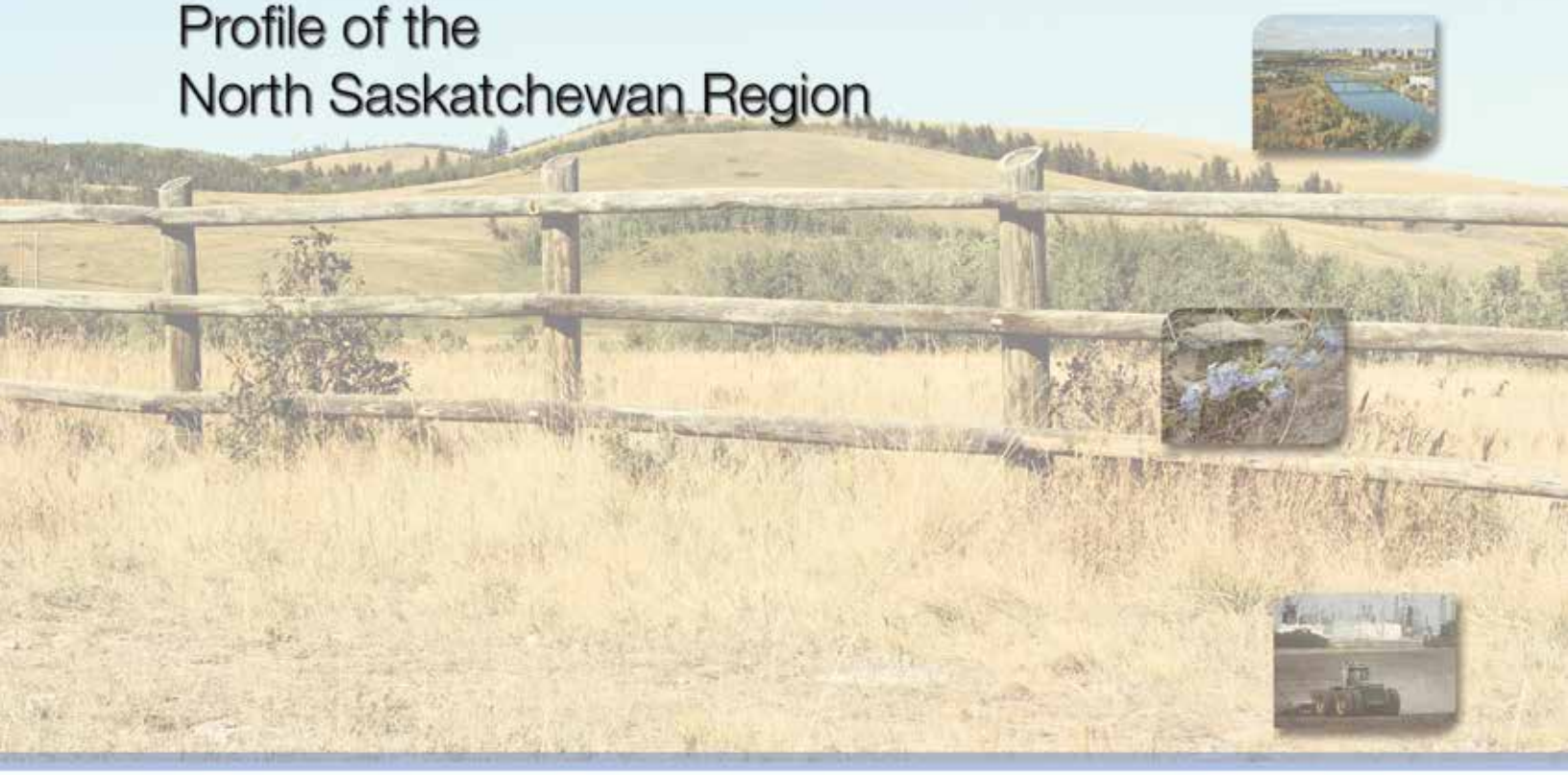
Profile of the North Saskatchewan Region

environmental • social • economic

Land-use Framework

Alberta Government

Profile of the North Saskatchewan Region



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INTRODUCTION

Alberta's Land-use Framework

In response to Alberta's remarkable growth in recent years, the Government of Alberta began a comprehensive initiative in 2006 to develop a new land-use system for the province. Following consultation with a broad range of Albertans, the government released the Land-use Framework[1] on December 3rd, 2008.

The Land-use Framework is a new approach to managing lands and natural resources to achieve Alberta's long-term economic, environmental and social goals. The framework provides a blueprint for making decisions that will help address growth pressures on our land, environment, and communities, while respecting the private property rights of Albertans. It is designed to ensure good stewardship of our lands and resources, so that future generations of Albertans can continue to benefit from the province's natural beauty and prosperity.

The framework establishes three desired outcomes:

- A healthy economy supported by our land and natural resources;
- Healthy ecosystems and environment; and
- People-friendly communities with ample recreational and cultural opportunities.

These outcomes recognize that Alberta's social, economic and environmental goals are highly integrated – how we choose to pursue one goal may affect the others. Achieving our goals will require decision-making and trade-offs about how, where, and when Alberta's lands and resources are used for the benefit of Albertans.

To make these important decisions, the Land-use Framework establishes seven new land-use regions and the development of a regional plan for each one, as shown in Figure 1. The regional boundaries were established following Alberta's major watersheds and adjusted to match municipal boundaries. This regional approach to planning recognizes the great diversity of Alberta's population and landscapes, while helping to ensure coordination between provincial and municipal-level decisions.

[1] Government of Alberta (2008). *Land-use Framework*. (ISBN No. 978-07785-7714-0). Retrieved from Alberta Environment and Resource Development website: www.landuse.alberta.ca/Documents/LUF_Land-use_Framework_Report-2008-12.pdf

Figure 1: Land Use Regions

Each plan will look to achieve regional outcomes that support Government of Alberta priorities and strategies such as Water for Life, the Provincial Energy Strategy, Plan for Parks, and the Climate Change Strategy. Once approved by Cabinet, these plans will articulate the land-use policy that will govern each particular region. Following approval, all provincial government department and local governments in the region must align their own plans and policies with the regional plan.

Purpose of this Profile

Land-use decisions need to consider current activities and future uses on public and private lands while ensuring the rights of private property owners are respected. As set out in the Land-use Framework, the impacts these activities and future uses have on the environment, economy and society need to be examined using a cumulative effects management approach. Through this approach, the combined effects of past, present and anticipated human activities are identified and steps are taken to manage these activities to meet our current and future needs without going beyond what our natural environment can support.

The purpose of this profile is to provide an overview of the key social, economic and environmental conditions in the North Saskatchewan Region that need to be considered in the development of the regional plan. It also outlines major land-uses and identifies important trends that highlight where change might be needed regarding activities and cumulative effects management in the region.

A Regional Advisory Council of Albertans with knowledge and interest in the region will be established to provide advice to the Government of Alberta regarding development of the North Saskatchewan Regional Plan. Guided by terms of reference, the Regional Advisory Council will use this profile, along with other information, to develop its advice.

THE NORTH

SASKATCHEWAN REGION

Regional Overview

The North Saskatchewan Region has a large and diverse landscape which contains the Rocky Mountains, rolling foothills and prairie parkland. The region is located in central Alberta and has an area of approximately 85,780 square kilometres, or just under 13 per cent of Alberta's total land base. The region is bordered by Saskatchewan to the east, British Columbia to the west, the Upper Athabasca and the Lower Athabasca regions to the north, and the South Saskatchewan and Red Deer regions to the south, as shown in Figure 2 on page 6.

The North Saskatchewan Region has a variety of landscapes. In the far west are the Eastern Slopes of the Rocky Mountains and rolling foothills. Much of this area is forested, and contains a diverse habitat that supports a wide range of wildlife and plants. This part of the region serves as a major source of recreation and tourism for the entire province. It is home to Banff National Park, Canada's first national park established in 1885, and is a prime destination for domestic and international visitors. The town of Banff lies within the national park and is the most southerly population centre in the region.

The foothills are home to grizzly and black bears, cougars and hundreds of other species, and also provide important opportunities for recreation and tourism. Other significant industries in this area include forestry, oil and gas extraction, and ranching. Urban centres, such as Rocky Mountain House, serve as important economic and recreation hubs for this part of the region.

The foothills give way to prairie parkland in the central part of the region, which forms a broad transitional area between the drier grasslands to the east and the boreal forest to the north, and spans a significant portion of the region. This part of the region has seen the greatest population growth and has seen the most agricultural and industrial development.

The northern areas of the region contain a mix of forests and low-lying wetlands. In the south and east, a mix of aspen forests and cultivated lands dominate, giving way as you move east to grasslands that stretch to the Saskatchewan border. Oil and gas, recreation, tourism and agriculture are key activities in this part of the region.

Historic landscape change in the North Saskatchewan Region has been extensive and largely driven by settlement, agricultural expansion and industrial development. The construction of the national railroad, combined with federal policies aimed at settling western Canada, supported the conversion of much of the region's native parkland into cultivated agricultural land.

[2] Land Use Secretariat, Government of Alberta. (2013, Feb. 26). *Land-use Framework regions dataset*. Edmonton, AB: Author.

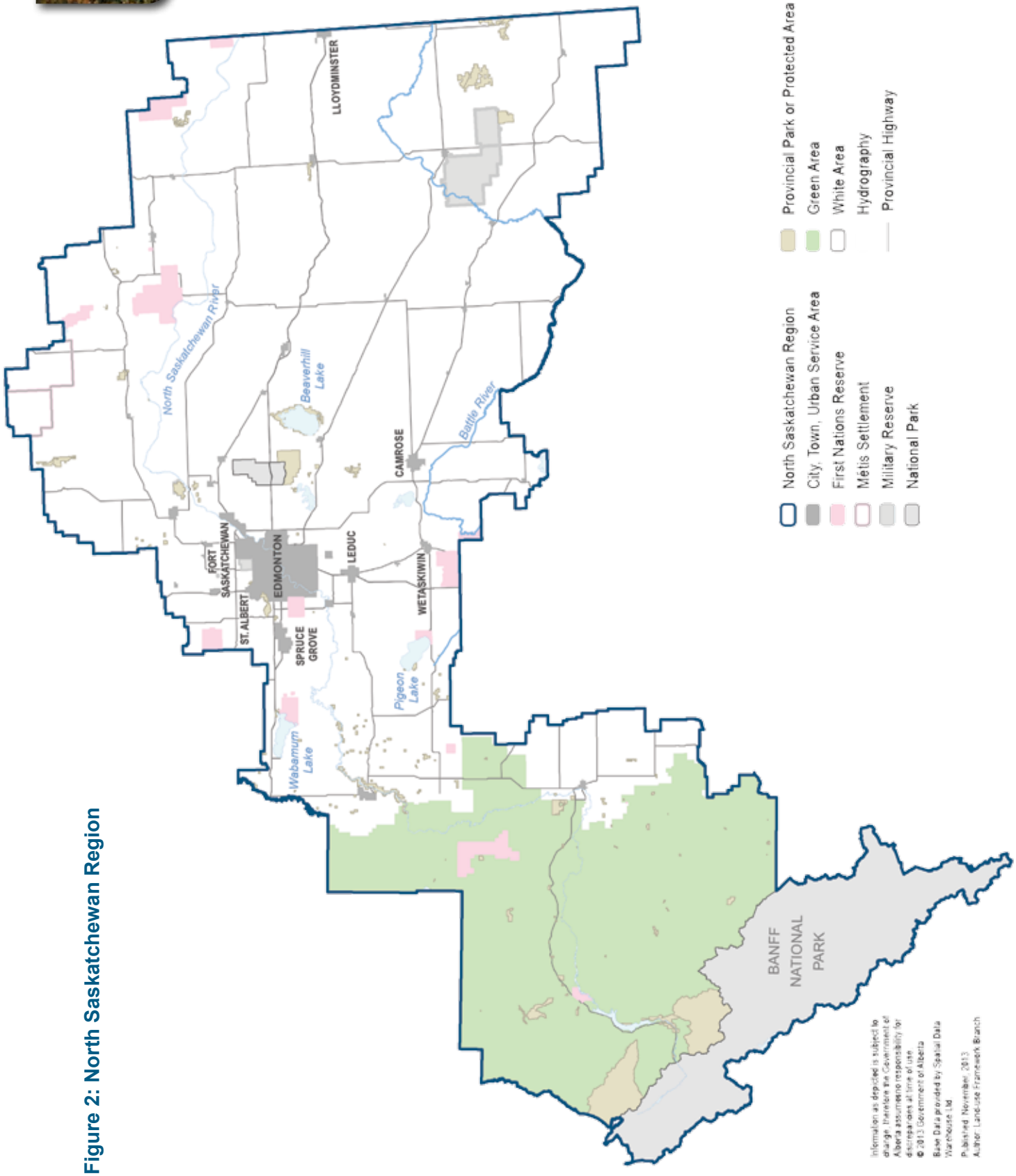


Figure 2: North Saskatchewan Region

Today the region is home to a diverse population and a vibrant economy. Opportunities across the region, bolstered by the growing City of Edmonton and other communities, have attracted new residents and businesses from across the country and around the world. This trend is expected to continue for the foreseeable future. Population growth, particularly in the City of Edmonton and the surrounding Capital Region, has led to expanded urban and rural residential development. Industries driving economic activity across the region continue to grow and include energy, agriculture, tourism, forestry and associated services.

The cumulative impact of human activity is a growing concern for the region, particularly in areas of significant ecological importance and areas with prime agricultural land. The ecologically important Eastern Slopes, which provide central Alberta with much of its water supplies, are facing growing pressures from recreational demand and industrial development. Rural and agricultural lands are increasingly under pressure from rural residential and industrial development, and tracts of agricultural land have been converted to non-agricultural uses to support this expansion.

SETTLEMENT AND LAND MANAGEMENT

Settlement

With a total population of approximately 1.52 million people, the North Saskatchewan Region contains eight cities, 18 municipal districts, one specialized municipality, 31 towns, 40 villages, 17 summer villages, 15 First Nations reserves and two improvement districts[3] (see Figure 3: Counties and Municipal Districts on page 10).

Edmonton, Alberta

Population growth has been shaped over the last 200 years by major developments such as trade and commerce, construction of the national railway, agricultural expansion, oil and gas extraction and the more recent development of the oil sands.

The region contains a wide variety of land uses, from low-impact tourism and recreation to intensive agriculture and industrial development. Resource-based activity in the region includes extensive oil and gas extraction and upgrading, coal mining and forestry, particularly in the Drayton Valley and Rocky Mountain House areas.

The Capital Region

The Capital Region is considered the gateway to northern Alberta and the Canadian North, particularly for transportation, forestry and the oil/natural gas and mineral exploration industries. Edmonton, Alberta's capital city, is located in the centre of the region. It is surrounded by 24 municipalities, urban and rural, collectively known as the Capital Region (see Figure 3 on page 10). The Capital Region is at the north end of the Calgary-Edmonton Corridor, and had a population of approximately 1.12 million people in 2011[4].

[3] Land Use Secretariat, Government of Alberta. (2013, Feb. 15). *Population and migration dataset*. Edmonton, AB: Author.

[4] Capital Region Board. (2013). About the CRB – Alberta's capital region. Retrieved from http://capitalregionboard.ab.ca/about

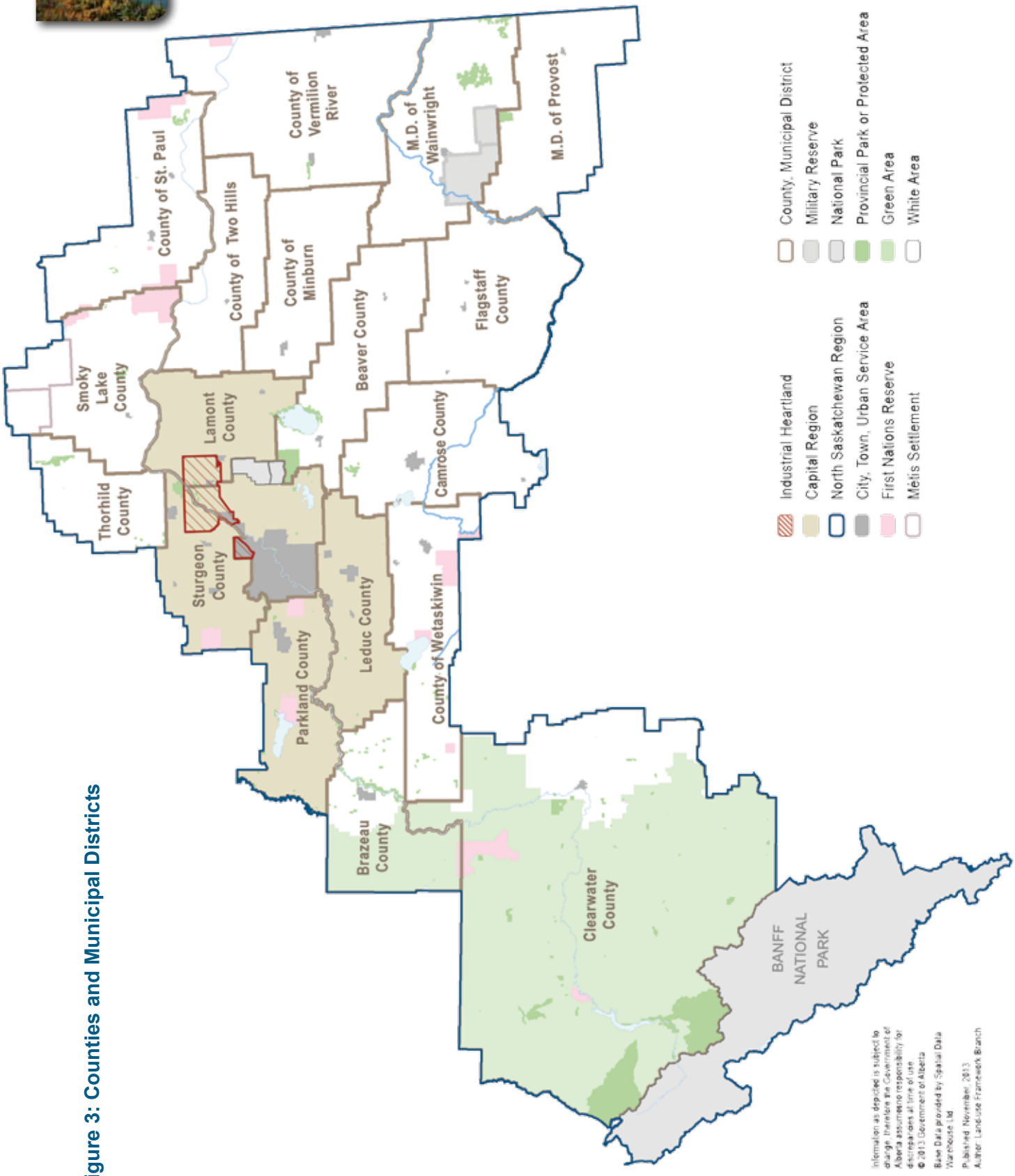


Figure 3: Counties and Municipal Districts

Alberta's Industrial Heartland is located in the northeast part of the Capital Region. This industrial area is home to the largest petrochemical complex in Canada, as well as a growing number of large petroleum refineries. These facilities are supported by a vast network of pipelines to transport upgraded and refined petroleum products.

In anticipation of further population and economic growth, municipalities in the area have developed a Capital Region Growth Plan to help collectively plan for this growth.

Private Lands

Privately owned land comprises more than 60 per cent of the region[5]. This includes land owned by homeowners, agricultural producers and private companies. Generally ownership rights are limited to the land surface and do not include subsurface, non-renewable natural resources.[6] Private landowners make decisions about how to use and manage their lands consistent with existing provincial legislation and municipal bylaws.

Planning on private lands is primarily governed by the *Municipal Government Act* (MGA) and instruments made under its authority such as the Subdivision and Development Regulation.

Land Management

Provincial Land Management

Crown lands include public lands under the *Public Lands Act*, parks under the provincial parks legislation and highways under the *Highways Development and Protection Act*. Crown lands are owned by the Crown and managed for the benefit of all Albertans. The government often allows individuals and businesses to use public lands through statutory consents that grant permission to do certain activities on public land – such as livestock grazing, timber harvesting, energy development or recreational use. The Government of Alberta also manages for watershed protection and ecosystem health (see Figure 4 and Table 1 on pages 12 and 13).

[5] Land Use Secretariat, Government of Alberta. (2013, May 5). *Land ownership dataset*. Edmonton, AB: Author.

[6] Most mineral rights are owned by the Government of Alberta. Some mineral rights are owned by individuals and companies. These are referred to as freehold mineral rights.

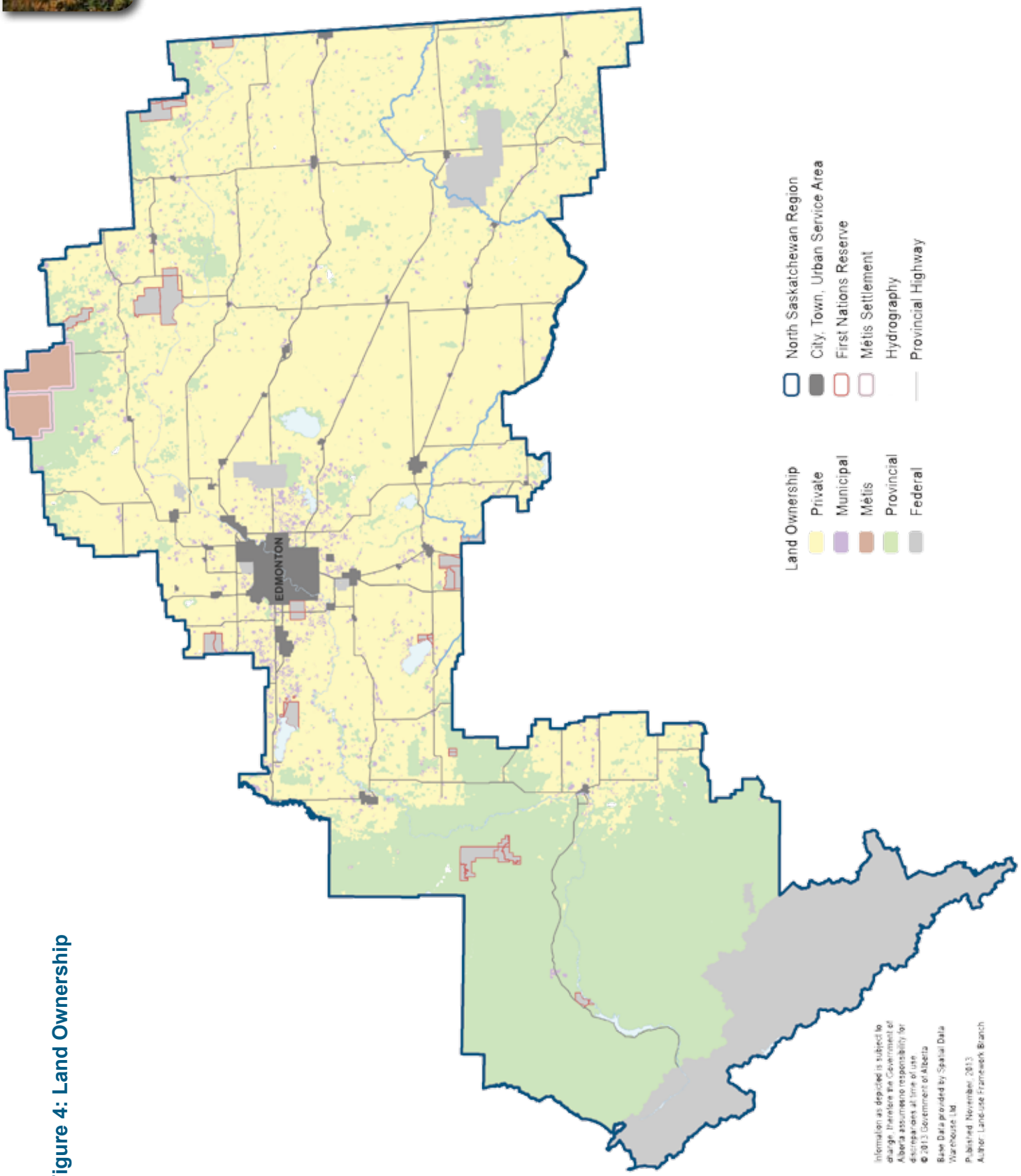


Figure 4: Land Ownership

Table 1: Provincial Protected Areas in the North Saskatchewan Region[7]

Provincial Protected Areas in the North Saskatchewan Region	Approximate Area (km^2)
Ecological Reserve	66
Natural Area	428
Provincial Park	138
Provincial Recreation Area	230
Wilderness Area	870
Wildland Provincial Park	2
Total	**1,734**

The Government of Alberta developed the Policy for Resource Management of the Eastern Slopes (1984) and Integrated Resource Plans (IRPs) to outline the land and resource management intent for specific areas within the region. These plans focus on watershed management, wildlife, fisheries, recreation, cultural and ecological resources, tourism, timber, oil and development. Although most IRPs are more than 20 years old, they continue to serve as a foundation for making land management decisions. The following management plans and decisions have been used to guide land and resource management on public land in the region:

- 1981 Beaverhill Lake Integrated Resource Plan
- 1986 Nordegg - Red Deer River Sub-Regional Integrated Resource Plan
- 1986 Rocky-North Saskatchewan Sub-Regional Integrated Resource Plan
- 1996 Burnstick Lake Management Plan
- 1992 David Thompson Corridor Local Integrated Resource Plan
- 1989 Ministik Lake Game Bird Sanctuary
- 1995 Island Lake Regional Integrated Decision
- 1996 Rocky Regional Integrated Decision
- 1996 Cold Lake Sub-Regional Integrated Resource Plan
- 2010 Buffalo Lake Integrated Shoreland Management Plan

These plans will be considered in the development of the North Saskatchewan Regional Plan, and once the regional plan is approved they will be amended or cancelled as required to align with the regional plan.

[7] ForCorp Solutions Inc. (2012). *Regional forest landscape assessment: North Saskatchewan region.* Edmonton, AB: Alberta Environment and Sustainable Resource Development.

Federal Land Management

The remaining lands in the region are administered by the federal government. These include Elk Island National Park, Banff National Park, and First Nations reserves. The Canadian Forces also has two bases in the region: Canadian Forces Base Edmonton (Land Force Western Area Headquarters) located north of Edmonton, and Canadian Forces Base (CFB) Wainwright south of the town of Wainwright (see Table 2 below and Table 3 on page 15).

CFB Wainwright is approximately 85 per cent leased provincial crown land and 15 per cent federally owned land[8]. It is administered under an agreement between Canada and Alberta for the long-term military use of the range and training area. These bases provide valuable economic benefits for the surrounding communities.

Federal and provincial land allocation in the North Saskatchewan Region

Table 2: Federal Protected Areas in the North Saskatchewan Region[9]

Federal Protected Areas in the North Saskatchewan Region	Approximate Area (km²)
Banff National Park of Canada	6,850
Elk Island National Park of Canada	192
Blue Quills National Wildlife Area	1
Total	**7,043**

Moraine Lake in Banff National Park

[8] Land Use Secretariat, Government of Alberta. (2013, May 5). *Land ownership dataset*. Edmonton, AB: Author.

[9] Ibid

Table 3: CFB Land in the North Saskatchewan Region[10]

Canadian Forces Base Land in the North Saskatchewan Region	Approximate Area (km^2)
CFB Edmonton	25
CFB Wainwright	613
Total	**638**

The region is home to 14 First Nations (Alexander, Beaver Lake, Enoch, Ermineskin, Frog Lake, Louis Bull, O'Chiese, Onion Lake, Paul, Saddle Lake, Samson Cree, Stoney, Sunchild and Whitefish [Goodfish]).

[10] Land Use Secretariat, Government of Alberta. (2013, May 5). *Land ownership dataset*. Edmonton, AB: Author.

ECONOMIC DEVELOPMENT AND PROSPERITY

Economy and Gross Domestic Product

With significant investment in petrochemical processing facilities over the last 15 years, the region is now one of the largest petrochemical producers in Canada. The region is home to a number of processing and upgrading facilities that convert raw oil, gas and bitumen into high-value end-use products such as gasoline and jet fuel, as well as a range of chemical products used by industry.

The rural areas of the region are home to significant agriculture, mining, forestry and tourism activities. In the major urban centres, widely diversified economies have developed with strong education, financial services, manufacturing, and information technology sectors.

Gross Domestic Product

The gross domestic product (GDP) for the North Saskatchewan Region grew steadily between 2000 and 2012. The average annual growth rate is 3.1 per cent. The majority of growth has occurred within the boundaries of the Edmonton Capital Region (CAPR), which alone grew at an annual rate of 3.8 per cent. During the same period, GDP for the entire province grew at an average rate of 2.8 per cent per year. At this rate of growth, the GDP of the North Saskatchewan Region is expected to double in approximately 23 years.

