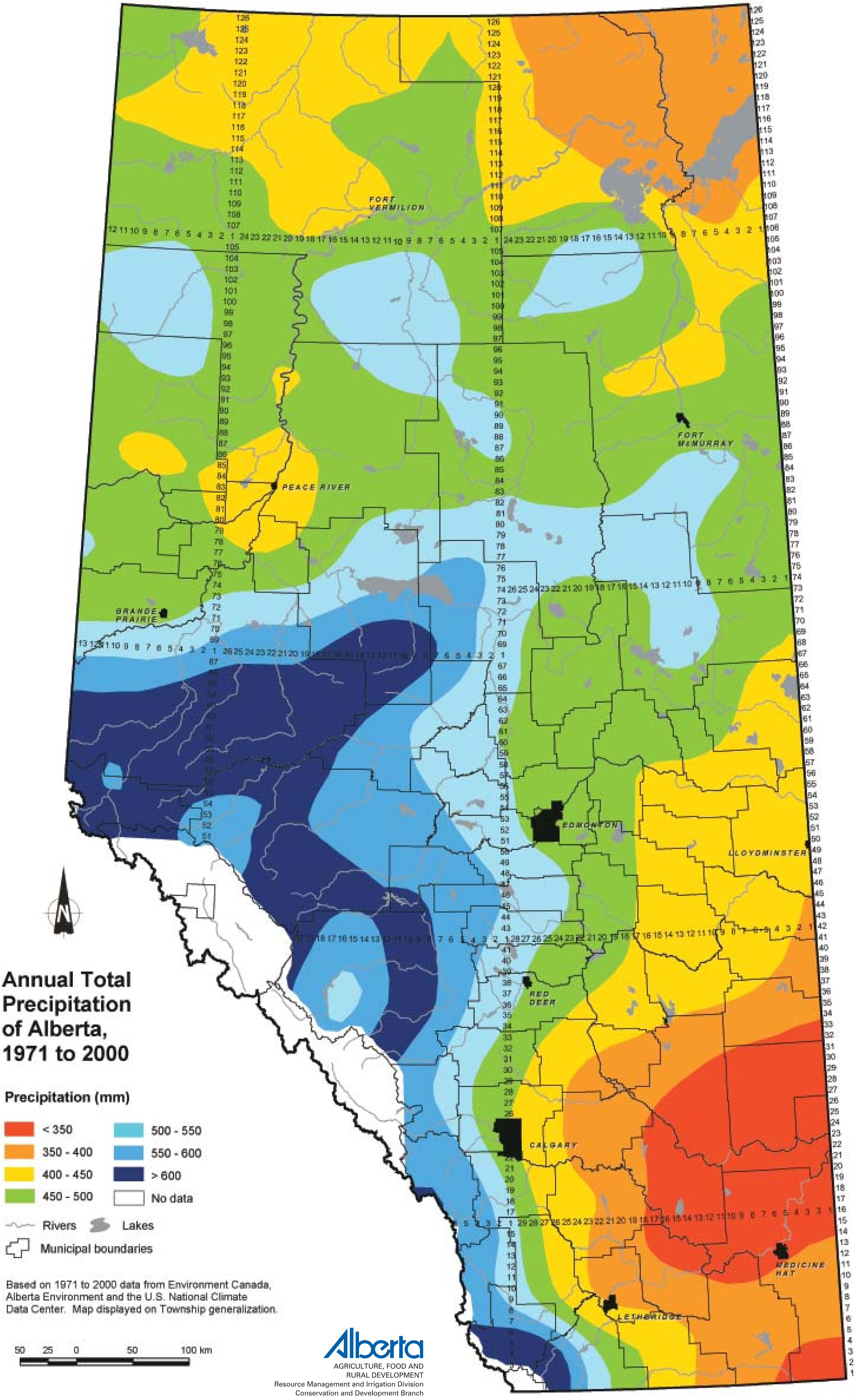
Limitations

The township generalization used in the map smoothes the look of the data, but townships between recording stations may have slight variations from what is shown on the map.

Further information

The *Agroclimatic Atlas of Alberta, 1971 to 2000,* is available online at the Alberta Agriculture, Food and Rural Development (AAFRD) website by using the topic bar at the left and following *Weather & Climate* and then *Agroclimatic Atlas*. Paper copies (Agdex 071-1) are available from the AAFRD Publications office in Edmonton by calling (780) 427-0391, or 1-800-292-5697 toll-free in Canada. www.agric.gov.ab.ca

Chetner, S. and the Agroclimatic Atlas Working Group. 2003. *Agroclimatic Atlas of Alberta, 1971 to 2000*. AAFRD. Agdex 071-1. Edmonton, Alberta.



Annual Total Precipitation of Alberta, 1971 to 2000
Precipitation (mm)
< 350
350 - 400
400 - 450
450 - 500
500 - 550
550 - 600
> 600
No data
Rivers
Lakes
Municipal boundaries
Based on 1971 to 2000 data from Environment Canada, Alberta Environment and the U.S. National Climate Data Center. Map displayed on Township generalization.
50 25 0 50 100 km
N
FORT VERMILION
PEACE RIVER
FORT McMURRAY
GRANDE PRAIRIE
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
Alberta
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Resource Management and Irrigation Division
Conservation and Development Branch

Frost-free Period of Alberta, 1971 to 2000

Description

This map illustrates the frost-free period in Alberta for the 30 years from 1971 to 2000. A 30-year period is used to describe the present climate since it is enough time to filter out short-term fluctuations but is not dominated by any long-term trend in the climate.

The frost-free period is the number of days between the last date of 0°C in the spring and the first date of 0°C in the fall. Frost-free periods in Alberta vary from more than 125 days in the south to less than 85 days in higher elevation, non-agricultural areas.

The frost-free period is presented as days above 0° C in the following classes: less than 85, 85 to 95, 95 to 105, 105 to 115, 115 to 125 and greater than 125.

Data sources

Frost-free Period of Alberta, 1971 to 2000, is found in the *Agroclimatic Atlas of Alberta, 1971 to 2000* (Chetner and the Agroclimatic Atlas Working Group, 2003). This map was based on 1971 to 2000 data from Environment Canada, Alberta Environment and the United States National Climate Data Center. These agencies collect data from over 1200 climate stations in Alberta and 1400 stations in neighboring provinces, territories and states. The stations collect daily temperature and precipitation information. Environment Canada receives the majority of the data from the federal and provincial networks and performs quality control on the data. Data from the United States stations is provided by the U.S. National Climate Data Center.

The temperature data collected was used to derive frost dates and, in turn, the frost-free period. Temperature data collected at climate stations was interpolated between stations and rolled up to a township. In order to avoid the blocky appearance of townships on the map, a township generalization was produced using smoothing procedures of computer graphics software for final presentation on the map.

Potential uses

The frost-free period provides a measure of the period during which plant growth should occur uninterrupted by frost, and it provides a way to compare growing conditions within the province. When selecting new crop types and varieties, producers consider climate characteristics including the length of the frost-free period and the expected date of fall frost. It is important information for producers for planning purposes, indicating where the advantages of growing a particular crop may outweigh the risk of occasional frost damage. The yield potential of some crops is closely related to the growing season length. Generally, for the production of marketable grain crops, the frost-free period needs to be greater than 100 days.

Limitations

A frost-free period of the same value in different areas of the province where the day length varies can have different meanings. For example, the longer day length in the Peace River Region partly compensates for the effects of the shorter frost-free period in the north, when compared to the shorter day length and longer frost-free period in southern Alberta. Each crop reacts differently to increasing day length, so no general adjustment of frost-free periods for day length is possible.

Further information

The *Agroclimatic Atlas of Alberta, 1971 to 2000,* is available online at the Alberta Agriculture, Food and Rural Development (AAFRD) website by using the topic bar at the left and following *Weather & Climate* and then *Agroclimatic Atlas*. Paper copies (Agdex 071-1) are available from the AAFRD Publications office in Edmonton by calling (780) 427-0391, or 1-800-292-5697 toll-free in Canada. www.agric.gov.ab.ca

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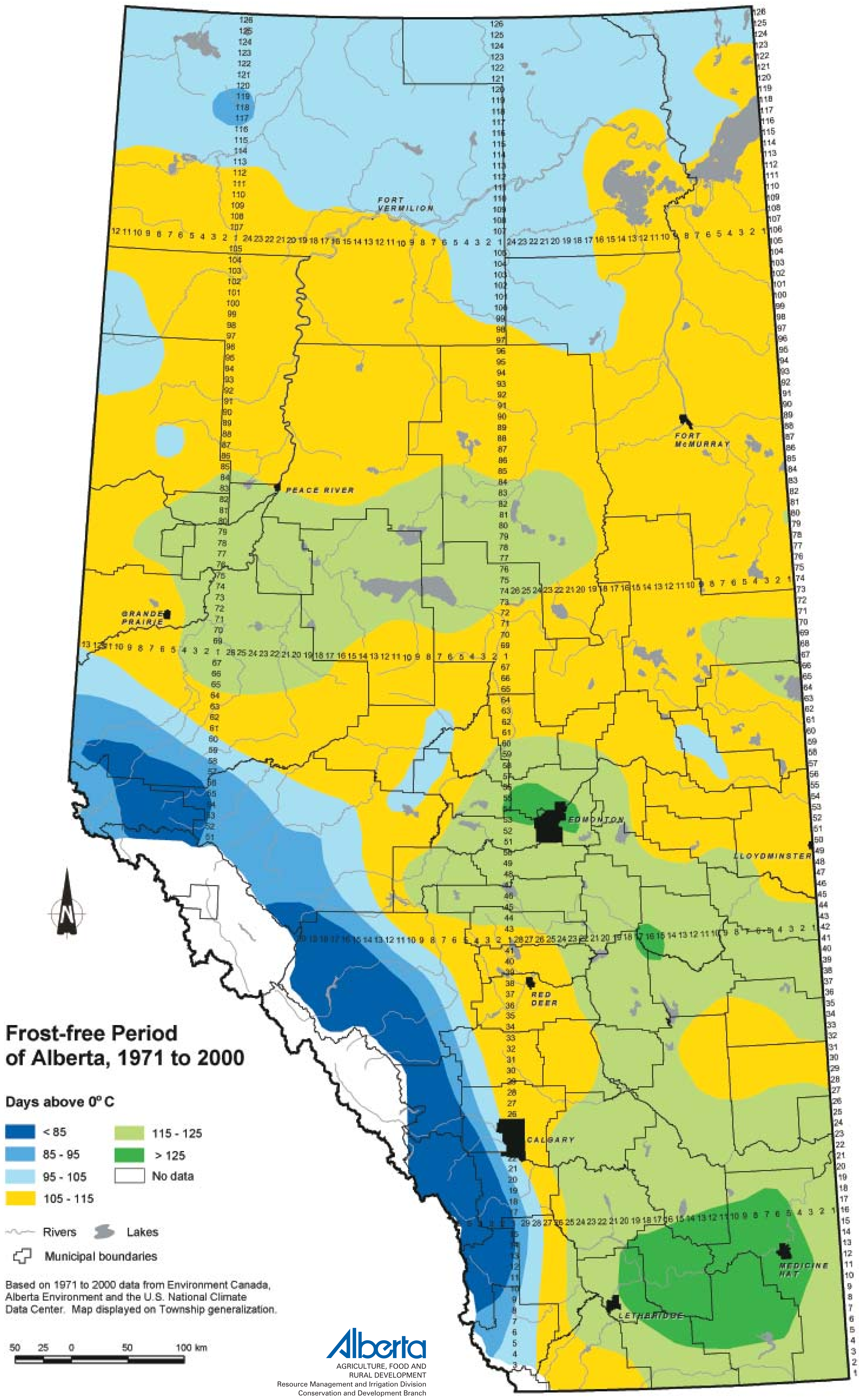

Frost-free Period of Alberta, 1971 to 2000

Annual Solar Radiation of Alberta, 1971 to 2000

Description

This map illustrates the annual solar radiation in Alberta over the 30-year period from 1971 to 2000. A 30-year period is used to describe the present climate since it is enough time to filter out short-term fluctuations but is not dominated by any long-term trend in the climate.

Daily total incoming solar radiation is measured in megajoules per square metre (MJ/m^2). The amount of solar radiation received at the earth's surface varies with two factors that depend on latitude: the angle of the sun's rays and the hours of daylight. The distance from the equator, and therefore the intensity of the sun's radiation has the greatest effect on climate. Canada's position in the northern portion of the earth's northern hemisphere means that it receives less solar radiation compared to countries nearer the equator. The northward decrease in solar radiation is also noticeable within Alberta. Temperatures are generally higher in southern Alberta in comparison to northern Alberta because the south receives more solar radiation.

The annual solar radiation is measured in MJ/m^2 and was mapped in the following classes: less than 4200, 4200 to 4400, 4400 to 4600, 4600 to 4800 and greater than 4800.

Data sources

Annual Solar Radiation of Alberta, 1971 to 2000, is found in the *Agroclimatic Atlas of Alberta, 1971 to 2000* (Chetner and the Agroclimatic Atlas Working Group, 2003). This map was based on 1971 to 2000 data from Environment Canada, Alberta Environment and the United States National Climate Data Center. These agencies collect temperature and precipitation data from climate and weather stations in Alberta, neighboring provinces, territories and states. Environment Canada receives the majority of the data from the federal and provincial networks and performs quality control on the data. Data from the United States stations is provided by the U.S. National Climate Data Center.

The synoptic weather stations, which collect weather data over a broad area at a single given time, collect data to measure solar radiation. These stations report near real-time (hourly, 6-hourly and daily) automated weather information used to prepare weather forecasts and in calculating climatic information. Few Alberta stations measure solar radiation, therefore, calculation of the likely values between the points (stations) where measurements are taken is done by interpolation. Solar radiation was calculated for each township of Alberta using an interpolation process. In order to avoid the blocky appearance of townships on the map, a township generalization was produced using smoothing procedures of computer graphics software for final presentation on the map.

Potential uses

Southern Alberta receives the greatest amount of annual global solar radiation with the amount gradually decreasing as you move farther north. However, cropping is successful in the northern (Peace River) area of Alberta because the longer summer day length helps compensate for the less intense solar radiation. Cloud cover in the mountains will reduce the amount of solar radiation received there.

Producers use climate information, including solar radiation, as a long-term planning tool. For example, in selecting a location for a farm or planning a cropping program, this information is important. Knowing that southern Alberta receives more solar radiation, making temperatures generally higher there, will affect the cropping choices and management options available. By combining knowledge of the agricultural operation with knowledge of what is likely to happen (climate), the producer can then decide on the acceptable level of risk due to adverse conditions.

Limitations

The number of weather stations in Alberta that collect solar radiation data is very limited. This makes the interpolated pattern less reliable than if data was received from more locations in the province.

Further information

The *Agroclimatic Atlas of Alberta, 1971 to 2000,* is available online at the Alberta Agriculture, Food and Rural Development (AAFRD) website by using the topic bar at the left and following *Weather & Climate* and then *Agroclimatic Atlas*. Paper copies (Agdex 071-1) are available from the AAFRD Publications office in Edmonton by calling (780) 427-0391, or 1-800-292-5697 toll-free in Canada. www.agric.gov.ab.ca

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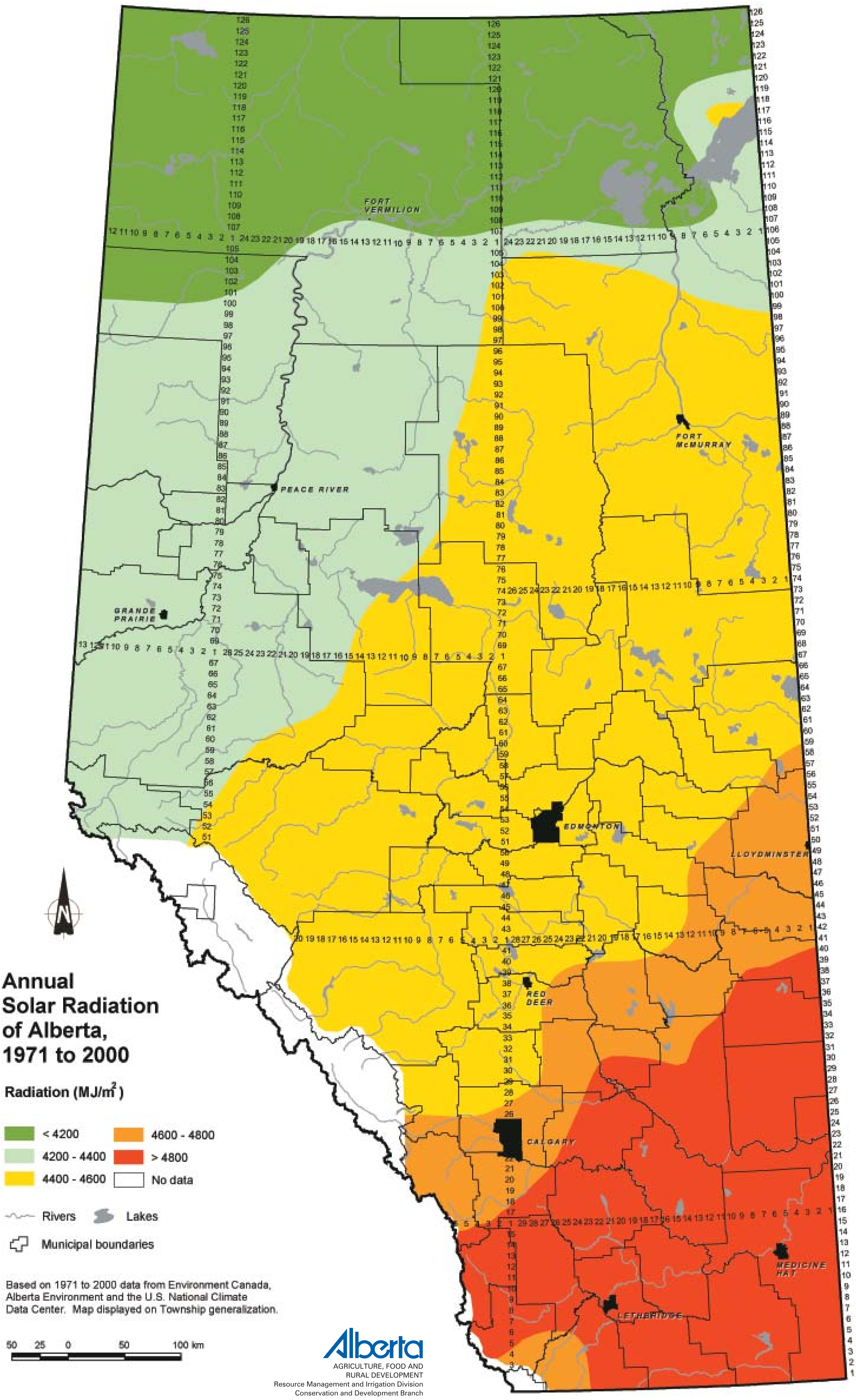
Annual
Solar Radiation
of Alberta,
1971 to 2000
Radiation (MJ/m²)
< 4200
4200 - 4400
4400 - 4600
4600 - 4800
> 4800
No data
Rivers
Lakes
Municipal boundaries
Based on 1971 to 2000 data from Environment Canada, Alberta Environment and the U.S. National Climate Data Center. Map displayed on Township generalization.
50 25 0 50 100 km
FORT VERMILION
PEACE RIVER
FORT McMURRAY
GRANDE PRAIRIE
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
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Areal Extent of Wetlands in the Agricultural Area of Alberta

Description

This map displays the density of wetland habitat in the agricultural region of Alberta. Wetlands are depressional areas that are wet for a long enough period that the plants and animals living in them are adapted to, and often dependent on, living in wet conditions for at least part of their life cycle. In drier areas of the province, wetlands tend to be more intermittent, while in wetter areas, wetlands tend to be more persistent. Topography also affects the occurrence of wetlands. Hummocky landscapes allow for pooling of water in depressions, while landscapes with longer slopes (e.g. the foothills) generally have better defined surface drainage patterns. A wetland is influenced by the interaction between the wet area, the wetland margin and upland area.