As shown in Figure 5, the top three industries by share of GDP in the North Saskatchewan Region in 2012 were:

- Other Services (32 per cent)
- Trade (13 per cent)
- Construction (12 per cent)

[11] Government of Alberta (2013), Alberta Enterprise and Advanced Education

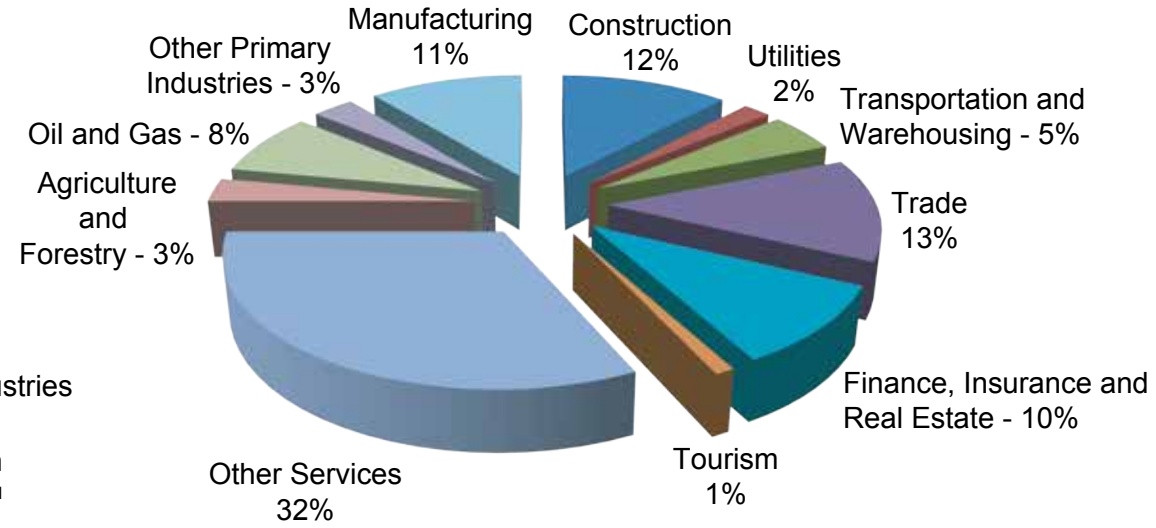


Figure 5: GDP Shares of Industries in the North Saskatchewan Region, 2012[11]

Comparing the region's GDP relative to the provincial total for GDP shows the North Saskatchewan Region accounts for:

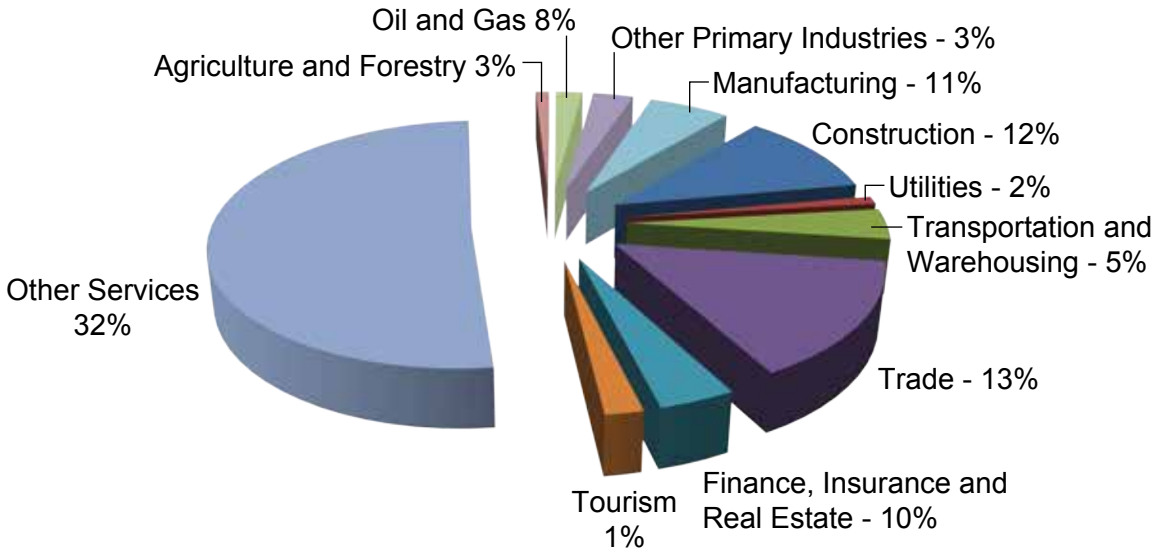
- 41 per cent of all manufacturing
- 40 per cent of all trade (wholesale and retail)
- 39 per cent of all construction

Employment

Employment in the region has increased by about 221,000 jobs between 2000 and 2012, an increase of 37 per cent. The majority of employment occurred in the Capital Region, which accounted for 204,000 of the region's total new jobs. Excluding the Capital Region, the region saw an increase of approximately 17,000 jobs in this same period.[12]

As employment has increased, distribution of employment between industry sectors has remained consistent in the region. As illustrated in Figure 6, the key employment sectors in the region include Other Services, followed by Trade, Construction, and Manufacturing.

Figure 6: Employment Shares of Industries in the North Saskatchewan Region 2012[13]



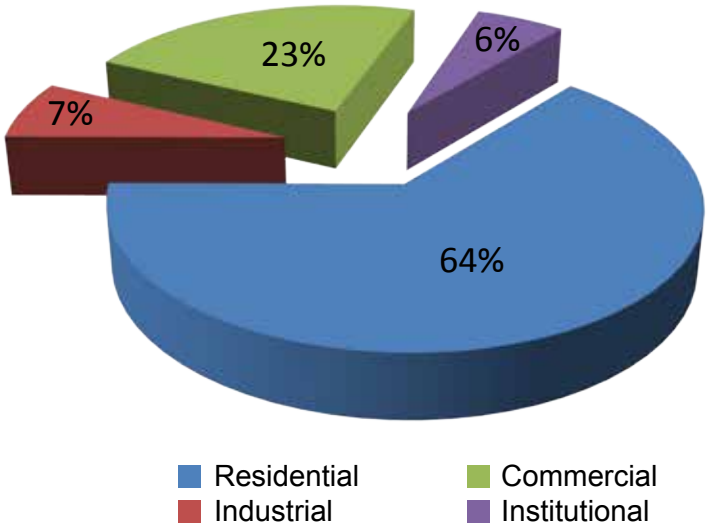
[12] Government of Alberta (2013), Alberta Enterprise and Advanced Education

[13] Government of Alberta (2013), Alberta Enterprise and Advanced Education.

Building Permits

The total value of building permits issued in the North Saskatchewan Region was $5.3 billion in 2012 (see Figure 7 below). Building permits are the first step in the construction process, which in turn is a major contributing factor to economic growth. They are estimates of the total cost of construction reported to municipalities before construction begins. Building permits are indicators of intentions to build and reflect confidence in the economy[14].

Figure 7: North Saskatchewan Region Building Permits (2012) - Share of Total Building Permit Value by Sector[15]



Inventory of Major Alberta Projects

The Inventory of Major Alberta Projects (IMAP) is produced by Alberta Enterprise and Advanced Education. It assists firms in identifying potential supply opportunities, as well as informing Albertans on the status of projects in the province valued at $5 million or greater.

As of August 2013, 30 per cent of provincial projects are taking place within the North Saskatchewan Region (see Table 4 on page 20). These projects account for only 17 per cent of the total value of all Alberta projects.

The industries contributing the greatest monetary value are:

- Oil and gas $8.7 billion (81 per cent of provincial value)
- Oil sands $7.4 billion (six per cent of provincial value)
- Infrastructure $6.3 billion (46 per cent of provincial value)

[14] It should be noted that not all construction in Alberta is reported under the building permits figures. A large proportion of industrial construction activity – especially associated with oil and gas – is not accounted for in this data. The total value of proposed construction across the province, and the share of the total accounted for by industrial construction, is much higher (Statistics Canada (2013), *Building Permits Survey*; available at http://www23.statcan.gc.ca/imdb/p2SV. pl?Function=getSurvey&SDDS= 2802&lang=en&db=imdb&adm= 8&dis=2)

[15] Land Use Secretariat, Government of Alberta. (2013, Mar. 18). *Building permits by Land-use Framework regions for 2012 sourced from Statistics Canada building permits survey dataset*. Edmonton, AB: Author.

Table 4: Inventory of Major Projects, August 2013[16]

Project Type	North Saskatchewan Region Projects		Alberta Projects		North Saskatchewan Region/AB Projects	
	Number	Value ($ Millions)	Number	Value ($ Millions)	% of Projects	% of Value
Agriculture and Related	3	$207.4	6	$288.4	50%	72%
Biofuels	3	$330.0	5	$398.0	60%	83%
Chemicals and Petrochemicals	1	$800.0	3	$1,5 80.0	33%	51%
Commercial / Retail	24	$1,602.7	82	$8,656.5	29%	19%
Commercial / Retail and Residential	1	$2,000.0	5	$2,846.5	20%	70%
Forestry and Related	1	$23.0	3	$105.0	33%	22%
Infrastructure	82	$6,346.1	243	$13,662.9	34%	46%
Institutional	39	$1,422.3	115	$5,497.4	34%	26%
Manufacturing	1	$7.5	1	$7.5	100%	100%
Mining	0	$0.0	3	$650.0	0%	0%
Oil and Gas	6	$8,650.0	16	$10,640.0	38%	81%
Oil Sands	7	$7,406.6	67	$115,281.6	10%	6%
Other Industrial	4	$132.9	8	$163.4	50%	81%
Pipelines	13	$1,512.7	47	$24,418.7	28%	6%
Power	5	$1,091.0	25	$9,073.0	20%	12%
Residential	31	$931.9	111	$2,553.5	28%	36%
Telecommunications	1	$103.0	2	$228.0	50%	45%
Tourism / Recreation	30	$1,702.5	91	$3,817.5	33%	45%
Total	**253**	**$34,402.1**	**833**	**$199,867.9**	**30%**	**17%**

[16] The Government of Alberta (2013), Enterprise and Advanced Education. *The Inventory of Major Alberta Projects*.

Energy and Minerals

Since the 1950s, the energy sector has driven Alberta's economy. The province provides about 75 per cent of the total hydrocarbon production in the country, and over 70 per cent of Canada's coal reserves are located in Alberta.

In the 2010-2011 fiscal year, Alberta's net non-renewable resource revenues totalled nearly $8.5 billion (just under 22 per cent of the provincial government's revenue). In 2010, there were 9,492 petroleum and natural gas wells completed across the province and the sector directly employed just over 140,000 people. In 2012, approximately $16.9 billion was invested in conventional oil and gas, and $12.7 billion in non-conventional oil and gas[17]. In the North Saskatchewan Region in 2012, the oil and gas industry contributed a total of $5.4 billion to GDP. This is the equivalent to 18 per cent of the total contribution by the oil and gas industry to provincial GDP. The sector directly employed 11,800 people in the region.

The region contains abundant energy resources, including conventional oil and natural gas, coal, renewable energy and other fuel sources. As well, some oil sands (unconventional oil or bitumen) are present in the Cold Lake portion of the region.

Energy

There is a long history of petroleum and natural gas exploration in the North Saskatchewan Region and this has led to extensive industrial development throughout the production areas, as shown in Figure 8 on page 22. This includes numerous well sites, seismic lines, roads and pipeline rights-of-way.

Conventional petroleum and natural gas production has grown significantly in recent years. The strength of this sector has stimulated activity in other industries such as pipeline construction, machinery manufacturing and engineering. There are just over 80,000 wells drilled in the region and about 20,000 wells are currently producing.

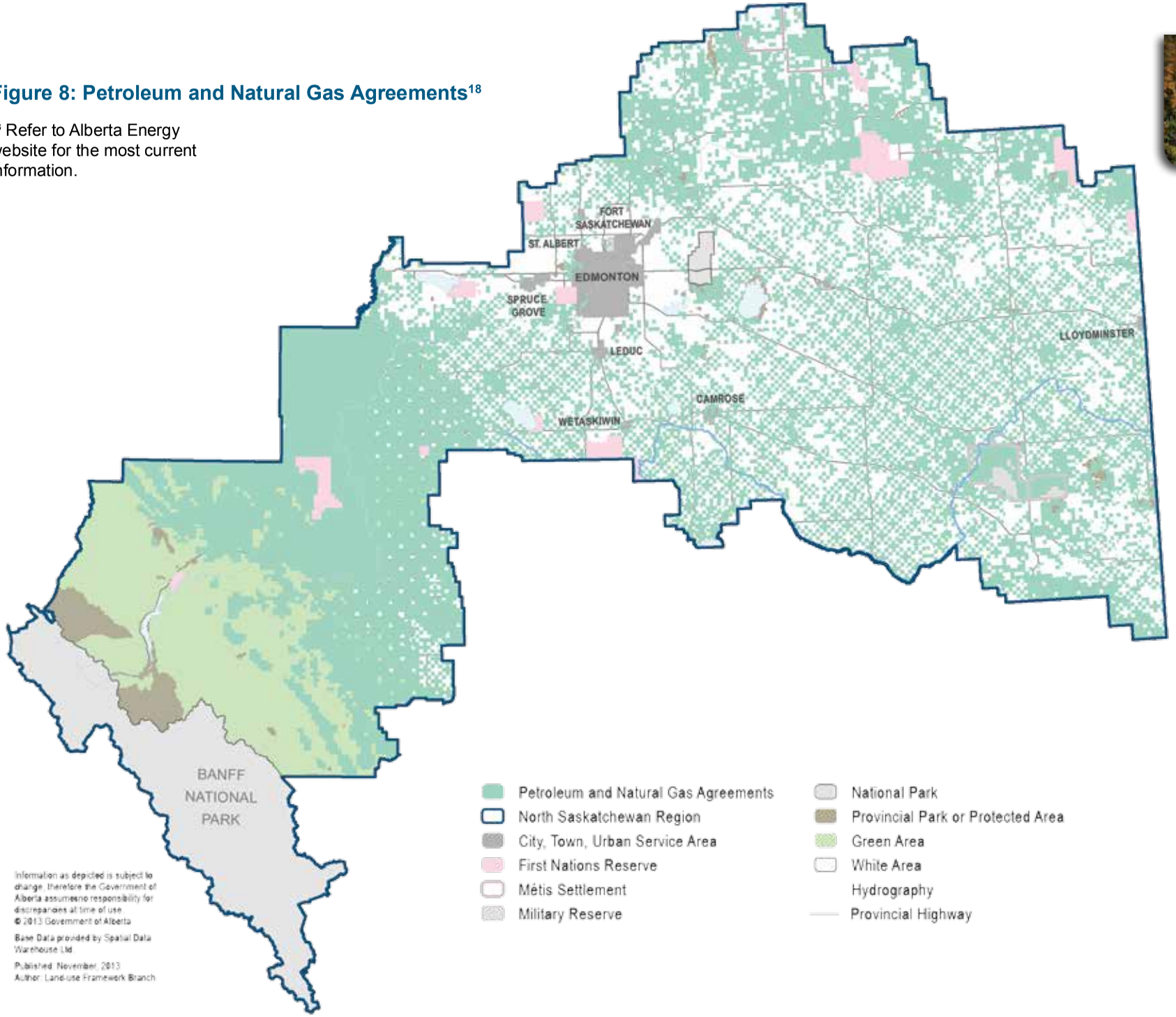
Oil

Conventional oil production occurs primarily in the eastern portion of the region. It peaked in the region in 2000 at 85 million barrels, declining to about 60 million barrels in 2009. New horizontal well and completion methods are continually increasing the amount of recoverable reserves. Since 2009, this has contributed to significant increases in production from mature oilfields (also known as "pools") such as the Pembina-Cardium field near Drayton Valley, Canada's largest conventional oilfield, which still contains almost one billion cubic metres (six billion barrels) of oil.

[17] The Government of Alberta (2013), Alberta Enterprise and Advanced Education, (in 2002 dollars).

Figure 8: Petroleum and Natural Gas Agreements[18]

[18] Refer to Alberta Energy website for the most current information.



Enhanced Oil Recovery

Enhanced oil recovery (EOR)[19], or tertiary recovery, is a generic term referring to a variety of methods used to increase the recoverable oil from certain pools. EOR can increase the overall recoverable reserves by up to 60 per cent of the initial reserves.

Enhanced oil recovery potential is extremely high in the region, and redevelopment of mature oil fields (such as Pembina and Leduc) could significantly add to the production volume of these oil reserves. Water-flooding (a secondary recovery method that uses water in much the same way as gases are used in EOR), infill drilling of mature fields with horizontal wells, and the potential for CO_2 injection into these mature oilfields continues to extend the life expectancy of oil development in these areas.

Oil sands production from the portion of the Cold Lake Oil Sands within the region is currently the largest contributor to the region's oil production – averaging around 55,000 barrels of oil per day. The major increase in production and number of wells in the region in the late 1990s was a direct result of the start-up of the ECHO (East Central Heavy Oil) pipeline.

There are currently 23 oil sands projects producing within the region, along with five proposed projects.

Natural Gas

Despite declining production, natural gas remains a significant part of the region's resource base. Production has declined from about 1.2 trillion cubic feet (tcf) in 2000 to around 812 million cubic feet (mmcf) in 2009.[20] Drilling has increased in existing areas to maintain production rates and to develop new unconventional resource opportunities such as deep shale gas.

The region contains extensive infrastructure that supports petroleum and natural gas exploration, development, value-added production and transmission. Pipelines (especially in and around the Industrial Heartland), gas plants, access roads and other features are already in place and may be used for future exploration and development purposes.

[19] Gas injection is a common method of EOR that uses various gases (including nitrogen, carbon dioxide and/or natural gas) to pressurize the reservoir and "push" the oil out or act as a solvent to thin out and cause the oil to swell, forcing it out of small pores in the rock. The gases are sent down an injection well and the oil is forced to the surface by way of a nearby production well. Carbon dioxide (CO2) can also be stored, to some degree, in the reservoir during EOR production. During operations it will be produced with the oil and recycled into the reservoir a number of times.

[20] Land Use Secretariat, Government of Alberta. (2013, Feb. 28). *Historical crude oil and natural gas dataset*. Edmonton, AB: Author.

Figure 9 on page 25 illustrates the crude oil and natural gas.

In terms of exploration, development of the Pembina-Cardium field near Drayton Valley has become increasingly important as a strategic energy reserve. This oilfield is the largest in western Canada, with original reserves estimated at more than 7.8 billion barrels (bbl). About 16 per cent has been recovered and, with the use of enhanced recovery methods, more conventional petroleum and natural gas may be available. The western portion of the region also contains a number of areas where conventional and unconventional energy resource developments overlap, particularly those related to natural gas.

Typically natural gas is sent to gas processing plants to remove impurities. From these plants, natural gas enters the Industrial Heartland and surrounding facilities, which are a part of an extensive network of energy-related pipelines. Infrastructure in the Industrial Heartland transports about 425 million cubic metres per day of natural gas to markets throughout North America.

Bitumen

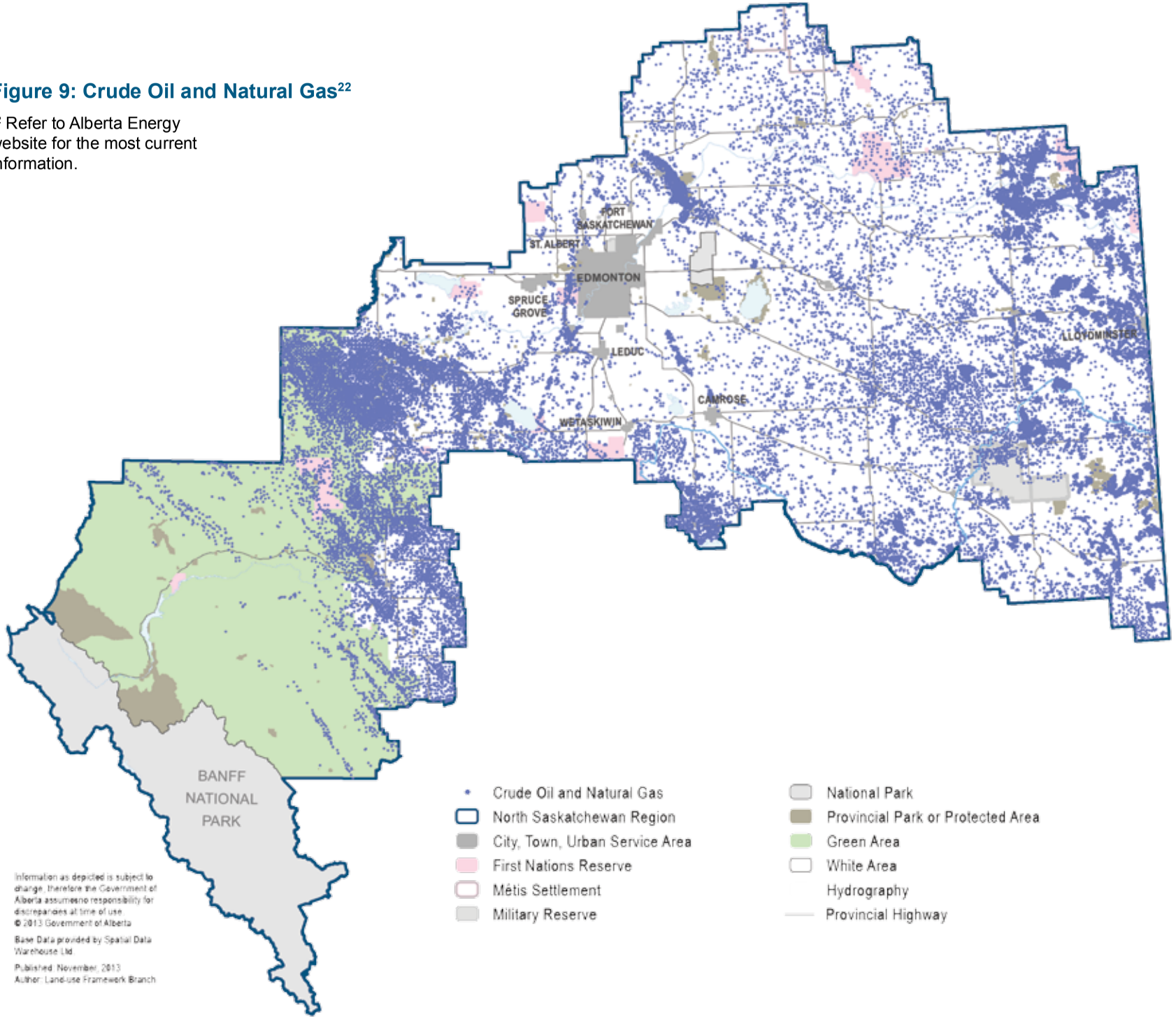
Unconventional oil production has played an increasing role in the region and the province. About one third, or 88 townships (8,200 square kilometres), of the Cold Lake Oil Sands Area falls within the region, and contains an estimated 15 billion barrels of crude bitumen with an estimated five per cent recovery rate[21] (see Figure 10 on page 26). Because of the nature of the bitumen in this area, it is cold-produced, requiring no steam. Township Line 53 (which runs east-west through the centre of Edmonton and roughly parallel to Highway 16) administratively separates these oil sands from conventional heavy oil deposits to the south. The Cold Lake Oil Sands Area covers most of the County of St. Paul and extends into the counties of Vermilion River and Two Hills, each of which has some active oil sands development.

Production of bitumen in the region is primarily done using cold heavy oil production with sand, although some cyclic steam stimulation was used in the past. Cold heavy oil production with sand requires low temperatures (no steam) and is a low-cost and low-energy process whereby the bitumen is pumped out along with some of the surrounding formation sand. While this method increases the recovery of bitumen, proper disposal of the produced sand must be considered.

[21] Alberta Energy (internal calculations) and the AERs ST98 2012. http://data.alberta.ca/data/st98-2012-albertas-energy-reserves-supplydemand-outlook.

Figure 9: Crude Oil and Natural Gas[22]

[22] Refer to Alberta Energy website for the most current information.



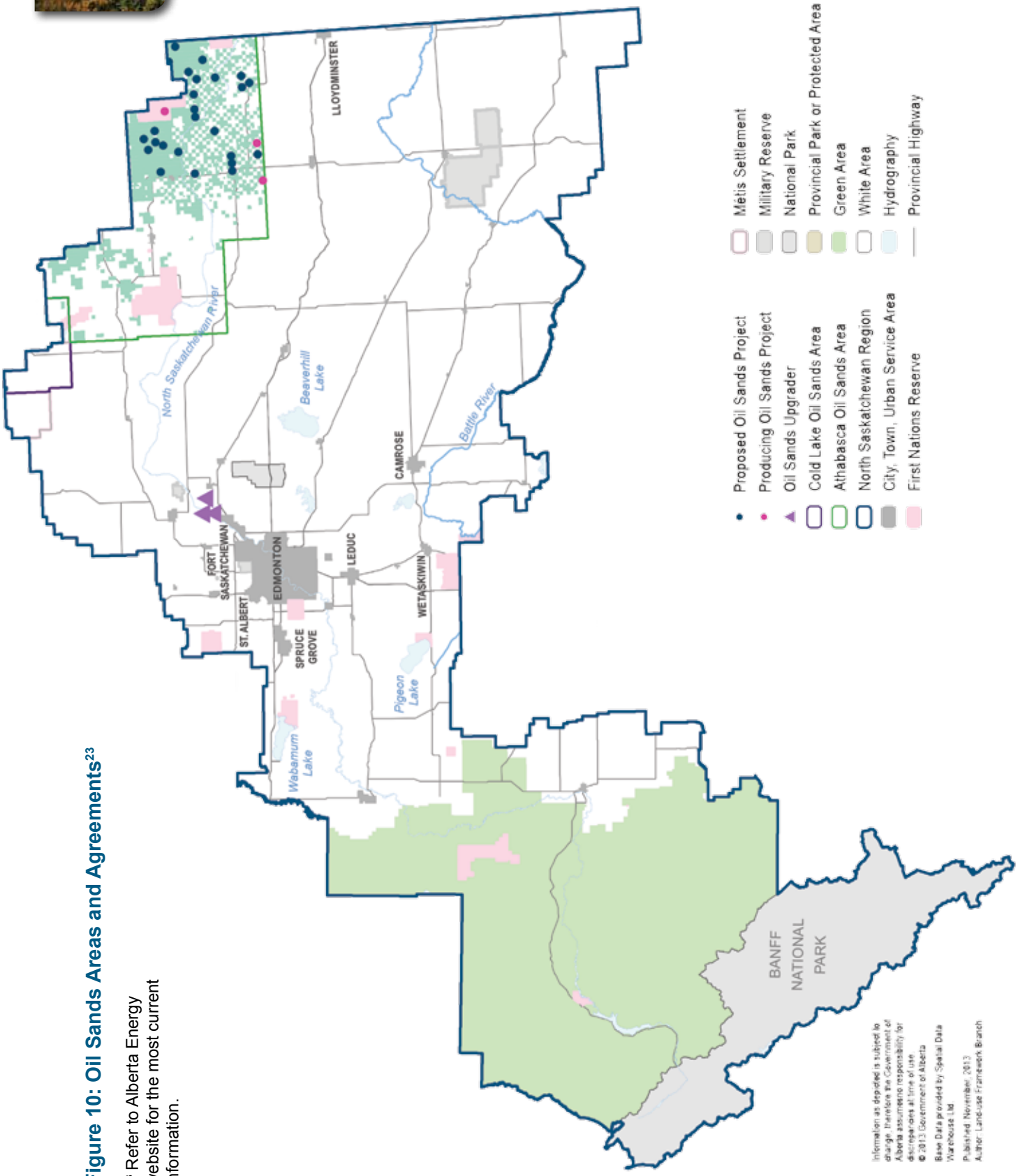


Figure 10: Oil Sands Areas and Agreements[23]

[23] Refer to Alberta Energy website for the most current information.

Coal Bed Methane

Coal bed methane extraction is a low priority in the region due to the amount of water in the coal seams. In addition, the depth of the coal makes the methane more costly and less attractive for extraction.[24]

In Situ Coal Gasification

Deep coal that cannot be mined through open-pit or other physical removal processes can be developed using an in situ coal gasification process.[25]

As with coal bed methane development, similar land-use practices will have to be considered if and when in situ coal gasification development expands. Water use will also need to be closely monitored, although water within the coal seams can be used to support production processes, thereby reducing overall water demand.

There are no in situ coal gasification projects in the North Saskatchewan Region currently. There is, however, significant potential for the region should in situ coal gasification become a more mainstream method of energy development.

An added advantage to the in situ coal gasification process is that any carbon dioxide (CO_2) which is produced can be efficiently captured and used for other extraction processes.

Coal

The current estimate for remaining established reserves of coal in Alberta is about 33 billion tonnes. In 2012, 34.7 million tonnes of marketable coal were produced. The province aims to ensure responsible development of its coal resources and supports leading-edge processes for efficient and clean energy production from coal. There are strategic reserves of metallurgical coal (coal used in steel production) along the foothills, which are currently exported to Asian markets. There are also two active coal exploration programs in the foothills area that are targeting metallurgical coal. Carbon capture and storage methods allow for increasingly fewer emissions released into the atmosphere when coal is burned.

Highvale Mine west of Edmonton

[24] In the coal bed methane extraction process, a well (or many wells) is drilled into a coal seam. The seam is then "dewatered" by pumping water out of it, causing the pressure within the seam to drop. This frees the adsorbed methane (methane that is physically "stuck" to the surface of the coal) from the coal and allows it to flow to the surface. Coal bed methane wells are located closer together than conventional gas wells, which allows for greater recovery of methane gas. Drilling multiple wells from a single location, aligning roads or pipelines along natural field breaks and other good land-use practices can reduce disturbance of the landscape.

[25] This process involves drilling a near-vertical injection well to the coal seam and then redirecting it to follow the horizontal coal seam. Some distance away, a vertical production well is also drilled. Predominantly saline/produced water is pumped into the injection well and heated well past its boiling point to create very hot steam within the well casing. This heat, coupled with the natural pressures of the overlying rocks, gasifies the coal, which is captured by the production well. The synthetic gas, or syngas, produced in this process consists of carbon dioxide, hydrogen, carbon monoxide and methane. The hydrogen can be used as feedstock for petroleum and petrochemical operations, while the methane can be used for electricity generation. The waste materials (such as char and ash) are left down-hole.

There are currently 11 coal mines operating in Alberta. Six of these are operating within the North Saskatchewan Region which produces 65 per cent of Alberta's coal: Dodds, Burtonsville Island, Genesee, Highvale, Vesta and Paintearth (see Figure 11 on page 29). Combined, the mines have approximately 580 million tonnes of remaining reserves and up to 33 years of remaining production life. There are two additional deposits of coal that are recoverable by surface mining occurring in the region. The first covers an area that stretches from northwest of Edmonton through the Camrose area to the southeast border of the region. The other stretches from Wabamun Lake southeast to Millet. The nature of the deposits suggests they could be developed for strip-mining and dedicated to electrical production or domestic heating.[26] There is also some potential for underground coal mining along the eastern edge of the Rockies between Jasper and Banff.

Value-added Energy – Refining/Upgrading Petroleum and Petrochemicals

Refining hydrocarbons into petrochemicals and petroleum products is the value-added portion of the energy industry. While some petroleum and natural gas is exported directly to other markets, much of the resource remains in the province for further upgrading and processing into end-use products such as petrochemicals, lubricants and fuels. The processing and manufacturing carried out in this sector creates additional economic activity, jobs and tax revenue.

Raw bitumen

The largest concentration of industrial activity in Alberta is located in the Industrial Heartland, which covers 582 square kilometres and is located in the northeastern part of the Capital Region. The Industrial Heartland is home to over 40 companies, refineries and upgraders, heavily industrialized infrastructure, rail lines, roads and processing facilities that spread out around the City of Fort Saskatchewan, and Lamont, Strathcona and Sturgeon counties.

The Industrial Heartland sits at a crossroad of extensively developed transportation infrastructure as well as oil, natural gas and bitumen pipelines and transmission lines. The energy industry is the dominant driver of Alberta's economy, accounting for more than 20 per cent of provincial GDP and more than 65 per cent of Alberta's exports.

The investment in the processing plants in the Industrial Heartland has resulted in one of the highest concentrations of petrochemical producing facilities in Canada. This value-added energy sector is supported by a vast network of pipelines to transport upgraded and refined petroleum products. In recent years, significant pipeline capacity has been added to accommodate expected increases in bitumen and synthetic crude oil (SCO) production.

[26] Energy Resources Conservation Board. *Coal Mines and Potential Coal Development*.

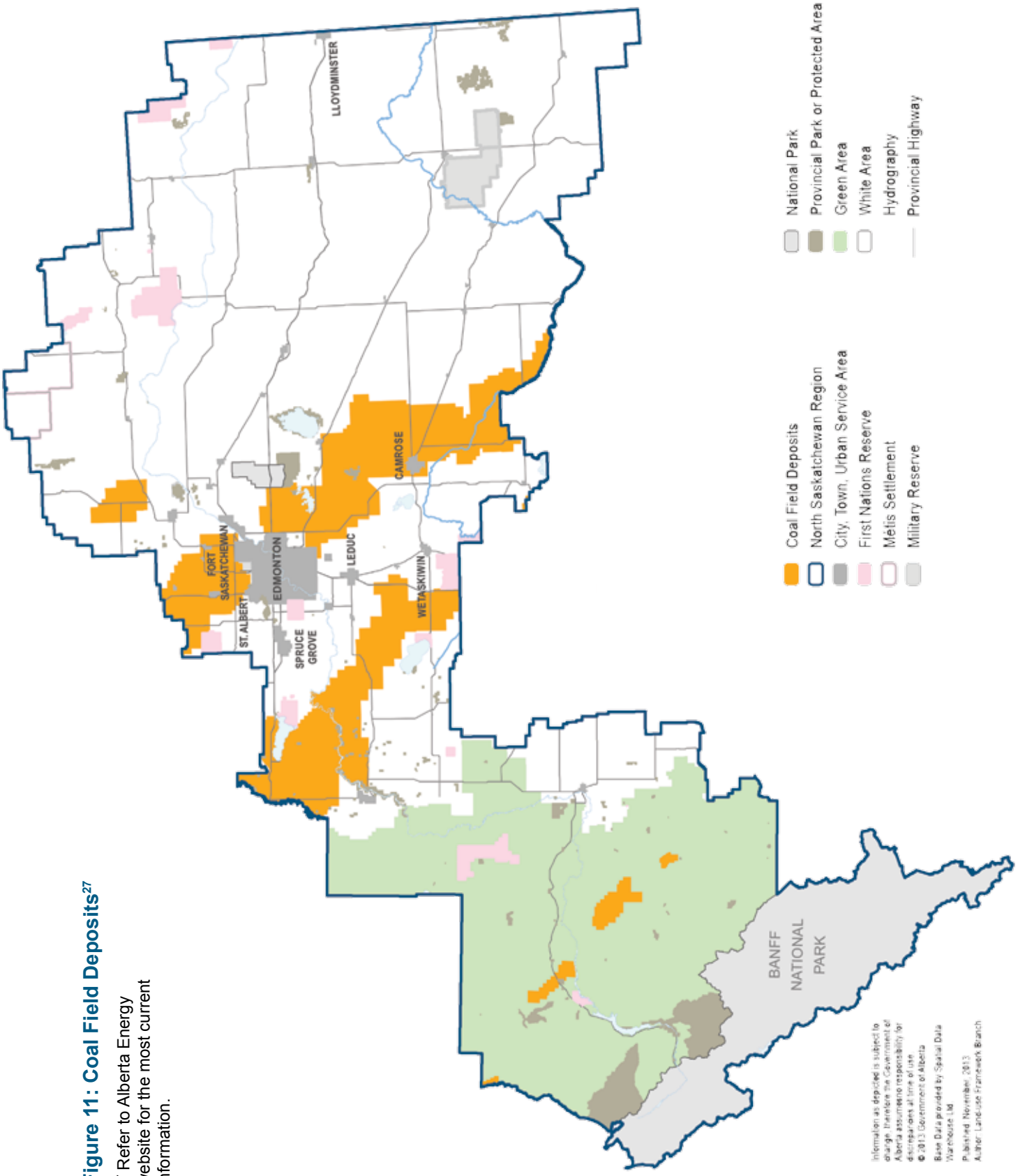


Figure 11: Coal Field Deposits[27]

[27] Refer to Alberta Energy website for the most current information.

Alberta upgraders process raw bitumen into SCO, while oil refineries produce a wide range of refined petroleum products including gasoline, diesel fuel and heating oil. Growth in this sector depends on various factors including the availability and price of feedstock[28], demand (local and foreign) and refining profit margins.

In recent years, the expansion of Alberta's oil sands has led to significant investments in upgraders, increasing the bitumen refining capacity in the province. Conventional crude oil refining capacity has remained relatively flat since 2003, however, largely reflecting the gradual decline in conventional oil production in the province.

There are three proposed upgraders in the region, and two currently operating. The Government of Alberta is negotiating with industry to develop additional bitumen upgraders, and developing carbon capture and storage capacity to mitigate increased emissions from the upgrading process. A new upgrader will be located in the region's Industrial Heartland and will be operated in joint partnership with the private sector. This could potentially serve as a model for future development in Alberta, given the strategic value of oil sands and the economic need to develop high-value oil and petroleum products within the province.

The province has two operating and three proposed bitumen upgraders, the third largest of which is located in the region near the City of Fort Saskatchewan. It has a production capacity of 158,000 barrels per day, or approximately 13 per cent of the total provincial capacity. All four oil refineries in the province are located in the region and include Imperial Oil in Edmonton (135,000 bpd), Suncor in Edmonton (187,000 bpd), Shell Canada in Fort Saskatchewan (110,000 bpd) and Husky Asphalt Refinery on the Alberta side of Lloydminster (25,000 bpd).

Alberta is also Canada's largest petrochemical manufacturer, with the largest group of petrochemical processors located near Fort Saskatchewan. This complex is an integrated petrochemical cluster based heavily on ethylene[29] and derivative products (e.g., polyvinyl chloride). The Fort Saskatchewan location offers extensive pipeline inter-connections, large underground storage capacity for hydrocarbons (raw materials and products), and nearby petroleum refineries for raw material acquisition and co-product exchange.[30]

Biofuels

The agriculture and forestry sectors produce large quantities of livestock manure, crop residues, food processing wastes, animal remains, wood chips and sawdust; this waste is collectively known as biomass. It often requires expensive management practices to reduce the environmental impact of these waste products. Biomass can be used, however, along with grains and other crops, to form an excellent feedstock for the production of bioenergy.

[28] Raw material to supply or fuel a machine or industrial process.

[29] Ethylene derivative products include: styrene monomer used largely in polystyrene for packaging and insulation; ethylene oxide used in detergents/ surfactants and ethylene glycol used in numerous products (textiles, plastics, antifreeze); and olefins used as a base in synthetic lubricants, detergents, plasticisers and additives.

[30] Government of Canada (2011), *Petrochemicals Industrial Profile*; available at http://www.ic.gc.ca/eic/site/chemicals-chimiques.nsf/eng/bt01135.html

To pursue opportunities to commercialize biomass as an energy source, the Government of Alberta developed Alberta's Nine-Point Bioenergy Plan in 2006. The province distributed more than $150 million in grants to industries that further developed the bioenergy sector. Although a number of programs under this plan expired in 2011, the Bioenergy Producer Credit Program (BPCP), a plan that provides incentives for producing biofuels in the form of bio-ethanol, bio-diesel, biogas, and biomass pellets, along with electricity and heat, continues until April 2016.

In addition to the BPCP, Alberta enacted a Renewable Fuel Standard (RFS) in 2010, requiring the mandatory inclusion of five per cent bio-ethanol in gasoline and two per cent biodiesel in diesel fuels that are sold in Alberta. This legislation came into effect in April 2011, and a number of commercial ventures have shown interest in investing in bioenergy production facilities to boost the province's current production level of 40 million litres of ethanol and 19 million litres of biodiesel.

Specifically within the region, the "Growing Power Hairy Hill" project is currently building a 40 million litre capacity ethanol production facility on the existing Himark Renewables site, a 0.8 Megawatt (MW) biogas facility that is expanding its capacity to 3 MW.

The City of Edmonton has partnered with a Quebec-based firm to construct a 36 million-litre ethanol facility, whose annual feedstock will be 100,000 tonnes of municipal solid waste from the City of Edmonton. In the eastern portion of the region, another company has started construction of a biodiesel facility in Lloydminster.

Pipelines

There are several pipeline systems that originate in, terminate in or pass through the region. These transport synthetic crude oil (SCO), crude bitumen, crude oil and natural gas within Alberta to jurisdictions outside the province.

There are 12 pipelines that transport bitumen/SCO from the Fort McMurray and Cold Lake areas into the region and on to other markets. Edmonton and Hardisty are the major pipeline hubs. Most of the bitumen (raw or upgraded) is sent to Hardisty through the East Central Heavy Oil pipeline which started transporting bitumen and heavy oil in 1997. The oil is then exported through the Hardisty hub to the United States (approximately 61 per cent of the province's total crude oil and bitumen was exported to the U.S. in 2010) or east to the Great Lakes region. There are 12 existing and one proposed pipelines that support transmission into and out of the region.

Pipeline construction

Crude oil is exported from the region through federally regulated (within Canada) pipeline systems that include the Express Pipeline, the Enbridge Pipeline, the Trans Mountain Pipeline and the Keystone Pipeline. Major pipeline proposals like the Northern Gateway, Trans Mountain and Keystone XL are aimed at providing greater export capacity to the U.S. and to Pacific ports in British Columbia. Currently, much of the exported crude is destined for the U.S. Midwest. Natural gas pipelines include the TransCanada (Foothills, Mainline) systems and the Alliance Pipeline.

Metallic and Industrial Minerals

The mineral potential of the region has not been fully realized and considerable exploration is needed to better understand the metallic and industrial mineral development potential. While there are no active mining operations, there is some metallic and industrial mineral potential based on the occurrence of phosphate, lithium-bearing brines and potash as identified by the Alberta Geological Survey in or near the region[31].

Exploration efforts reveal:

- Traces of placer gold along the North Saskatchewan River valley from the headwaters to the Alberta-Saskatchewan border;
- Traces of alluvial diamond occurrences;
- Occurrence of lead-zinc in the Edmonton–Camrose corridor;
- Traces of iron-titanium in the vicinity of the foothills; and
- Traces of potash deposits around Lloydminster and surrounding area.

There are active metallic and industrial mineral leases and permits that are held for limestone (and other building stone) in the mountain area of the region, including producing quarries. Limestone is an important industrial mineral. It is a key ingredient in cement and has many other uses, such as aggregate, lime, building stone and other products derived from limestone. Salt mining is ongoing in the region; salt is produced from in situ brine extraction from wells drilled into salt within the Elk Point group strata of the western Canadian Sedimentary Basin. Consequently, the region is attracting mineral exploration activity and must respond to access needs for the mining sector. There have also been recent discoveries of economically viable diamond, phosphate, lead-zinc, ion-titanium, lithium potash and gold deposits in the region.

[31] Alberta Geological Survey (2012), *Atlas of the Western Canada Sedimentary Basin*; available at www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Reclamation

Reclamation is required for most industrial disturbances on public and private land in Alberta through provisions in the *Public Lands Act* and the *Environmental Protection and Enhancement Act*. Alberta was the first province in Canada to legislate mandatory land reclamation.

Reclamation returns land to a state where it is capable of supporting land uses that existed prior to disturbance. All specified land in Alberta that has been disturbed by industrial development must be reclaimed. Achieving timely reclamation is important for the management of cumulative effects.

Energy Development

Energy development, production and value-added activity will continue to be very significant in the region for many decades. Gaining access to new markets for Alberta's resources, both overseas and within North America (via rail or pipeline), will be a critical factor in the success of the energy industry and in shaping the regional and provincial economy. Other factors like potential changes to greenhouse gas emissions regulations could result in more opportunities for sectors like hydroelectricity or mineral exploration, while reviews of the national and provincial energy strategies could provide additional opportunities to all energy-related sectors. Global demand for coal is on the rise which will have an increasingly beneficial impact on the region's economy based on its extensive resources.

As hydrocarbon production from historically significant sources declines, production from oil sands, shale and other unconventional sources, along with enhanced recovery methods, will become increasingly important. Enabling, regulating and monitoring this new development will need to take into account a balancing of economic, social and environmental considerations.

Agriculture

Wheat was grown at Fort Edmonton as early as 1846 and, by the 1860s, farm-scale agriculture was practised at the St. Albert Mission. An influx of agricultural settlement followed in the late 1890s and early 1900s with the commencement of railway service to the Edmonton area and the promise of free homestead land. The area of land under cultivation in the region increased substantially between 1920 and 1960, as did the number of cattle and swine.

Agriculture is the province's largest renewable resource. It contributes to a safe and secure domestic and international food supply, generates employment and creates a multitude of small and large business opportunities. In 2012, agriculture in the North Saskatchewan Region contributed $1.7 billion to the province's GDP, and employed approximately 9,500 people[32].

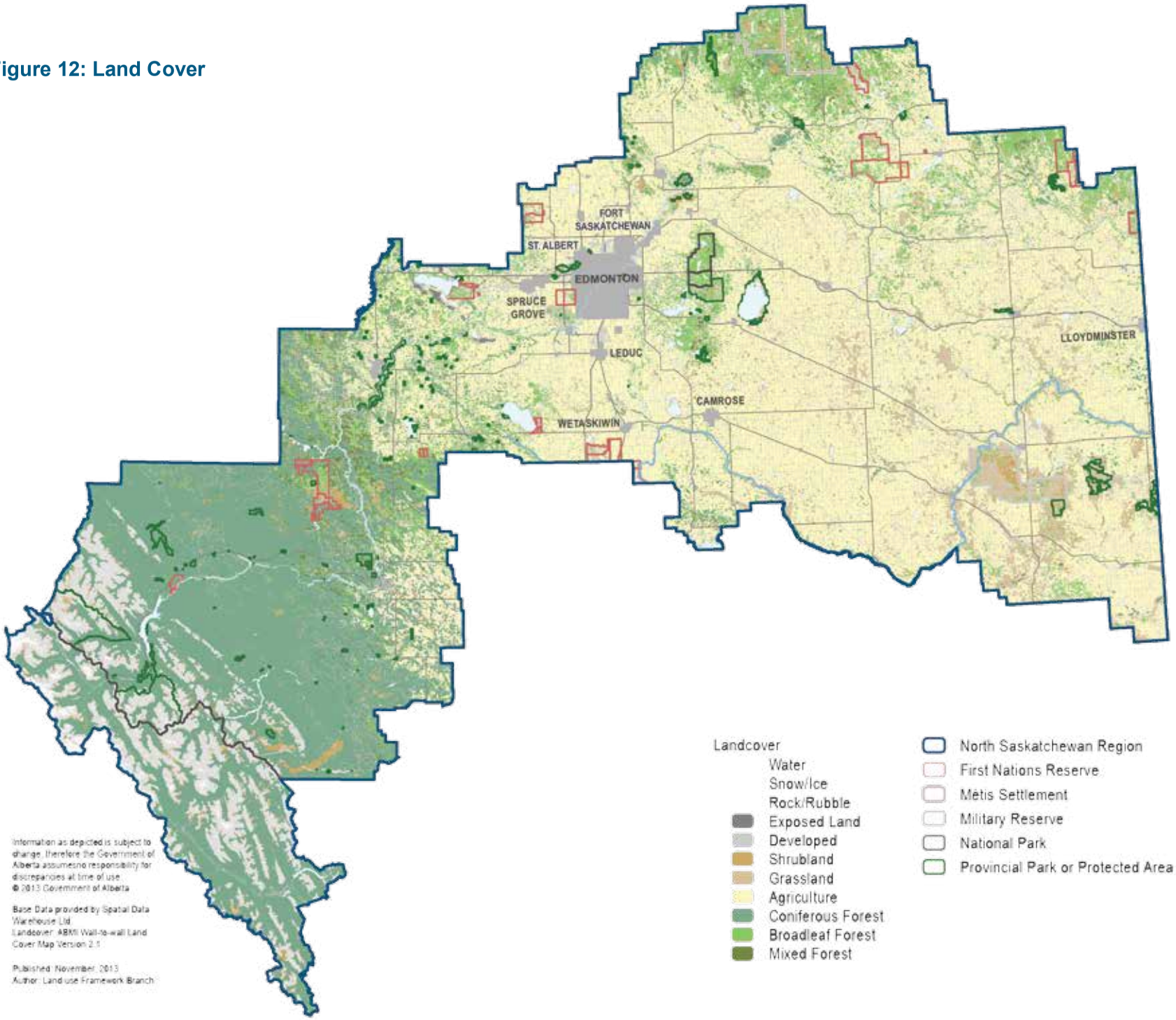
The region has a wide variety of land cover and soil types (see Figure 12 on page 35). About 50,000 square kilometres of land in the region (i.e., approximately 59 per cent of the total land area)[33] is used for agricultural production, including crops and tame[34] and native pasture for grazing. This represents about 25 per cent of the total farm land in Alberta.

[32] The Government of Alberta (2013), Alberta Enterprise and Advanced Education. (In 2002 dollars)

[33] Statistics Canada. (2013). *Census of Agriculture, Alberta, custom land use regions*. Ottawa, ON: Author.

[34] Tame pastures are cultivated fields planted with introduced (non-native) grass and legume species or cultivars with the multiple purposes of providing livestock grazing forage to improve animal nutrition and health, balance forage supply and demand during low forage production, reduce soil erosion, improve water quality, improve soil quality and health, and provide food and cover for wildlife. United States Department of Agriculture (2013), Tame Pasture Grass and Legume Species and Grazing Guidelines, available at: http://www.nrcs.usda.gov wps/portal/nrcs/detail/mt technical/landuse/pasture/ ?cid=nrcs144p2_057699

Figure 12: Land Cover



In 2011, agriculture in the region included approximately 14,026 farms representing 32 per cent of the total number of farms in Alberta (43,234). The number of farms is declining and is approximately 70 per cent of the 1981 values (see Table 5 below). Although the number of farms in the region has declined, the average farm size has increased from 241 ha in 1981 to 359 ha in 2011, which is still smaller than the provincial average of 473 ha.

Table 5: Farm Statistics for 1981-2006 for the North Saskatchewan Region[35]

	1981	1986	1991	1996	2001	2006	2011[36]
Number of Farms	20,006	15,569	18,533	19,746	17,591	16,096	14,026
Average Farm Size (ha)	241	261	267	265	298	325	359
Total Farm Area (ha)	**4,811,012**	**4,058,086**	**4,945,041**	**5,238,015**	**5,235,004**	**5,229,132**	**5,038,021**

Prepared by: Alberta Agriculture and Rural Development, Economics and Competitiveness Division, Statistics and Data Development Branch

While fragmentation and conversion of agricultural land to non-agricultural uses remains an on-going issue throughout the province, the amount of farm land in the North Saskatchewan region has remained virtually unchanged over the last 40 years. Although there has been a conversion of higher-value cultivated lands used for annual crop production to non-agricultural uses, these losses have been offset by increases in the use of more marginal land. These lands, however, often require greater crop inputs (i.e., fertilizers and herbicides) to be as productive as those soils that were lost to non-agricultural uses.

Land Suitability Rating System

Developed in 1995, the Land Suitability Rating System (LSRS) is a comprehensive approach to integrating and modelling soil, landscape and climate factors. Universally, LSRS Class 1, 2 and 3 lands are considered suitable for annual crop production, and LSRS Class 4 through 7 are considered marginal or not suitable for crop production. In Alberta, the highest rated soils are LSRS Class 2[37], which in this region are largely found surrounding the cities of Edmonton and Lloydminster (Figure 9). The lower class land (LSRS Class 4 and 5) supports cattle and other forms of livestock grazing throughout much of the region.

[35] Statistics Canada (2006), *Census of Agriculture, 1971 – 2006*

[36] Statistics Canada. (2013). *Census of Agriculture, Alberta*, custom land use regions. Ottawa, ON: Author.

[37] LSRS Class 1 is unattainable in Alberta because of our climate.

Crop Production

Ongoing advances in the science and technology of raising crops have contributed to tremendous growth and development in the agricultural industry in the region. Improvements include plant breeding and research into crop varieties, variable rate nutrient application and other advances in farm equipment and technology. Crop production in the region benefits from a highly sophisticated and technologically advanced industry, and is expected to maintain a healthy growth rate for the foreseeable future.

A significant amount of land in the region is suitable for cultivation and annual cropping due to the amount of high-quality soils (LSRS Class 2 and 3). The land surrounding the Capital Region has some of the most fertile soils in western Canada (see Figure 13 on page 38). In 2011, approximately 35,000 square kilometres were cultivated for crops and tame or seeded pasture, with canola and wheat representing the largest cropped area in the region (approximately 8,400 square kilometres and 7,500 square kilometres, respectively) (see Table 6). An additional 11,000 square kilometres of land is covered in native and/or natural area (both public and privately held lands) and is used for livestock grazing.

Table 6: Agricultural Land Use in the North Saskatchewan Region[38]

Farm Type	Area (km^2)	Number of Farms	% of Alberta (Total Area)
Field Crops	27,565	11,688	28
Wheat	7,456	3,758	27
Oats	1,138	2,626	32
Barley	3,663	3,718	25
Alfalfa	3,944	6,122	27
Canola	8,397	4,461	34
Potatoes	24	123	11
All other field crops	2,900	9,120	-
Summer fallow	577[39]	1,290	11
Tame or seeded pasture	7,022[40]	6,285	29
Natural land for pasture	11,274[41]	7,892	18
All other land	1,263	10,177	29

[38] Statistics Canada. (2013). *Census of Agriculture, Alberta, custom land use regions*. Ottawa, ON: Author.

[39] Alberta Agriculture and Rural Development, Statistics and Data Development Branch. (2013, May 02). *North Saskatchewan region agriculture profile - 2011 Census of Agriculture*. Edmonton, AB: Author.

[40] ibid

[41] ibid

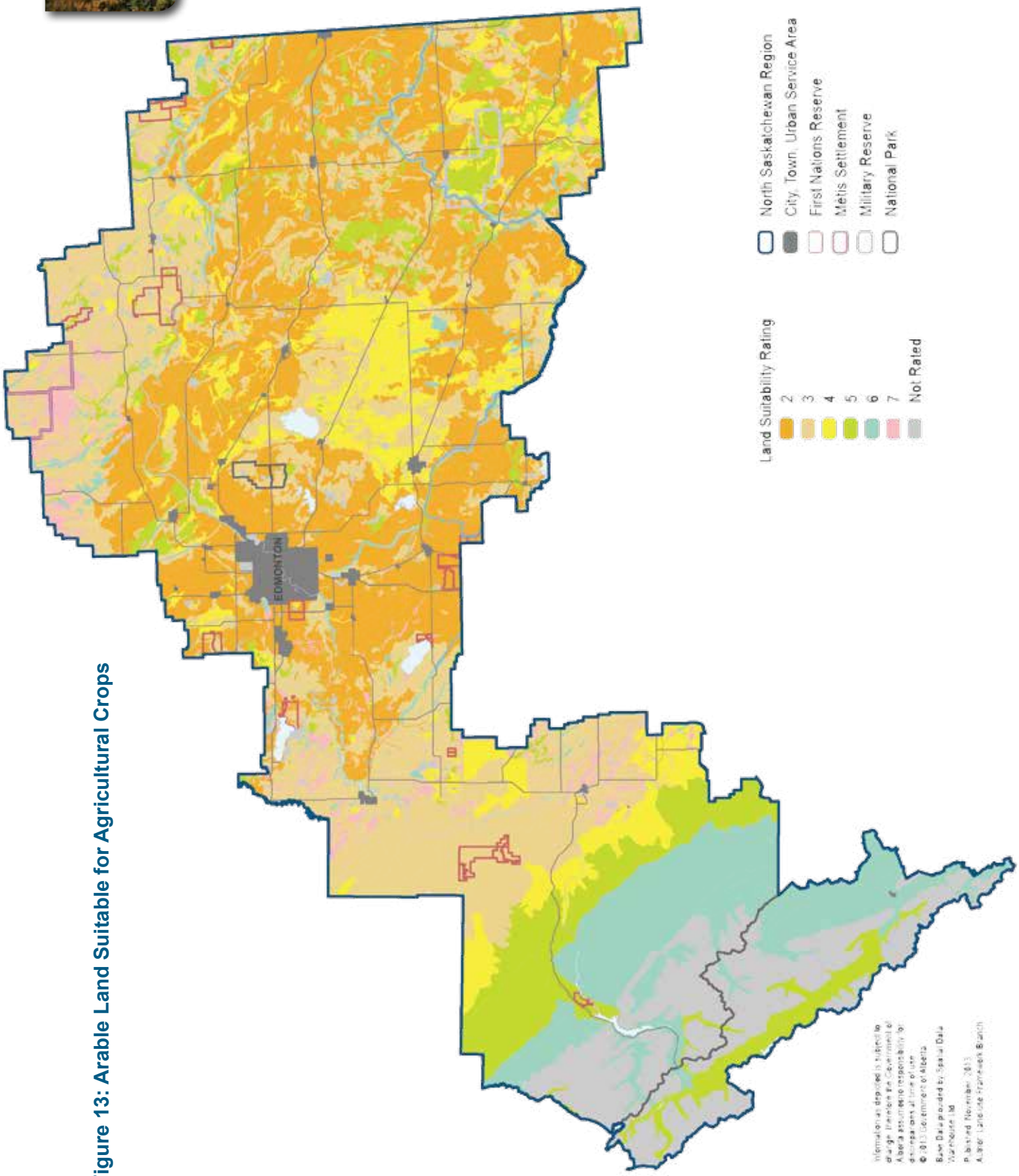


Figure 13: Arable Land Suitable for Agricultural Crops

Although total farm area in the region has remained relatively constant since 1971, the land devoted to different crops has varied over time. Changes in global commodity prices can significantly affect cropping choices made by the region's grain and oilseed producers, which has a direct impact on the land area used for crops. Dryland cropping is predominant in the region with only 67 square kilometres (0.3 per cent of the total agricultural land base) under irrigation. This irrigated land is used mostly for high-value horticultural crops.

Cereals such as wheat, oats and barley occupy the largest area for crops and are typically grown in rotation with oilseeds, pulses (crops such as peas, dry beans, fava beans, lentils or chickpeas) specialty crops, or perennial forages such as timothy or alfalfa hay. The major cropping trends in the region are an increase in area devoted to canola and pulse crops and a decrease in summer fallowing.[42]

The use of summer fallow in rotation has decreased significantly from 7,663 square kilometres in 1971 to 577 square kilometres in 2011. This is in response to changes in farming practices, including significant increases in the use of direct seeding technologies (e.g., reduced tillage), broad spectrum herbicides, improvements in soil fertility management and the inclusion of perennial forages in crop rotation. These practices have also contributed to a reduction in regional soil, wind and water erosion issues.

In the region, canola acreage has increased over 250 per cent from 2,375 square kilometres in 1971 to 8,397 square kilometres in 2011. This represents approximately 34 per cent of Alberta's total canola area.

Pulses have also experienced major growth in Alberta, increasing from just a few square kilometres in the early 1980s to approximately 3,500 square kilometres in 2011. Although pulse crops are commonly grown in southern Alberta, owing to the drier and warmer growing conditions there, the region contains approximately 19 per cent (647 square kilometres) of the province's pulse acreage. Pulses are considered a key growth area for the province and are expected to increase another 10 per cent by 2022.

The region is second to the South Saskatchewan for potato production, with seed potatoes being a particularly significant specialty crop in the region. A desirable summer climate with long, warm days and cooler nights, combined with cold winter temperatures that reduce the potential for potato disease, make the region a leading producer of seed potatoes. Alberta is the largest exporter of seed potatoes in Canada, with the province exporting approximately 75 per cent of its seed potatoes. These are shipped to Mexico and the U.S., particularly to Washington, Oregon and California.