The map is based on the areal extent of wetlands in each Soil Landscapes of Canada (SLC) polygon. The area of wetlands as a percentage of the total area of the SLC is displayed on the map using the following classes: less than 1, 1 to 4, 4 to 8, 8 to 13 and greater than 13.

Data sources

The data for this map is derived from Ducks Unlimited Canada's wetland database. The database used satellite imagery acquired in early to late May from 1982 to 1987. May satellite imagery was used to capture spring conditions at their wettest.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Potential uses

Wetlands provide important habitat for waterfowl and many other types of wildlife. Wetlands reduce the impact of flooding, provide erosion control, purify water by removing sediment and nutrients, and contribute to groundwater recharge.

Being aware of where wetland densities are greater reveals areas where beneficial management practices may be used if there are multiple land use issues. For example, fencing off wetland areas to prevent livestock from using these areas for watering or grazing may be an option. Areas of lower wetland density may indicate where special care should be taken to preserve remaining wetlands.

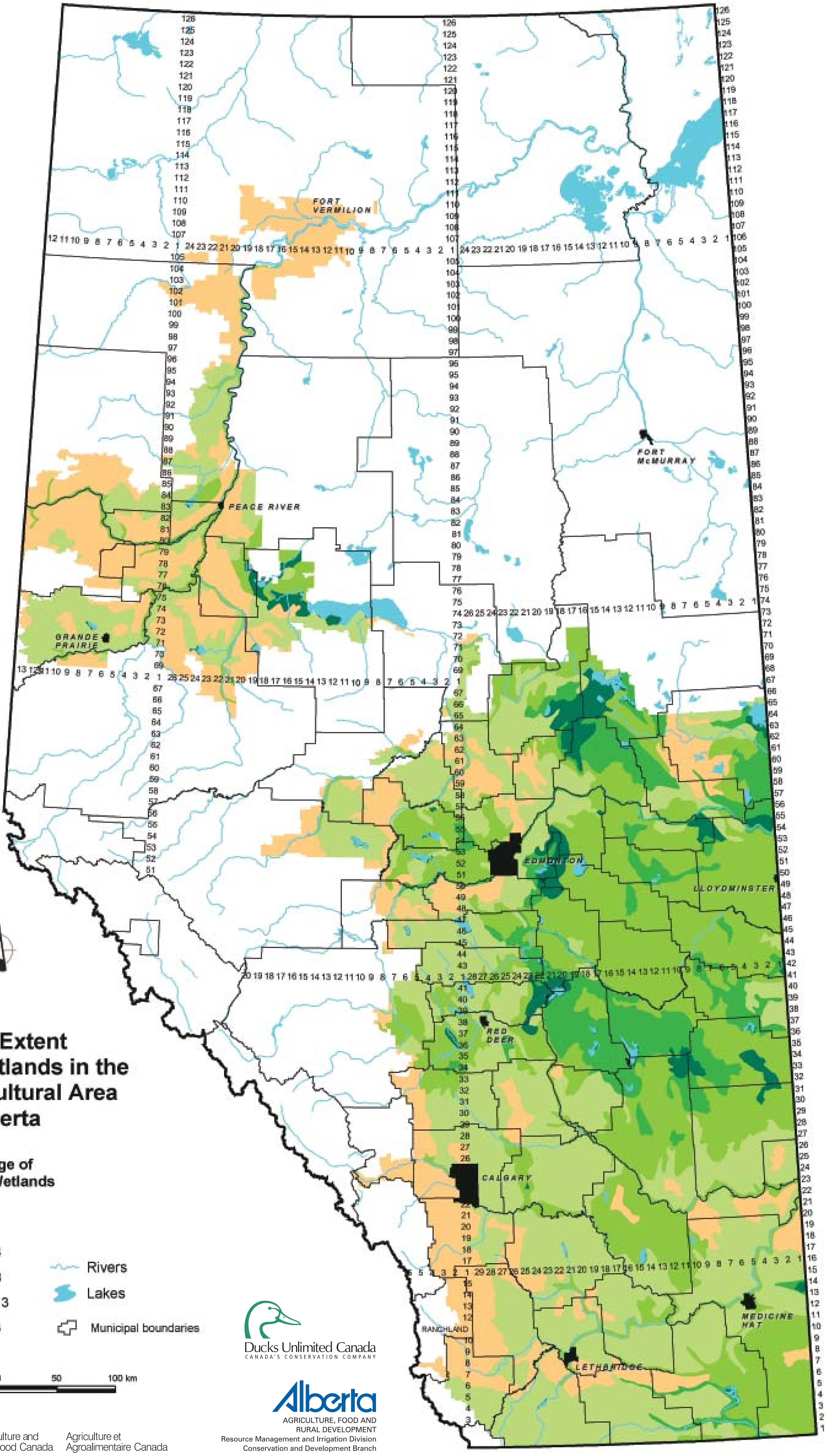
Limitations

The map displays the percentage of the SLC that is covered by wetlands, but this does not reflect the total number of wetlands or the size of individual wetlands within the SLC.

Further information

Ducks Unlimited Canada www.ducks.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis



Areal Extent of Wetlands in the Agricultural Area of Alberta

Percentage of Area in Wetlands

- < 1
- 1 - 4
- 4 - 8
- 8 - 13
- > 13

Rivers

Lakes

Municipal boundaries

50 25 0 50 100 km

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Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

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Conservation and Development Branch

Soil Groups of Alberta

Description

This map displays the distribution of the main soil types found within the province. The distribution pattern of soils in Alberta is strongly linked to climate and parent materials. Climate affects the location of different soil groups. The driest area in southeastern Alberta is represented by the presence of Brown Chernozems. As one proceeds north and west, the soils and associated vegetation reflect the increase in available moisture.

Chernozemic soils are primarily associated with grassland vegetation. Brown Chernozemic soils occur in the southeast part of the province and are characterized by the presence of a brown surface layer approximately 10 to 12 cm thick that generally contains 3 to 4 percent organic matter. Available moisture is the limiting factor to crop growth with most of the area in native range. With increasing available moisture, there is a transition to Dark Brown Chernozemic soils. These soils are characterized by the presence of a dark brown soil surface layer that is 12 to 15 cm thick that generally contains 4 to 6 percent organic matter. Moisture continues to be a limiting factor to crop production; however, the majority of the area is cultivated. Black Chernozemic soils are associated with grassland areas with the most available moisture and cooler temperatures. These soils are characterized by the presence of a black surface horizon that is 12 to 20 cm thick with organic matter generally in the range of 6 to 10 percent. These are highly productive soils that are used to grow a wide variety of agricultural crops. Dark Gray Chernozemic soils are associated with the transition between grassland and forest vegetation. These soils are similar to Black Chernozems with respect to surface layer thickness and organic matter content; however, the average frost-free period is a more limiting factor for annual agricultural crops.

Luvisolic soils are associated with mixed forest vegetation under native conditions. This vegetative cover reflects an increase in available moisture in conjunction with cooler temperatures. Under native conditions, there is a layer of decomposing litter on the surface of the mineral soil. Upon removal of the forest vegetation for agricultural activities, the organic matter is incorporated into the mineral soil resulting in a dark gray surface colour. The organic matter content of this surface layer generally increases under long-term agricultural activities.

Brunisolic soils within Alberta are generally associated with well-drained landscapes. In Alberta, they occur in high elevation montane, sub-alpine and alpine areas as well as on the Canadian Shield. These soils are characterized by having a thin (2 to 15 cm thick) dark brown to black surface layer of variable organic matter content. Climatic limitations, primarily the frost-free period, limit agricultural activities.

Cryosolic soils have permafrost within one meter of the surface. In Alberta, these soils are associated with the upper reaches of the Caribou Mountains and Cameron Hills. Agricultural activities are not feasible in these areas.

In Alberta, *Organic soils* generally occur in association with Luvisolic soils. These soils form under wet conditions where the organic layer (greater than 30% organic matter) accumulates faster than it decomposes. The organic layer varies in thickness from 40 to 160+ cm, and under natural conditions, the water table is at or near the surface. In some areas of the province, Organic soils may be artificially drained and used for agricultural production.

Data sources

The soil group polygons shown on the map represent Alberta Soil Survey information. The information represented by this map is consistent with *The Canadian System of Soil Classification*, which is the basis for describing soils across the country that was compiled by the Alberta Land Resource Unit, Research Branch of Agriculture and Agri-Food Canada, in 1995.

Potential uses

Soils have been classified and grouped based on their similar properties and the factors that contributed to their formation. Familiarity with the soil group of a particular area provides a broad scale overview of the general landscape characteristics, management options and limitations as related to agricultural production potential.

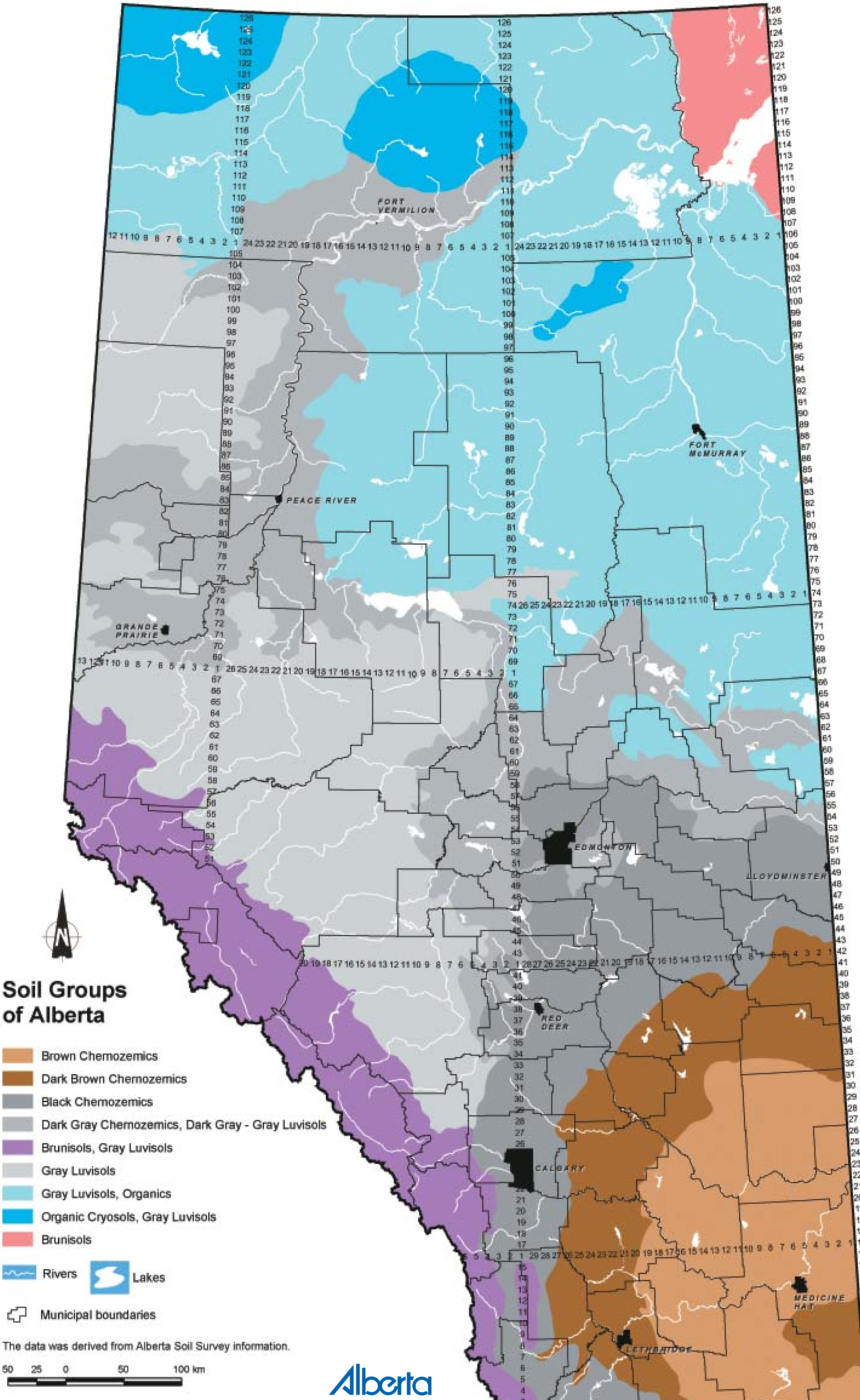
Limitations

The soil groups are broad groupings of the dominant soil types of an area. Within any one area, many other soil types are present. At this map scale, only the most prevalent soil type(s) is described. Boundaries between soil groups are transitional in nature.

Further information

Alberta Soil Information Centre provides digital files and published maps and reports for users of soils information. The Soil Groups of Alberta map is also available here with links to further soil descriptions as well as landscape and profile photographs. www.agric.gov.ab.ca/asic

Canadian Soil Information System (CanSIS) provides soils information and maps for all of Canada. Publications including *The Canadian System of Soil Classification* are available from the website. http://sis.agr.gc.ca/cansis



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Conservation and Development Branch

Soil Texture of the Agricultural Area of Alberta

Description

This map illustrates the distribution of soil parent material textures in the agricultural region of Alberta. Soil texture is defined by the relative proportions of the sand, silt and clay particles present. Soil textures are identified by classes using the Soil Texture Triangle illustrated below. The Soil Texture Triangle identifies the textural class of a soil at the intersection of the percent sand (x-axis) and the percent clay (y-axis). The percent silt of the soil is the remainder to add up to 100 percent.

Textural Class Groupings

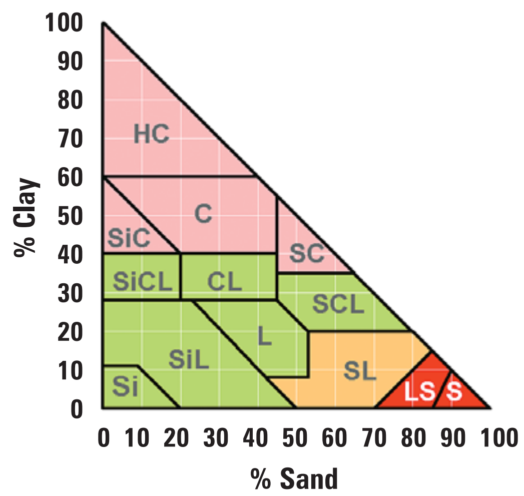
Textural Group

Fine
HC - Heavy Clay
SiC - Silty Clay
C - Clay
SC - Sandy Clay

Medium
SiCL - Silty Clay Loam
CL - Clay Loam
SCL - Sandy Clay Loam
Si - Silt
SiL -Silt Loam
L - Loam

Moderately Coarse
SL - Sandy Loam

Very Coarse
LS - Loamy Sand
S - Sand



Example Textural Class - Clay Loam CL
% Clay - 28 to 40
% Sand - 20 to 45
% Silt - 15 to 52

For presentation on this map, the texture classes of soil parent materials identified with each Agricultural Region of Alberta Soil Inventory Database (AGRASID) soil landscape polygon were combined into four more general groups – fine, medium, moderately coarse and very coarse. These are represented on the map by solid colors when the areal extent of the texture group occupies more than or equal to 60 percent of the soil area. Textural groupings with patterned symbols are complex areas where texture groups occupy more than or equal to 30 percent, but less than 60 percent of the area.

Other groupings identified in the map legend are *Peat*, *Undifferentiated* and *Water Bodies*. Peat soils have greater than 30 percent organic matter and are greater than 40 cm thick. Undifferentiated soils refer to soils where the textural group is unknown. Water Bodies refers to permanent bodies of water.

Data sources

AGRASID 3.0 was used to produce this map. AGRASID is a digital database describing the spatial distribution of soils and associated landscapes within the agricultural region of Alberta.

Potential uses

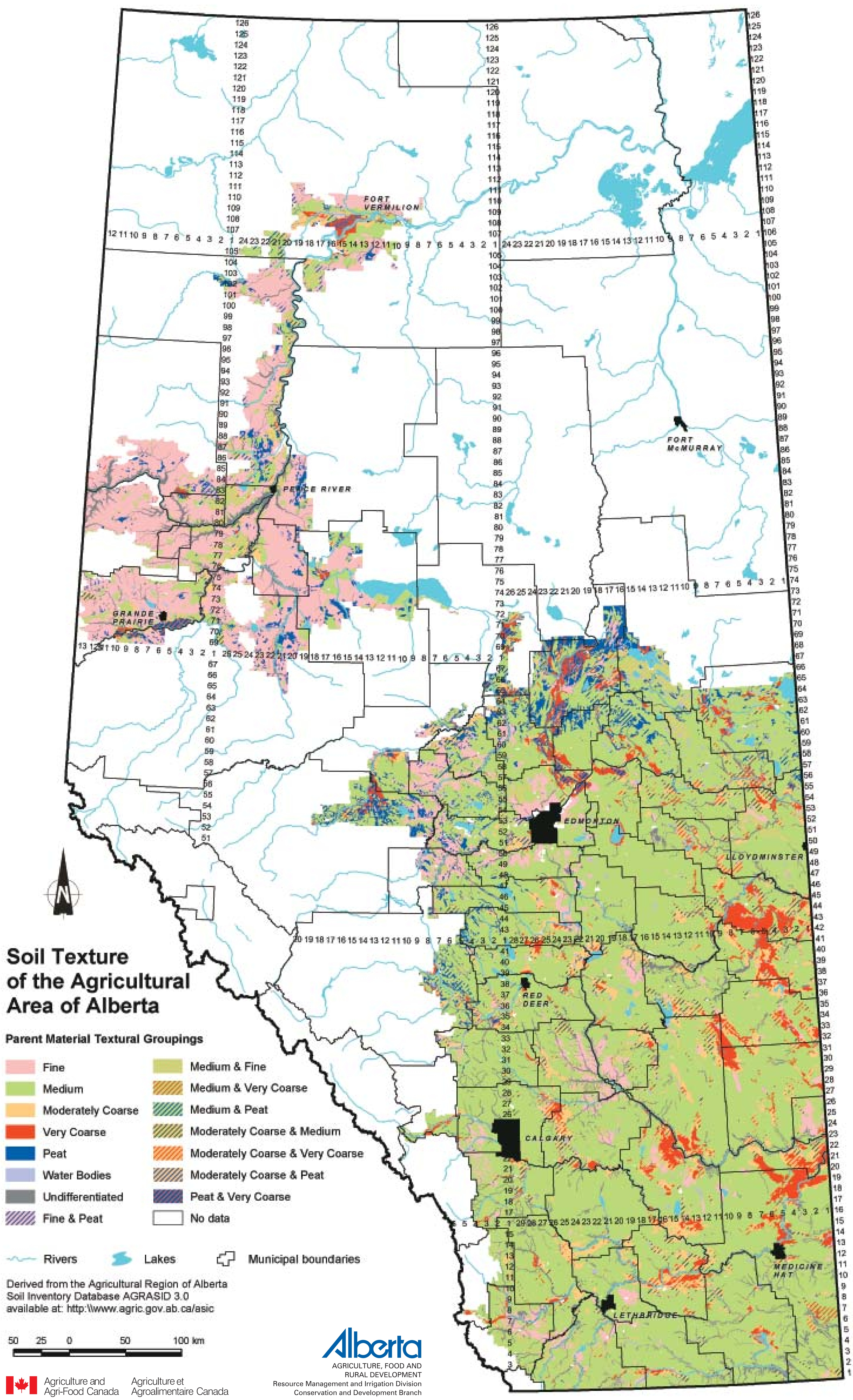
Soil texture will influence the water holding capacity of the soil and is useful information when considering the potential for wind and water erosion. Soil texture along with other factors including topography, climate, vegetative cover and agricultural practices will influence the degree of soil degradation that may occur in a particular area. For example, water erosion potential is generally higher for unconsolidated clays and silts than for sands and gravels.

Limitations

Soil texture will vary within each soil landscape polygon.

Further information

AGRASID provides extensive soil information and is available to download from the Alberta Soil Information Centre at the Alberta Agriculture, Food and Rural Development website. www.agric.gov.ab.ca/asic


Soil Texture of the Agricultural Area of Alberta
Parent Material Textural Groupings
Fine
Medium
Moderately Coarse
Very Coarse
Peat
Water Bodies
Undifferentiated
Fine & Peat
Medium & Fine
Medium & Very Coarse
Medium & Peat
Moderately Coarse & Medium
Moderately Coarse & Very Coarse
Moderately Coarse & Peat
Peat & Very Coarse
No data
Rivers
Lakes
Municipal boundaries
Derived from the Agricultural Region of Alberta Soil Inventory Database AGRASID 3.0 available at: http:\\www.agric.gov.ab.ca/asic
50 25 0 50 100 km
FORT VERMILION
PEACE RIVER
FORT McMURRAY
GRANDE PRAIRIE
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
Alberta
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Conservation and Development Branch
Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Saline Soils of the Agricultural Area of Alberta

Description

This map displays the occurrence of saline soils in the agricultural region of Alberta. A saline soil is a non-alkali (pH less than 8.5 and exchangeable-sodium less than 15%) soil containing soluble salts in great enough quantities that they interfere with the growth of most crop plants.

For this map, saline soils were defined as having a soil horizon with an electrical conductivity (EC) of greater than or equal to 4.0 mS/cm within 30 cm of the surface. This is the level of salinity at which crop growth is significantly reduced. The areal extent of saline soils within each Agricultural Region of Alberta Soil Inventory Database (AGRASID) soil landscape polygon was represented as a percentage of the total area using the following classes: greater than 30, 10 to 30 and less than 10.

Data sources

The data for this map was derived from AGRASID 3.0. AGRASID is a digital database describing the spatial distribution of soils and associated landscapes within the agricultural region of Alberta.

Potential uses

Knowledge concerning the distribution of saline soils in the province can be useful in assisting municipalities and producers in targeting salinity control and cost effective management activities.

Limitations

The map gives a broad view of the distribution of soil salinity in the province based on the areal extent of each class. The extent of saline soils will vary within each soil landscape polygon.

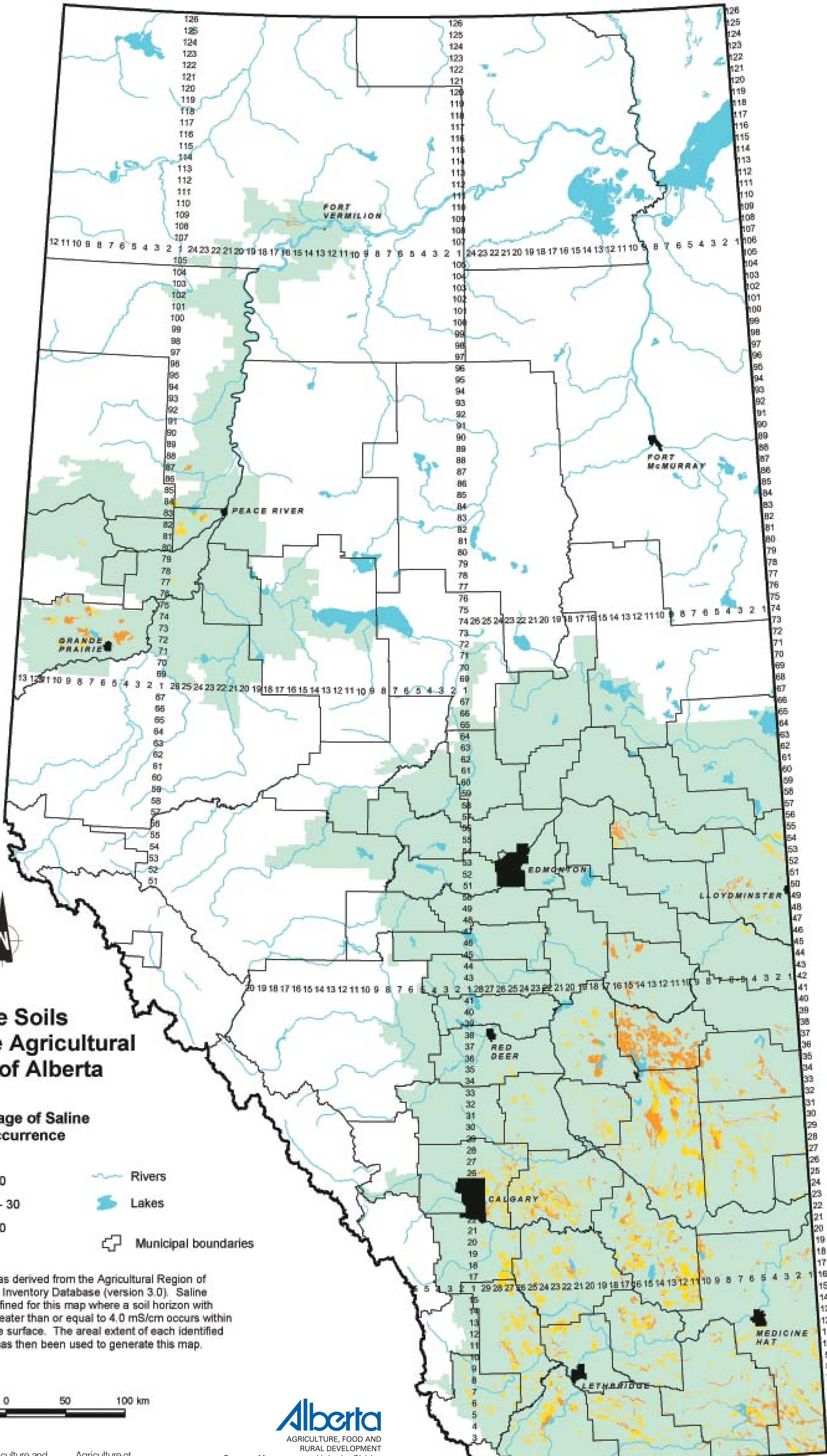
Further information

Alberta Agriculture, Food and Rural Development (AAFRD) provides information about saline soils.

- From the AAFRD website, under Quick Links on the right side follow: *Publications & More,* then *Soils and Water Publications* to access a number of saline soil publications.
- From the AAFRD website, use the topic bar on the left and follow: *Soil/Water/Air*, *Soil Fertility* and *Salinity* to find information about municipal salinity mapping projects completed in the province. Or, contact Conservation and Development Branch, AAFRD, for further information. Toll free call 310-0000, then dial (780) 422-4385.

www.agric.gov.ab.ca

AGRASID provides extensive soil information and is available to download from the Alberta Soil Information Centre at the AAFRD website. www.agric.gov.ab.ca/asic



Saline Soils of the Agricultural Area of Alberta

Percentage of Saline Soils Occurrence

- > 30
- 10 - 30
- < 10
- Rivers
- Lakes
- Municipal boundaries

The data was derived from the Agricultural Region of Alberta Soil Inventory Database (version 3.0). Saline soils are defined for this map where a soil horizon with an EC of greater than or equal to 4.0 mS/cm occurs within 30 cm of the surface. The areal extent of each identified saline soil has then been used to generate this map.

50 25 0 50 100 km

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Solonetzic Soils of the Agricultural Area of Alberta

Description

This map displays the distribution of Solonetzic soils in the agricultural region of Alberta. Solonetzic soils have developed on saline parent material that is high in sodium and have a characteristic hardpan layer that has formed in the subsoil. This hardpan is very hard when dry and has low permeability when wet. This results in restricted root and water penetration that may limit the productivity of these soils. Solonetzic soils occur in association with Chernozemic soils and, to a lesser extent, with Luvisolic soils.

The Agricultural Region of Alberta Soil Inventory Database (AGRASID) soil landscape polygons that contained soils belonging to the Solonetzic Order were identified, and the areal extent of these soils was represented as a percentage of the total area using the following classes: greater than 30, 10 to 30 and less than 10.

Data sources

The data for this map was derived from AGRASID 3.0. AGRASID is a digital database describing the spatial distribution of soils and associated landscapes within the agricultural region of Alberta.

Potential uses

Recognizing where areas of Solonetzic soils are found in the province is important for producers due to the management requirements of these soils. If the presence of Solonetzic soils appears to be limiting a soil's productivity, further investigation may be required. Through a number of agronomic field trials, Solonetzic soil properties with the greatest potential for improvement have been identified and crop responses determined. Management techniques that improve the productivity of these soils have been developed. Recognizing the low organic matter content and increased erosion potential of these soils is important when completing an environmental farm plan.

Limitations

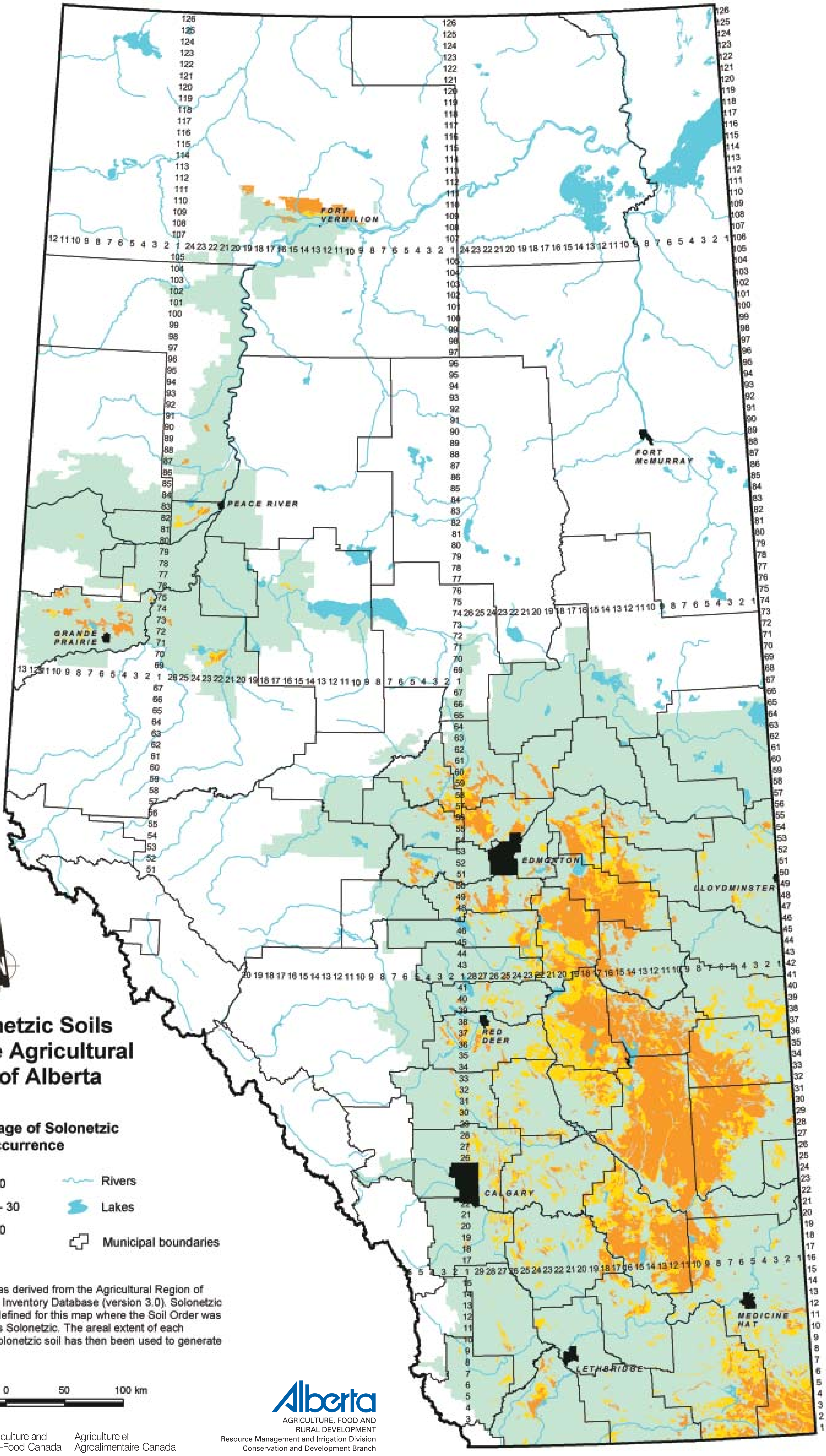
The map shows the areal extent of soils in the Solonetzic Order. The nature of these soils makes them quite variable with respect to factors such as depth of topsoil, fertility and subsoil characteristics. This variability often requires further investigation to verify the distribution and degree of severity of Solonetzic soils within a soil landscape polygon.

Further information

Alberta Agriculture, Food and Rural Development (AAFRD) provides additional information about managing Solonetzic Soils. From the AAFRD website, under Quick Links on the right side, follow: *Publications & More,* then *Soils and Water Publications*. www.agric.gov.ab.ca

AGRASID provides extensive soil information and is available to download from the Alberta Soil Information Centre at the AAFRD website. www.agric.gov.ab.ca/asic

Canadian Soil Information System (CanSIS) provides information about Solonetzic soils. Manuals including *The Canadian System of Soil Classification* are available from the website. http://sis.agr.gc.ca/cansis



Solonetzic Soils of the Agricultural Area of Alberta

The data was derived from the Agricultural Region of Alberta Soil Inventory Database (version 3.0). Solonetzic soils were defined for this map where the Soil Order was classified as Solonetzic. The areal extent of each identified Solonetzic soil has then been used to generate this map.

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Organic Matter Content of Cultivated Soils of the Agricultural Area of Alberta

Description

This map displays the percentage of organic matter in the surface layer of cultivated soils in the agricultural region of Alberta. Soil organic matter (SOM) is derived primarily from the decomposition of plant biomass. SOM improves both the physical and chemical properties of soil and has beneficial effects on agricultural soil quality. SOM is reported on the map as a percentage using the following classes: less than 2 (very low), 2 to 4 (low), 4 to 6 (medium), 6 to 8 (high) and greater than 8 (very high).

Data sources

Data used in this map comes from Norwest Labs and was presented in a study conducted by Norwest Labs and Alberta Agriculture, Food and Rural Development (AAFRD). The study looked at distribution of soil fertility parameters, including SOM, on an ecodistrict basis. Ecodistricts are land areas that "*are characterized by distinct assemblages of landform, relief, surficial geological material, soil, water bodies, vegetation and land uses*" (Ecological Stratification Working Group, 1995).

The Norwest Labs database represented 77,962 records from 1993 to 1997. Producers submitted soil samples taken at a depth of 0 to 30 cm. An average SOM value was calculated for each ecodistrict and then assigned to classes ranging from very low to very high.

Potential uses

Since SOM is an important factor influencing soil quality and agricultural productivity, it is useful to know how SOM levels vary. Awareness of the factors that affect SOM levels may help producers adopt beneficial management practices. Land use practices including increased use of forages in crop rotations, tillage and residue management affect SOM levels.

Limitations

The data used is an average of soil samples taken within each ecodistrict. Assessment of SOM is very site-specific due to factors that include soil moisture levels, soil texture and climate. SOM varies across the landscape. This map should be viewed as a characterization of SOM levels across the province.

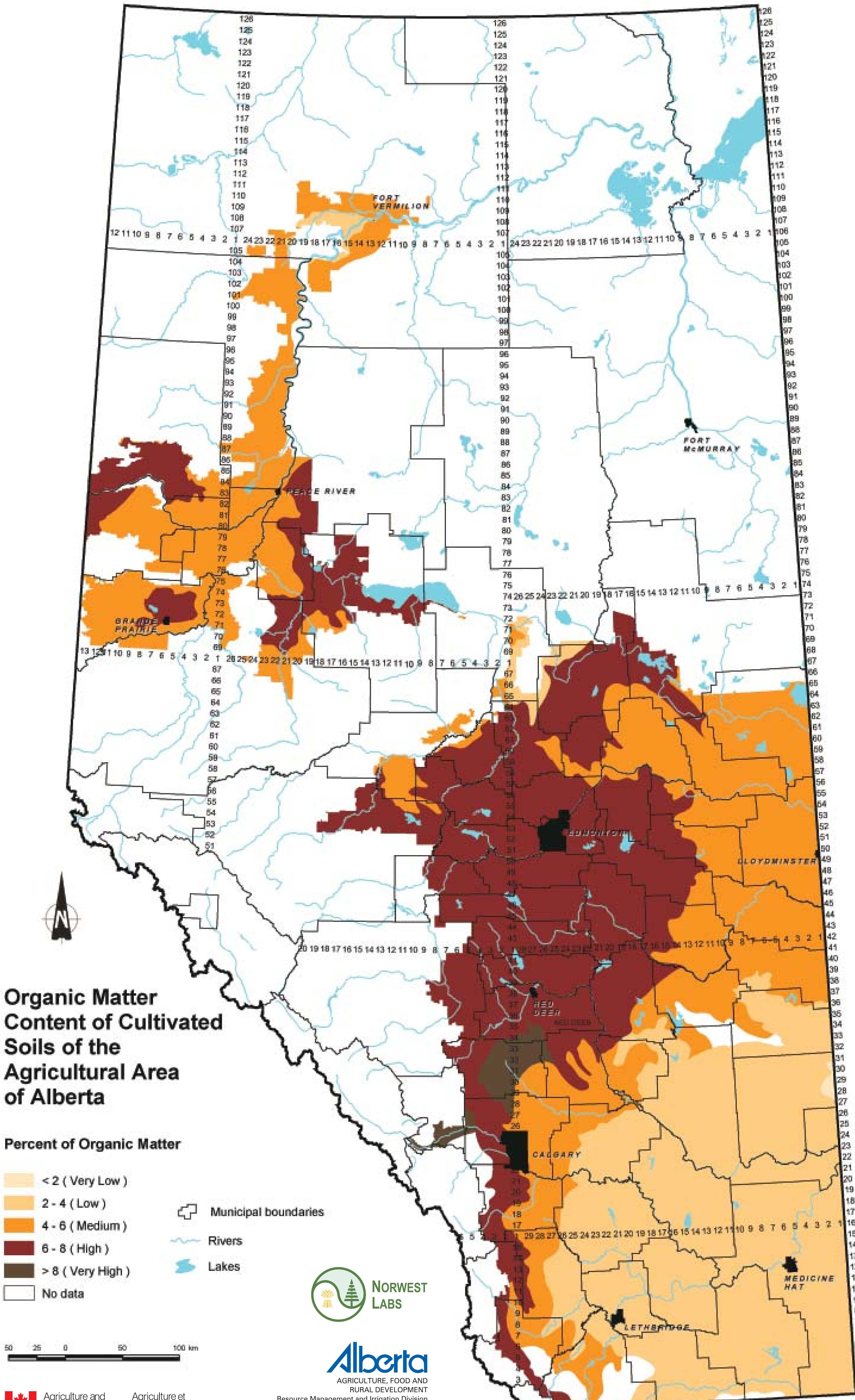
Further information

AAFRD has additional information about the importance and management of SOM. From the AAFRD website, use the topic bar on the left and follow: *Soil/Water/Air*, *Soil Fertility* and *Nutrient Management*. www.agric.gov.ab.ca

Keyes, D., Cannon, K. and Kryzanowski, L. 1999. *Spatial Relationships Between Soil Fertility Parameters and Ecological Landforms*. Proceedings of the 36th Annual Alberta Soil Science Workshop. February 16-18, 1999. Calgary, Alberta.