[42] Summer fallow is a process in which the land is left unseeded for a growing season to improve overall soil moisture conditions, control pests and improve soil fertility. Stats Canada (2013) 2006 Census of Agriculture, can be located at: www.statcan.gc.ca/ca-ra2006/gloss-eng.htm#gt30

Livestock

Livestock are a key component of agricultural production in the region, with about 48 per cent of farms in the region reporting livestock. The main livestock types in the region (see Table 7 below) are cattle (beef and dairy), hogs, poultry (including non-quota holders, egg producers and meat), sheep (wool and meat) and horses. About one-third of the provincial total number of horses is found in the region, particularly in municipalities within the Capital Region. The primary equine interests in the region are focused around recreational activities such as trail riding, showmanship, cattle penning/roping and rodeo competition.

Table 7: Livestock Numbers in the North Saskatchewan Region (2011)[43]

Farm Type	Livestock Number	Number of Farms	% of Alberta (Total Farms)
Cattle and calves (including dairy)	1,128,420	6,929	32
Pigs	231,980	227	26
Sheep and lambs	50,611	505	29
Horses and ponies	42,413	4,618	31
Hens and chickens	3,789,073	895	29

The North Saskatchewan Region is home to 6,929 beef and dairy farms, and the abundance of grazing land and feedstock for winter feeding (hay, silage) provides the ideal conditions for many multi-generational cattle operations. Close to 1,600 provincial grazing dispositions (i.e., licences, leases, permits and allotments) and 10 provincial grazing reserves on public land offer optimal summer grazing opportunities that help maintain and promote ecosystem function and regional biodiversity (see Table 8 on page 41). Tame pasture is generally the long-term permanent cover used for livestock grazing.

[43] Statistics Canada. (2013). *Census of Agriculture, Alberta, custom land use regions*. Ottawa, ON: Author.

Table 8: Livestock Grazing in the North Saskatchewan Region[44]

Type of Agricultural Disposition in Region	Number	Total Animal Unit Month[45] (AUM)	Area in Square Kilometres
Forest Grazing Licence	34	3,851	219
Grazing Lease	1,352	209,118	3,078
Grazing Permit	180	9,485	141
Grazing Reserve	10	71,352	703
Forest Reserve Allotment	21	12,349	2,787
Cultivation Permit	30	N/A	5
Farm Development Lease	144	N/A	96

The region's 262 dairy farms are an important part of the agriculture industry of the region, and dairy cow numbers (18,193 in 2011) rank a close third behind the Red Deer and South Saskatchewan regions (31,412 and 22,717, respectively). Most of the region's dairy operations are within rural municipalities adjacent to the City of Edmonton. Similar to beef cattle feedlots, dairy farms are considered Confined Feeding Operations (CFO), and applications for their development and/or expansion are reviewed and approved by Alberta's Natural Resources Conservation Board (NRCB), which has the mandate for monitoring compliance under the *Agricultural Operation Practices Act*. There are more than 675 registered CFOs in the region (see Figure 14 on page 42).[46]

Economic Impact of Agriculture

Agriculture is one of the main economic drivers in the region and is considered a central economic factor in the livelihood of many rural municipalities. Livestock and crop production contribute greatly to Alberta's exports and provide the foundation for a strong food-processing industry in the region. Further economic activity is generated through a vast range of agricultural support industries such as farm supply companies, machinery and equipment dealerships, auction marts and grain elevators. As such, the agricultural industry's economic impact is far-reaching, making agriculture important to the well-being of rural and urban communities alike. A snapshot of agriculture's economic impact in the region is as follows:

- Agricultural production in Alberta, as measured by farm cash receipts, amounted to approximately $10.4 billion in 2011; 23 per cent of this ($2.4 billion) was attributed to production in the North Saskatchewan Region[47].

[44] Alberta Department of Sustainable Resource Development. (2011). *Surface activity standing search: Detailed descriptions*. Retrieved from Alberta Energy website: www.energy.alberta.ca/Org/pdfs/ActivityStandingSearch.pdf

[45] An Animal Unit Month refers to the amount of forage needed by an "Animal Unit" grazing for one month. This measure helps in determining stocking rates to produce the maximum agricultural returns without causing damage to the available grassland resources. Government of Alberta (2007), *Using the Animal Unit Month (AUM) Effectively*; available at www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex1201.

[46] "A Confined Feeding Operation means fenced or enclosed land or buildings where livestock are confined for the purpose of growing, sustaining, finishing or breeding by means other than grazing, and any other building or structure directly related to that purpose that does not include residences, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, race tracks or exhibition grounds." From the *Agricultural Operation Practices Act* (2013)

[47] The Government of Alberta (2013), Alberta Enterprise and Advanced Education. (In 2002 dollars)

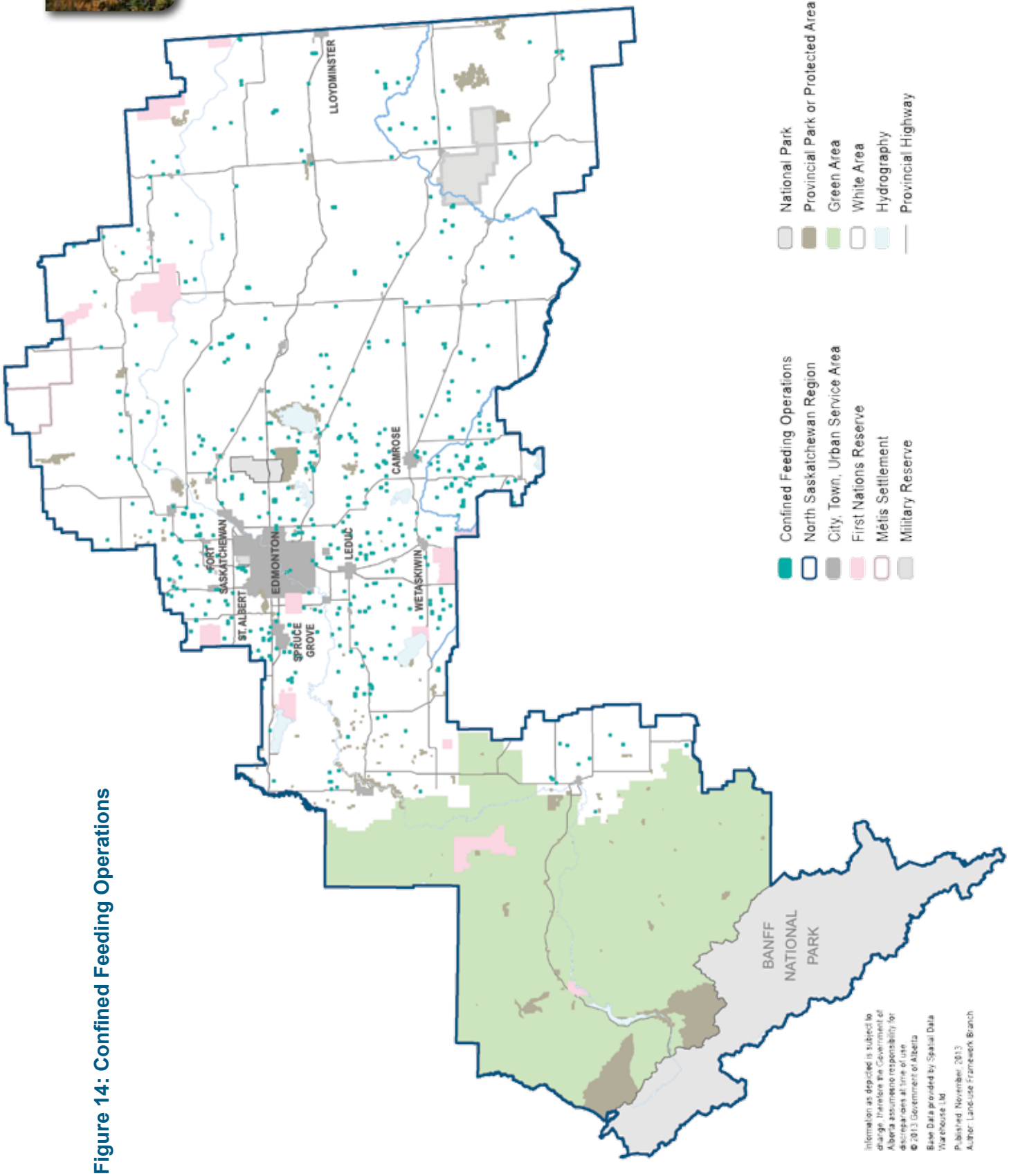


Figure 14: Confined Feeding Operations

Farm Cash Receipts (FCR) are a measure of the total value of agricultural sales, less the value of the sale of agricultural goods between farms. That is, FCR exclude inter-farm sales such as the sale of hay from one farm to another farm, but would include the sale of a crop at the grain terminal. They are measured and reported annually, however only at the provincial level, and not by rural municipality or Land-use Framework (LUF) region. To determine the value of FCR at the LUF region, the per cent distribution by municipality of the Gross Farm Receipt (GFR, the total value of all farm sales) value, as determined by the most recent Census of Agriculture, is applied to the FCR value. This allows for the derivation of municipal FCR estimates for each year the GFR was not reported (i.e., the non-census years). The individual municipal FCR values could then be rolled up to each LUF region.

- Farm cash receipts from crop production in the North Saskatchewan region were approximately $1.5 billion ($908 million for canola and $456 million for wheat) in 2011; livestock production contributed an additional $700 million.
- The main generator of revenue in the livestock sector is cattle, which represented approximately $437 million in farm cash receipts in 2011, or 60 per cent of the livestock total.
- The dairy and poultry and egg sectors, which are supply managed sectors, had a combined farm cash receipt value of approximately $223 million in 2011.
- In 2012, the provincial sales value of Alberta's food and beverage processing industry, which includes value added from primary production, was approximately $11.8 billion.
- Based on 2012 annual estimates, 75,900 people were employed in agri-food industries, representing just fewer than four per cent of the total provincial workforce. Agriculture industries employed 56,200 workers, while the remaining 19,700 workers were employed in food and beverage manufacturing industries.[48]
- The agriculture sector continues to maintain or expand production of traditional export products (i.e., wheat, canola and beef), and pursue new domestic and international market opportunities. The major drivers for agricultural production lie in the purchasing power and product preferences of many key regions around the world (U.S., China, Japan and Mexico). Specifically, in terms of export percentages for primary commodities and value-added products, the five-year (2007 to 2011) export averages for Alberta were 48 per cent and 31 per cent, respectively.

[48] Statistics Canada Labour Force Survey (2008), Agriculture and Rural Development, Economics and Competitiveness Division, Statistics and Data Development Branch

- The expanding capacity of the livestock industry and productivity of the grain, oilseed and pulse industries is a key economic opportunity in the region. Higher production will enable Alberta to meet increasing demand for high-quality agriculture and agri-food products, particularly from growing markets such as Asia. Fertile soils and adequate ground and surface water supplies in most of the region facilitate increased yield and productivity. Beyond primary production, expansion of the agri-processing and value-added industries is viewed as a potential economic growth opportunity.
- In addition to the export market, there is a growing domestic market for direct-marketed fresh, locally grown and/or raised products in the region. This increased demand represents one of many opportunities for the agricultural sector through contribution to regional and/or local markets. Demographic shifts in the age and ethnicity of populations in the region are impacting, and will continue to impact, future demand and production.
- A growing world population will continue to generate increased demand for food, and changing dietary requirements and preferences will continue to create niche markets and market demand for new and innovative products. The region is well positioned to take advantage of these global opportunities through its well-developed transportation infrastructure.

Although challenges exist, such as an aging farmer population, a lack of young people entering the primary production side of agriculture, and the loss of high-quality agricultural land to other land uses, agriculture is expected to remain a significant industry in the region and will continue to contribute to the region's economy.

Forestry

Forests are an important renewable resource for our province. They provide economic and environmental benefits to all Albertans, in addition to being a source of recreation for local residents and visitors from afar. Government of Alberta legislation, policies, programs and actions help ensure the forests on public lands are healthy and productive. Alberta manages its forests by applying the principles of sustainable forest management and responsible stewardship.

Alberta is covered by about 380,000 square kilometres of forest (approximately the size of Japan). The provincial government is responsible for managing public land for timber production and other uses within the forested and settled areas across the province.[49] In 2009, Alberta became the first province in Canada to receive the International Organization for Standardization (ISO) 9001[50] certification through its Forest Operations Monitoring Program.

[49] Government of Alberta ESRD (2011), *Sustainable Forest Management: Current Facts and Statistics*; available at www.srd.alberta.ca/LandsForests/ForestManagement/ForestManagement FactsStatistics/documents/GeneralBoundary-CurrentFactsAndStatistics-2011.pdf

[50] ISO, a non-government organization, is a federation of the national standards bodies of 157 countries. ISO defines itself as the world's leading developer of international standards and has a portfolio of 17,000 standards covering business, industry and technology. International Standards Association (2013) What is ISO; available at: www.iso.org/iso/home/about.htm

Additional forest lands in the region are either in the national parks, provincial parks, or zones identified as protected under A Policy for Resource Management of the Eastern Slopes (1984). Forests are managed for all environmental values including water, wildlife, grazing, timber, recreation and aesthetics.

Public land supporting forestry operations are subdivided into forest management units as a way to manage timber and other renewable resources. Alberta uses three types of tenure systems: timber permits, timber quotas and forest management agreements — to ensure forest resources are managed sustainably.

Forest management agreements cover 62 per cent of the province's public lands, as shown in Figure 15 on page 46. A forest management agreement is an agreement, usually 20 years in duration, between the Government of Alberta and a forest company to harvest, remove and grow timber in a specific area. Under a forest management agreement, a forest company is responsible for all parts of forest management, including conducting natural resource inventories, developing comprehensive long-term and detailed forest management plans, completing forest renewal, and carrying out consultations on their activities with the public.

Alberta's total sustainable annual allowable cut consists of 61 per cent coniferous timber and 39 per cent deciduous timber. The Government of Alberta sets the annual volume of timber (in cubic metres per year) that forest management agreement holders can sustainably harvest from each forest management unit.

At the end of the 2010-2011 fiscal year, the annual allowable cut for the province consisted of approximately 18.7 million cubic metres of coniferous and 12 million cubic metres of deciduous timber. Of this, the region had approximately 12-13 per cent and four per cent of the total provincial annual allowable cut for coniferous and deciduous species, respectively.[51] Within the region, the pro-rated annual allowable cut for coniferous trees is 2,287,194 cubic metres per year with 478,008,468 cubic metres per year for deciduous trees.

How We Manage Alberta's Forests

- Through sustainable forest management, Albertans will continue to enjoy the many benefits our forest ecosystems provide.
- Sustainability of forest ecosystems and capturing environmental services from our forests are key policies of Alberta's forest management program.
- Forest renewal is part of environmental stewardship and sustainable development, and has been required under the laws of Alberta since 1966.
- Responsible stewardship considers a wide variety of forest values.
- Forest planning addresses reforestation, watershed protection, recreation, wildlife habitat and other values through an integrated approach.

[51] Government of Alberta ESRD (2011), *Sustainable Forest Management: Current Facts and Statistics*; available at www.srd.alberta.ca/LandsForests/ForestManagement/ForestManagementFactsStatistics/documents/GeneralBoundary-CurrentFactsAndStatistics-2011.pdf

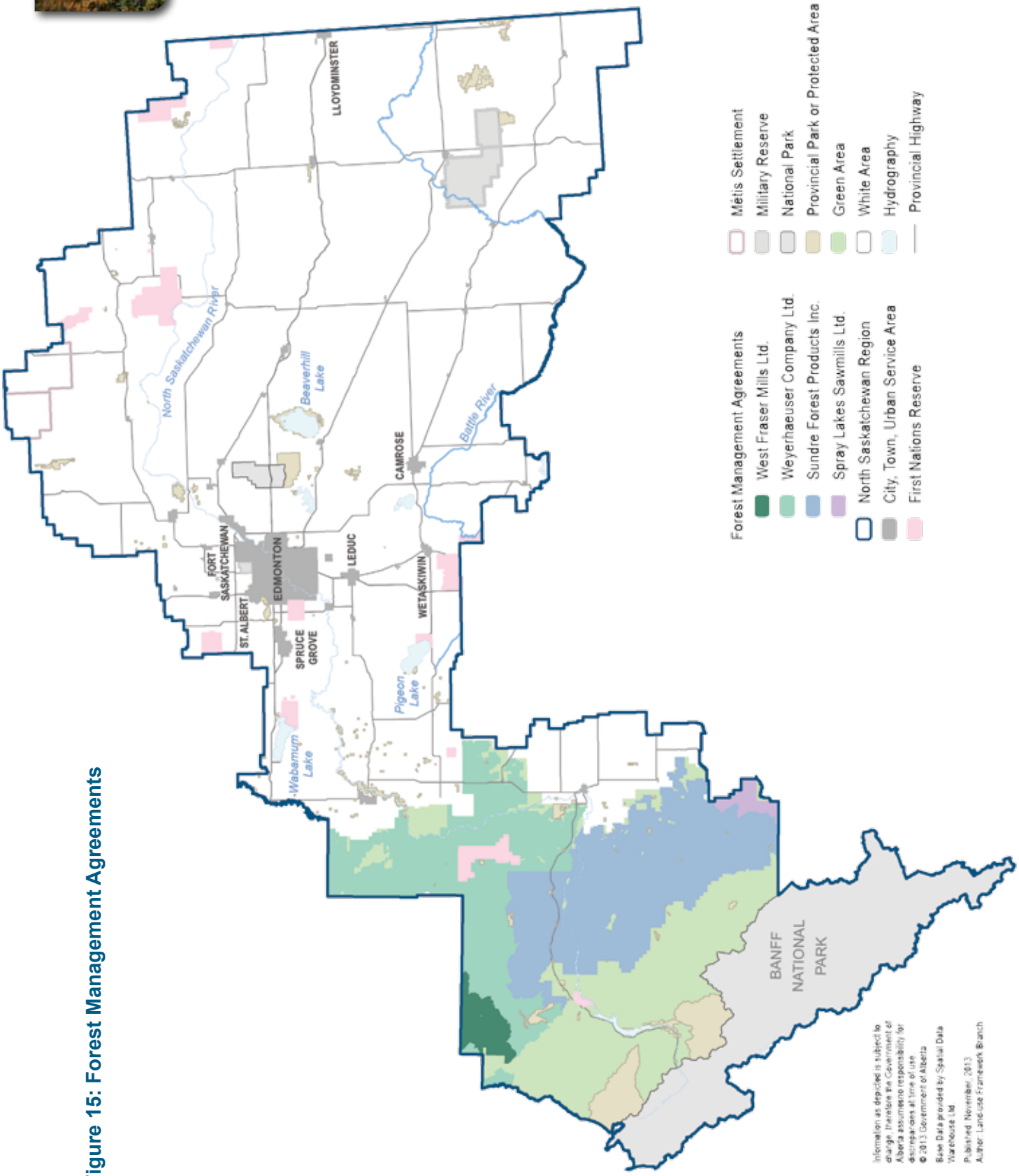


Figure 15: Forest Management Agreements

The details of where, when and how trees on public lands are harvested and managed are contained in forest management plans. Forest management plans are developed by the forest management agreement holder and approved by the Government of Alberta. They set forest management objectives, strategies and commitments, and identify intended methods of harvesting, reforesting and managing timber resources within the managed area.

The duration of a forest management plan is 200 years, which generally represents two full life cycles (or rotations – growing to fully mature trees). The provincial government prepares forest management plans for areas not covered by a forest management agreement.

Forestry Economic Impact

Alberta's forests play an important role in supporting the provincial economy. In the North Saskatchewan Region, forestry contributed $69 million in 2012 to the provincial GDP and provided approximately 300 jobs.[52] The sustainable management of Alberta forest ecosystems is adaptive, and will continue to be based on the best scientific and sustainability practices available.

Forestry operations in the region provide employment opportunities for local residents and contribute to the local tax base. Rocky Mountain House, Drayton Valley, and their surrounding municipalities receive substantial economic benefits from forest activity occurring in the region.

In addition to primary production (harvesting and processing trees), the forest industry contributes to secondary manufacturing including cabinetry, engineered building components and millwork. Altogether there are eight different large scale manufacturing facilities and 15 smaller-scale mills associated with the forest sector in the region.

The region contains portions of the Drayton Valley, Rocky Mountain House-Calgary-Southern Alberta, and Edmonton forest economic reporting regions. The industry has traditionally benefited from low costs to deliver wood, which has helped it to be competitive. The forest industry's largest export market is the U.S. In 2007, over 75 per cent of forest exports went to the U.S. with 15 per cent to Asia.

The capacity to produce bio mass products, including fuel made from renewable feedstocks such as forestry waste, is being developed in the region, and is central to Drayton Valley. Biomass products have the potential to generate additional revenue for forestry companies and diversify the economies of rural communities that currently depend on the forestry sector.

[52] The Government of Alberta (2013), Alberta Enterprise and Advance Education. (In 2002 dollars).

Reforestation

Reforestation is a key component of sustainable forest management. Alberta law requires harvested areas on public land to be reforested to provincial standards. Alberta's reforestation standards reflect the outcomes as set out in forest management plans. Reforestation is deemed sufficient when the harvested areas contain appropriate species of trees that are growing at a rate consistent with that stated in the forest management plan for that area. Reforestation status on harvested areas must be reported to the Government of Alberta at least twice (eight years and 14 years after harvesting); as well, a portion is monitored over the full lifespan of the trees as part of the Permanent Sample Plot (PSP) program. PSPs are created and maintained by both the forest industry and the Government of Alberta to provide data on how forests grow and develop over time.

Reforestation must be underway within two years of harvesting. Reforestation plans and activities are approved and monitored by the province. All commercial forestry operations annually report on reforestation activities and outcomes, and the Government of Alberta publicly reports on the status of reforestation success in its annual report.

Reforestation activities often include preparing the harvested areas to enhance seedling growth, followed by planting nursery-raised seedlings. During 2010, almost seven million seedlings were planted on approximately 50 square kilometres of harvested area in the region.[53] Failure to maintain accurate data, conduct activities as per approved plans and report on reforestation performance may result in a non-compliance action against the forest management agreement holder.

Wildland Fires

The region has been shaped by wildfire for thousands of years. Wildfires have influenced forest habitat and grassland types while maintaining the health of natural systems throughout the region. Historically wildfires occurred when the forest ecosystems were quite young and were a regular event in their lifecycle; these were generally low intensity fires.

Wildfire helps keep forests within their natural range of vegetation types and ages, supporting forest regeneration and ecosystem health. It is necessary to provide the variety of habitats needed to maintain forest biodiversity. Forestry policies and fire-fighting practices, however, have changed the natural course of fire as a result. There has been an increase in the amount of fuel build-up (undergrowth and deadfall), which creates the potential for fires of greater intensity to occur. In some areas, the lack of disturbance from wildfire or harvesting has increased the risk of wildfire to extreme levels. A healthy forest industry plays an important role in mitigating wildfire risk through incorporating wildfire risk mitigation strategies within forest management planning.

[53] Government of Alberta ESRD (2011), *Sustainable Forest Management: Current Facts and Statistics*; available at www.srd.alberta.ca/LandsForests/ForestManagement/ Forest ManagementFacts Statistics/documents/GeneralBoundary-CurrentFactsAnd Statistics-2011.pdf

Recent Fire History

In recent decades, approximately 90 wildfires averaging 770 ha per fire have occurred annually within the region's forested area. Human-caused fires account for approximately 66 per cent of the ignitions and 34 per cent are caused by lightning strikes. Over 90 per cent of the areas that have burned since the 1960s have been the result of a few larger fires. For example, the Dogrib Creek fire in 2001 burned approximately 100 square kilometres in a single afternoon. Over 90 per cent of the fires that occur in this region are less than four ha in size.

In recent decades, fire use and natural fire disturbance have been largely eliminated from the parkland area due to land use changes and settlement. A few fires in the last decade, however, have impacted communities in the region.

Wildfire Risk

The potential for large, unmanageable wildfires is increasing yearly in parts of the region. About 30 per cent of the forest in the Forest Protection Area (FPA) currently has a very high fire potential during the fall season. The risk of ignition is highest in the summer months during times of peak recreation. When these factors are combined with a high wind event during periods of significant hazard, the probability of a large catastrophic wildfire increases dramatically.

A catastrophic wildfire would seriously threaten communities, residential developments, commercial lodges, industrial sites and campgrounds. In addition, thousands of hectares of timber could be burned, which would have a considerable impact on forest companies and communities that depend on that industry. The quantity and quality of local water bodies and water courses may be severely disrupted for short durations, and multiple ecological systems would also be impacted. The community FireSmart program has been ongoing for many years in a number of communities to help reduce wildfire risk.

Forest Pests

A healthy forest sustains itself while providing economic and recreational opportunities. Alberta's forest health program monitors key factors that may influence the health of the forest including insects, disease and climatic factors.

The major forest insect pests that threaten trees in the region include aspen defoliators (such as forest tent caterpillar, bruce spanworm and large aspen

tortrix), mountain pine beetle, spruce budworm, and spruce beetle. The major diseases include dwarf mistletoe, armillaria root disease and western gall rust. The major climatic impacts are caused by hail, wind damage, red belt (the reddening and death of foliage) and frost.[54]

Mountain Pine Beetle

The forests in the Eastern Slopes of the Rocky Mountains, which contain 70 per cent mature and over-mature lodgepole pine, are susceptible to attack from mountain pine beetle (MPB). During an outbreak, the mountain pine beetle can kill 80 per cent of the mature pine, which has serious consequences on water supplies, biodiversity, recreation and forestry. The dead and dying trees also increase the risk of intense wildfires. Alberta is taking aggressive control measures to protect major watersheds and prevent or slow the spread of the beetle along the Eastern Slopes. A healthy forest industry in the region plays an important role in mitigating the mountain pine beetle risk through its sustainable harvesting and management practices.

Currently the mountain pine beetle has a limited presence in the region. Forest experts estimate infestations in Alberta will increase substantially over the next several years as the MPB population in British Columbia increases, and there will be a greater possibility of the Alberta infestation spreading from the north or south. Successive years of weather favourable for the beetle can lead to an explosion in their population numbers.

Tourism

The region's geographic diversity, natural, cultural and built tourism features, together with the region's diversity of tourism settings provide tremendous competitive advantages on which to build a strong tourism industry. The North Saskatchewan Region is the second most popular tourism destination in the province. 12.2 million visits were made to the region to experience the wide range of nature-based, sport, culinary, festivals, shopping, cultural and other tourism opportunities. The region accounts for approximately 35 per cent of annual tourism expenditures. The economic impact associated with these tourism expenditures is $3 billion in value-added income, and includes $1 billion of direct income and $2 billion of indirect and induced income. These tourism expenditure amounts represent new money into the region that would not have occurred had tourists chosen to visit other locations[55].

[54] Government of Alberta ASRD (2012). Detecting and Monitoring Forest Pests; available at www.srd.alberta.ca/ManagingPrograms/ForestPests/DetectingMonitoringForestPests.aspx

[55] The Economic Impacts of Tourism Expenditures in the LUF Regions of Alberta.

Tourism in Alberta is good for the economy; it's a $7.8 billion dollar industry that supports 15,000 tourism businesses and employs more than 139,000 people, either directly or indirectly. Tourism revenue is a key economic driver for the province and contributes to the well-being of all Albertans[56].

Motorized recreation is a growing activity in Alberta for residents, and visitors and recreationalists spend a substantial amount of money on their recreational activities. The number of off-highway vehicles (OHV, including ATV-tracked, quads, motorcycles, snowmobiles) registered in Alberta rose from 37,042 in 1987 to 138,177 in 2010[57]. Additionally, 316,998 recreational vehicles were registered in Alberta in 2010; this is a 23 per cent increase from 2005. Providing areas for people to recreate is linked to the economic diversification of the region. In 2009, snowmobiling enthusiasts spent $111.3 million on purchasing new snowmobiles, accessories, parts, and clothing, and another $254.7 million was spent on operating and maintaining these vehicles and on tourism-related activities[58].

Many of the region's recreational and tourism visitations come from outside the region. The region is home to all or portions of 135 parks and protected areas including two national parks (Banff and Elk Island), one national wildlife area, 14 provincial parks, 50 provincial recreation areas, one wildland park, two wilderness areas, 63 natural areas, and two ecological reserves.[59] Public land, particularly along the Forestry Trunk Road (Highway 734) and the Eastern Slopes, is heavily used for outdoor recreation. Together, the parks and public land offer a wide range of recreational opportunities such as camping, boating, fishing, hiking, horse riding, rock and ice climbing, swimming, off-highway vehicle (OHV) use and cycling.

Diverse, year-round outdoor recreation helps Albertans and visitors learn about and appreciate Alberta's natural and cultural heritage, and provides economic benefits to local communities. Internationally known recreational events in the region, such as the Birkebeiner Ski Festival (Canada's largest classical-format cross-country ski festival) held in Cooking Lake Blackfoot Provincial Recreation Area, contribute to local culture and quality of life and provide regional economic benefits through tourism.

The natural scenery of the North Saskatchewan Region is a defining aspect of its character and fundamental to the region's sense of place and identity. The scenic resources found in the region are essential to maintaining the tourism industry, appealing recreation opportunities, and liveable communities. In 2011, the Government of Alberta undertook visual preference research and a scenic resource assessment to understand and map the region's most significant scenic resources.