Ecological Stratification Working Group. 1995. *A National Ecological Framework for Canada*. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. 125pp. One map (scale 1:7 500 000).

Organic Matter Content of Cultivated Soils of the Agricultural Area of Alberta



NORWEST LABS

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Organic Soils of the Agricultural Area of Alberta

Description

This map displays the distribution of organic soils in the agricultural region of Alberta. Organic soils consist of layers of material with greater than 30 percent organic matter and a total thickness of greater than 40 cm.

Organic soils are generally saturated with water for most of the year unless drained. Saturation inhibits decomposition and encourages continued accumulation of organic material. Drainage of these soils can result in a rapid increase in decomposition and a reduction in the thickness of the organic material.

The Agricultural Region of Alberta Soil Inventory Database (AGRASID) soil landscape polygons that contained soils belonging to the Organic Order were identified, and the areal extent of these soils was represented as a percentage of the total area using the following classes: greater than 30, 10 to 30 and less than 10.

Data sources

The data for this map was derived from AGRASID 3.0. AGRASID is a digital database describing the spatial distribution of soils and associated landscapes within the agricultural region of Alberta.

Potential uses

This map shows where organic soils occur, which is important since special management may be required on these soils. Organic soils may be used for extraction of peat moss, but drainage is necessary first.

Agricultural production is limited on organic soils. They are usually deficient in phosphorous, potassium and many micronutrients. Where cereal crops are grown on organic soils, copper deficiency is commonly seen in the crop. Additions of copper sulfate to the soil can correct this deficiency. Specific soil management techniques such as drainage, using forages in rotation or establishing permanent cover will enhance agricultural production on these soils.

Limitations

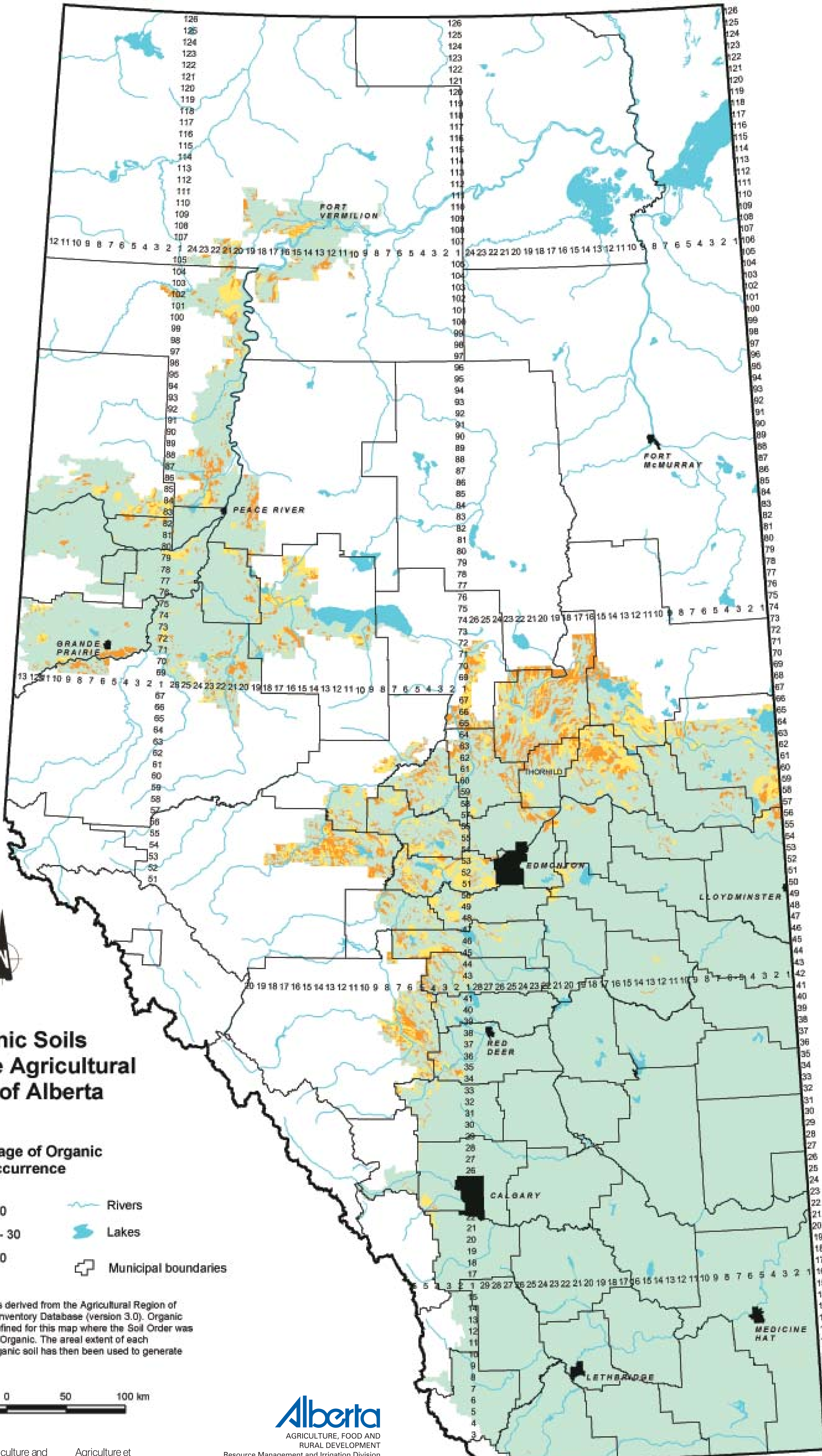
The map shows the areal extent of Organic Order soils. Further investigation of the soil landscape polygons is required to assess the nature of the soils present and the level of their limitations for agricultural production.

Further information

Canadian Soil Information System (CanSIS) provides soils information and maps for all of Canada. Publications including *The Canadian System of Soil Classification* are available from the website. http://sis.agr.gc.ca/cansis

AGRASID provides extensive soil information and is available to download from the Alberta Soil Information Centre at the Alberta Agriculture, Food and Rural Development website. www.agric.gov.ab.ca/asic

Organic Soils of the Agricultural Area of Alberta



Percentage of Organic Soils Occurrence

- > 30
- 10 - 30
- < 10

- Rivers
- Lakes
- Municipal boundaries

The data was derived from the Agricultural Region of Alberta Soil Inventory Database (version 3.0). Organic soils were defined for this map where the Soil Order was classified as Organic. The areal extent of each identified Organic soil has then been used to generate this map.

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Water Erosion Risk of the Agricultural Area of Alberta

Description

This map displays the risk of soil degradation by water in the agricultural region of Alberta. Water erosion is a concern because it reduces soil quality by removing soil particles and nutrients, and reduces water quality if these particles are carried into nearby water bodies.

The map uses five classes to describe the water erosion risk on bare, unprotected mineral soil: negligible, low, moderate, high and severe.

Data sources

This is a 1:3 000 000 scale representation of a map titled *Water Erosion Risk, Alberta* by Tajek and Coote (1993). The original 1:1 000 000 scale map used the Soil Landscapes of Canada (SLC) polygons to display the soils information.

SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Water Erosion Risk, Alberta used SLC information and the Universal Soil Loss Equation (USLE) to estimate the risk of water erosion on bare, unprotected mineral soils. USLE analyses are useful for comparing the erosion risk between polygons rather than focusing on the actual value of soil loss. The USLE combines soils data and factors that affect water erosion including erosivity of rainfall and snowmelt, soil erodibility, slope length and steepness. Crop cover and conservation practice are parameters that can be incorporated into the USLE, but in this case, these factors were not included since erosion risk ratings for bare, unprotected soil were desired.

Potential uses

This map illustrates that some areas of the province have a greater potential for water erosion based on soil and land characteristics of the SLC and climatic conditions. By understanding that some areas of the province have a greater risk of water erosion than others, beneficial management practices that reduce the effects can be directed to these areas. For example, practices that increase crop residue cover and decrease the amount of tillage could be promoted in high-risk areas.

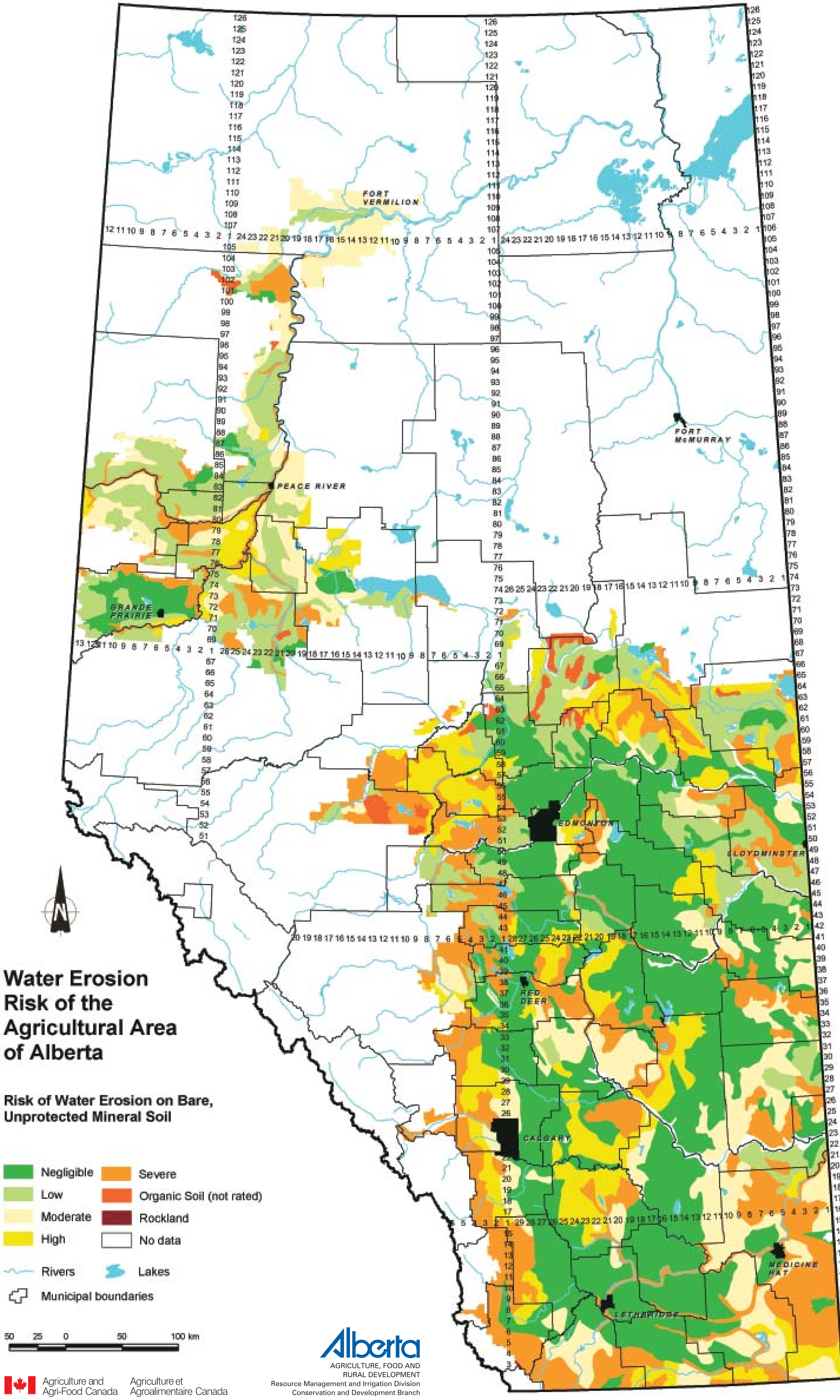
Limitations

The map is intended for interpreting water erosion risk in general classes useful at the regional level only.

Further information

Alberta Agriculture, Food and Rural Development (AAFRD) has information about water erosion, its control and prediction as well as management practices that can be used for its prevention. From the AAFRD website, under Quick Links on the right side, follow: *Publications & More,* then *Soils and Water Publications*. www.agric.gov.ab.ca

Tajek, J. and Coote, D.R. 1993. *Water Erosion Risk, Alberta.* Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5292/B. Contribution Number 92-05.



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Wind Erosion Risk of the Agricultural Area of Alberta

Description

This map displays the risk of soil degradation by wind in the agricultural region of Alberta. Wind erosion is a concern because it reduces soil quality by removing soil nutrients, smaller soil particles and organic matter. Wind erosion can reduce air quality during extreme erosion events and also reduce water quality if eroded particles drift into streams and lakes.

The map uses five classes to describe the wind erosion risk on bare, unprotected mineral soil: negligible, low, moderate, high and severe.

Data sources

This is a 1:3 000 000 scale representation of a map titled *Wind Erosion Risk, Alberta* by Coote and Pettapiece (1989). The original 1:1 000 000 scale map used the Soil Landscapes of Canada (SLC) polygons to display the soils information.

SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Wind Erosion Risk, Alberta used SLC information as well as information on wind speed, soil resistance to movement and available moisture. These factors were used to estimate the long-term risk of wind erosion on bare, unprotected soils.

Potential uses

This map illustrates that some areas of the province have a greater potential for wind erosion based on soil and land characteristics of the SLC and climatic conditions. By understanding that some areas of the province have a greater risk of wind erosion than others, beneficial management practices that reduce the effects can be directed to these areas. For example, practices that maintain a vegetative cover (e.g. perennial forages or crop residues), reduce cultivated fallow, reduce or eliminate tillage, use field shelterbelts and avoid overgrazing, could be promoted in high-risk areas.

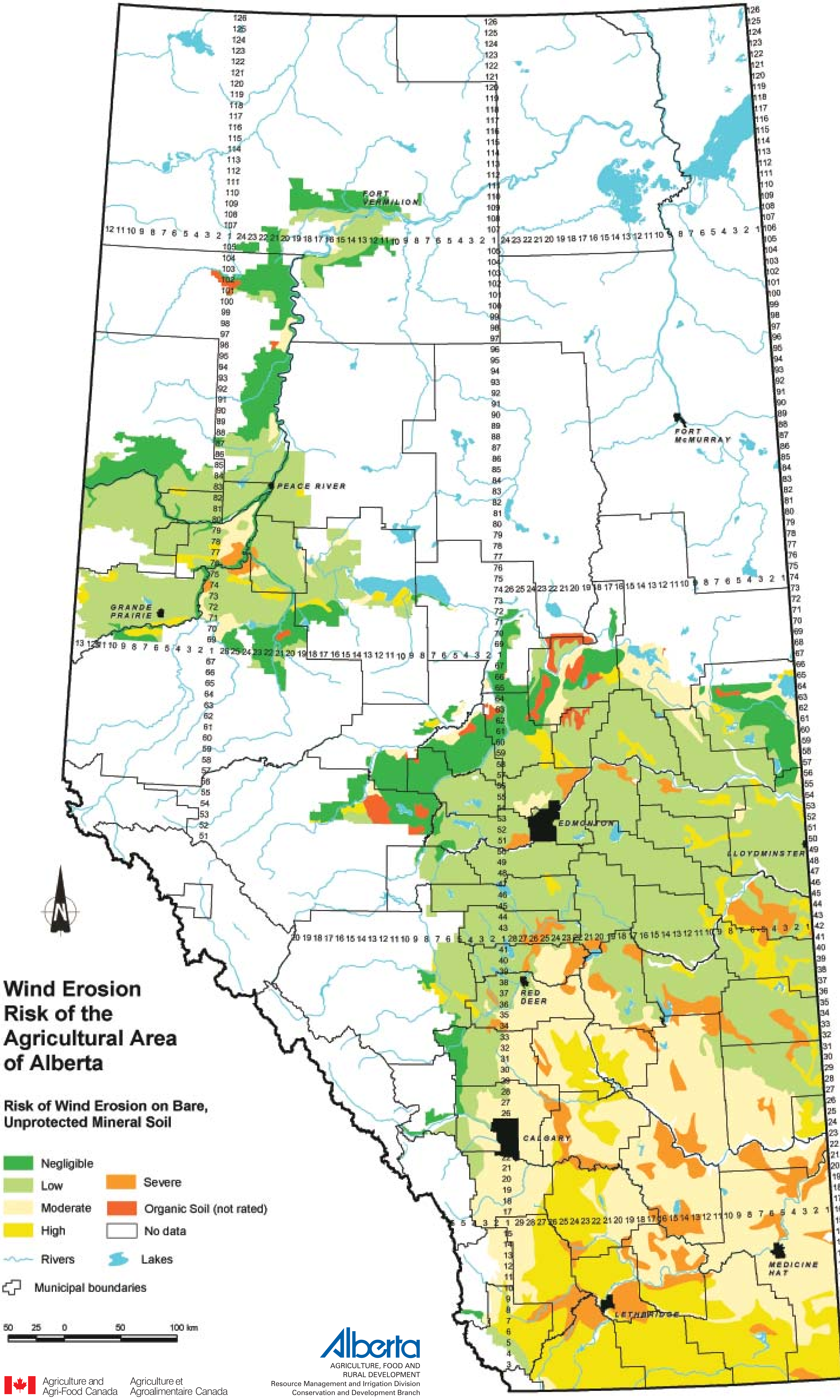
Limitations

The map is intended for interpreting wind erosion risk in general classes useful at the regional level only.

Further information

Alberta Agriculture, Food and Rural Development (AAFRD) provides information about wind erosion control, management practices and losses from wind erosion. From the AAFRD website, under Quick Links on the right side, follow: *Publications & More,* then *Soils and Water Publications*. www.agric.gov.ab.ca

Coote, D.R. and Pettapiece, W.W. 1989. *Wind Erosion Risk, Alberta.* Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5255/B. Contribution Number 87-08.



FORT VERMILION
FORT McMURRAY
PEACE RIVER
GRANDE PRAIRIE
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
N
Wind Erosion Risk of the Agricultural Area of Alberta
Risk of Wind Erosion on Bare, Unprotected Mineral Soil
Negligible
Low
Moderate
High
Severe
Organic Soil (not rated)
No data
Rivers
Lakes
Municipal boundaries
50 25 0 50 100 km
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Aquifer Vulnerability Index for the Agricultural Area of Alberta

Description

The Aquifer Vulnerability Index (AVI) is a method for assessing the vulnerability of aquifers to surface contaminants. An aquifer is a geologic formation that is permeable enough to transmit sufficient quantities of water to possibly support the development of water wells. In the assessment of aquifer vulnerability to potential contamination, the depth to the aquifer and the types of geological materials above them are considered. For example, aquifers closer to the surface overlain with pervious surface materials are more vulnerable to contaminants, as compared to aquifers found deeper and covered with thick layers of impervious materials.

The AVI ratings indicate the potential of surficial materials to transmit water with contaminants to the aquifer over a period of time. The AVI ratings are displayed on the map in classes ranging from low to high. An area with a low class rating implies that water percolating through the surficial materials in this area takes a long time (in the range of thousands of years) to reach the aquifer. On the other hand, in an area with a high rating, contaminated water is predicted to reach the aquifer within "tens" of years.

Data sources

This map was generated using two steps. The first step in generating the Index incorporated the AVI prepared by Prairie Farm Rehabilitation Administration (PFRA) and Alberta Agriculture, Food and Rural Development (AAFRD). Dash and Rodvang (2000) prepared Groundwater Vulnerability maps for the Hog Environmental Management Strategy (HEMS) Initiative. The methodology was further developed in Agriculture and Agri-Food Canada Technical Bulletin 2001-1E (Eilers and Buckley (eds.) 2002).

The AVI method maps the vulnerability of aquifers to contamination from the surface, with aquifers nearest to the surface generally the most at risk to contamination. Vulnerability is based on the thickness (depth to aquifer) and the estimated hydraulic conductivity of the geologic layers above the aquifer.

The data used for the AVI comes from Alberta Environment's Groundwater Information Center database that contains general groundwater information from water-well descriptions called well logs. This data was standardized and interpreted for mapping purposes.

The surficial geology maps for southern and central Alberta prepared by Shetsen (1987 and 1990) provided the basis for the polygon lines for amalgamating the interpreted well log data. PFRA also developed a surficial geology map to cover the Peace River region of the province.

The second step in developing the map involved incorporating *precipitation minus potential evapo-transpiration* (P – PE) values taken from the National Ecological Framework for Canada ecodistrict climate files into the final index. Aquifers in areas with a higher *precipitation minus potential evapo-transpiration* value are considered to be more susceptible to contaminants through leaching to the groundwater. Inclusion of climate data as a component of the final rating acknowledges the contribution of groundwater recharge through precipitation to the vulnerability of aquifers. Integrating the groundwater vulnerability and precipitation data together resulted in the final AVI ratings (low to high) displayed on the map.

Potential uses

The AVI is an indication of how much an aquifer is vulnerable to contamination by considering the depth to the aquifer, the surficial geology and groundwater recharge through precipitation.

Limitations

This map should be used as a guide for the relative differences in aquifer vulnerability in the province at a regional level.

Further information

Groundwater Assessment Reports available from PFRA provide information on the yield, quality and depth of aquifers in Alberta. From the PFRA website, use the topic bar on the left and click on *Clean Water*, then *Water Supply* and in that document, click on *Groundwater assessment reports in Alberta*. www.agr.gc.ca/pfra

Agricultural Region of Alberta Soil Inventory Database (AGRASID) version 3.0 is a standardized compilation of all soil survey information for the province. It portrays soils, surficial geology, landforms and depth-to-bedrock data at a scale of 1:100 000 and is available to download from the AAFRD website. www.agric.gov.ab.ca/asic

General information about groundwater vulnerability can be found at the AAFRD website; use the topic bar on the left and follow: *Soil/Water/Air*, *Water Quality* and *Groundwater*. www.agric.gov.ab.ca

Dash, T. and Rodvang, J. 2000. *HEMS Thematic Mapping – Test Data Alberta*. Draft analysis approach, preparation of "Groundwater Vulnerability" Maps for HEMS Initiative. CD. December 19, 2000. PFRA and AAFRD.

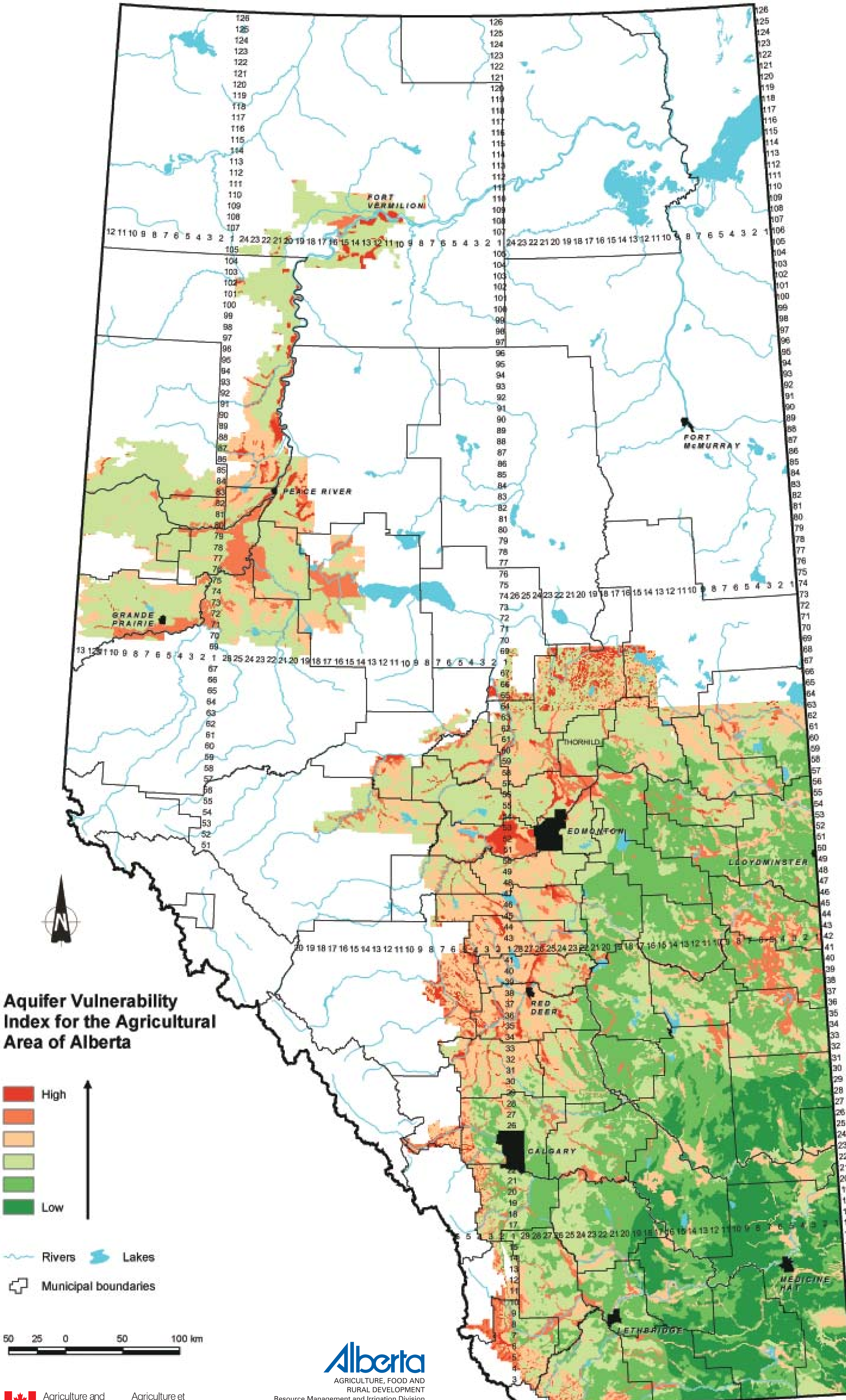
Eilers, R.G. and Buckley, K.E. (eds.). 2002. *A Methodology for Evaluating Soils, Landscapes and Geology for Nutrient Management Planning in the Prairie Landscape – A systematic approach to land based decision making with standardized resource databases, digital map information, manure management research and farm practices guidelines using GIS as a decision tool*. Technical Bulletin 2001-1E Land Resource Group, Research Branch, Agriculture and Agri-Food Canada.

Ecological Stratification Working Group. 1995. *A National Ecological Framework for Canada.* Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. Report and national map at 1:7 500 000 scale. sis.agr.gc.ca/cansis/nsdb/ecostrat/district/climate.html.

Shetsen, I. 1987. Quaternary Geology, Southern Alberta. Alberta Research Council. Scale 1:500 000.

Shetsen, I. 1990. Quaternary Geology, Central Alberta. Alberta Research Council. Scale 1:500 000.

Aquifer Vulnerability Index for the Agricultural Area of Alberta



Fertilizer Expense Index for the Agricultural Area of Alberta

Description

This map shows the relative expense of fertilizer and lime in the agricultural area of Alberta. It is an estimate of the degree to which agriculture may affect nutrient levels in surface and groundwater. The classes shown on the map are ranked between 0 (lowest) and 1 (highest).

Data sources

Data on the amount spent on fertilizer and lime by producers was collected during the 2001 Census of Agriculture. Custom processing of the Census data by Statistics Canada gives the fertilizer expense ($) for each Soil Landscapes of Canada (SLC) polygon. That amount was divided by the SLC area (square km) to result in a ratio of the amount spent on fertilizer per unit area for each SLC.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The values for each SLC were ranked with the lowest value assigned a new value of 0.0 and the SLC with the maximum ratio assigned a new value of 1.0. All other values were assigned a new value between 0.0 and 1.0 based on their rank order.

Potential uses

Mapping the relative values of fertilizer expenses by SLC polygon area is useful as an indication of where more fertilizer is applied in the province and as a proxy indicator for crop production.

It also suggests the relative agricultural intensity in various parts of the province. Fertilizer use has been used as one component of an Agricultural Intensity Index (AII), developed through the Alberta Environmentally Sustainable Agriculture (AESA) Water Quality Monitoring Program. Work by Anderson, Cooke and MacAlpine (1999) and by Johnson and Kirtz (1998) developed that Index. The AII has been identified as a good indicator of agricultural impacts on surface water.

Fertilizer use is a part of that equation to determine a measure of surface water quality risk. Therefore, if an area is known to have certain risk factors that would affect surface water quality, a higher fertilizer expense index ranking in that same area may be of concern. Where risks of surface water contamination exist, environmental farm planning can help to minimize them.

Limitations

Fertilizer expense data from the 2001 Census of Agriculture is used here as a proxy for the actual amount of fertilizer that is applied. While this is a reasonable connection to make, there is no adjustment made to the data to account for fertilizer price differences across the province.

Further information

The AESA Water Quality Monitoring Program directs the numerous water quality monitoring activities taking place across the province. From the Alberta Agriculture, Food and Rural Development (AAFRD) website, use the topic bar on the left and follow: *Soil/Water/Air*, *Water Quality* and *Stream Monitoring*. www.agric.gov.ab.ca

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

Anderson, A., Cooke, S. and MacAlpine, N. 1999. *Watershed Selection for the AESA Stream Water Quality Monitoring Program.* Alberta Environmentally Sustainable Agriculture, AAFRD.

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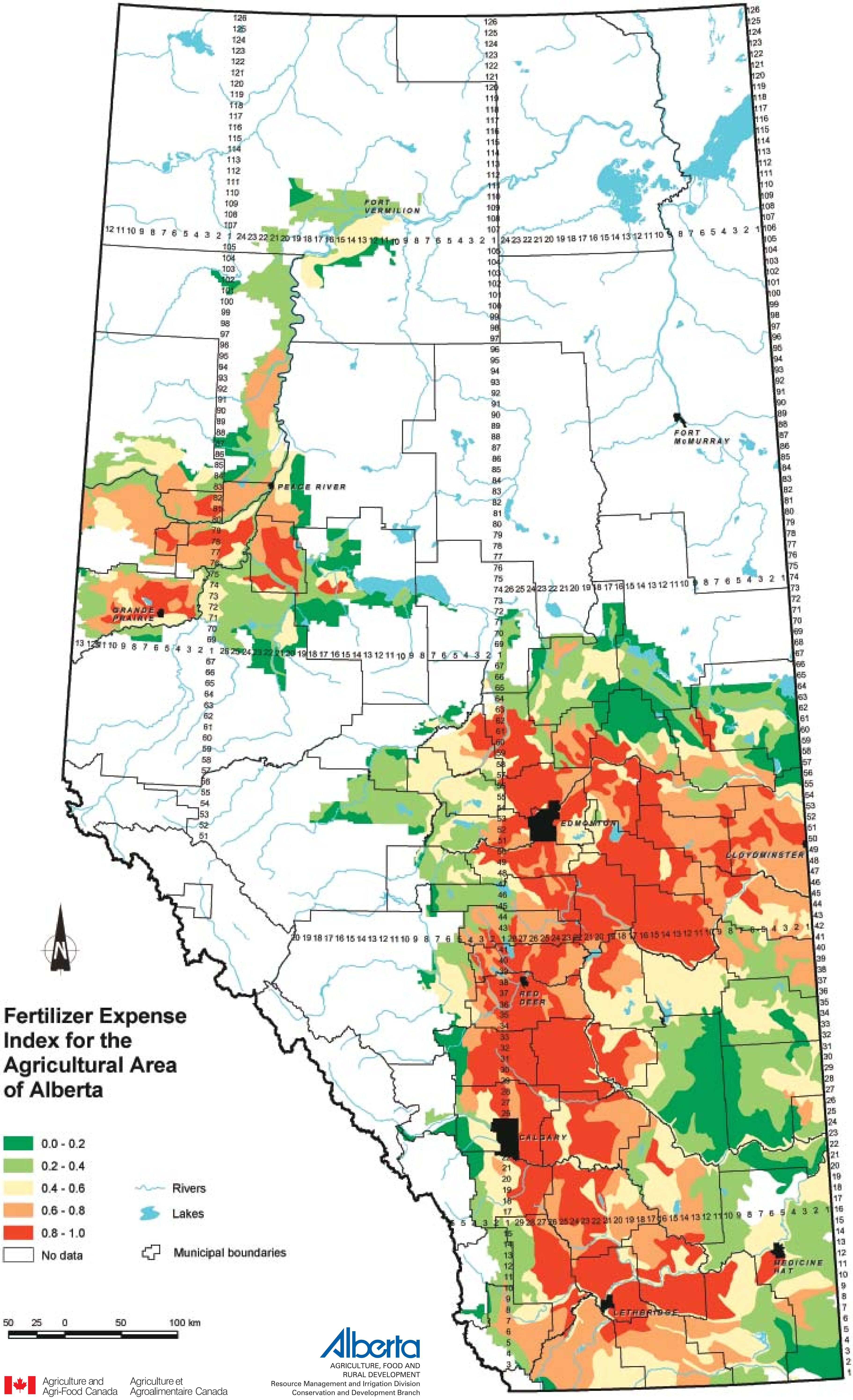

Fertilizer Expense Index for the Agricultural Area of Alberta
0.0 - 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1.0
No data
Rivers
Lakes
Municipal boundaries
50 25 0 50 100 km
FORT VERMILION
PEACE RIVER
GRANDE PRAIRIE
FORT McMURRAY
EDMONTON
LLOYDMINSTER
RED DEER
CALGARY
MEDICINE HAT
LETHBRIDGE
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Chemical Expense Index for the Agricultural Area of Alberta

Description

This map describes the relative expense of farm chemicals (herbicides, insecticides and fungicides) in the agricultural area of Alberta. It is an estimate of the degree to which crop production agriculture may contribute to surface or groundwater contamination. The classes shown on the map are ranked between 0 (lowest) and 1 (highest).

Data sources

Data on the amount spent on chemicals (herbicides, insecticides and fungicides totalled together) by producers was collected during the 2001 Census of Agriculture. Custom processing of the Census data by Statistics Canada gives the chemical expense ($) for each Soil Landscapes of Canada (SLC) polygon. That amount was divided by the SLC area (square km) to result in a ratio of the amount spent on farm chemicals per unit area for each SLC.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The values for each SLC were ranked with the lowest value assigned a new value of 0.0 and the SLC with the maximum ratio assigned a new value of 1.0. All other values were assigned a new value between 0.0 and 1.0 based on their rank order.

Potential uses

Agricultural production that makes greater use of herbicides, insecticides and pesticides is generally considered more intensive. Presenting the relative farm chemical expenses by SLC polygon reveals where the most intensive agricultural production in the province occurs.

Farm chemical use has been used as one component of an Agricultural Intensity Index (AII), developed through the Alberta Environmentally Sustainable Agriculture (AESA) Water Quality Monitoring Program. Work by Anderson, Cooke and MacAlpine (1999) and by Johnson and Kirtz (1998) developed that Index. The AII has been identified as a good indicator of agricultural impacts on surface water.

Chemical use is therefore a part of that equation to determine a measure of surface water quality risk. If an area is known to have certain risk factors that would affect not only surface, but groundwater quality as well, a higher chemical expense index ranking in that same area may be of concern. Where risks of surface or groundwater contamination exist, environmental farm planning can help to minimize them.

Limitations

Chemical expense data from the 2001 Census of Agriculture is used here as a proxy for the actual amount of herbicides, insecticides and fungicides that are applied. No adjustment has been made for differences in farm chemical prices across the province.

Further information

The AESA Water Quality Monitoring Program directs the numerous water quality monitoring activities taking place across the province. From the Alberta Agriculture, Food and Rural Development (AAFRD) website, use the topic bar on the left and follow: *Soil/Water/Air*, *Water Quality* and *Stream Monitoring*. www.agric.gov.ab.ca

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

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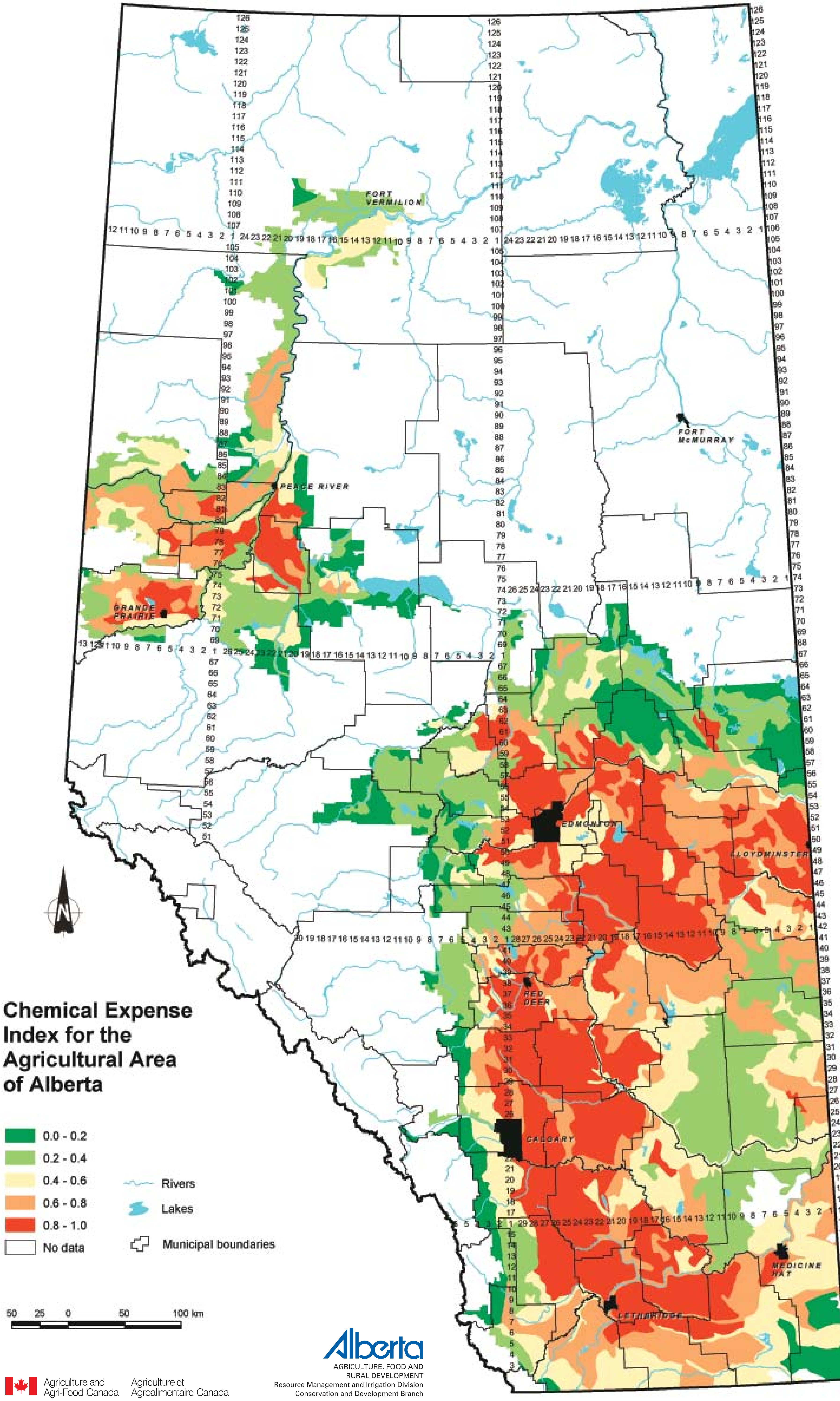

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Manure Production Index for the Agricultural Area of Alberta

Description

This map describes the relative amount of manure production in the agricultural area of Alberta. It is an estimate of the degree to which livestock production may contribute to nutrient loading, pathogens and odour. The classes shown on the map are ranked between 0 (lowest) and 1 (highest).