[56] Tourism, Parks and Recreation Business Plan 2013-16. (2013, Feb.20) www.finance.alberta.ca/publications/budget/budget2013/tourism-parks-recreation.pdf

[57] Alberta Registries registration system 1987 to 2010

[58] Economic Impact of Snowmobiles in Alberta in 2009

[59] Ibid. www.albertaparks.ca

Dramatic terrain, deep glacial valleys, carved river valleys, complex vegetation patterns, water resources and vast prairie landscapes combine to create a region with some of the highest scenic quality[60] ratings in the province. These same landscapes provide regionally important recreational, tourism and spiritual values and are essential to quality of life in the region. Highway, trail and waterway access, together with a significant number of designated recreation and tourism features, create areas that are very sensitive to landscape alterations. Recent visual preference research in Alberta has confirmed that human interventions have a negative effect on scenic quality, though the significance of the effect differs depending on the type of land alteration. For example, the mountainous areas of the region, portions of the upper foothills and some agricultural lands maintain high scenic integrity[61] ratings while the lower foothills, due to a high density of industrial development and landscape alteration, have low scenic integrity ratings.[62]

Within the region, some of the most visited tourism locations include the Bighorn Backcountry west of Nordegg, the David Thompson Corridor, the Beaver Hills area southeast of Edmonton, the Capital Region (e.g., Edmonton's North Saskatchewan River valley and West Edmonton Mall), the Lakeland area south of Bonnyville and, of course, Banff National Park. In many communities in the region, tourism is being used as a viable strategy to diversify local economies. Clearwater County is one example of this strategy of economic diversification. The county borders Banff and Jasper national parks and boasts several Wilderness Areas and Ecological Reserves. It is currently designing a recreational trail to attract motorized and non-motorized users.

The Edmonton Regional Tourism Group is an association tasked with the development and promotion of a wide range of recreation and tourism attractions, events, festivals and unique products for residents of and visitors to the Capital Region. Currently 57 partnering municipalities, representing hundreds of operators, participate in this group consisting of economic development and tourism professionals, and private industry operators representing tourism business, attractions and events. The success and competitiveness of the region's tourism industry is strongly tied to maintaining the region's tourism features and assets, and creating an attractive climate for new investment.

Future opportunities for tourism in the region will be determined by assessing opportunities to showcase areas of aboriginal, historical and cultural importance, and the ability to offer a diversity of potential recreational opportunities. Areas of tourism development include Saunders/Alexo, Shunda/Goldeye, Bighorn Canyon, Whitegoat Lakes and Nordegg. In addition, the inclusion of the North Saskatchewan River in the Canadian Heritage River System would provide another tourism draw.[63]

[60] Scenic quality can be understood as the attractiveness of a landscape's scenery. It is the human response to a landscape resulting from perceptual characteristics of the environment and the observer's experience which arises from the relationship between landscape properties and their effects on human viewers. (Sheppard 2004; Daniel 2001)

[61] The scenic integrity of the landscape is the degree to which the scenic quality of that landscape is perceived to be affected by the presence of cultural modifications or human alteration.

[62] Government of Alberta, Alberta Tourism (2011), *Scenic Resource Assessment of the North Saskatchewan Region*.

[63] Established in 1984 by the federal, provincial and territorial governments, the Canadian Heritage Rivers System was created in order to conserve rivers with outstanding natural, cultural and recreational values, to give them national recognition and to encourage the public to enjoy and appreciate them.

Other Industry

Aggregate Mining and Peat Harvesting

Population growth and infrastructure demands are increasing the need for surface material products such as sand and gravel. Aggregate mining (sand, gravel, clay, marl and silt), is an essential component for development and maintenance of infrastructure. Aggregate mining often requires land disturbance to extract surface material throughout the North Saskatchewan Region on both private and public land.

The aggregate mining industry is expected to continuously review operating practices and equipment to improve environmental practices. Areas of focus for continuous improvement aim to minimize the development's footprint, the disturbance of sensitive environments, water use and dust, noise and contamination, and maximize resource extraction, improved effectiveness of soil handling equipment and processes, direct placement of topsoil and speed of progressive reclamation.

Operators are required to develop mining plans that include resource conservation and mitigation measures for environmental concerns associated with their operations. Each surface material deposit is removed as completely as the environment will allow, followed by complete reclamation and proper end use of the land. The land must be returned to environmental conditions and economic productivity levels that are equivalent to or better than the condition of the site that existed before removal of the surface material.

Peat harvesting operations also exist in the region, and there is potential for expansion in the future.[64] Significant areas in the non-settled area of Alberta contain bogs and fens that that are suitable for peat mining. A small peat mining industry exists in Alberta, and has contributed approximately $500,000 in royalties since 2000.

Mining peat moss for horticulture purposes has been occurring in Alberta since the mid 1960s. Peat mining in Alberta has, and continues to be, for horticultural purposes only. Peat is not mined for fuel. Peat is classified as a surface material under the *Public Lands Act*.

There are currently six peat companies operating in Alberta. Together they hold 17 active leases involving around 14,031.94 acres (5,678.53 ha) of land. The largest operator is SunGro. Industry mines peat at seven bog locations and there are four processing plants located in Alberta.

[64] Peat moss is sphagnum moss that has partially decomposed. It is harvested from bogs and fens (also called peatlands). Peat moss is harvested through the use of drainage ditches and allowed to initially dry by the wind and the sun. It is then harvested with vacuum harvesters or other equipment and then sent to a plant to be processed, packaged and distributed.

REGIONAL INFRASTRUCTURE

Transportation Infrastructure

Transportation systems are crucial to the movement of people and goods in and out of the region. Like many other aspects of the region, transportation corridors trace their origins to the historic settlement and the economic development of Western Canada. Today the region has over a dozen airports and a large network of roads, railways and pipelines.

In 2012, the Gross Domestic Product[65] (GDP) of Alberta was approximately $306.7 billion[66]; many of these goods and services were produced in the region. Transportation systems are required for exporting the region's products to local, provincial, national and international markets. Table 9 shows a breakdown by value of the role played by the different transportation modes in the province.

Table 9: Alberta Exports and Imports by Mode (2008)[67]

Mode	Exports (% by value)	Imports (% by value)
Pipelines	66.6 %	9.9 %
Rail, Intermodal	23.0 %	35%
Truck	8.8%	40.6 %
Air	1.6%	14.5%

Local Roads and Highways

The region contains approximately 4,600 kilometres of provincial highways, of which 4,210 kilometres (over 91 per cent) are paved[68] (see Figure 16 on page 56). Highways in the region are managed by the Government of Alberta. These include highways 2, 16, 1, 28, 63, 15, 43 and Anthony Henday Drive.

Roads are generally laid out based on the township grid system that covers the province, creating a grid of interconnected roads across much of the region. On public land in the western part of the region, industrial roads have been developed to serve oil, forestry and coal industry activities. While these roads have been instrumental for industry and the development of new communities, they have also fragmented the landscape and had effects on other uses of the land.

Approximately 18 per cent of all vehicles travelling in the region are commercial (single unit trucks and tractor-trailers). In 2010, the Government of Alberta issued 90,103 permits for overloads and over-sized loads. About 30 per cent of these permits were for loads travelling through the region rather than remaining within it[69].

[65] GDP is the total value of final goods and services produced and does not include the value of intermediate goods used in the production of final consumer goods.

[66] Alberta Enterprise and Advanced Education. (2013, June). *Highlights of the Alberta economy 2013*. Retrieved from http://albertacanada.com/files/albertacanada/SP-EHhighlights ABEconomy Presentation.pdf

[67] Statistics Canada's International Merchandise Trade Database (2011). Transportation & Trade Report. Alberta Transportation February 2013.

[68] ForCorp Solutions Inc. (2012). *Regional forest landscape assessment: North Saskatchewan region*. Edmonton, AB: Alberta Environment and Sustainable Resource Development.

[69] Alberta Transportation's automated permit system (TRAVIS)

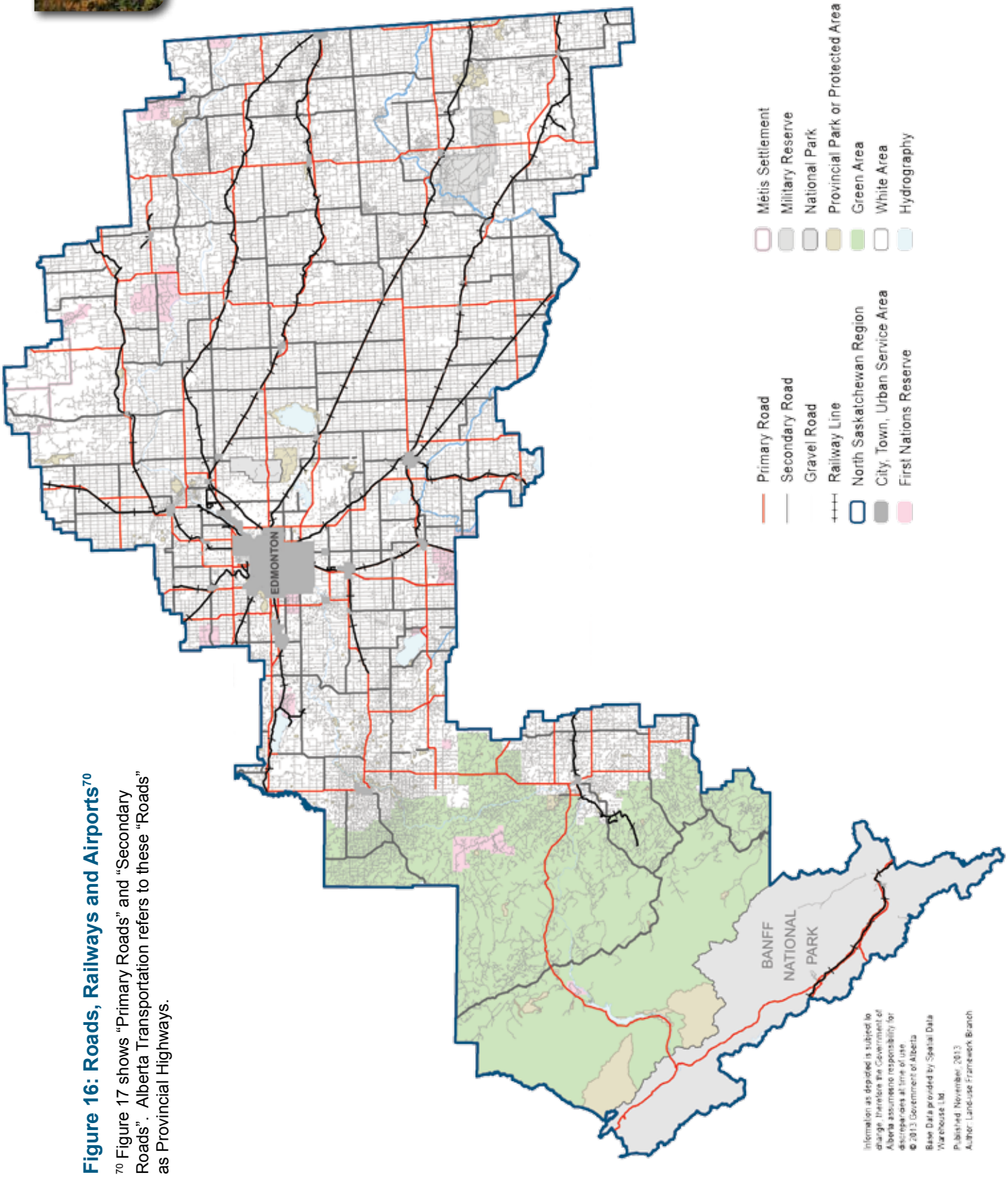


Figure 16: Roads, Railways and Airports[70]

[70] Figure 17 shows "Primary Roads" and "Secondary Roads". Alberta Transportation refers to these "Roads" as Provincial Highways.

Economic growth within the Capital Region has stimulated increased industrial growth in areas such as the Industrial Heartland, Nisku Business Industrial Park, Acheson Industrial Area, Edmonton International Airport, Sturgeon County and Strathcona County. Industrial growth, combined with increased levels of trade, tourism and recreational activity, will continue to increase traffic volumes on major highways. The completion of the Anthony Henday ring road around the City of Edmonton is an initiative intended to help address this issue. More study is required to identify the future transportation networks that will be needed to accommodate the anticipated growth in traffic. To ensure this is effective, coordination of the transportation system must occur between municipalities, across the province, and even with other provinces.

Within the region, examples of major transportation links are as follows:

The East-West Transportation Corridor: This corridor includes Highway 16 and two Canadian National Railway lines (Vegreville and Edson). This corridor passes through the Capital Region and provides connections to Saskatchewan and British Columbia, including ports on the Pacific coast.

The North-South Trade Corridor: This corridor includes Highway 16, Anthony Henday Drive and Highway 2, which is the main route between Edmonton, Red Deer and Calgary. This corridor connects Alberta with the United States, extends to the British Columbia border west of Grande Prairie, and provides access to the Alaska Highway. Significant work is currently underway to improve both rural and urban portions of this corridor.

Airports

The region has 12 airports certified by Transport Canada[71]. The largest of these is the Edmonton International Airport (EIA), which served more than 6.7 million passengers in 2012.[72] It is the fifth busiest passenger traffic airport in Canada, and with a land area of just under 70 square kilometres it is the largest airport in the country.

The EIA is located adjacent to Highway 2, a provincial transportation route that efficiently connects to the Yellowhead Highway (Highway 16) and Via Rail's "Transcontinental Canadian" route. Public bus service is also offered to and from the airport by the City of Edmonton. The airport's location makes EIA a centre for cargo handling and distribution. In 2008, the EIA had a direct economic impact on the region of approximately $300 million and supported 4,400 direct jobs.[73]

[71] Government of Alberta (2003), *Inventory of Alberta Regional and Local Airport*; available at www.transportation.alberta.ca

[72] Edmonton Airports (2012), Facts & Statistics; available at http://corporate.flyeia.com/media_resources/facts_statistics.aspx Link does not work.

[73] Edmonton Airports (2009), *Economic Impact Reports*; available at http://corporate.flyeia.com/about_us/reports_publications/economic_impact_reports.aspx Link does not work

Rail

An influx of settlement in Alberta in the late 1860s and early 1900s came with railway service to the Edmonton area (C. and E. Railway in 1892, Canadian North Railway in 1905, and Grand Trunk Pacific in 1909). Alberta's current railway network consists of approximately 6,800 kilometres of rail line. Current carriers in the region are Canadian National Railway (CN) and Canadian Pacific Railway (CP), both of which provide access to global markets.

Within the region CN has rail lines and facilities (e.g., transload, intermodal[74]) to accommodate the movement of commodities and finished products. CN's main line runs through the region providing connections to Pacific, Atlantic and Gulf Coast ports, as well as major centres in Canada, the U.S. Midwest and the Gulf Coast. CN lines also provide access from the Edmonton area to the oil sands region near Fort McMurray and north to Hay River in the Northwest Territories.

CP rail lines and facilities provide connections from the region to the Port of Vancouver, as well as ports on the Atlantic coast and locations in the U.S. Midwest. Similar to CN, CP provides intermodal, transload and other services in the region which accommodate movement of raw and manufactured products in and out of the region.

Water, Wastewater and Waste Management Infrastructure

Solid Waste Facilities

Alberta's waste strategy, Too Good to Waste, focuses on managing the impact of waste on air, land, water and human health. The strategy is a road map for reducing and managing waste across the province, and identifying actions to reduce waste and conserve resources. It also recommends the development of regional waste management plans to recognize that waste moves across municipal borders throughout the province through collection and landfill agreements.

Waste generated in Alberta can be grouped into five broad waste sectors[75]:

- Municipal solid waste
- Hazardous waste
- Oilfield waste
- Forestry residuals
- Agricultural residuals

[74] Transload refers to the transfer of a shipment from one form of transportation to another (for example from trucks to rail cars). Intermodal refers to shipment of products in containers that can be transferred from one form of transportation to another without unloading the containers themselves (for example, shipping containers).

[75] Government of Alberta (2007), *Too Good to Waste: Making Conservation in Alberta a Priority*; Edmonton ESRD; available at www.environment.alberta.ca/01534.html

Solid waste management in the region includes 28 active landfills, 15 composting facilities, one municipal waste incinerator in Wainwright, one bio-refinery[76] in Vegreville and one waste-to-biofuel facility[77] in Edmonton. There are also a variety of waste management companies and services that collect and transfer waste (hazardous and non-hazardous) for recycling or disposal within and outside the region. Many industrial facilities in this region have their own on-site landfills and disposal wells. Over the last 30 years, several rural communities have closed their landfills; currently there are 73 closed or inactive landfills in the region.

In Alberta there are two Class I hazardous waste landfills and both are located in the region (Pembina and Ryley). There are 25 facilities in the region that are approved to manage hazardous waste/hazardous recyclables. In addition, there are 26 oilfield waste management facilities approved by the Alberta Energy Regulator to accept various types of waste.

Since the Capital Region is home to one third of Alberta's population, it produces a large portion of the waste generated and disposed in the province. The City of Edmonton has developed an integrated waste management system for residential and commercial waste entering its Cloverbar facility. Much of Edmonton's commercial and industrial waste is managed at privately owned waste management facilities in and around the Capital Region.

Wastewater Facilities and Systems

There are 138 wastewater treatment facilities in the region, and only seven have been identified as requiring upgrades over the next 20 years. Many of the facilities that require upgrades already have or are in the process of joining a regional system to better manage their current and future treatment requirements. To maintain high quality groundwater, the province is increasing its use of disinfectant to minimize virus contamination of drinking water. This is done by treating groundwater that is susceptible to microbial contamination.

Four municipalities discharge treated wastewater directly into the North Saskatchewan River: Rocky Mountain House, Drayton Valley, Devon and Edmonton. All have mechanical wastewater treatment facilities and treat the water prior to discharge. Most other municipalities in the region discharge treated wastewater from municipal sewage lagoons into tributaries of the North Saskatchewan and Battle Rivers on a periodic basis.

[76]A biorefinery takes a wide range of bio-feedstocks (crop residues, forestry bi-products, and purposely grown grass crops or woody shrubs) and converts them into a wide range of bioproducts (fuels, chemicals, and energy). Biorefineries make full use of their biomass feedstock to extract the greatest value and high-value products. (Alberta Innovates (2011), What Is a Biorefinery; available at http://bio.albertainnovates.ca/stratthemes/bioecoadvance/bioe-initiative/background/#biorefinery)

[77] Waste-to-biofuel is a process that uses municipal waste to produce fuels and chemicals. (Enerkem 92010), Is this a date or a number? *Technology Platform: Process*; available at www.enerkem.com/en/technology-platform/process.html)

The Goldbar Wastewater Treatment Plant and the Capital Region Wastewater Treatment Plant are the major dischargers of treated municipal wastewater in the region. They are physically connected and collectively provide wastewater treatment for the cities of Edmonton, Fort Saskatchewan, Leduc, St. Albert and Spruce Grove; towns of Gibbons, Beaumont, Bon Accord, Morinville and Stony Plain; and Parkland, Strathcona, Sturgeon and Leduc counties.

In rural areas, it is estimated there are around 10,000 private septic systems within the region that service farms, acreages and cabins.

Water Treatment Facilities

There are 82 regulated waterworks facilities within the region: 46 are high quality groundwater systems, seven are surface water treatment plants, and eight are groundwater systems that are replenished by surface water sources.[78] The remainder are distribution-only systems which receive treated water from regional commissions or other municipal facilities. The majority of facilities within the region meet the latest Standards and Guidelines for Waterworks, Wastewater and Storm Drainage Systems. Facilities that do not meet the latest standards have been identified, ranked, and are in the process of upgrading or joining a regional line to ensure safe drinking water is available for the foreseeable future. If not connected to one of the piped water distribution networks, residents within the region receive drinking water from private water wells or haul water from regulated facilities.

Regional Water Systems

The E.L. Smith and Rossdale Water Treatment Plants along the North Saskatchewan River provide potable water to the Capital Region and surrounding areas through a vast network of regional line connections. Through these regional systems, communities in Leduc, Parkland, Beaver, Minburn, Strathcona, Lamont, Smoky Lake and Thorhild counties receive treated water from Edmonton. Efforts are underway to connect communities all the way to the County of Vermilion River through the Alberta Central East (ACE) regional line in the east; to Spedden and Garner Lake Provincial Park through the Highway 28/63 regional line in the northeast; and to Parkland County and Lac Ste. Anne County in the west through the West Inter Lake District (WILD) regional line.

Several municipalities have developed regional water systems. The town of Elk Point will soon receive drinking water from the Town of St. Paul's water treatment plant. The Westlock Regional Water Services Commission will also be providing water from the town of Westlock to Vimy and Clyde in the County of Westlock.

[78] A groundwater source that is located close enough to a surface water system (e.g., a river or lake) to receive direct surface water recharge. Since a portion of the groundwater source's recharge is from surface water, the groundwater source is considered at risk of contamination from pathogens and viruses that are not normally found in groundwater.

Electricity Generation and Transmission Facilities

Electricity generation and transmission facilities are expanding in the region. Currently there are approximately 4,500 megawatts (MW) of generating capacity in the region, providing 34 per cent of Alberta's total generating capacity, primarily from coal-fired generators. Over the next 10 years, pending federal emissions regulations and facility retirements will affect coal-fired generation in this region. By 2020, the Alberta Electric System Operator (AESO) estimates generating capacity will be between 4,385 MW and 5,420 MW. The transmission system in the region has undergone few upgrades in recent decades and is prone to congestion (difficulty meeting demand). The AESO's 2012 long-term transmission plan estimates the need for $711 million in upgrades in the regional transmission system by 2020. In the bulk transmission system, three projects will expand and reinforce the transmission system to relieve congestion and improve reliability. These projects include:

- North-South Transmission Reinforcement – two 500 kilovolt (kV) high voltage direct current transmission lines, from Genesee to Langdon and the Heartland industrial area to Brooks, with an estimated cost of $3 billion.
- Heartland – a double circuit 500 kV alternating current transmission line from south Edmonton to the Heartland industrial area, with an estimated cost of $610 million.
- Fort McMurray – two double circuit 500 kV alternating current transmission lines, from the Heartland industrial area to Thickwood and Genesee to Thickwood, with an estimated cost of $3 billion.

COMMUNITY AND QUALITY OF LIFE

Population and Demographics

Community sustainability is essential to capitalize on economic growth while ensuring a high quality of life for Albertans. A central pillar of community sustainability is labour force growth. The growth of Alberta's labour force has slowed due to an aging population and a mixed record of attracting interprovincial migrants and immigrants. Slow labour force growth is currently a limitation on the region's and the province's economic performance.

Forecasts estimate the provincial population will increase by approximately 30 per cent between 2010 and 2030.[79] Today about 38 per cent of the province's 4 million people live in the region and more than 66 per cent live in urban areas[80], (see Figure 17 on page 64). Forecasts estimate that some parts of the North Saskatchewan Region will grow by more than 30 per cent between 2006 and 2026. In particular, the Smoky Lake/St. Paul area is projected to grow by more than 40 per cent over the period as more oil sands projects in the neighbouring Lower Athabasca Region are developed to the northeast.

Between 2000 and 2013, the population of the region grew by about 27 per cent (from approximately 1.2 million to 1.5 million), while Alberta's population increased by 33 per cent (from 3 million to 4 million). Over that same period, the region has remained home to about 38 per cent of the provincial population[81]. By 2050, Alberta's population is forecast to grow to six million, and the region will account for approximately 2.1 million, or 35 per cent of that figure.[82]

In the future, the region's urban communities will come under pressure to meet demands for more residential and commercial developments. The increased demand for residential developments will have implications for land-use planning and the environment. As these communities continue to grow, so too will demand for urban infrastructure, transportation corridors, schools, parks, tourism and recreation opportunities, which will fuel competing ideas on how best to use the region's finite land base.

For rural communities, unless the necessary capacity, quality of life and infrastructure are in place, it is unlikely they will be able to attract and retain new businesses and industries. The Government of Alberta is committed to helping rural communities identify and capitalize on opportunities that will contribute to a sustainable and profitable rural economy.

Historically, population growth in the region accelerated in the mid-1940s with the Leduc Number 1 oil discovery, and then again in the early 1990s when the pace of investment in the oil sands started to grow significantly. Between 2006 and 2011, the population of the region grew by more than nine per cent, resulting in part from interprovincial and international migration which has led to greater population diversity.[83]

[79] Treasury Board and Finance, Government of Alberta. (2012). *Population Forecast by Land-use Framework Regions*. Edmonton, AB: Author.

[80] Land Use Secretariat, Government of Alberta. (2013, Feb. 15). *Population and migration dataset*. Edmonton, AB: Author.

[81] The Government of Alberta (2013), Alberta Enterprise and Advanced Education.

[82] Treasury Board and Finance, Government of Alberta. (2012). *Population Forecast by Land-use Framework Regions*. Edmonton, AB: Author.

[83] Government of Alberta Education, Alberta's Commission on Learning.

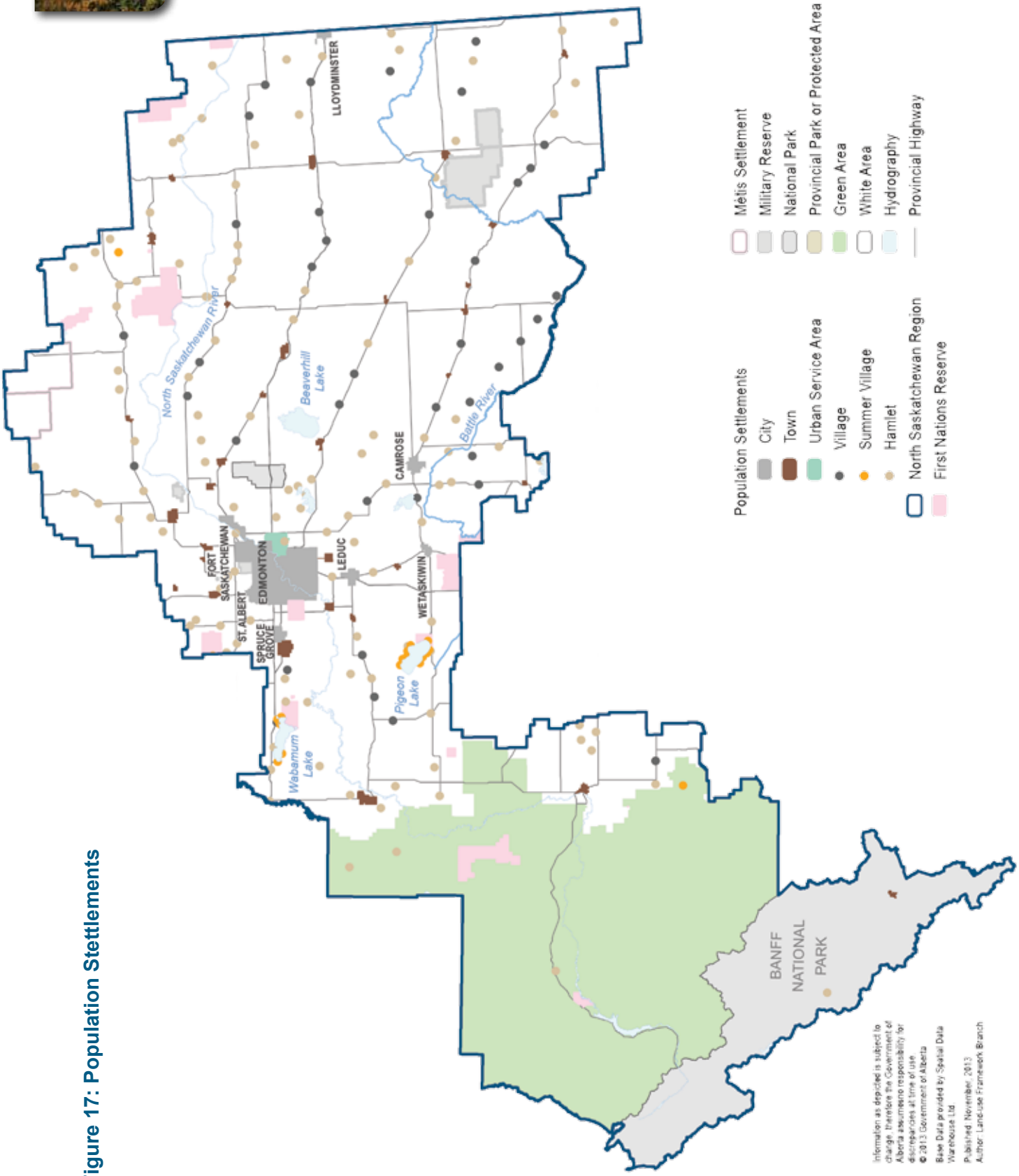
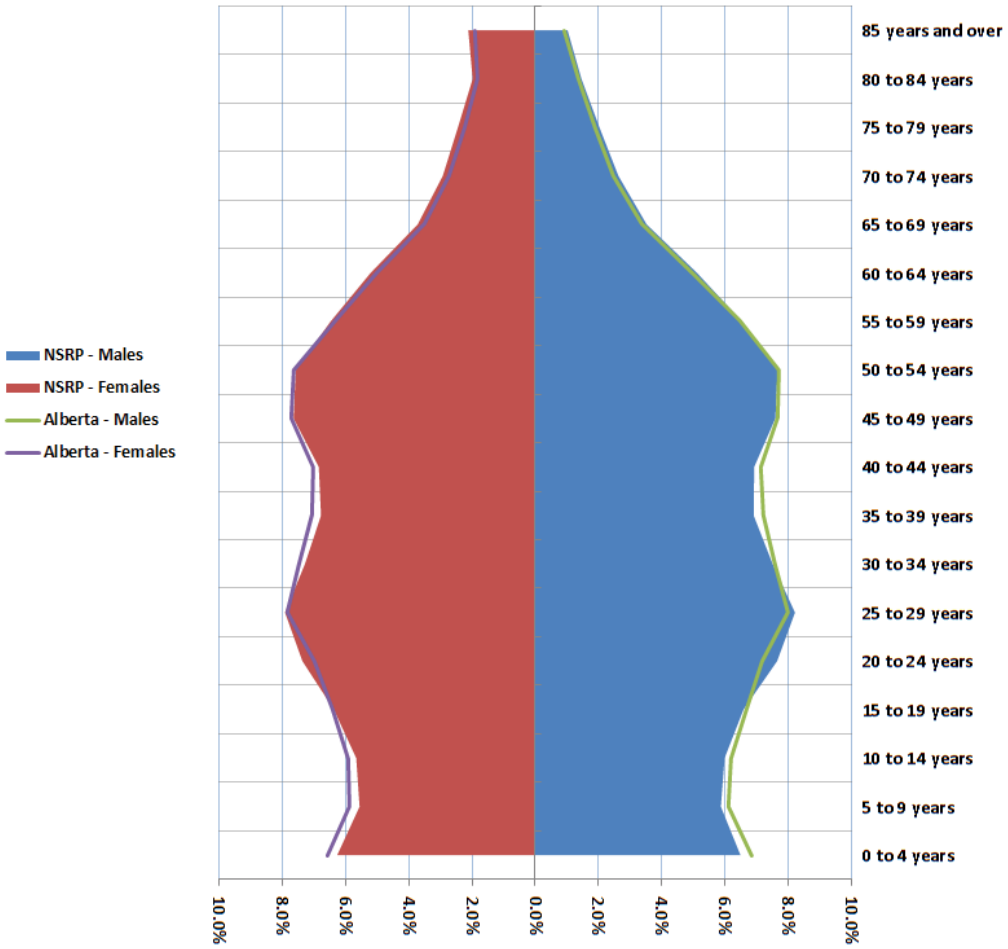


Figure 17: Population Stettlements

As shown on Figure 18 below, although the region does have a lower percentage of people between the ages of 0 to 15, and 30 to 45 as compared to the provincial average, the population breakdown for the region tends to match or slightly exceed that of the rest of the province.