Data sources

Data on manure production in Alberta was derived from the 2001 Census of Agriculture. Calculation and custom processing of the Census data by Statistics Canada results in manure production in tonnes for each Soil Landscapes of Canada (SLC) polygon. That amount was divided by the SLC area (square km) to result in a ratio of the manure produced per unit area for each SLC.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The 2001 Census of Agriculture collected information about the numbers of all livestock raised in the province. Using research by Culley and Barnett (1984), Statistics Canada calculated the amount of manure produced by the total number of livestock. A formula that weighted the different livestock based on animal size and average manure output was used. The numbers of each type of livestock reported in the Census, multiplied by its manure factor, were totalled to give the total manure produced in tonnes.

The values for each SLC were ranked with the lowest value assigned a new value of 0.0 and the SLC with the maximum ratio assigned a new value of 1.0. All other values were assigned a new value between 0.0 and 1.0 based on their rank order.

Potential uses

Mapping manure production gives some indication of where in the province livestock production is most concentrated. This is important to know when issues related to manure management arise. Proper manure storage, handling and application are important wherever livestock are produced but especially in areas with a higher manure production index.

Manure production has been used as one component of an Agricultural Intensity Index (AII), developed through the Alberta Environmentally Sustainable Agriculture (AESA) Water Quality Monitoring Program. Work by Anderson, Cooke and MacAlpine (1999) and by Johnson and Kirtz (1998) developed that Index. The AII has been identified as a good indicator of agricultural impacts on surface water.

Manure production is a part of that equation to determine a measure of surface water quality risk. Therefore, if an area is known to have certain risk factors that would affect not only surface water but groundwater quality as well, a higher manure production index ranking in that same area may be of concern. Where risks of surface or groundwater contamination exist, environmental farm planning can help to minimize them.

Limitations

The Census of Agriculture does not collect data about how much manure is actually produced. The calculation used is a best estimate of manure production per animal unit based on the numbers of livestock raised in the province.

Further information

Alberta Agriculture, Food and Rural Development (AAFRD) has information about manure management. From the AAFRD website, use the topic bar on the left and follow: *Soil/Water/Air*, *Soil Fertility* and *Manure.* www.agric.gov.ab.ca

ManureNet is an online national information resource and coordination centre for manure and nutrient management research, initiatives and expertise. http://res2.agr.gc.ca/initiatives/manurenet/manurenet_en.html

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

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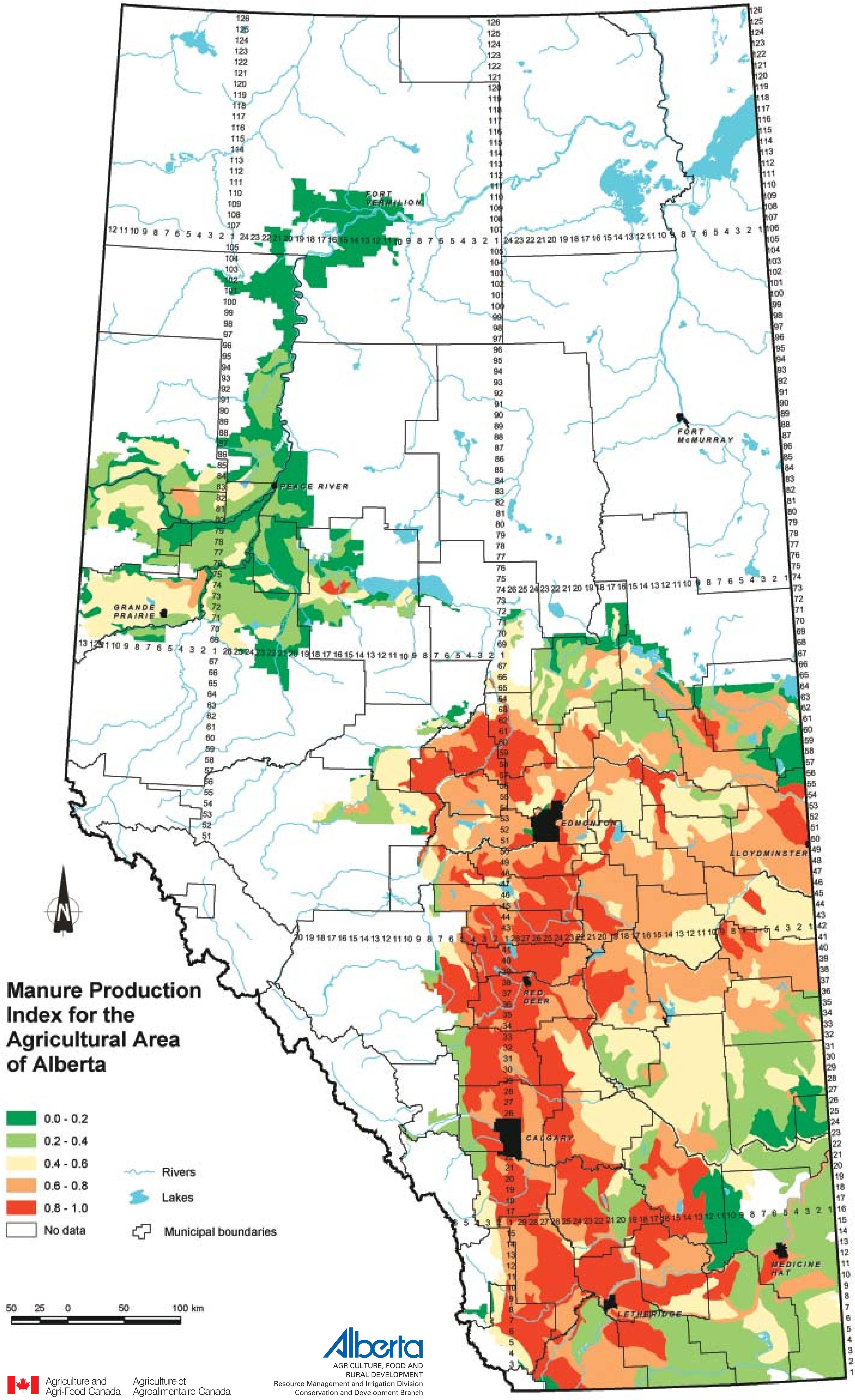
Culley, J.B. and Barnett, G.M. 1984. *Land Disposal of Manure in Province of Quebec*. Canadian Journal of Soil Science. 64: 75-86.

Johnson, I. and Kirtz, J. 1998. *Agricultural Intensity in Alberta, 1996 and Changes Since 1991.* Alberta Environmentally Sustainable Agriculture, AAFRD.

Manure Production Index for the Agricultural Area of Alberta



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Cultivation Intensity Index for the Agricultural Area of Alberta

Description

This map presents the relative cultivation intensity in the agricultural area of Alberta. Cultivation intensity refers to the frequency of cultivation associated with the following management systems: no till, conservation tillage, conventional tillage and summerfallow. It is an estimate of the degree to which cultivation contributes to wind and water erosion. The classes shown on the map are ranked between 0 (lowest) and 1 (highest).

Data sources

Data used to determine the cultivation rating was collected during the 2001 Census of Agriculture. Census questions provided an estimate of the area of no till, conservation tillage, conventional tillage and summerfallow on farms in Alberta. Custom processing of the data by Statistics Canada yielded the percent of the land within each Soil Landscapes of Canada (SLC) polygon associated with the four management systems.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The cultivation rating is a measure of the cultivation intensity, with management systems having a greater frequency of cultivation weighted higher. The cultivation rating was calculated for each SLC by the following formula:

Cultivation rating = (% area in no till) x 1 + (% area in conservation tillage) x 2 + (% area in conventional tillage) x 3 + (% area in summerfallow) x 4

The cultivation rating for each SLC was converted to an index value between 0.0 and 1.0, where 0.0 referred to uncultivated land and 1.0 had the highest value of cultivation intensity.

Potential uses

The agricultural activity with the most impact on soil quality in Alberta is cultivation. This impact is represented quantitatively through a cultivation rating based on frequency of cultivation called the cultivation intensity.

In general, more cultivation means a greater risk of wind and water erosion. However, the physical characteristics of the soil and landscape will have an influence on the sensitivity of the soils to cultivation. Mapping this information identifies areas with a high cultivation intensity index, which then can be assessed for soil characteristics that may make them susceptible to erosion. In these areas, promotion of beneficial management practices such as reduced tillage, direct seeding and reducing or eliminating summerfallow can be encouraged.

Limitations

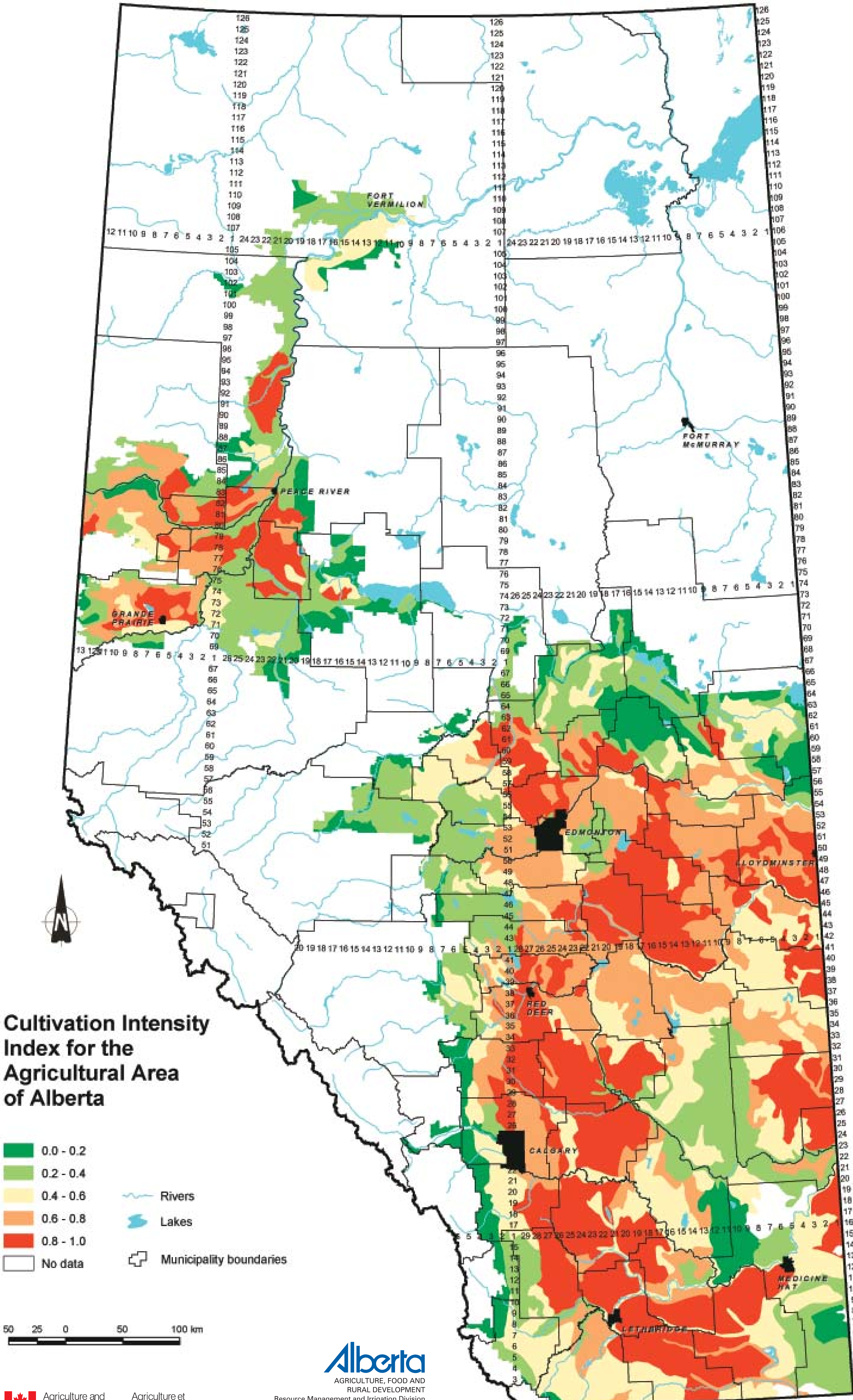
One rating is given for each SLC, which makes the data useful at a regional level only.

Further information

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Reduced Tillage LINKAGES (RTL) is a partnership with broad-based support to develop an extension program focused on improving the environmental and economic sustainability of farming in Alberta. www.reducedtillage.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis



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Number of Species at Risk in Alberta

Description

This map describes the number of animal and plant species that are at risk in Alberta. "Species at risk" is a term used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that includes the following categories of plants and animals:

- Extirpated species – no longer in the wild in Canada.
- Endangered species – species facing imminent extirpation or extinction.
- Threatened species – likely to become an endangered species if nothing is done to reverse factors leading to its extirpation or extinction.
- Species of special concern – species that may become threatened or endangered due to biological characteristics or identified threats.

The number of species at risk are displayed on the map using the following classes: 0, 1 to 3, 4 to 6, 7 to 9, and 10 to 16. The species at risk in Alberta in 2002 were:

- American badger (jeffersonii subspecies)
- Anatum peregrine falcon
- Burrowing owl
- Deepwater sculpin (Great Lakes populations)
- Eastern short-horned lizard
- Ferruginous hawk
- Great plains toad
- Grizzly bear
- Hare-footed locoweed
- Long-billed curlew
- Monarch butterfly
- Mountain plover
- Northern leopard frog (Prairie population)
- Ords kangaroo rat
- Piping plover (circumcinctus subspecies)
- Prairie loggerhead shrike
- Sage grouse (Prairie population)
- Sage thrasher
- Short-eared owl
- Slender mouse-ear-cress
- Small-flowered sand-verbena
- Smooth goosefoot
- Soapweed
- Spragues pipit
- Swift fox
- Tiny cryptanthe
- Weidemeyer's admiral
- Western blue-flag
- Western silvery minnow
- Western spiderwort
- Wolverine (Western population)
- Wood bison
- Woodland caribou (Boreal population)
- Yellow rail

Data sources

COSEWIC is a committee of experts that assesses and designates which wild species are in some danger of disappearing from Canada. Individual COSEWIC 2002 Species Range Maps were downloaded from the COSEWIC website. These maps show the natural habitat area of each of the species at risk. The number of these areas that overlapped at any given location in the landscape was used to designate the number of species at risk at that location.

Potential uses

This map is useful for increasing awareness of biological diversity (biodiversity) concerns in the province. Maintaining biodiversity is essential for ensuring a healthy environment. The more diverse the ecosystem, the better it is able to respond to environmental changes or stresses, such as floods, drought, pests and disease.

Knowing where more species are at risk creates awareness of how human activities may be affecting biodiversity. Greater biodiversity in agricultural landscapes provides more land management choices and increases the stability of an ecosystem.

Limitations

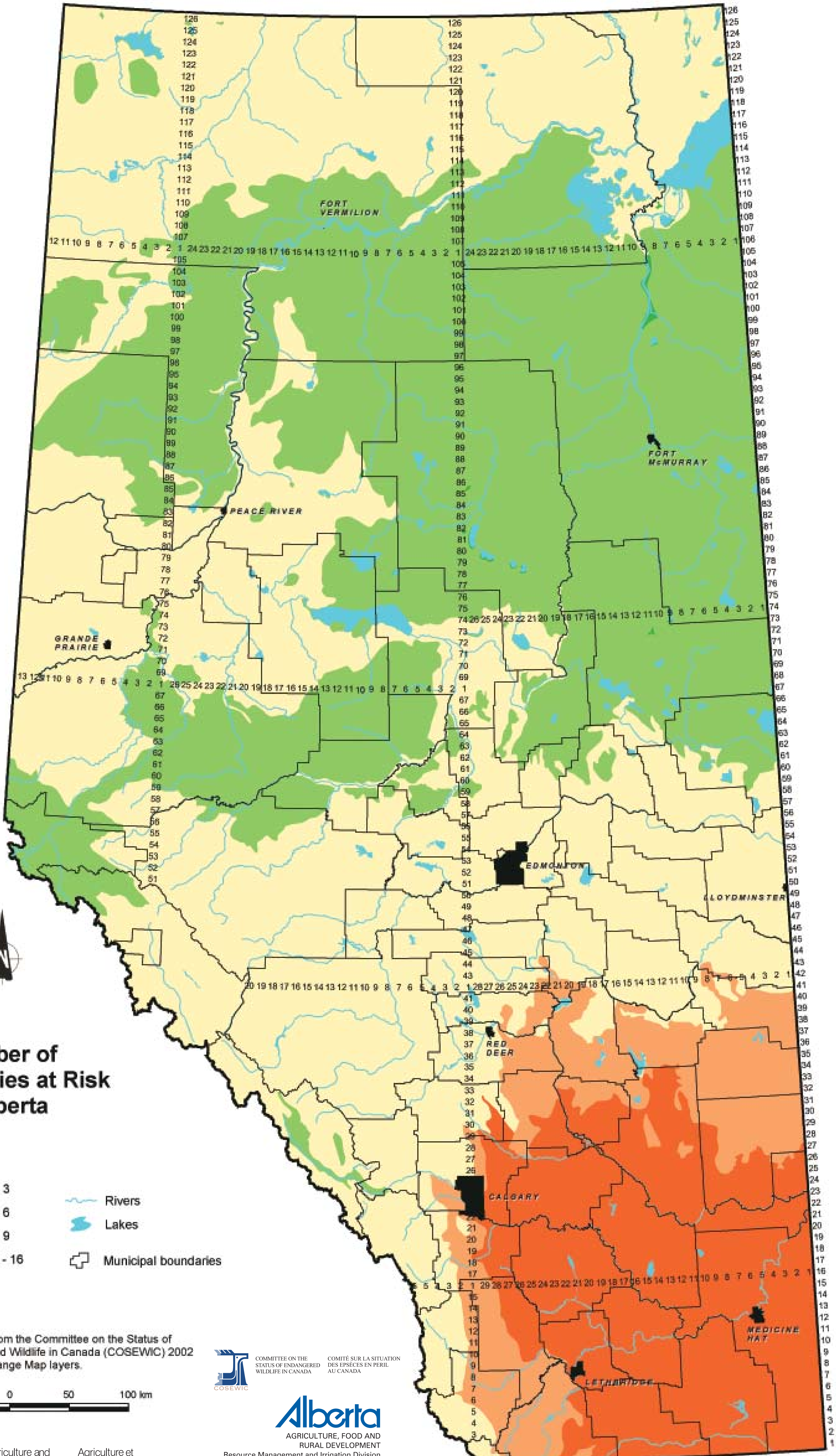
This map should be used as a broad indication of the number of species at risk and distribution of those numbers in the province. By using the number of natural habitat areas of the species at risk that overlap as a surrogate for actual density of species at risk, the map is showing the range of the species that overlap and should be used at a regional level only.

Further information

COSEWIC www.cosewic.gc.ca

Alberta Environmentally Sustainable Agriculture program provides information about agricultural biodiversity. From the Alberta Agriculture, Food and Rural Development website, use the topic bar on the left and follow: *Soil/Water/Air*, *Environmental Stewardship* and *Biodiversity*. www.agric.gov.ab.ca

Number of Species at Risk in Alberta



Adapted from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2002 Species Range Map layers.

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA
COMITÉ SUR LA SITUATION DES EPSÈCES EN PERIL AU CANADA
COSEWIC

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Surface Water Quality Risk for the Agricultural Area of Alberta

Description

This map displays an assessment of surface water quality risk for the agricultural area of Alberta. Agricultural activities that may have an impact on surface water quality, including livestock, crop production and agrochemical use, were identified and used to produce this map. The classes shown on the map were ranked from 0 (lowest risk) to 1 (highest risk).

Data sources

To assess surface water quality risk, physical characteristics and agricultural intensity were considered. Physical characteristics that make some surface waters more susceptible than others to contamination from agricultural activities are site-specific and therefore could not be addressed in this regional representation.

Soil Landscapes of Canada (SLC) Version 1.9 polygons were used to spatially represent the index values. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The components used in the Agricultural Intensity Index (AII) were derived from the 2001 Census of Agriculture data. Manure production was calculated from Census data collected about the numbers of all livestock raised in the province. Using research by Culley and Barnett (1984), Statistics Canada calculated the amount of manure produced by the total number of livestock. A formula that weighted the different livestock based on animal size and average manure output was used. The numbers of each type of livestock reported in the Census, multiplied by its manure factor, were totalled to give the total manure produced in tonnes.

Fertilizer use was determined from Census data collected on the amount spent on fertilizer and lime by producers. In the same way, agrochemical use was determined from Census data collected on the amount spent on farm chemicals (herbicides, insecticides and fungicides totalled together) by producers.

These agricultural inputs were used to derive the AII. The AII was developed through the Alberta Environmentally Sustainable Agriculture (AESA) Water Quality Monitoring Program and work done by Johnson and Kirtz (1998) and by Anderson, Cooke and MacAlpine (1999). The AII is the relative ranking of the sum of the rankings of watersheds by each of manure production, fertilizer use and agrochemical use, per unit area, based on 2001 Census of Agriculture data. For this process, agricultural inputs were integrated by SLC polygons, not watersheds. Calculation and custom processing of the Census data by Statistics Canada provided manure production (tonnes), fertilizer expense ($) and agrochemical expense ($) for each SLC polygon. These values divided by the SLC polygon area (square km) resulted in a ratio per unit area for each of manure, fertilizer and agrochemicals. These ratios were totalled to give the overall surface water quality risk factor, as displayed on the map.

Potential uses

The AII was found to correlate well with measured water quality from monitoring sites on small streams and therefore is a good indicator of surface water quality risk. Each component of the Index is an important factor that illustrates agricultural intensity. Mapping livestock numbers is an indication of manure production and the potential risk of contamination by pathogens and nutrients. In the same way, mapping the use of fertilizers and agrochemicals is a proxy for crop production intensity and possible contamination of surface water through runoff and leaching of these inputs. In areas where these risk factors may affect surface water quality, environmental farm planning can help to mitigate them.

Limitations

The physical characteristics of a particular geographic area and the agricultural activities may contribute to surface water quality risk. This map represents the risk at a regional level. The site-specific physical characteristics are not applicable at this scale. Landowners can locate their own property on the map and identify the potential relative risks, but then must assess and evaluate their own conditions and determine the appropriate beneficial management practices (BMPs) based upon their site-specific knowledge.

Further information

The AESA Water Quality Monitoring Program directs the numerous water quality monitoring activities taking place across the province. From the Alberta Agriculture, Food and Rural Development website, use the topic bar on the left and follow: *Soil/Water/Air*, *Water Quality* and *Stream Monitoring*. www.agric.gov.ab.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

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Culley, J.B. and Barnett, G.M. 1984. *Land Disposal of Manure in Province of Quebec*. Canadian Journal of Soil Science. 64:75-86.

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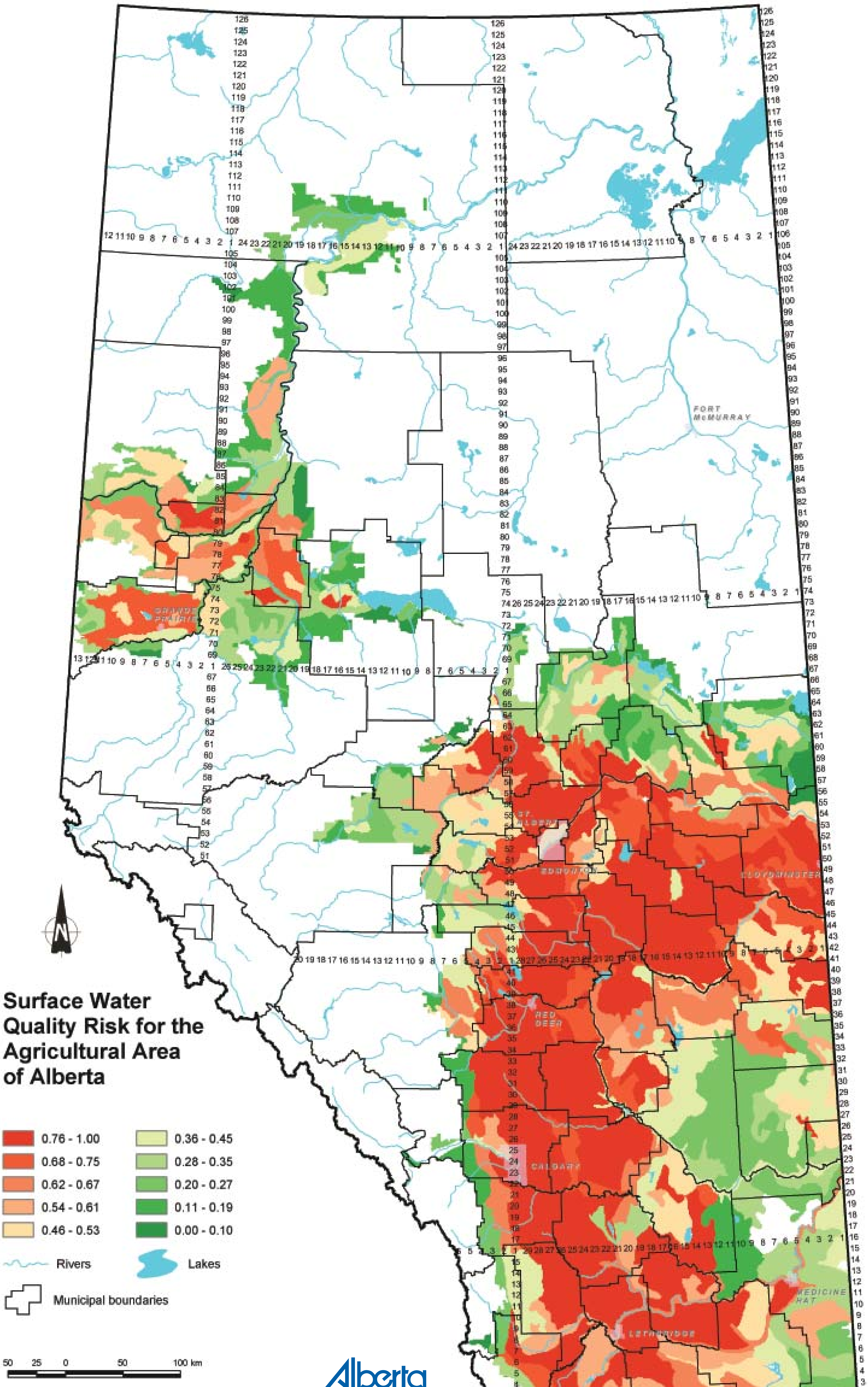
Surface Water Quality Risk for the Agricultural Area of Alberta



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Groundwater Quality Risk for the Agricultural Area of Alberta

Description

This map displays an assessment of groundwater quality risk for the agricultural area of Alberta. Agricultural activities that may have an impact on groundwater quality include livestock, crop production and agrochemical use. These activities along with the physical characteristics represented by aquifer vulnerability and available moisture were combined to produce this map. The classes shown on the map were ranked from 0 (lowest risk) to 1 (highest risk).

Data sources

To assess groundwater quality risk, the aquifer vulnerability, aridity and agricultural intensity were specifically considered. Soil Landscapes of Canada (SLC) Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Physical vulnerability of aquifers varies from location to location in Alberta and is represented by the Aquifer Vulnerability Index (AVI) prepared by Prairie Farm Rehabilitation Administration (PFRA) and Alberta Agriculture, Food and Rural Development (AAFRD) (Dash and Rodvang, 1999 and Cowen and Dash, 2003). The AVI ranks aquifer vulnerability in four classes, based on surficial geology and depth to aquifer. Aquifers in areas with a higher *mean annual precipitation minus potential evapo-transpiration* (P-PE) value are considered to be more susceptible to contaminants through leaching to the groundwater. P-PE values were obtained from the National Ecological Framework for Canada ecodistrict climate files. Aquifer vulnerability classes were combined with P-PE ratings to create the groundwater physical sensitivity factor.

The components used in the Agricultural Intensity Index (AII) were each derived in different ways from the 2001 Census of Agriculture data. Manure production was calculated from Census data collected about the numbers of all livestock raised in the province. Using research by Culley and Barnett (1984), Statistics Canada calculated the amount of manure produced by the total number of livestock. A formula that weighted the different livestock based on animal size and average manure output was used. The numbers of each type of livestock reported in the Census, multiplied by its manure factor, were totalled to give the total manure produced in tonnes.

The AII was developed through the AESA Water Quality Monitoring Program and work done by Johnson and Kirtz (1998) and by Anderson, Cooke and MacAlpine (1999). The AII is the relative ranking of the sum of the rankings of watersheds by each of manure production, fertilizer use and agrochemical use, per unit area, based on 2001 Census of Agriculture data. For this process, SLC polygons, and not watersheds, were used to integrate agricultural inputs. Calculation and custom processing of the Census data by Statistics Canada yielded manure production (tonnes), fertilizer expense ($) and agrochemical expense ($) for each SLC polygon. These values divided by the SLC polygon area (square km) resulted in a ratio per unit area for each of manure, fertilizer and agrochemicals, which were totalled to give the AII rating. The AII rating was multiplied by the groundwater physical sensitivity factor described previously, and the resultant values were ranked from 0 to 1, to give the groundwater quality risk factor as displayed on the map for each SLC polygon.

Potential uses

The groundwater quality risk is an indication of where the groundwater quality may be impacted by leaching of contaminants.

Limitations

This map displays groundwater quality risk at a regional level. Landowners can locate their own property on the map and identify the potential relative risks, but then must assess and evaluate their own conditions and determine the appropriate beneficial management practices (BMPs) based upon their site-specific knowledge.

Further information

Information about groundwater vulnerability and the AESA Water Quality Monitoring Program can be found at the AAFRD website. Use the topic bar on the left and follow: *Soil/Water/Air*, then *Water Quality*. www.agric.gov.ab.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Groundwater Assessment Reports available from PFRA provide information on the yield, quality and depth of aquifers in Alberta. From the PFRA website, use the topic bar on the left and click on *Clean Water*, then *Water Supply* and in that document, click on *Groundwater assessment reports in Alberta*. www.agr.gc.ca/pfra

Anderson, A., S. Cooke, and N. MacAlpine. 1999. *Watershed Selection for the AESA Stream Water Quality Monitoring Program*. Alberta Environmentally Sustainable Agriculture, AAFRD.

Ecological Stratification Working Group. 1995. *A National Ecological Framework for Canada.* Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. Report and national map at 1:7 500 000 scale. sis.agr.gc.ca/cansis/nsdb/ecostrat/district/climate.html

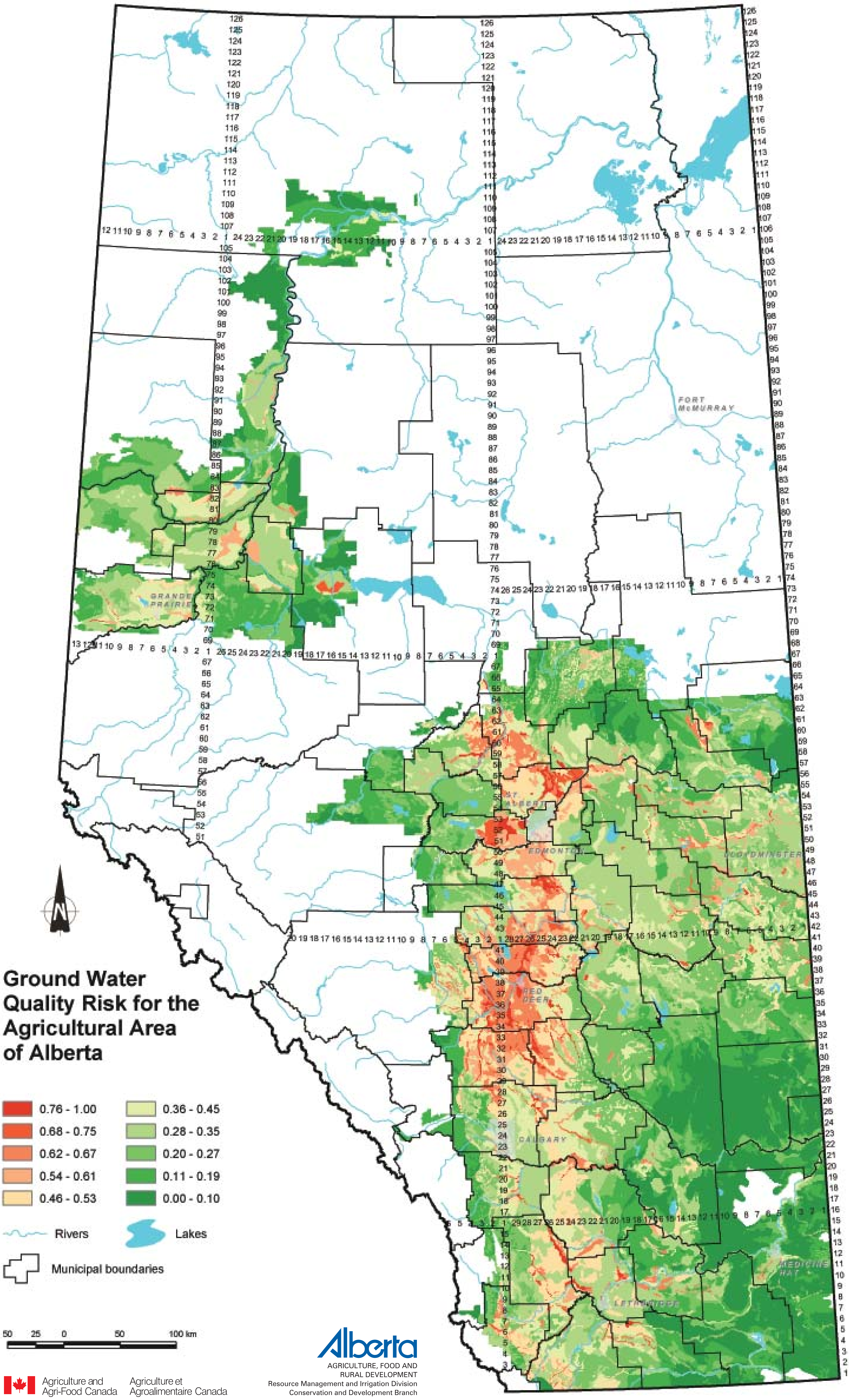
Cowen, T. and Dash, T. 2003. *Groundwater Vulnerability Map of Northern Alberta*. PFRA, unpublished.

Culley, J.B. and Barnett, G.M. 1984. *Land Disposal of Manure in Province of Quebec*. Cdn. Journal of Soil Science. 64:75-86.

Dash, T. and Rodvang, J. 1999. *Draft Approach to the Preparation of Groundwater Vulnerability Maps for the Oldman Basin Water Quality Initiative*. PFRA and AAFRD.

Johnson, I. and Kirtz, J. 1998. *Agricultural Intensity in Alberta, 1996 and Changes Since 1991*. Alberta Environmentally Sustainable Agriculture, AAFRD.

Ground Water Quality Risk for the Agricultural Area of Alberta



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Soil Erosion Risk for the Agricultural Area of Alberta

Description

This map displays an assessment of soil erosion risk for the agricultural area of Alberta. Loss of protective residue cover through cultivation will increase the potential risk of soil erosion. The vulnerability of the soil to erosion combined with the intensity of cultivation determines the degree to which the soil may be at risk. The classes shown on the map were ranked from 0 (lowest risk) to 1 (highest risk).

Data sources

The soil erosion risk assessment procedure integrates wind and water erosion risk with land management practices, specifically cultivation.

Information about tillage practices was collected during the 2001 Census of Agriculture. The Census questions provided an estimate of the area of no till, conservation tillage, conventional tillage and summerfallow on farms in Alberta. Custom processing of the data by Statistics Canada yielded the percent of the land within each Soil Landscapes of Canada (SLC) polygon associated with the four management systems.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

The cultivation rating is a measure of the cultivation intensity with management systems having a greater frequency of cultivation weighted higher. The cultivation rating was calculated for each SLC polygon by the following formula:

Cultivation rating = (% area in no till) x 1 + (% area in conservation tillage) x 2 + (% area in conventional tillage) x 3 + (% area in summerfallow) x 4

The assessment of the soil erosion risk is based, in part, upon the potential erodibility of the soil landscape by wind and water. For this assessment, the wind erosion risk (Coote and Pettapiece, 1989) and water erosion risk (Tajek and Coote, 1993) ratings were used. Risk classes were assigned integer values to describe the wind erosion risk and water erosion risk on bare, unprotected mineral soil for each SLC. The risk classes were negligible (1), low (2), moderate (3), high (4) and severe (5). The erosion risk value assigned to each SLC polygon was the average of the corresponding wind risk value and water risk value.

The cultivation rating was multiplied by the soil erosion risk value and the result ranked from 0 to 1 to form the soil erosion risk factor for each SLC as displayed on the map.

Potential uses

This map helps to identify areas where soil may be at risk to wind or water erosion. In areas of greater soil erosion risk, promotion of beneficial management practices such as reduced tillage, direct seeding, field shelterbelts, reduce or eliminate summerfallow, increase crop residue cover or avoid overgrazing can be encouraged.

Limitations

A soil erosion risk rating at the SLC polygon level of representation makes the data useful at the regional level only.