Figure 18: Age and Gender Demographic Profile of the North Saskatchewan Region and Alberta, 2011[84]



Capital Region

Throughout 2007 and 2008, Alberta experienced a period of tremendous economic growth, and the pressures facing the City of Edmonton and surrounding communities created an urgent need for integrated planning. The Capital Region Board (CRB) was established by the provincial government in April 2008, and was required to prepare a growth plan for the Capital Region. The 25 original member municipalities worked together to create the Capital Region Growth Plan, a detailed plan that focuses on specific growth management and coordinating the needs of the Capital Region.

[84] Statistics Canada (2011). The Government of Alberta, Alberta Enterprise and Advanced Education.

The Capital Region lies at the north end of the Calgary-Edmonton Corridor. The 2001 federal census identified the Calgary-Edmonton corridor as one of four major urban regions in Canada that accounted for a large and growing proportion of the nation's population. This corridor has continued to grow and, in 2011, it collectively contained a little over 74 per cent of Alberta's total population.

Aboriginal Communities

There are 19 First Nations Reserves in the region which are home to 13 different First Nations groups (Alexander, Beaver Lake, Enoch, Ermineskin, Frog Lake, Louis Bull, O'Chiese, Onion Lake, Paul, Saddle Lake, Samson Cree, Stoney, Sunchild and Whitefish [Goodfish]). There are also two Métis Settlements (Buffalo Lake and Kikino) and overlaps with Regions 1, 2, 3 and 4 of the Métis Nation of Alberta (see Table 10 and Table 11 on pages 66 and 67).

The First Nations groups in the region are mainly descendants of the Cree, Nakota and Saulteaux-Ojibway people who have lived in this part of what is now Alberta for centuries. Each First Nation has their own traditional area, where they continue to exercise Treaty rights while pursuing traditional land uses. In addition to those listed here, there are other First Nations who may have lands adjacent to, or have traditional land use areas which overlap into, this region. All aboriginal groups that express an interest will have the opportunity to participate in the regional planning process.

First Nations Population

Table 10: Population of First Nations[85]

First Nation	On- Reserve	Off- Reserve Population	Total Area (km^2)	Total Reserve
Alexander First Nation	1025	908	1936	94
Enoch Cree Nation	1595	662	2260	53
Ermineskin Cree Nation	3128	900	4131	108
Frog Lake First Nation	1841	1012	2857	188
Louis Bull Tribe	1659	371	2039	39
O'Chiese First Nation	799	360	1160	141
Onion Lake First Nation**	3184	2042	5226	584
Paul First Nation	1332	605	1939	73
Saddle Lake First Nation	6223	3324	9560	259
Samson Cree Nation	5962	1584	7555	151
Stoney Nakota First Nation	4635	407	5049	21
Sunchild First Nation	856	407	1263	52
Whitefish (Goodfish) First Nation	1217	878	2333	45

Note: Totals do not include members living on provincial Crown land

*Note: Totals do not include numbers for Beaver Lake First Nation which shares the Blue Quills Reserve with five other groups. As such, population numbers for this reserve are unavailable.

**Note: In the case of Onion Lake First Nation, approximately 25 per cent of the on-reserve population lives in Alberta. Numbers in the table above reflect both Alberta and Saskatchewan.

[85] Aboriginal Affairs and Northern Development Canada (2013), *First Nations Profile Data*; available from http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/index.aspx

Table 11: Métis Population[86]

Métis Settlement	Total Population
Buffalo Lake Métis Settlement	1206
Kikino Métis Settlement	1113

Aboriginal Participation in Land-use Planning

In accordance with the provincial government's First Nations Policy on Land Management and Resource Development (2013), Alberta must consult First Nations on decisions that may potentially affect their ability to practice their Treaty rights. This includes consultation during the early strategic planning stages of a project or initiative such as a major industrial development or a land-use plan.

Alberta is home to the largest Métis population in Canada, and is the only province that has an official land base for Métis, the Métis Settlements, of which there are eight. In addition to the settlements, there are many more Métis people in Alberta who do not have a land base but are represented by the Métis Nation of Alberta.

Strategy 7 of the Land-use Framework encourages the participation of aboriginal people in the development of the regional land-use plans. Aboriginal people have long had a close relationship with the land and, given their intimate understanding of the local environment, wildlife and aquatic ecosystems, they are able to contribute to land-use planning in a unique way through their traditional knowledge. Information on ecosystems and the impacts of human developments on plants and animals that use these habitats can be obtained through the use of traditional knowledge and contemporary science, both of which are incredibly valuable to the regional land-use planning process.

Community Health

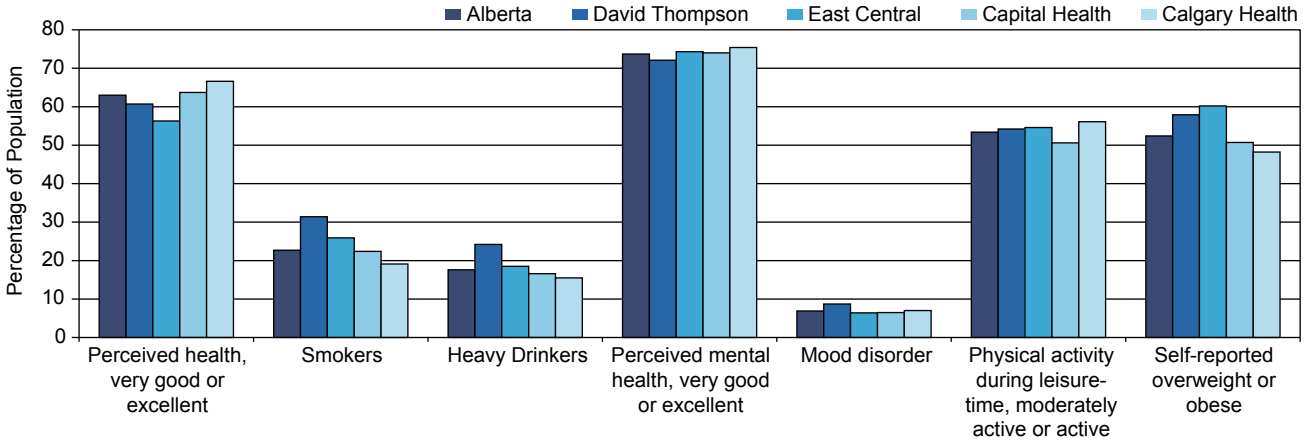
The overall health of Albertans in the region is a reflection of their communities' social, economic and environmental conditions, which must be considered in land-use planning. Health status is determined by a variety of factors, such as physical activity, income, employment and education.

Health Trends

The way in which land use within communities is planned, designed and developed can have positive or negative implications on the health and wellness of residents. Communities planned and designed to support active living provide opportunities for residents to realize the health benefits of recreation.

[86] Government of Alberta (2012), 2012 *Municipal Affairs Population List*; available at http://municipalaffairs.gov.ab.ca/documents/msb/2012_pop.pdf

Figure 19: Health Trends in the North Saskatchewan Region



Source: Statistics Canada, Canadian Community Health Survey 2007

In general, for selected lifestyle risk factors such as self-reported fruit and vegetable consumption, physical activity, heavy drinking, and daily smoking, residents of the North Saskatchewan Region were similar to other regions in Alberta, as illustrated in Figure 19 above. Fewer North Saskatchewan Region residents reported being overweight or obese compared to residents of the Upper Peace and Upper Athabasca regions.[87]

Cost of Living

A commonly used metric for the cost of living in Canada is the Consumer Price Index (CPI). It measures the change in prices of a "fixed basket" of goods and services purchased by Canadian consumers. This basket consists of goods and services that do not vary appreciably in quality or quantity, which means that CPI reflects pure price fluctuations. This also means that CPI can be used as a measure of inflation. CPI has an inverse relationship with the purchasing power of the Canadian dollar – when CPI increases, the purchasing power of the dollar falls, and vice-versa.[88]

From 2000 to 2012, the inflation rate implied by the CPI has been quite volatile for both the province and for the City of Edmonton (the only area of the North Saskatchewan Region for which CPI data is available). The average annual inflation rate from the CPI was 2.4 and 2.5 per cent for Edmonton and Alberta respectively, although from year to year the inflation rate exhibits a high degree of volatility[89].

[87] Statistics Canada (2007), *Canadian Community Health Survey 2007.*

[88] Statistics Canada (2013), Consumer Price Index; available at www.statcan.gc.ca

[89] The Government of Alberta (2013), Alberta Enterprise and Advanced Education

Higher Education

Education is not only an important factor in an individual's life, it is a key component in a modern world-class economy. The region maintains strong levels of educational achievement and in particular, a higher proportion of residents who completed post-secondary and master's degrees compared to the provincial average, as shown in Table 12, below.

Table 12: Higher Education in the North Saskatchewan Region (2006)[90]

Community	High school certificate or apprenticeship/trades/College /CEGEP/University certificate, diploma or degree, high school diploma, certificate, (% aged 15 and over)	University certificate, diploma or degree (% aged 20 and over)	Masters and PhD degree (% aged 25 and over)
Banff	80.8	22.2	3.4
Edmonton	77.7	19.6	3.6
Alberta	76.6	23.6	4.2
Camrose/ Lloydminster	68.4	10.4	1.2
Flagstaff/ Provost/ Wainwright	67.5	7.2	0.6
Smoky Lake/ St. Paul	66.7	9.5	1.4
Thorhild*	65.8	7.5	0.9
Clearwater	63.9	7.2	0.9

*Only partially within the region.

There are eight major public post-secondary institutions[91]:

- With over 100 years of history, the University of Alberta (U of A) is one of the top research-intensive universities in Canada. Serving more than 42,000 students, the U of A is also one of the largest universities in Canada. Sixteen faculties offer over 60 undergraduate degrees, 200 majors and specializations, and approximately 5,000 individual courses.
- Grant MacEwan University, established in 1971, serves about 19,000 students and offers more than 60 programs including undergraduate degrees, applied degrees, diplomas, certificates, continuing education and corporate training. Students can choose from programs that will prepare them for further study at a graduate or professional level or for

[90] Land Use Secretariat, Government of Alberta. (2013, Feb. 15). *Population and migration dataset*. Edmonton, AB: Author.

[91] Government of Alberta (2012), Alberta Enterprise and Advanced Education.

a career in business, arts and science, health and community studies, or the performing and visual arts.

- The Northern Alberta Institute of Technology (NAIT) is Alberta's fourth-largest post-secondary institute. As one of two polytechnical institutions in Alberta, NAIT offers apprenticeship, certificate and diploma programs, as well as baccalaureate programs and applied degree programs. NAIT is Alberta's leading apprenticeship trainer, educating nearly 50 per cent of all apprentices in the province. Technical training is offered in 33 apprenticeship trades.
- Lakeland College opened in 1913 as the Vermilion School of Agriculture. Today Lakeland has campuses in Vermilion and Lloydminster and serves more than 7,000 full-time and part-time students. As a Comprehensive Community Institution, Lakeland College offers a variety of programming, including certificate and diplomas, high school completion, apprenticeship, applied degrees and collaborative baccalaureate programming.
- NorQuest College was originally established in Edmonton as the Alberta Vocational College in 1965. NorQuest is Alberta's largest community college, with campuses in Edmonton, Wetaskiwin and Stony Plain, as well as learning centres in Camrose, Drayton Valley, Westlock and Whitecourt. NorQuest offers academic upgrading, adult literacy and English as a second language courses. The college offers approximately 37 career-focused diploma and certificate programs in areas such as business, health, human services, pre-apprenticeship and industry training.
- Concordia University College of Alberta, originally Concordia College, was founded in 1921 by the Lutheran Church-Missouri Synod to prepare young men for preaching and teaching ministries. Today, Concordia offers undergraduate and graduate degree programs, as well as church work programs and certificate programs in career development and academic upgrading.
- The King's University College was founded in 1979 as a Christian undergraduate university. Currently the college has more than 700 students enrolled in bachelor degrees in the arts, humanities, social sciences, natural sciences and commerce.
- Founded in 1933 by the University of Alberta, the Banff Centre began with a single course in drama. Its success generated additional arts programs and the Centre became known as the Banff School of Fine Arts in 1935. It is one of Canada's creative leaders in arts and culture. The Banff Centre is internationally known for playing host to exceptional artists and leaders from around the world who create and perform new works of art; share skills and knowledge in an interdisciplinary environment, while exploring and developing solutions in the arts and leadership.

Culture and Community

Culture and community provide a sense of common identity for local communities and residents. Participating in cultural activities provides opportunities to build social skills, develop self-sufficiency, build leadership abilities, learn about and appreciate Alberta's natural and cultural heritage and improve one's sense of place and community pride. The region has a wide range of cultural opportunities, facilities and services, which have diversified and enriched its cultural fabric.

National and international recognition of the region has also increased over time, thanks to major cultural events such as the Canadian Finals Rodeo, Banff International Film Festival, the Edmonton Folk Music Festival, the Edmonton International Fringe Theatre Festival and the Big Valley Jamboree in Camrose.

Edmonton is the capital of Alberta and it is known as Canada's festival city (hosting more than 30 annual festivals). Major cultural centres in Edmonton include the Winspear Centre, Art Gallery of Alberta, the Royal Alberta Museum and the Telus World of Science.

A variety of events draw people to other communities within the region as well. These events include the Blueberry Bluegrass and Country Music Society Festival in Stony Plain, the Motion Notion Electronic Music Festival in Drayton Valley, and the Wainwright Stampede.

Volunteerism

Volunteers provide a vital component in strengthening the cultural fabric and capacity of communities. Parks, open spaces and recreational opportunities enable volunteers (individuals and groups) to learn about and become involved in environmental stewardship through interpretative programs and volunteer projects. As an example, over 290 individuals and nearly 60 steward organizations participate in the Alberta Parks volunteer steward program.

Volunteer centres across the province support the needs of volunteers and local organizations requiring assistance. Of the 25 volunteer centres in Alberta, nine are located in the region.

Parks and Recreation

Recreation is an important regional land use that provides significant economic, social and environmental benefits to regional communities, individuals and visitors. From improving personal health and well-being and diversifying local economies, to improving the investment attractiveness of

communities to new businesses and addressing crime and anti-social behaviours, recreation is an essential service and fundamental to maintaining and enhancing the quality of life in the North Saskatchewan Region.

Recreation is important in Alberta. A recent study[92] found that:

- 92 per cent of Albertans agreed recreation participation is a major contributor to improved quality of life.
- 93 per cent of Albertans agreed recreation participation contributes to an individual's health and wellbeing.
- 94 per cent agreed recreation is an important way of ensuring children and youth live healthy lifestyles.
- 90 per cent agreed parks make an important contribution to the quality of the environment.

Regional Recreation Features and Settings

A recreation opportunity is the ability for an individual to participate in a desired recreation activity within a preferred recreation setting. In many cases, recreation in the region is a "natural resource-based industry." The availability and quality of many recreation opportunities in the region depend on the combination of natural or human-made features and appealing settings. As land use in the region has intensified, the need to purposefully plan for meeting regional recreation needs and maintaining recreation features and settings has become clear.

Recreation settings are the backdrop for outdoor recreation activities in the region, some people seek remote backcountry settings free from encounters with others, some look for settings that have many people and all the conveniences of home, while others prefer something in the middle. The North Saskatchewan Region provides a full diversity of outdoor recreation settings. However, these outdoor settings are not equally distributed throughout the region and the region is largely dominated by more front-country[93] settings.

Most of the region's backcountry areas are located in the eastern slopes, west of Rocky Mountain House, and away from the region's major population centres. Areas around Edmonton provide relatively homogenous settings dominated by more front-country opportunities. However, some lands around the Beaver Hills, Wainwright Dunes, Ribstone Creek Heritage Rangeland, Frog Lake and the Whitefish uplands provide a greater diversity in outdoor recreation settings to larger population centres and are within a reasonable day-use trip distance. Maintaining areas that provide diverse recreation settings near highly populated areas is important to meeting growing outdoor recreation needs and to address changing trends toward more day-use opportunities.

The most popular recreation activities in the Alberta include walking, jogging, hiking, golfing, camping, swimming, bicycling and fishing.[94]

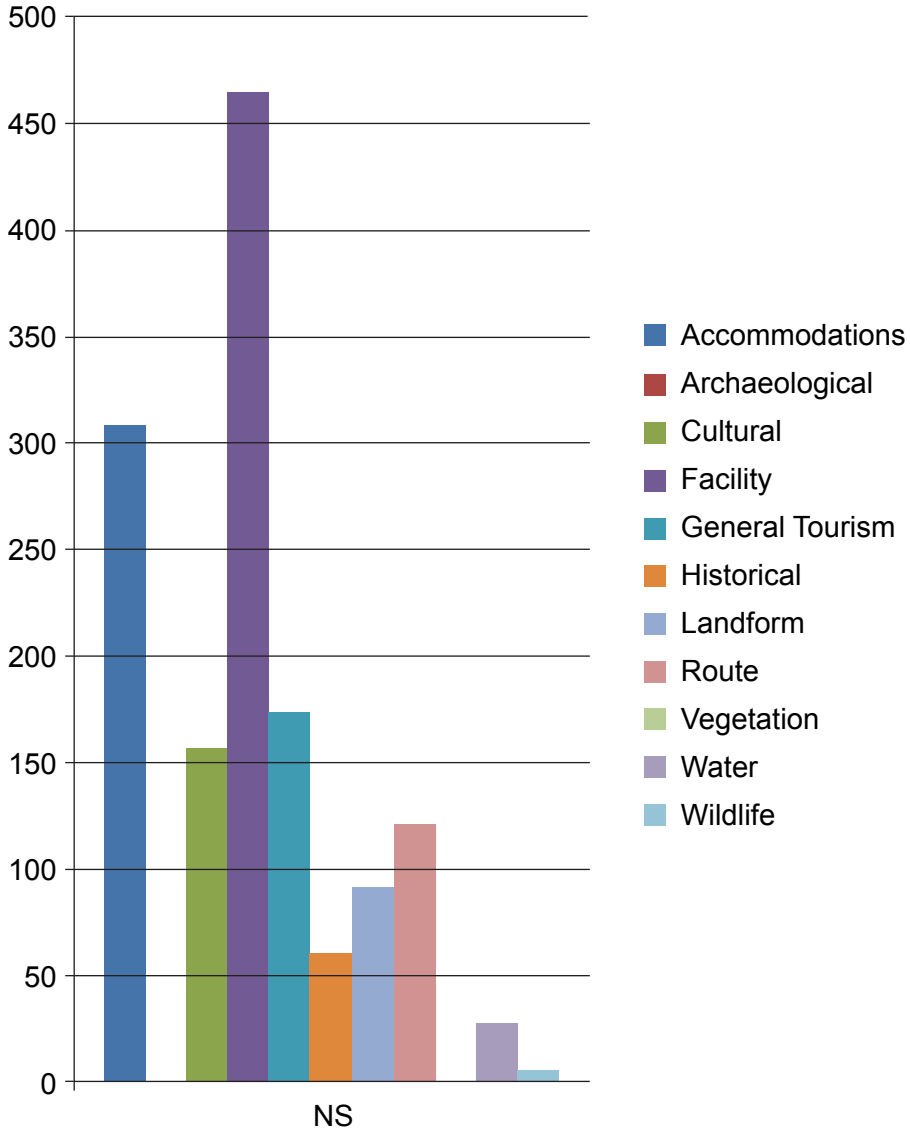
[92] Alberta Recreation and Parks Association (2009), *In Alberta…Recreation and Parks Matter!*; available at http://s3.arpaonline.ca/docs/In-AB-Rec-and-Parks-Matter.pdf

[93] Front-country is mostly natural appearing landscapes with obvious human modifications that are generally in harmony with the surroundings. Recreation and tourism infrastructure and management controls are obvious and desired. The area is easily accessible and interaction with other visitors is common. Motorized and non-motorized activities occur. Opportunities to experience solitude are rare.

[94] Government of Alberta (2008), *Alberta Recreation Survey 2008*; available at www.tpr.alberta.ca/recreation/ars/surveypdf/2008_ARS_Survey.pdf

The supply of recreation features and settings is the foundation of recreation opportunities in the region. The region contains diverse natural and human-made recreation features whose scarcity, uniqueness and significance vary considerably (see Figure 20 below).

Figure 20: Regional Supply of Recreation and Tourism Features



Recreation opportunities are provided on public lands, on municipal government lands, in provincial and national parks, as well as on some private land. The public, not-for-profit and private sectors each play an important role in planning and delivering the region's recreation system. For example, many not-for-profit organizations in the region work with land managers to develop and operate all-season recreational infrastructure such as trails and related facilities.

National Parks

Founded in 1885, Banff National Park was Canada's first national park and is a UNESCO World Heritage Site.[95] Banff's 6,641 square kilometres of mountainous terrain is home to grizzly and black bears, cougar, lynx, wolverine, wolves, elk, mountain goat, bighorn sheep and hundreds of species of birds. Approximately 33 per cent of the total number of international tourists to Alberta in 2007 visited the Canadian Rockies tourism destination region where Banff is located. In 2011, Banff had approximately 3.15 million visitors.[96] One of the entrances to this park is by way of Highway 11, and is frequently noted as one of the most scenic routes in North America.

First established as a wildlife reserve in 1906, Elk Island was declared a national park in 1930. Located 40 kilometres east of Edmonton, the park is within the Beaver Hills, which is underlain by the Cooking Lake Moraine, a plateau of wetland, mixedwood, aspen forest and grassland. The Government of Canada manages the park, which contains free-roaming plains bison, wood bison, moose, deer and elk. Elk Island is home to over 250 species of birds, 42 species of mammals, five species of amphibians, two species of fish and one reptile species. The park covers a total area of 194 square kilometres and receives about 185,000 visitors per year, of whom more than four-fifths are Albertans.[97]

Table 13: Federal Protected Areas in the North Saskatchewan Region

Federal Protected Areas in the North Saskatchewan Region[98]	km^2
Banff National Park	6,850
Elk Island National Park	192
Blue Quills National Wildlife Area	0.97
TOTAL	**7,044**

Table 13 above shows the total federal areas in the region. Together, Banff and Elk Island national parks offer 14 campgrounds and 2,551 campsites (group/random camping sites). Banff National Park also provides a variety of hotels, motels, bed and breakfast, backcountry lodges and hostels.

Alberta Parks

Alberta's parks inspire people to discover, value, protect and enjoy the natural world and the benefits it provides for current and future generations[99]. The provincial parks system preserves natural landscapes, provides habitat for wildlife, offers recreation opportunities and contributes to our economy, our

[95] Parks Canada (2012) www.pc.gc.ca

[96] Parks Canada (2011), *Banff 2011 Year in Review*.

[97] Elk Island National Park (2012), *Fast Facts*; available at www.elkislandwildlife.ca/fastfacts.htm.

[98] Government of Alberta (2013), *Management & Land Use*; available at www.albertaparks.ca/albertaparksca/management-land-use/current-parks-system.aspx

[99] Alberta Tourism, Parks & Recreation (April 2009). http://albertaparks.ca/albertaparksca/about-us/plan-for-parks.aspx

communities and our personal health and well-being. Alberta's parks system receives more than 8.5 million visitors annually, many of whom participate in a wide range of nature-based outdoor recreation and learning activities including hiking, camping, environmental appreciation, fishing, family and social gatherings, photography and bird watching.

The David Thompson Corridor (along Highway 11) includes 27 parks managed by the Government of Alberta, with two large wilderness areas (Siffleur and White Goat –, one provincial park (Crimson Lake), one ecological reserve (Kootenay Plains) and one large provincial recreation area (Wapiabi), as well as many smaller sites including 19 provincial recreation areas and three natural areas (see Table 14 below).

There are 132 provincial parks and protected areas in the region (see Figure 21 on page 77) which include all or portions of 14 provincial parks, 50 provincial recreation areas, two wilderness areas, one wildland park, 63 natural areas and two ecological reserves covering a total of 1,735 square kilometres (about two per cent of the region's land base).

The region is home to some of Alberta's first provincial parks – both Aspen Beach and Gooseberry Lake provincial parks were established in 1932 as significant community recreation and gathering places. Two wilderness areas (Siffleur and White Ghost), both established in 1961, are considered to be some of Canada's most highly protected parks, providing valuable wildlife habitat and pristine opportunities for solitude and nature appreciation. Beaver Hills Lake, lying within the Beaver Hills Lake Heritage Rangeland Natural Area[100], is an internationally recognized and designated wetland under the Ramsar Convention.[101]

The region's growing population, and the increasing demand for recreational opportunities in parks such as motorized recreation and camping, is placing increasing pressure on the region's provincial park facilities, many of which were built in the 1970s. Most of the 3,172 campsites within the region's provincial parks are fully used during the summer, and there is limited capacity to expand their number because of a lack of suitable locations for development within the existing parks.

Table 14: Alberta Parks in the North Saskatchewan Region[102]

Alberta Parks in the North Saskatchewan Region	km²
Banff National Park	6,850
Ecological Reserve	66
Natural Area	428
Provincial Park	138
Provincial Recreation Area	230
Wilderness Area	870
Wildland Provincial Park	2
TOTAL	1,735

[100] http://albertaparks.ca/albertaparksca/management-land-use/national-international-programs/other-partnerships.aspx#Ramsar

[101] The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. www.ramsar.org/cda/en/ramsar-documents-list/main/ramsar/1-31-218_4000_0_

[102] www.albertaparks.ca.

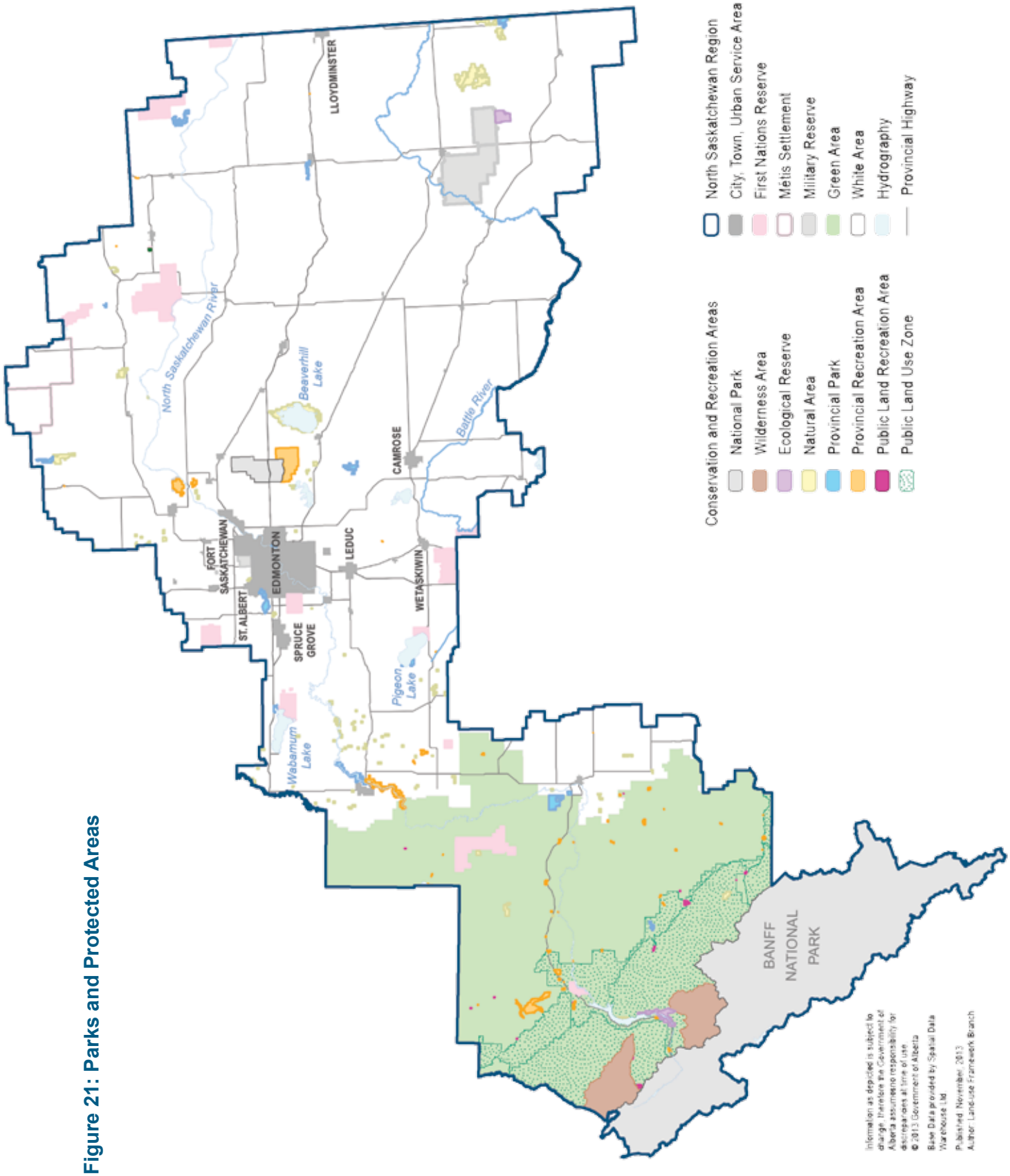


Figure 21: Parks and Protected Areas

Recreation on Public Land

A significant number of visitors recreate and camp outside municipal, provincial and national parks on public land in the region. Open spaces including well sites, pipelines and industrial roads frequently serve as temporary campsites and ad hoc trails on summer weekends for thousands of people seeking to random camp and to recreate with off-highway vehicles.