Further information

Alberta Agriculture, Food and Rural Development (AAFRD) provides information about wind and water erosion including control and management practices. From the AAFRD website, under Quick Links on the right side follow: *Publications & More*, then *Soils, Water, Reclamation Publications* under Free Publications. www.agric.gov.ab.ca

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Reduced Tillage LINKAGES (RTL) is a partnership with broad-based support to develop an extension program focused on improving the environmental and economic sustainability of farming in Alberta. www.reducedtillage.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

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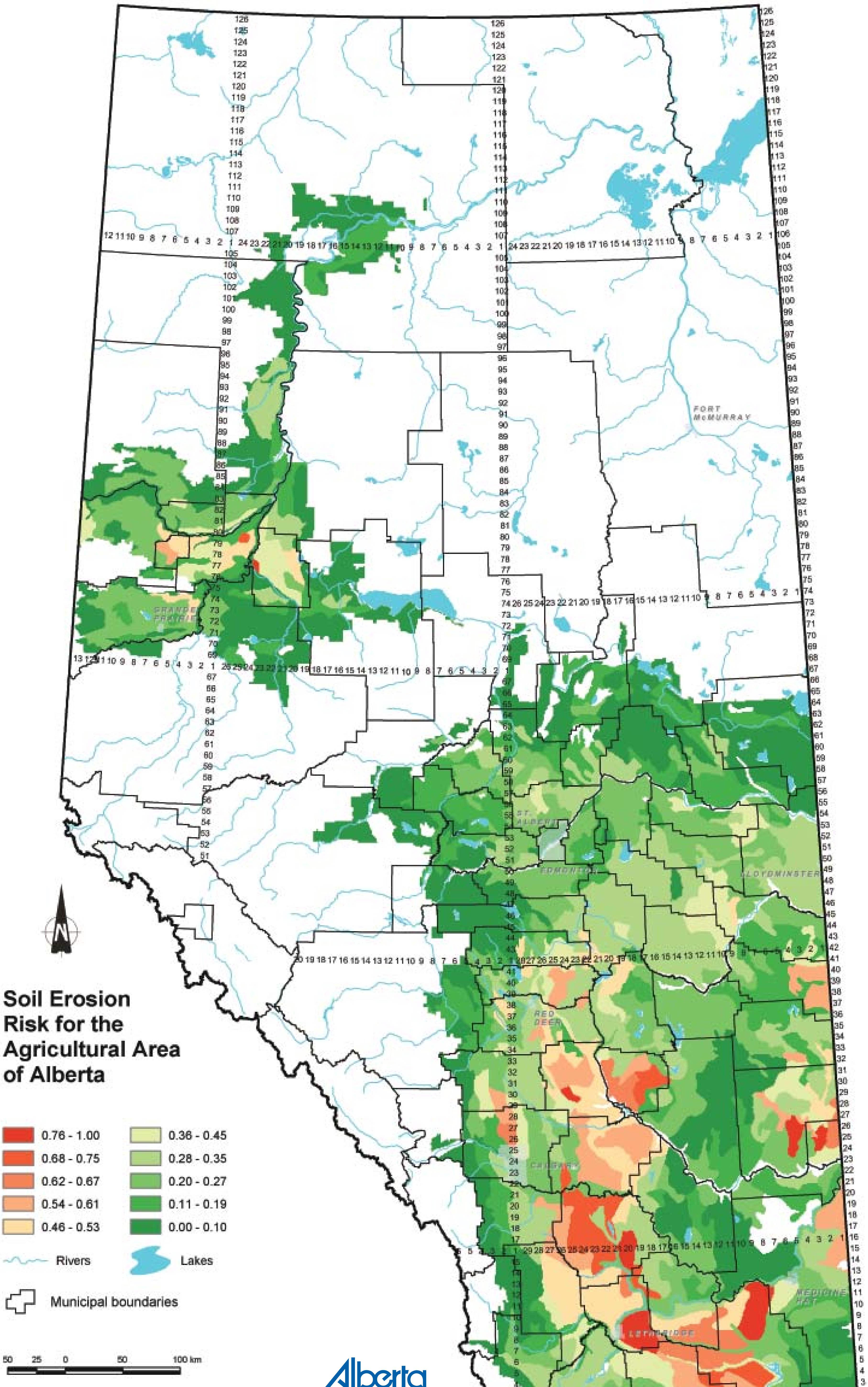

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AGRICULTURE, FOOD AND RURAL DEVELOPMENT
Resource Management and Irrigation Division
Conservation and Development Branch

Air Quality Risk for the Agricultural Area of Alberta

Description

This map displays an assessment of air quality risk for the agricultural area of Alberta. Agricultural activities that may have some influence on air quality include manure production (odour) and cultivation intensity (particulate matter). The airsheds of the agricultural region of Alberta are considered to be uniform in their physical susceptibility to risk from agricultural activities. The classes shown on the map were ranked from 0 (lowest risk) to 1 (highest risk).

Data sources

The air quality risk assessment procedure utilized 2001 Census of Agriculture data related to livestock numbers and tillage practices.

Soil Landscapes of Canada (SLC) Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Odour was considered directly correlated to manure production. Manure production was calculated for each SLC polygon from 2001 Census of Agriculture data collected about the numbers of all livestock raised in the province. Using research by Culley and Barnett (1984), Statistics Canada calculated the amount of manure produced by the total number of livestock. A formula that weighted the different livestock based on animal size and average manure output was used. The numbers of each type of livestock reported in the Census, multiplied by its manure factor, were totalled to give the total manure produced in tonnes. That value divided by the SLC area (square km) resulted in a ratio per unit area for each SLC (manure rating).

Particulate matter in the air was considered directly correlated to cultivation intensity. A cultivation rating based on frequency of cultivation used in various management systems was calculated. Data was collected during the 2001 Census of Agriculture. Census questions provided an estimate of the area of no till, conservation tillage, conventional tillage and summerfallow on farms in Alberta. Custom processing of the data by Statistics Canada yielded the percent of the land within each SLC polygon associated with the four management systems.

The cultivation rating is a measure of the cultivation intensity with management systems having a greater frequency of cultivation weighted higher. The cultivation rating was calculated for each SLC by the following formula:

Cultivation rating = (% area in no till) x 1 + (% area in conservation tillage) x 2 + (% area in conventional tillage) x 3 + (% area in summerfallow) x 4

The manure rating and the cultivation rating were added, and the result was ranked from 0 to 1 to form the air quality risk factor for each SLC polygon as displayed on the map.

Potential uses

Air quality risk is a useful measure for those concerned about health, safety and nuisance issues related to the quality of air in agricultural areas. Awareness of where agricultural activities related to livestock production and intensive cultivation are located may be useful for people with health or nuisance related concerns. Blowing soil can cause respiratory problems and can reduce visibility on roads and highways. Dust from farm traffic can be a concern during peak agricultural activity, such as harvesting or manure hauling. Frequent strong odours can be an unpleasant nuisance for neighbours.

In areas of greater air quality risk, environmental farm planning can help to address the issues and provide solutions. Practices including pen/barn maintenance, method of manure application, manure application timing, manure storage, composting, adjusting feed rations and reducing or eliminating tillage can be looked at in an environmental farm plan.

Limitations

Since the airsheds of the agricultural region of Alberta were considered to be uniform in their physical susceptibility to risk from agricultural activities, no physical characteristics were included to determine the air quality risk factor. Site-specific characteristics may be found, but they are not applicable at the regional level displayed on this map. Landowners can locate their own property on the map and identify the potential relative risks, but then must assess and evaluate their own conditions and determine the beneficial management practices (BMPs) to address the risk.

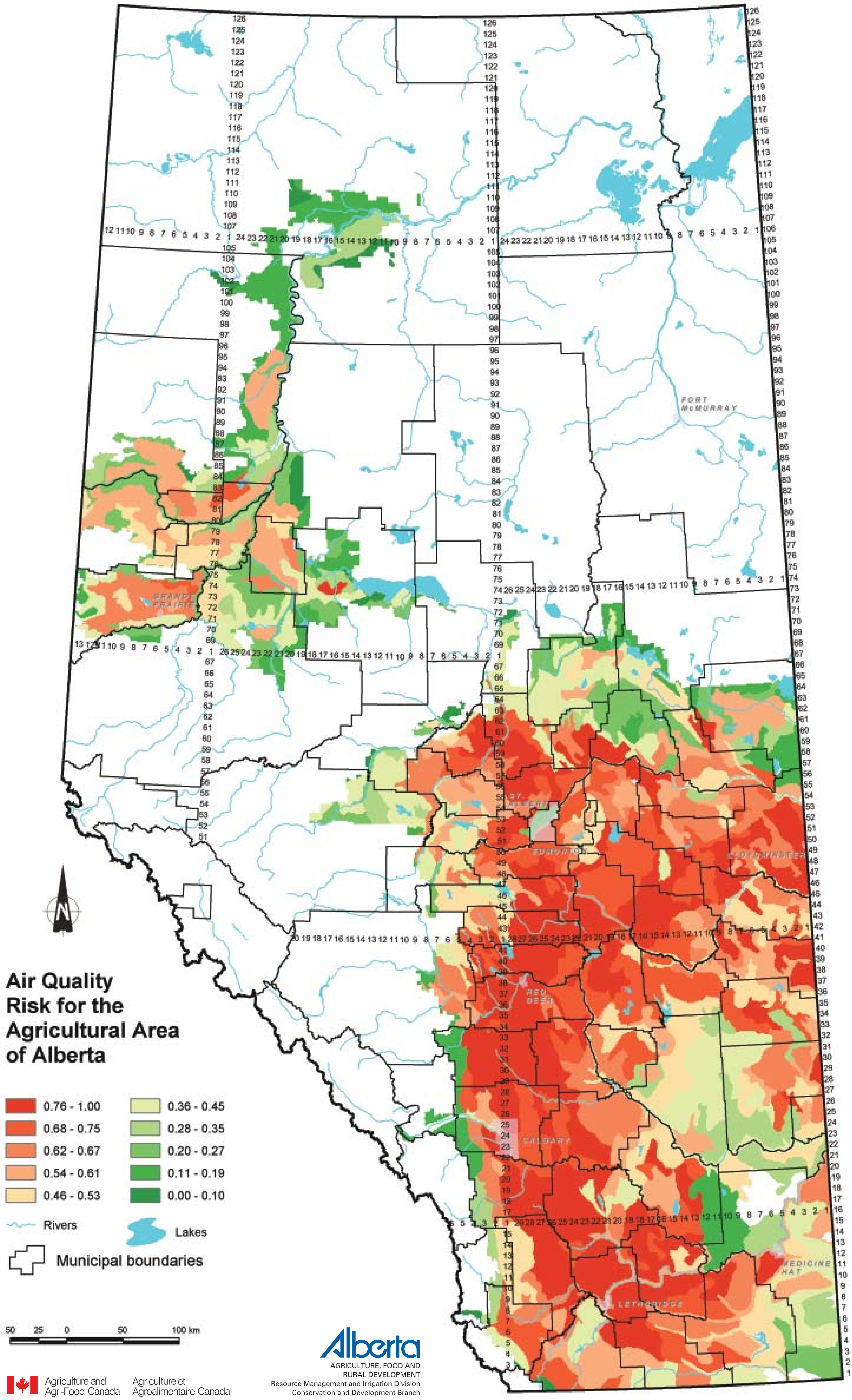
Further information

Alberta Agriculture, Food and Rural Development (AAFRD) provides information about air quality including odour concerns and beneficial management practices. From the AAFRD website, use the topic bar on the left and follow: *Soil/Water/Air, Air* and *Odours & Dust.* www.agric.gov.ab.ca

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Culley, J.B. and Barnett, G.M. 1984. *Land Disposal of Manure in Province of Quebec*. Canadian Journal of Soil Science. 64:75-86.



Air Quality Risk for the Agricultural Area of Alberta

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Biodiversity Risk for the Agricultural Area of Alberta

Description

This map displays an assessment of biodiversity risk for the agricultural area of Alberta. Biodiversity risk refers to the loss of biological diversity, or the variety of plant and animal life in agricultural landscapes. This decrease in biodiversity is believed to affect the overall health of the environment. A diverse ecosystem is better able to respond to environmental changes or stresses, such as floods, drought, pests and disease. The goal of maintaining biodiversity in agricultural landscapes may be more readily attained through prevention of further losses in areas less impacted by agriculture rather than through efforts to restore biodiversity in more heavily impacted areas. Information about physical features that affect biodiversity was combined with economic information on agricultural activities that show how human activity affects biodiversity. The classes formed as shown on the map were ranked from 0 (lowest risk) to 1 (highest risk).

Data sources

A physical description of biodiversity was provided by four spatial databases regarded as acceptable surrogates on the subject:

- **Density of upland habitat** – estimated from the landuse / landcover map prepared by Prairie Farm Rehabilitation Administration (PFRA) for the Western Grain Transportation Payments Program. For each Soil Landscapes of Canada (SLC) polygon, the percentage of land classified as trees, shrubs or grasslands was considered "upland habitat."
- **Density of wetland habitat** – estimated from the Ducks Unlimited Canada (DUC) wetland database. For each SLC polygon, the percentage of land identified as wetlands was considered "wetland habitat." The database used satellite imagery acquired in early to late May from 1982 to 1987. Imagery from the month of May was used to capture spring conditions at their wettest.
- **Density of waterways** – reported in linear kilometers per square kilometer of land in each SLC and used as a surrogate for riparian area density. Linear waterways were identified from the Alberta government's Base Features Single Line Network map (1: 20 000 scale).
- **Species at risk** – the number of natural habitat areas of species at risk, which overlap at any given location in the landscape, was used as a surrogate for the density of species at risk at that location. "Species at risk" is a term used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that includes plant and animal species that are either extirpated, endangered, threatened or a species of special concern. Individual COSEWIC 2002 Species Range Maps were downloaded from the COSEWIC website.

These four maps were converted to a 0 to 1 ranking and spatially added together with the wetland density index given a double weighting. A physical factors map with a range of values from 1 to 6 was the result.

While all human activity impacts biodiversity, the more geographically concentrated the activities are, the more biodiversity is impacted. Total economic activity by region was used as a surrogate for agricultural impact on biodiversity. An Economic Activity Index was calculated from 2001 Census of Agriculture data as the sum of **total capital value**, **gross sales** and **total expenses** for all farms in a SLC polygon, normalized to a per-area basis and ranked from 0 to 1. The Economic Activity Index was multiplied by the biodiversity physical factors map and the result ranked from 0 to 1 to form the biodiversity risk factor for each SLC polygon as displayed on the map.

SLC Version 1.9 was used for this map. SLC polygons were created using existing soil survey information. Each polygon is described by a standard set of soil and land attributes that characterizes the soil landscapes found in each SLC polygon. Soils, landscapes and climate are the key natural resource factors that determine agricultural productivity, and the farms within a soil landscape unit usually have similar production characteristics.

Potential uses

Biodiversity risk is a complex issue, but this map tries to show where biodiversity could be threatened, such as in areas with significant habitat that coincide with areas of greater agricultural economic activity. Agriculture has a significant influence on biodiversity because of its occurrence over a large portion of the landscape, the management intensity associated with modern methods of farming and the effects that some management practices have beyond the target area. However, agricultural land can play a positive role in the maintenance of biodiversity, especially in areas where there are competing and more disruptive land uses, such as urbanization. Conservation efforts can be enhanced by the adoption of management practices that encourage the integration of wild species within agricultural landscapes. The preservation of non-crop habitats is important to the conservation potential of the agricultural lands. Sustainable farming can integrate the interests of agriculture and wildlife.

Limitations

In order to get an accurate as possible picture of biodiversity in the agricultural area of Alberta, data from a number of sources was used, and all were surrogates to determine the best possible physical description of biodiversity in Alberta. As well, data on the agricultural activities was based on economic activity as the best representation of human impact on biodiversity, although it is understood that not all activities will have an equal impact on biodiversity. The methodology can be applied at the landscape and regional level but is not useful at the farm level. Landowners can locate their own property on the map and identify the potential relative risks, but then must assess and evaluate their own conditions and determine the beneficial management practices (BMPs) to address the risk.

Further information

Alberta Environmentally Sustainable Agriculture program provides information about agricultural biodiversity. From the Alberta Agriculture, Food and Rural Development website, use the topic bar on the left and follow: *Soil/Water/Air*, *Environmental Stewardship* and *Biodiversity*. www.agric.gov.ab.ca

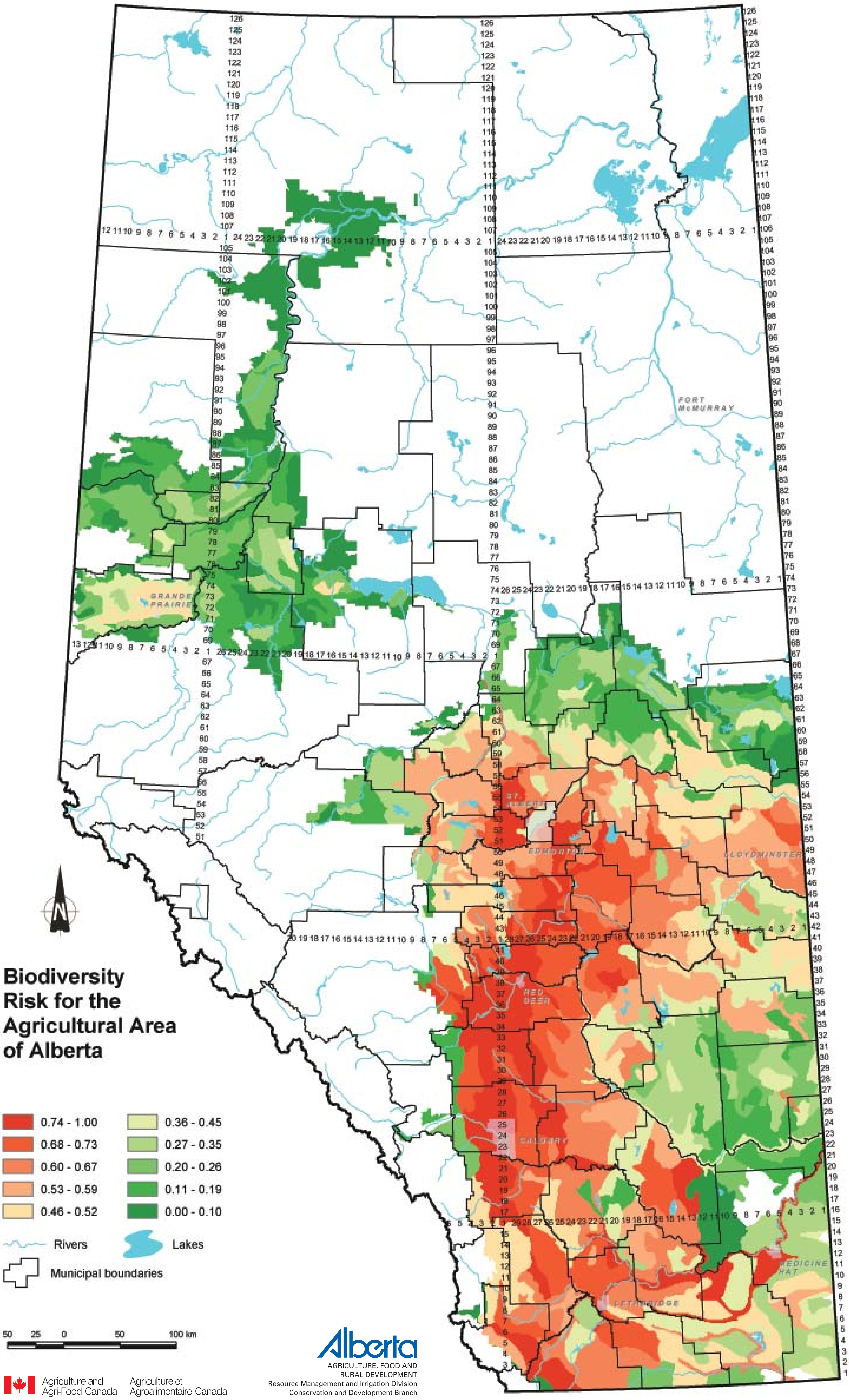
COSEWIC www.cosewic.gc.ca

Ducks Unlimited Canada www.ducks.ca

2001 Census of Agriculture website expands on the use of the data collected. www.statcan.ca/english/agcensus2001

Canadian Soil Information System (CanSIS) provides soils information and data including information about SLCs. From the CanSIS website under *Data*, click on *Soil Landscapes* on the left side topic bar. http://sis.agr.gc.ca/cansis

Biodiversity Risk for the Agricultural Area of Alberta



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