Public lands are also an important resource for hiking, wildlife viewing, mountain biking, skiing and snowmobiling. Some outdoor recreation features on public lands in the region, such as ice climbing along the David Thompson Corridor, facilitate world-class recreation opportunities. Under the *Public Lands Act*, random camping is legal for a limited period of time. Users are often attracted by the opportunity to camp in large groups, and believe there are fewer restrictions, lower costs, and greater access to ad hoc trails for off-highway vehicle use.

The Bighorn Backcountry covers nearly 5,000 square kilometres. It is subdivided into six public land-use zones (PLUZ), regulating public access east of the Banff and Jasper national parks along Highway 734 (Forestry Trunk Road). Motorized use in these PLUZs is restricted to primitive designated trails. Recreation services (e.g., staging areas, trail maintenance, campgrounds and garbage/waste facilities) are not typically provided on these lands.

While public lands are typically enjoyed responsibly by recreating visitors, concerns related to safety, environmental impact and conflict with other land uses and users are common. Holiday long weekends are particularly busy on some areas of public land. Public access to provincial waterways in the region is generally limited to access points provided by the relevant municipality.

Since 2005, the region has seen approximately:

- an 18 per cent increase in boat trailer ownership
- a 70 per cent increase in off-highway vehicle ownership
- a 25 per cent increase in recreation vehicles (RVs, campers)
- a 26 per cent increase in snowmobile ownership

Local Governments and Other Recreation and Tourism Providers

The manner in which our communities are planned and designed can have a positive or negative effect on physical activity and recreation participation. Through municipal planning and development permitting, local governments plan for and facilitate the provision of recreation opportunities for their residents and visitors, and many municipalities work to ensure the design of their community's public infrastructure inspires active living and active forms of transportation. Local governments provide a wide variety of indoor and outdoor recreation and tourism opportunities including parks, open spaces, trails, playgrounds, recreation complexes, cultural centres, golf courses, sports fields, municipal campgrounds, community centres and many more. As populations continue to grow, communities will need land to meet growing needs and to replace infrastructure that is reaching the end of its useful life.

One of the region's premier municipal recreation resources is the Capital Region's River Valley Park which connects Devon, Leduc County, Parkland County, Edmonton, Strathcona County, Sturgeon County and Fort Saskatchewan. The river valley park system is an important tourist attraction and receives almost 10 million visits a year, making it one of the most visited park sites in Alberta. The River Valley Alliance, made up of seven municipalities, is developing and implementing a strategic plan for the area.

Trails

Trails offer a wide range of benefits to individuals, communities and the province. Trails enable residents to increase physical activity, improve health and wellness, and enjoy areas of natural and human history. Trails also help diversify and strengthen local economies.

Many municipalities or communities in the region are looking to enhance trail systems. While local governments are naturally focused on providing opportunities for their own residents, more and more municipalities are beginning to realize the importance and benefits of creating trails to provide alternative transportation options, and pathway systems that link communities to each other and to other regional destinations.

The North Saskatchewan Region contains leading examples of coordinated trail planning and development. The Iron Horse Trail (a part of the TransCanada Trail and primarily partially located in the region) is an extensive trail system that links 15 communities between Cold Lake, Heinzburg and Waskateneau. Other prominent trails in the region include the trail between Rocky Mountain House and Crimson Lake Provincial Park, the Legacy Trail that links Canmore (South Saskatchewan Region) and Banff, the trail between Vermilion and Vermilion Provincial Park, the paved trail from Bentley to Aspen Beach Provincial Park, and the TransCanada Trail link between Edmonton, Strathcona County and Fort Saskatchewan. Despite the significant effort of trail planners and developers, the region's supply and diversity of managed and designated trails have not yet caught up with demands and population growth. This is particularly true for motorized recreation in this region.

Sport

Sporting events such as the 2005 World Masters Games and 2001 World Championships in Athletics provided an opportunity for Albertans to proudly showcase the province and provide for legacies in infrastructure (such as Commonwealth Stadium), as well as human legacies (volunteer development and a large number of internationally qualified officials). The province supports regular Alberta Summer and Winter Games for youth as well as Alberta 55-plus Summer and Winter Games that have been hosted by

communities in the region, which provide ongoing legacies after the events. Many not-for-profit organizations are awarded for national and international sporting events; this raises the profile of the province and the region on the national and international stage. The many new and refurbished municipal sport and recreation facilities in the region provide opportunities for Albertans to train and compete at extremely high levels, which allows these individuals to advance in their sport and go on to represent the province and the country at world class competitions.

The Capital Region and the City of Edmonton are home to major league sports teams including the Edmonton Oilers and the Edmonton Eskimos.

A number of downhill ski areas are located within or near urban areas throughout the region, including Mount Joy Ski Area in Lloydminster, Long Lake Ski Area in Long Lake, Rabbit Hill Snow Resort, Sunridge Ski Area and the five ski hills administered by the Edmonton Ski Club in Edmonton. Banff National Park contains the Lake Louise, Sunshine and Mt. Norquay ski areas.

Historic Resources

Designated Historical Resources and Preservation

The *Historical Resources Act* enables the Government of Alberta to protect historic resources such as historic sites (e.g., Fort George and Buckingham House), archaeological sites (e.g., Bodo Bison Skulls site), palaeontological sites (e.g., Genesee site), Aboriginal heritage sites, and other significant places from adverse effects resulting from land development. The Act applies to all lands within provincial jurisdiction, both publicly and privately owned.

The Government of Alberta screens development projects for their potential to impact historic resources from a variety of sources including industry, municipalities, Government of Alberta departments, and the federal government. Historic resource screening is often a requirement within other provincial regulatory processes, including Alberta Environment and Sustainable Resource Development's Environmental Impact Assessment process and Environmental Field Report, and the Alberta Energy Regulator's Directive 056.

The potential effects of developments on historic resources are evaluated[103] using information about the distribution and significance of known historic resources and terrain analysis. The nature of the development disturbance combined with this knowledge determines the outcome of the review. While their physical expression is typically limited in extent, the intrinsic value of historic resources is often intimately tied to the landscapes in which they occur. Conservation of these non-renewable resources frequently requires consideration of these fundamental linkages.

[103] The Government of Alberta may require a Historic Resources Impact Assessment (HRIA) for any proposed activity likely to threaten the integrity of a historic resource. Once a report describing the HRIA has been submitted, the Government of Alberta may require avoidance or further study of the threatened historic resource. The proposed activity may proceed only after clearance has been issued under the Act.

Archaeological and Palaeontological Sites

More than 5,900 archaeological sites have been discovered, evaluated and found to have scientific value in the region. The third-oldest known archaeological site in Alberta, the James Pass Meadow site (10,000 years old), was discovered on the western side of Clearwater County.

River drainages in the region often expose fossil-bearing bedrock. Excavations at several palaeontological sites within the region have yielded important dinosaur finds, and gravel operations occasionally encounter mammal remains from the ice age. These discoveries and the continuing research activities associated with them have attracted significant interest and visitors to Alberta, resulting in direct and indirect cultural and heritage tourism development.

Palaeontological excavations of Edmontosaurus bones in Edmonton [photograph courtesy of Dr. Philip Currie, University of Alberta]

Designated Historical Resources

Since 2006, some aboriginal groups have provided the Government of Alberta with the locations of places of cultural or spiritual significance. The specific nature of these places is kept strictly confidential, even within government. These sites meet the definition of “historic resources” and are, therefore, afforded protection under the Act. When such locations come into potential conflict with development, proponents are required to consult with the First Nations whose traditional use sites of an historic resource nature are potentially at risk. The Eastern Slopes contain the highest numbers of aboriginal traditional use locations shared with the minister of Culture, and hundreds are recorded within the region.

The highest level of formal protection under the *Historical Resources Act* is the Provincial Historic Resource Designation. With this designation, a provincial historic resource cannot be altered without the written permission of the minister responsible for Culture. This ensures that sites of importance to Albertans are protected for future generations.

The region contains several designated sites or sites under consideration for designation as a historic resource. Examples of designated sites in the region range from Government House in Edmonton to the Viking Ribstones Archaeological Site pictured above.

The Act also empowers municipal councils to designate Municipal Historic Resources. Municipalities throughout Alberta have used this authority to designate historic resources that are locally significant. Through the Municipal Heritage Partnership Program, the Government of Alberta supports municipalities in identifying and protecting locally significant historic places and reflecting the diversity of Alberta’s communities. To date, these include over 180 sites including farmsteads, community halls, churches, schools, homes and commercial blocks. More than 60 per cent of sites in Alberta recognized through Municipal Historic Resource designation lie in the North Saskatchewan Region, the vast majority of which are in the City of Edmonton.

ECOSYSTEMS AND THE ENVIRONMENT

Natural Regions and Subregions

Natural Regions are the broadest levels of ecological classification of Alberta's landscape and are areas that have similar physical qualities and attributes. A natural region is defined on the basis of landscape patterns, vegetation, soils, physical features, climate, topography and geology. Wildlife distribution is also helpful in understanding natural regions. There are six natural regions in Alberta: Grasslands (approximately 15 per cent), Foothills (approximately 10 per cent), Rocky Mountains (approximately seven per cent), Parkland (approximately nine per cent), Boreal Forest (approximately 58 per cent) and Canadian Shield (approximately one per cent)[104]. Of the six natural regions, five are found within the North Saskatchewan Region: Grasslands, Foothills, Rocky Mountains, Parkland and Boreal Forest (see Figure 22 on page 84).

The Canadian Shield Natural Region is the only natural region not represented in the North Saskatchewan Region. Each natural region is divided into subregions, defined as an area of land within a natural region characterized by vegetation, climate, elevation and other physical differences. Conditions within a natural region or subregion are not identical throughout; each has diverse species and landscape conditions.

As shown on Table 15 on page 85, the North Saskatchewan Region contains five natural subregions.

Parkland Natural Region

Approximately 61 per cent of the total Parkland Natural Region and one of its three natural subregions are found in the North Saskatchewan Region. An optimal climate and rich soils have made the Parkland Natural Region a good area for agriculture. Sixty-nine per cent of the Central Parkland Natural Subregion is included within the North Saskatchewan Region and makes up almost half the planning region. This subregion is the most productive agricultural region in Alberta, and forms a broad transitional area between the drier grasslands to the south and the boreal forest to the north.

The Central Parkland Natural Subregion contains all or part of Edmonton and Red Deer, making it the most densely populated region in Alberta. As a result, in 2010 only about 22 per cent of this subregion was still in native land cover within the North Saskatchewan Region. This has placed the native biodiversity dependent on this habitat at high risk.

The numerous and productive wetlands of the Central Parkland Natural Subregion are regarded as the "duck factory" of North America, given it is home to many different species of waterfowl, some of which are unique to North America.

[104] Land Use Secretariat, Government of Alberta. (2013, Mar. 18). *Natural regions and subregions dataset*. Edmonton, AB: Author.

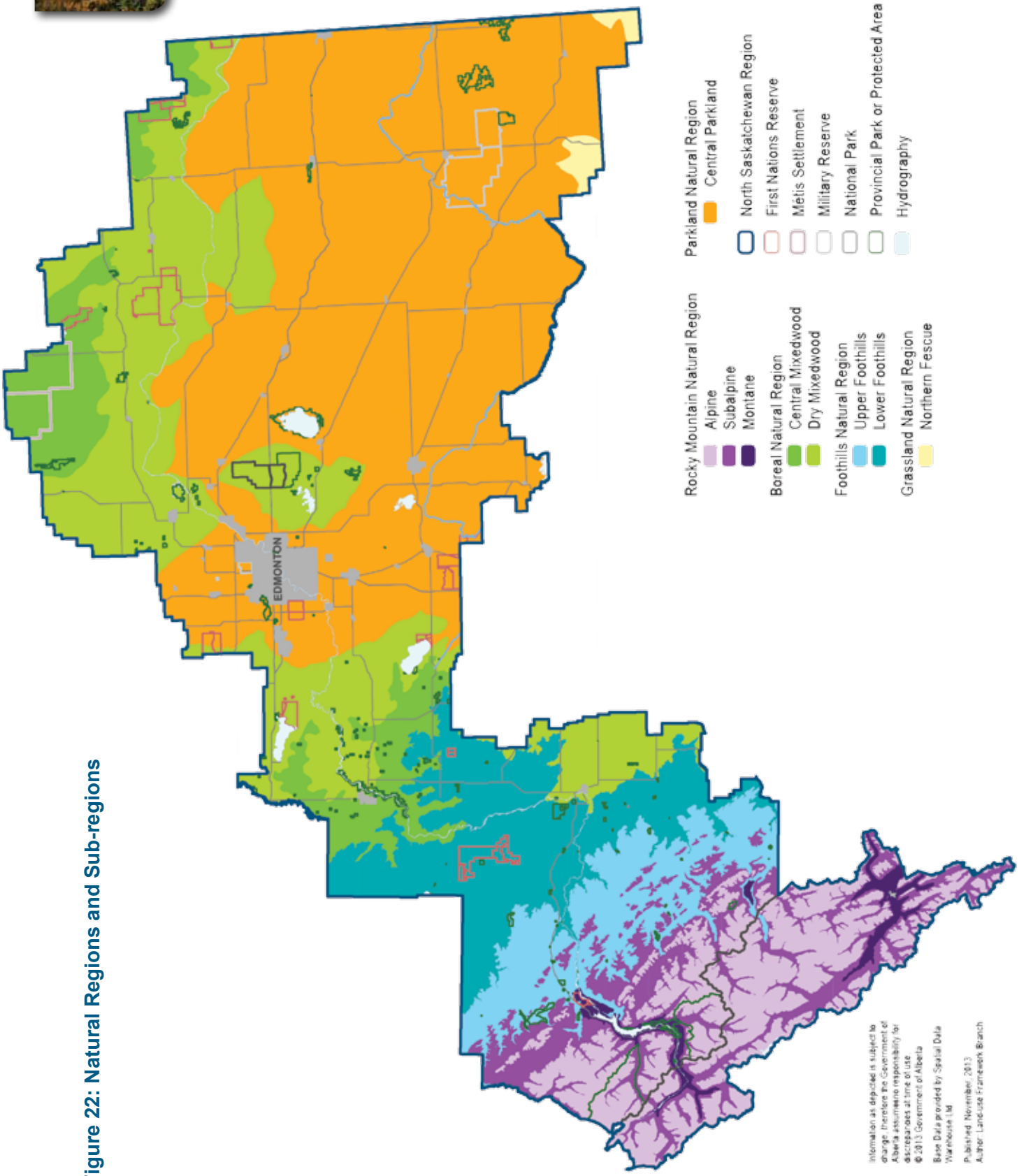


Figure 22: Natural Regions and Sub-regions

Table 15: Natural Subregion distribution within the North Saskatchewan Region

NSR Subregion	Total Area of Subregion in LUF Region (ha)	% of Subregion within LUF Region
NSR - Boreal Subregions		
Central Mixedwood	576,858	3.4%
Dry Mixedwood	1,637,801	19.2%
Subtotal (Boreal Only)	**2,214,659**	
NSR - Parkland Subregion		
Central Parkland	3,711,937	69.1%
Subtotal (Parkland Only)	**3,711,937**	
NSR - Grassland Subregion		
Northern Fescue	46,960	3.1%
Subtotal (Grassland Only)	**46,960**	
NSR - Foothills Subregions		
Lower Foothills	809,243	18.0%
Upper Foothills	495,854	23.0%
Subtotal (Foothills Only)	**1,305,096**	
NSR - Rocky Mountains Subregions		
Alpine	644,488	42.7%
Montane	79,750	9.1%
Subalpine	575,813	22.8%
Subtotal (Rocky Mountains Only)	**1,300,052**	

In years with good moisture, more than 272 species of birds have been reported at Beaverhill Lake alone; with 145 known to breed locally. In 1995, 32 species of shorebirds were recorded during a single year including approximately 20 per cent of the estimated North American Pectoral Sandpiper population and almost 16 per cent of the estimated North American Black-bellied Plover population.

Beaverhill Lake has become drier over time. In addition, over 10,000 square kilometres of prairie-parkland wetlands have been drained and converted

to agricultural use in the course of Alberta's history. Between 1970 and 1990, approximately 2.4 wetland basins per square kilometre were lost. Wetland margins, which provide even richer wildlife habitat than the wetlands themselves, have shrunk or disappeared and that has resulted in a loss of wildlife habitat.

Foothills Natural Region

Almost one-fifth of the total Foothills Natural Region and portions of the Upper and Lower Foothills Natural Subregions are in the North Saskatchewan Region. Approximately 23 per cent of Alberta's Upper Foothills Natural Subregion occurs in this planning region; in 2010, 84 per cent of this subregion was still in native land cover. About 18 per cent of Alberta's Lower Foothills Natural Subregion occurs in the North Saskatchewan Region, and approximately 71 per cent of it is in native land cover.

Outside the North Saskatchewan Region, about 74 per cent of these subregions were in native land cover in 2010. In general this means the biodiversity is in the low risk category; however, some sensitive species like bull trout (Species of Special Concern) and grizzly bear (Threatened) are at much higher risk because of their sensitivity to human encroachment into their habitats.

The Foothills Natural Region is also home to some other threatened and endangered species, including the wolverine and trumpeter swan. The forests of this natural region, lying along the Eastern Slopes regulate spring runoff which helps to minimize flood damage by slowing snowmelt and storing, holding and slowly releasing water.

Rocky Mountain Natural Region

About 26 per cent of the total Rocky Mountain Natural Region and portions of all three subregions are in the North Saskatchewan Region. The North Saskatchewan Region contains approximately 43 per cent, 23 per cent and nine per cent, respectively, of Alberta's Alpine, Subalpine and Montane Natural Subregions. Of this land, over 94 per cent of each of these subregions was in a natural condition in 2010. Despite this large percentage of natural condition, woodland caribou are no longer present in the North Saskatchewan Region, although they are still considered to be in the northern and central parts of the Rocky Mountain Natural Region.

Outside the North Saskatchewan Region, more than 85 per cent of each of these subregions was in a natural condition as of 2010. A significant proportion of the rare species in Alberta can be found in this natural region.

Grassland Natural Region

Only .5 per cent of the total Grassland Natural Region and only part of one of the three Grasslands Natural Subregions is included within the North Saskatchewan Region. Approximately three per cent of Alberta's Northern Fescue Subregion occurs within the southern edge of the North Saskatchewan Region and of that, approximately 46 per cent remained in native vegetation in 2010. About 40 per cent of this natural subregion outside the North Saskatchewan Region was still in native vegetation. The Northern Fescue Natural Subregion is characterized by low and gently rolling terrain and tends to have more moisture than the Dry Mixedgrass Natural Subregion found further south.

Boreal Forest Natural Region

Less than six per cent of the total Boreal Forest Natural Region and only two of eight natural subregions are within the North Saskatchewan Region. The North Saskatchewan Region contains approximately 19 per cent of Alberta's Dry Mixedwood Subregion; of that, only about 38 per cent remained in native vegetation within the region in 2010.

The Dry Mixedwood Natural Subregion is characterized by aspen forests and cultivated landscapes, with fens commonly occurring in low-lying areas. The North Saskatchewan Region contains approximately three per cent of Alberta's Central Mixedwood Subregion; of that, 67 per cent remained in native vegetation within the region in 2010. About 90 per cent of this subregion outside the North Saskatchewan Region remained in native vegetation. The Central Mixedwood Natural Subregion is characterized by a mix of aspen-dominated stands, aspen-white spruce forests, white spruce and jack pine stands on upland terrain with wet, poorly drained fens and bogs covering almost half the area.

Protecting the Region's Natural Diversity

One of the core goals of Alberta's parks system is to preserve, in perpetuity, a network of areas that represents the natural diversity of the province. Based on sound conservation science, representation of Alberta's natural diversity is determined through a coarse filter/fine filter conservation planning approach. Broad landscape types in each of Alberta's six natural regions and 21 subregions[105] are used to develop conservation targets. Completing these conservation targets would achieve representation of 85-90 per cent of species, features and many ecological processes. However, species and landforms, especially the rarest, may not be captured through the coarse filter. As such, a fine filter assessment is also used to focus on specific species and natural features that may not be predictably associated with a landscape type, or may be highly localized. Examples include unique geologic features, rare or localized species or communities, or critical

[105] Government of Alberta (2005) 2005 Natural Regions and Subregions of Alberta Map; available at: www.albertaparks.ca/media/442827/nsr2005_final_letter.pdf

habitat for wide-ranging species like grizzly bear and caribou. Coarse filter conservation targets[106] have been set for all identified natural landscape types in Alberta. They provide the basis for completing the parks system.

Existing protected areas in the region, including national parks, have been evaluated to determine the extent to which each natural landscape type is represented. The provincial protected areas system has made good progress in achieving its representation targets. However, not all natural landscape types are adequately represented as envisioned by Alberta's Plan for Parks. In addition to coarse filter targets, there are more than 500 rare species within the region, many of which are also under-represented within the Alberta Parks system. It is important to recognize numerous endangered, threatened and/or sensitive species such as the Piping Plover, Short-eared Owl, Ferruginous Hawk and the Leopard Frog are protected in various parks.

Natural landscape types and fine filter elements that are missing or under-represented indicate gaps in the system that need to be filled by establishing new parks or expanding existing ones (see Table 16 on page 89).

Biodiversity

Biodiversity, or "biological diversity," represents the assortment of life on earth – including the variety of genetics and species and the habitats in which they occur – all shaped by natural processes of change and adaptation. Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals.

Biodiversity forms the foundation of the vast array of ecosystem services that contribute to human well-being.[107] Biodiversity and the services it provides are critical to the well-being of current and future generations of Albertans. Some examples of the benefits that come from healthy functioning ecosystems and the biodiversity found in them:

- food, fibre, fresh water
- flood control, water and air purification
- spiritual, recreational, esthetic, cultural benefits
- nutrient cycling, soil formation

[106] Government of Alberta (2012) Representation of Natural Landscape Types by Natural Region and Subregion within Parks and Protected Areas in Alberta; available at: www.albertaparks.ca/media/3117610/natural_landscape_types-targets___progress.pdf

[107] Government of Alberta (2013), *Management & Land Use Scientific Framework*; available at www.albertaparks.ca/albertaparksca/management-land-use/building-the-parks-system/scientific-framework.aspx

Table 16: Under-represented Natural Landscape Types by Natural Subregion within Protected Areas in the North Saskatchewan Region[108]

Natural Landscape Types		Natural Subregion				
Component	**Theme**	**Central Parkland**	**Lower Foothills**	**Upper Foothills**	**Northern Fescue**	**Dry Mixedwood**
Non-Sandy Upland	Glacial Lake Bed	Poor			Poor	Poor
	Ground Moraine	Poor			Poor	Poor
	Hummocky Moraine	Poor			Complete	Good
	Bedrock					
Sandy Upland	Sandy Plain	Poor			Poor	Poor
	Dune Field	Good			Not represented	Poor
	Kame/Moraine Complex	Poor				
Valley/Ridge	Exposed Slope	Good			Moderate	Moderate
	Protected Slope	Moderate			Moderate	Complete
	Valley Floor/Stream	Moderate	Moderate	Complete	Poor	Poor
	Valley Wall/Ridge		Poor	Good		
Wetland	Alkali Wetland	Poor			Moderate	
	Mineral	Complete	Poor	Moderate	Complete	Moderate
	Organic		Poor	Poor		Good
	Lake	Complete	Complete	Good	Poor	Good
Glacier / Snowfield						

Table Legend: Greyed-out cells indicate that a natural landscape type is not present within the natural subregion. Other natural subregions within the North Saskatchewan Region (Alpine, Montane and Central Mixedwood) have complete representation of all natural landscape types

Poor = less than 50 per cent representation
Moderate = between 50-75 per cent representation
Good = between 75-99 per cent representation
Complete = 100 per cent representation

[108] Millennium Ecosystem Assessment (2005), *Ecosystems and Human Well-being: Biodiversity Synthesis*. World Resources Institute, Washington, DC

Biodiversity Trends

Population growth and economic development in the North Saskatchewan Region have significantly altered the region's biodiversity over time. The North Saskatchewan Basin drains 80,000 square kilometres, approximately 12.5 per cent of Alberta's land area. Much of the region's native vegetation in the settled area has been converted to other land uses. In the first part of the 20th century, many of these lands were developed for agricultural purposes with a change in focus to accommodate expanded urban, rural residential and industrial developments.

Oil, gas, mining and forestry activity have been occurring in the more westerly forested areas of the region, resulting in landscape fragmentation, habitat loss and impacts to biodiversity. Suppressing forest fires has increased the average age of the forest, which also has had an effect on biodiversity. In the forested portion of the region, the rapid proliferation of access in the form of roads and trails to support resource development, is possibly the single largest threat to biodiversity, since it has led to tremendous growth in mechanized public use on the landscape. This has contributed to significant declines in habitat security and connectivity for many large and sensitive wildlife species.

In the eastern part of the region, human activity and development have transformed much of the parkland landscape by clearing and conversion to cropland. This has decreased the native biodiversity and the ecosystem services they provide. Measuring these changes and planning for desired levels of biodiversity in the future are challenges that land-use planning will need to address. The greatest threats to terrestrial organisms are disturbances that remove, damage, fragment or alter (beyond the range of natural variability) their natural habitat.

Significant amounts of the Lower Foothills (29 per cent), Central Mixedwood (33 per cent), Northern Fescue (54 per cent), Dry Mixedwood (62 per cent) and Central Parkland (78 per cent) natural subregions, as well as wetlands in the region have been fragmented and converted to other uses.

Aquatic biodiversity has been impacted as well. The North Saskatchewan River basin supports 32 of the 51 fish species native to Alberta, plus seven known introduced fish species (e.g., rainbow trout).

The water quality in the North Saskatchewan River declines as it moves downstream due to inputs from anthropogenic, point and nonpoint sources. Nutrients (notably phosphorous), bacteria and pesticides typically increase, while dissolved oxygen levels decrease downstream of urban centres. These are all changes that impact biodiversity.

Water uses such as hydroelectric generation have a significant influence on the natural flow regime of the North Saskatchewan and Lower Brazeau rivers, which also contributes to changes in aquatic biodiversity. Access development has impacted the health of aquatic ecosystems and associated fish populations through sedimentation of water bodies, harmful physical alteration of aquatic habitat, and fragmentation of aquatic habitats due to poorly installed and maintained stream crossings that create fish migration barriers.

Riparian lands are those areas of high water table along the margins of streams and lakes. They are critically important to biodiversity due to their transitional nature from water to upland, and also because they are highly productive. They often harbour some of the most rich and diverse plant and animal communities on the landscape and provide shade, erosion protection and water quality and quantity buffering to the aquatic systems. These areas in the North Saskatchewan Region as well as much of the rest of the province have undergone significant changes and reductions in quantity and quality as the province has developed. Current monitoring indicates that in the settled part of the province about 11 per cent of riparian areas are considered healthy, 49 per cent have some problems and 40 per cent are unhealthy.

Species at Risk

The North Saskatchewan Region is home to a number of the province's species at risk. They inhabit many parts of the landscape, but are particularly concentrated in the remaining native habitats. Species at risk include diverse mammals, birds, amphibians, reptiles, fish, plants and invertebrates. There are many reasons that species are at risk including habitat loss, disturbance and landscape fragmentation, direct mortality, environmental contaminants, introduction of exotic/invasive species, and the cumulative effects of all these factors.

Alberta's strategy to manage species at risk is to use scientific expertise, along with input from landowners, stakeholders and land managers to develop species-specific recovery plans. For example, Alberta's Grizzly Bear Recovery Plan includes education initiatives, population status evaluation, ongoing research, and data management to manage habitat and ensure this key species remains a part of Alberta's landscape.

When a species significantly declines or is lost, biodiversity as a whole is affected and ecosystem function disrupted. Based on detailed assessments, the Government of Alberta monitors and classifies the population of species as follows:

- Extinct – the species no longer exists.

- Extirpated – within a defined area the species no longer exists, but does exist elsewhere.
- Endangered – a species faces imminent extirpation or extinction.
- Threatened – if nothing is done to reverse the factors leading to the decline in population will become endangered.
- Special concern – applies to species that exhibit sensitivity to human or certain natural activity or events.
- Data deficient – a species where there is insufficient data to determine its status.

Two other classifications from the General Status of Alberta Wild Species assessments are also used:

- May be at risk – any species that may be at risk of extinction or extirpation and is therefore a candidate for detailed risk assessment.
- Sensitive – any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Table 17 below lists the vertebrate species that are at risk within the region.

Table 17: Species at Risk (Vertebrates)[109]

Species	Designation	Location*
Woodland Caribou – Mountain Ecotype	Extirpated	WP
Banff Springs Snail	Endangered	WP
Piping Plover	Endangered	CA, EP
Grizzly Bear	Threatened	WP
Lake Sturgeon	Threatened	all
Northern Leopard Frog	Threatened	all (h)
Peregrine Falcon	Threatened	WP, CA
Trumpeter Swan	Threatened	CA
Bull Trout	Recommended - Threatened	WP, CA(h)
Whitebark Pine	Endangered	WP
Limber Pine	Endangered	WP
Harlequin Duck	Special Concern	WP
Loggerhead Shrike	Special Concern	possibly EP
Porsild's Bryum	Endangered	WP

[109] Government of Alberta ESRD (2013), Species at Risk; available at http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/Default.aspx

Species	Designation	Location*
Long-toed Salamander	Special Concern	WP
Prairie Falcon	Special Concern	WP
Western Grebe	Special Concern	CA, EP
Barred Owl	Special Concern	WP, CA, possibly EP
Wolverine	Data Deficient	WP
Bay-breasted Warbler	Recommended – Special Concern	possibly EP
Black-throated green warbler	Recommended – Special Concern	all
Cape May Warbler	Recommended – Special Concern	possibly EP
Short-eared Owl	May Be at Risk	CA, EP
Northern-long-eared Bat	May Be at Risk	all
Canadian Toad	May Be at Risk	all
Columbia Spotted Frog	Sensitive	WP
Brown Creeper	Sensitive	all
Northern Pygmy Owl	Sensitive	WP
Northern Goshawk	Sensitive	all
Pileated Woodpecker	Sensitive	all
Columbia Spotted Frog	Sensitive	WP
Great Blue Heron	Sensitive	all
American Bittern	Sensitive	CA, EP
Osprey	Sensitive	all
Bald Eagle	Sensitive	all
Broad-winged Hawk	Sensitive	CA, EP
Great Grey Owl	Sensitive	all
Black Tern	Sensitive	CA, EP
Forster's Tern	Sensitive	EP
Blackburnian Warbler	Sensitive	possibly EP
Fisher	Sensitive	WP
American Badger	Sensitive	CA, EP
Canada Lynx	Sensitive	WP, CA, possibly EP

*Location: WP=Western Portion, CA=Capital Region, EP=Eastern Portion, and (h) =historically

Landscape Disturbances

Wildfire, wind, flooding, grazing, insect outbreaks and diseases all have significant effects on vegetation composition and succession[110], creating variability in habitats and landscapes. Where possible, native species have evolved to use the various stages of these successive habitats, thus a greater number of species exist over the landscape but they are dependent on landscape disturbances continuing to provide this variety of habitats over time.

Historically, the main causes of disturbance over the last several centuries have been wildfire in forested areas, and grazing in the grasslands areas.[111] The intensity of fire disturbance is a significant factor in shaping forest and grassland habitats. It is thought by experts that the forests of this region have historically had relatively frequent fires of low or mixed levels of intensity.

Population growth and economic development have significantly altered the region's biodiversity over time. Much of the region's native vegetation has been converted to other land uses. Linear features (i.e., roadways, pipelines, etc.) from economic development which provide ready access, combined with population growth, have resulted in more pressure on ecosystem health.

Habitat Alteration

The greatest threats to species are disturbances that remove, damage, fragment or alter their natural habitat. Significant amounts of Lower Foothills (approximately 29 per cent), Central Mixedwood (approximately 33 per cent), Northern Fescue (approximately 54 per cent), Dry Mixedwood (approximately 62 per cent), and Central Parkland (approximately 78 per cent) natural subregions, as well as wetlands in the region have been fragmented and converted to other uses. Habitat management, and therefore wildlife management, is complex due to the numerous landowners and land managers across the North Saskatchewan Region.

Hunting, Trapping and Fishing

Hunting, trapping and fishing play vital roles in wildlife management in the province, and are historically important cultural and trade-related activities that contribute to the region's economy. Hunting is also the primary means of controlling animal populations on privately owned land where there are few large natural predators. Linear features (i.e., roadways, pipelines, etc.) from economic development which provide ready access, combined with population growth, have resulted in more pressure on species that are hunted, trapped and fished.

[110] Change in types of species present in an ecosystem over time.

[111] Stockdale, C. (2011), *Disturbance Regimes of the North Saskatchewan Regional Plan Area*; Foothills Research Institute.

Non-native Species

Non-native invasive species often have few natural predators or parasites. They may also be superior competitors over native species for space, food, nutrients and water, particularly on lands that have been disturbed.

Climate Variability and Biodiversity

Historical climate records in Alberta indicate a warming trend in the last century. It is assumed that this trend will continue for the foreseeable future. This is expected to mean greater extremes in weather and changes to the natural habitats of many species. As a result, non-native species may move into new habitats, and may force other species to adapt or move elsewhere. Some cold water habitat for trout may be at risk.

Many forest pest species, such as the Mountain Pine Beetle, are expanding into more northerly regions. This suggests that pests are adapting to new environments as they gain greater access to the region. Combined with climate variability, this could lead to an increasing number of pest outbreaks.[112]

Native insects are often able to adapt to new environments in a relatively short time. Because pest species can move into habitats where the trees lack the sufficient natural defences to protect themselves, native insects are able to expand their range and can have as negative an impact as invasive species.[113]

Air and Emissions

Air Management

Ambient air quality in Alberta is managed using a comprehensive network of monitoring stations and through the combined efforts of a number of different agencies and groups including: Government of Alberta, Government of Canada, Clean Air Strategic Alliance (CASA), local airshed zone organizations, municipalities and other stakeholder groups. Six local airshed zone organizations operate in the North Saskatchewan Region: Alberta Capital Airshed, Calgary Region Airshed Zone, Fort Air Partnership, Lakeland Industry and Community Association and Parkland Airshed Management Zone.

Within the North Saskatchewan Region, ambient air quality is monitored by local airshed zone organizations, industry, the Government of Alberta and the Government of Canada, with the local airshed zone organizations operating most of the monitoring stations in the region (see Figure 23 on page 96).

[112] Government of Alberta ESRD (2013), *Forest Pests*; available at www.srd.alberta.ca/LandsForests/ForestHealth/ForestPests/Default.aspx

[113] Ibid.

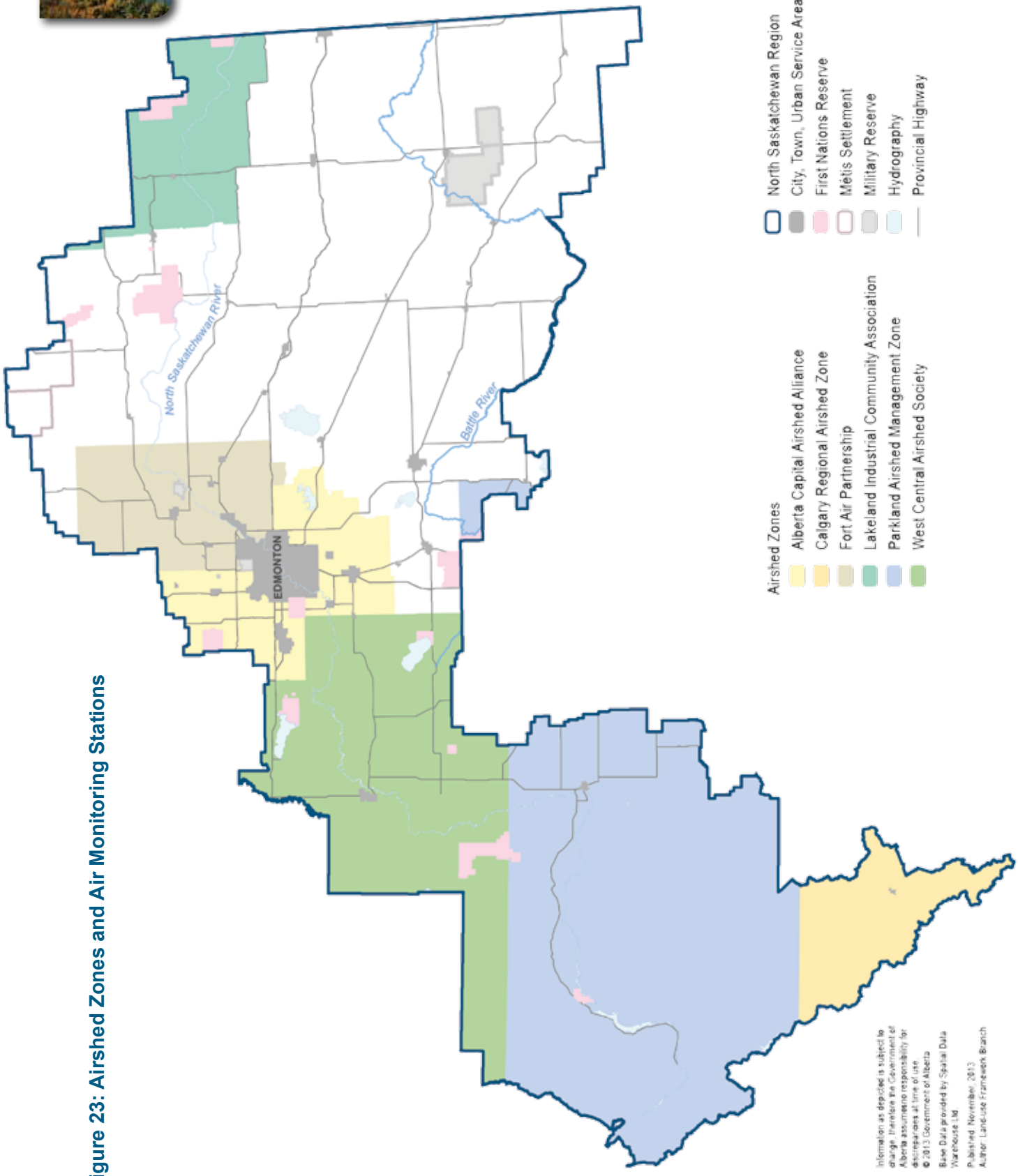


Figure 23: Airshed Zones and Air Monitoring Stations

Air Emissions and Ambient Air Quality

There are various types of industrial facilities distributed throughout the region that contribute to air pollutant emissions (with the exception of the far western section of the region, where there is little to no industry). The most significant industrial emissions are from power generation facilities west of Edmonton and the petroleum and chemical industries in the Industrial Heartland.

Other important sources of air pollutant emissions in this region include commercial and residential fuel combustion for heating and transportation. Use of personal and commercial vehicles, recreational vehicles, airplanes and trains for the transportation of people and goods contributes to air pollution in the region. Air pollution is also associated with agricultural activity ¬(confined feedlot operations and fertilizer application), dust (roads and construction operations), and waste disposal (sewage treatment facilities and open burning).

From a human and ecological health standpoint, the primary substances of concern related to ambient air quality in the region are carbon monoxide (CO), volatile organic compounds (VOC), hydrogen sulphide (H_2S), nitrogen oxides (NO_x), including nitrogen dioxide NO_2, coarse particulate matter (PM_{10}), sulphur oxides (SO_x) including sulphur dioxide (SO_2), ammonia (NH_3), fine particulate matter ($PM_{2.5}$), total particulate matter (TPM) and bioaerosols/ pathogens. These components are linked to ground-level ozone (O_3), dust, acid deposition, and issues related to human health, ecosystem health and integrity, visibility and odour. Above certain exposure thresholds, these substances can adversely affect humans and ecosystems.

Current Air Quality in the Region

Over the past two decades, better technologies in the control of pollutant emissions have led to improvements in ambient air quality in the region. Levels of many air pollutants such as nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) have declined.

With the improvements in vehicle emission control equipment since the 1970s – such as catalytic converters, oxygenated gasoline, and the introduction of electric/hybrid vehicles – there has also been a reduction in carbon monoxide (CO) ambient concentrations in the region. Most often, the ambient concentration levels in the region for NO_2, SO_2 and CO are below the Alberta Ambient Air Quality Objectives (AAAQO) levels.

There have been decreases in the average ambient concentrations of hydrogen sulphide (H_2S) in the region. These decreases are a result of better technologies and emissions practices being used by industry, and new initiatives such as acid gas disposal by the oil and gas industry.

The CASA Particulate Matter and Ozone Management Framework[114] is Alberta's commitment to achieve Canada-wide Standards levels and establish ambient triggers for particulate matter and ground-level ozone. If the triggers are reached, action may be required, including the development of management plans. In some areas of the Capital Region, triggers have been reached and exceeded. As a result, three airshed zones in the area developed the Capital Region Ozone Management Plan at the request of the provincial government. The plan is currently being implemented and tools are being identified that can be used on a voluntary basis to help further reduce increases in emissions. More recently, particulate matter levels have exceeded the CWS in some areas of the Capital Region. Alberta Environment and Sustainable Resource Development is currently leading efforts to develop a mandatory plan to reduce ambient concentrations of particulate matter.

In October 2012, Alberta endorsed the national Air Quality Management System, a comprehensive approach to air quality management developed through the Canadian Council of Ministers of the Environment (CCME). One aspect of the system is the Canadian Ambient Air Quality Standards (CAAQS) for particulate matter and ozone. The CAAQS will replace the less stringent CWS, with reporting against the CAAQS starting in 2014.

The quality in the North Saskatchewan Region is generally rated as "low health risk" according to the Alberta Air Quality Health Index (AQHI). Implemented in Alberta in 2011, the index is a tool designed to help people understand what ambient air quality means to their health and the health of those they care for. In the North Saskatchewan Region there are nine communities where the AQHI is reported: Bruderheim, Caroline, Genessee, Edmonton, Elk Island, St. Lina, Tomahawk, Lamont County and Fort Saskatchewan. On occasion, the AQHI reports moderate health risk which is often the result of stagnant air conditions (limiting pollution dispersion). A High or Very High health risk classification rarely occurs, and is often associated with wildfires or strong atmospheric inversions.

Water

The region includes the watersheds of the North Saskatchewan River, the Battle River and Sounding Creek (see Figure 24 on page 99). Small portions of the Bow, Red Deer, Athabasca and Beaver River basins are also found in the planning region; however, their areas are limited.

While the North Saskatchewan River and Battle River basins are both contained within the same planning region, they have different hydrologic regimes, originate in different headwaters, contain different land uses, and face different pressures. Therefore, management directions need to be specific to each basin in order to achieve the desired objectives.

[114] Government of Alberta ESRD (2003), *Particulate Matter and Ozone Management Framework*, Clean Air Strategic Alliance (CASA) September 2003.

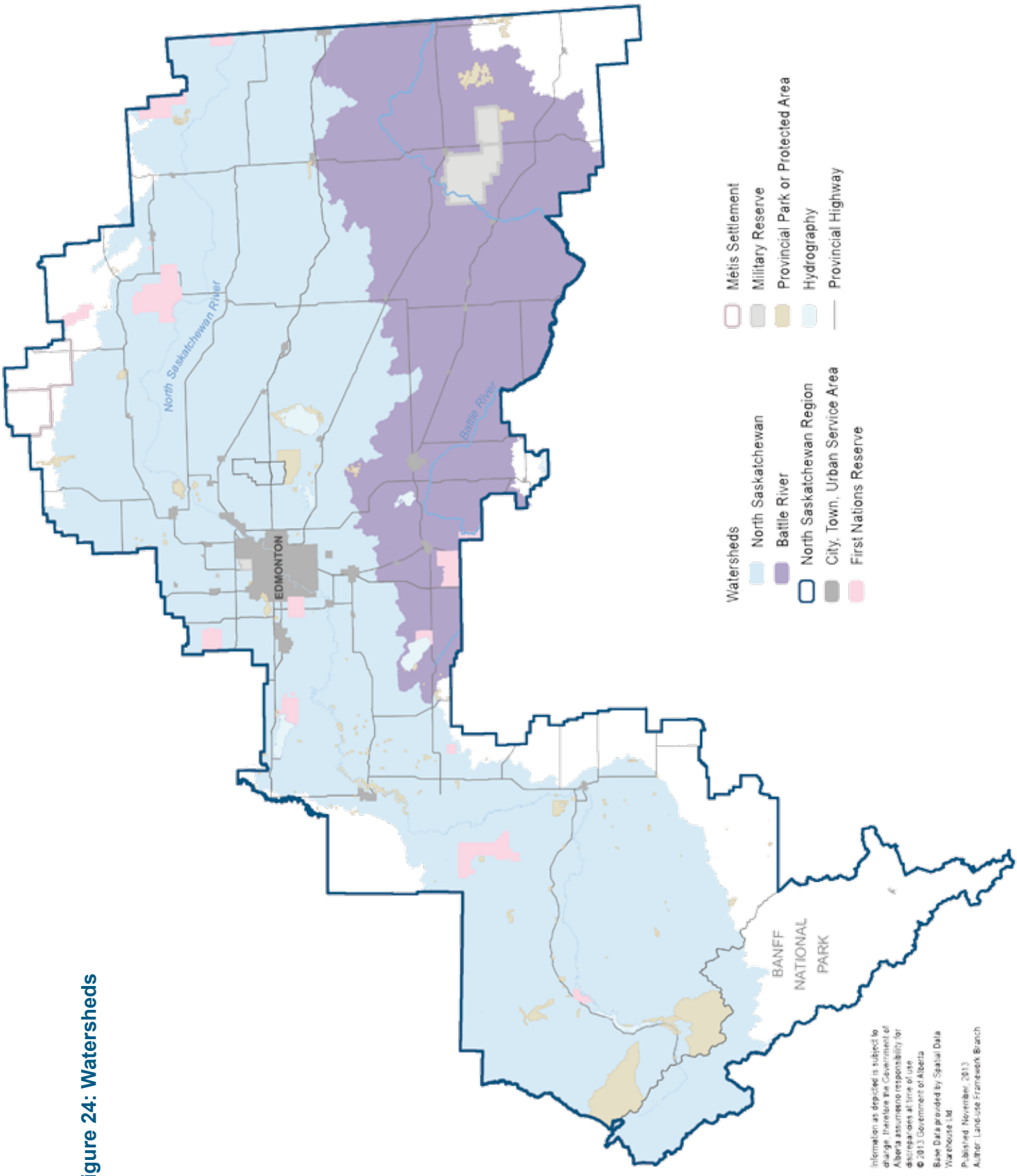


Figure 24: Watersheds

As part of the broader Industrial Heartland cumulative effects management system, a Groundwater Management Framework for the Capital Region and Industrial Heartland is being considered. This Groundwater Management Framework would aim to improve groundwater quality in the Industrial Heartland and prevent or mitigate any cumulative effects.

North Saskatchewan River Basin

The Alberta portion of the North Saskatchewan River Basin covers 92,799 square kilometres, and includes the Battle River (25,585 square kilometres) and Sounding Creek (10,337 square kilometres) watersheds. The North Saskatchewan River comprises 12 watersheds originating in the Rocky Mountains and foothills, where precipitation, snowmelt and glaciers supply the largest proportion of this river's volume. Spanning the full width of the province, the river passes through four natural regions, namely the Rocky Mountains, Foothills, Boreal Forest and Parkland. Approximately 7,113 million cubic metres of water flow annually into Saskatchewan.

Battle River Basin

The Battle River drains 28 per cent of the North Saskatchewan River Basin, yet it contributes four per cent (265 million cubic metres) of the mean annual water volume compared to that of the North Saskatchewan River. The headwaters of the Battle River originate within the southern extent of the Boreal Forest Natural Region at Battle Lake and the river drains a predominantly flat topography of the Parkland and Grassland Natural Regions.

Approximately 65 per cent of the flow volume in the Battle River occurs during the spring and early summer months (March to June), with melting of the local winter snowpack and spring storms. Summer precipitation, including heavy rainfall events, account for approximately 35 per cent of the annual flow volume. The Battle River does not have a significant base flow, making it vulnerable to drought. It is highly susceptible to annual climate cycles and seasonal low-flow conditions.

The Battle River Basin contains five watersheds, including Bigstone, Paintearth, Iron, Ribstone and Blackfoot. Although Sounding Creek is classified as a tributary of the Battle River, it is considered a non-contributing basin. The Sounding Creek basin terminates at Manito Lake in Saskatchewan, and there has been no outflow recorded from Manito Lake into the Battle River since European settlement.

Water Quantity and Allocation

Under the Water for Life Strategy, two Watershed Planning and Advisory Councils have been established within the North Saskatchewan Region. Both of these watershed councils have been working on developing watershed management plans and other technical documents. The North Saskatchewan Watershed Alliance released their Integrated Watershed Management Plan in 2012. It provides guidance and recommendations related to managing water quality, instream flow needs, aquatic ecosystem health, groundwater and land-use planning. The Battle River Watershed Alliance is developing a Watershed Management Plan for the Battle River and Sounding Creek. It will consider issues related to surface water quality and quantity, as well as biodiversity, land-use management, wetlands, riparian areas, and develop a Drought Management Plan.

Seven of Alberta's nine drainage districts are partially or entirely located within the North Saskatchewan region. The focus of drainage districts has been the cooperative improvement of water management on arable lands allowing increased agricultural production. The Drainage Districts Council, that oversees the drainage districts, is currently exploring an expanded role that encompasses other aspects of water management beyond drainage.

Under Alberta's *Water Act*, the use of most surface and groundwater is regulated through a system of water licences issued by the provincial government. Applications can be made for permission to use water for drinking, irrigation, industrial processes or other uses. The terms of the licence include the maximum volume and may conditions of use, such as rate of diversion and timing of withdrawals.

Licence allocations only indicate the maximum water volumes allowed for a specific use and do not always reflect actual water use. Some licences were granted with room for growth, as some users have demands that can vary widely depending on weather conditions (such as irrigation). Water allocations are a general measure of the degree of pressure placed on a water basin.

The Master Agreement on Apportionment[115] administered by the Prairie Provinces Water Board obligates Alberta to pass on one-half of the natural water flows to be available where rivers cross into Saskatchewan including both the North Saskatchewan and Battle Rivers. The requirement to meet this apportionment agreement affects water allocations and management activities. Within this apportionment agreement obligations also exist to meet established Water Quality Objectives for these waters at the border which are currently being reviewed for future amendment. Upstream activities must therefore be managed appropriately to meet these inter-provincial agreements.

[115] Prairie Provinces Water Board (2009), The 1969 *Master Agreement on Apportionment and By-laws, Rules and Procedures*; Regina. 78 pp.

The Eastern Slopes Policy (1984) provides direction on management of the North Saskatchewan River to maintain natural flows and manage headwaters to maintain recharge capabilities.

Water quantity in the North Saskatchewan Region is not seen as a serious limiting factor for development and growth in the region. The majority of its volume comes from headwater streams in the mountains and foothills from snowmelt, glaciers, and precipitation. Although still susceptible to the effects of climate variability, these headwaters provide greater, more consistent flows than do prairie-fed streams such as the Battle River and Sounding Creek.

The industrial sector represents the largest total surface water allocation in the North Saskatchewan Region (approximately 83 per cent), followed by municipal (approximately eight per cent), petroleum (approximately five per cent), other (approximately two per cent), and commercial and agricultural sector (both about one per cent).[116] There has been a relatively significant proportion of the North Saskatchewan River's volume allocated in licences (approaching 30 per cent), but much of this is for non-consumptive use, such as industrial cooling. The actual amount used on average is less than four per cent. So even with significant allocations, a greater amount of water remains in the river compared to other rivers in the province, including the Battle River and those in the South Saskatchewan basin.

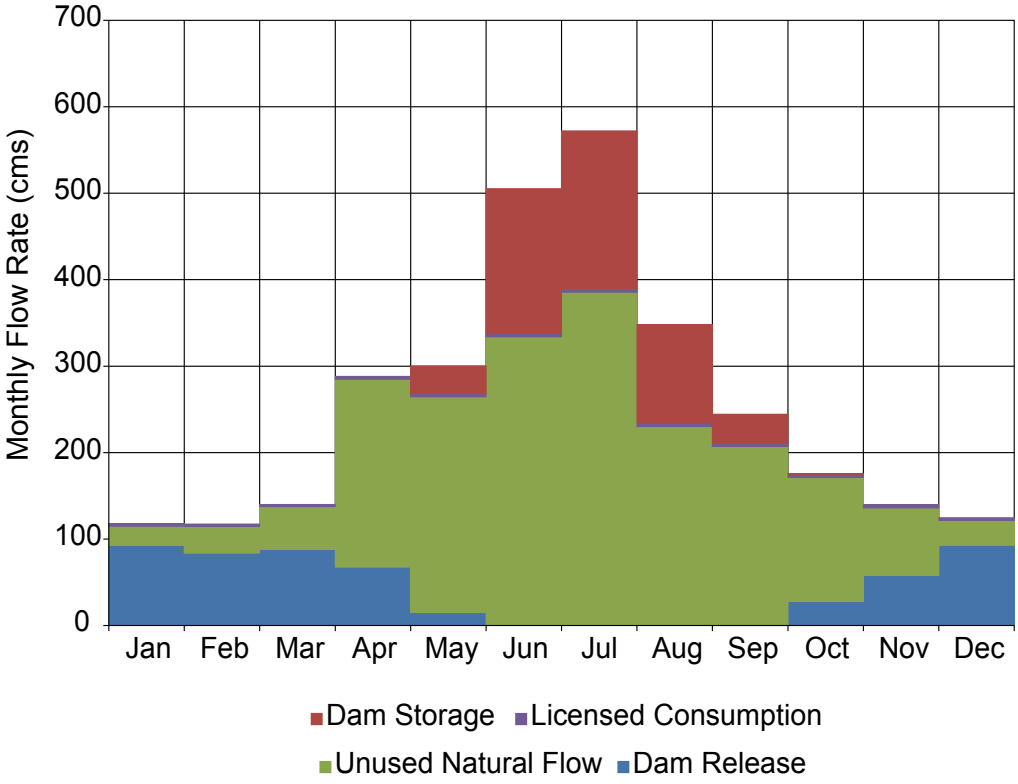
Flows in the North Saskatchewan River are regulated by the operation of the Brazeau Dam (near Drayton Valley) and the Bighorn Dam (near Nordegg) for the purpose of hydroelectricity production. Although there are negative effects to the aquatic ecosystem, the dams provide benefits in the form of water supply security, river regulation, and assimilation of treated wastewaters through winter months. The modified flow regime, together with the reliability of the natural water supply and the relatively small allocations of volume to users, means that volumes in the North Saskatchewan River are rarely seen as a concern. The monthly breakdown of flow is shown in Figure 25 on page 103.

In the Battle River Basin, water quantity is a pressing issue. The lack of mountain snowpack and glacier runoff as a source for the river, combined with the flat topography of the watershed and variability in annual precipitation, means that low flows predominate throughout most of the year.

The Battle River is nearing its capacity for water licence allocations, which currently exceed the mean annual discharge of water. The Government of Alberta has issued 10,568 surface water licences and registrations for a total water allocation of approximately 752,000 cubic decametres; however, there is a high return flow volume back into the river. A better descriptor of current water allocations is the maximum amount of water that is licensed for consumption, meaning that portion of a licence or registration which is not returned to the river.

[116] AMEC (2007), *Current and Future Water Use in the North Saskatchewan River Basin*; Prepared for North Saskatchewan Watershed Alliance. September 2007.

Figure 25: Monthly Breakdown of Flow in the North Saskatchewan River



Of the 10,568 surface water licences and registrations, three licences issued for thermal electric power generation account for approximately 22 per cent of the net consumptive water allocated in the Battle River Basin. Licensed consumptive use, combined with traditional agricultural registrations, result in a potential maximum net consumption water allocation of 49,800 cubic decametres of water, which is about 19 per cent of the mean annual natural flow. Although water licence holders are permitted to divert a volume of water specified under the terms and conditions of their licence, the actual amount used by many water licence holders is often less than that amount.

The Battle River Basin has 10 major regulated lakes and reservoirs used primarily for lake stabilization, flow control, municipal and rural water supply, and wetland protection. The largest structures are the ATCO dam and Forestburg Reservoir, which supply cooling water for the Battle River Electricity Generating Station. The spillway on the dam is designed to release a base flow at all times.

In terms of reservoir storage capacity, the top three ranked in descending order are Coal Lake (approximately 48,975 cubic decametres), Driedmeat Lake (approximately 36,400 cubic decametres) and Forestburg Reservoir (approximately 14,480 cubic decametres). The total storage capacity of all

three reservoirs is about 38 per cent of the total mean annual flow in the Battle River. This limited storage capacity, combined with characteristic low flows, means there is little opportunity to regulate flow through the management of reservoirs.

Water Quality

Water quality data is collected at the provincial Long-term River Network monitoring stations located throughout the province. These monitoring stations have been used for regular monthly sampling for a wide range of water quality parameters over the past 30 to 50 years. This initiative has resulted in an extensive database useful for examining changes in the health of a water body over time.

The River Water Quality Index is used to evaluate water quality in Alberta's major river systems with respect to four groups of variables – metals, bacteria, nutrients, (including oxygen and pH), and pesticides. Data from these four groups are combined to provide an indication of overall water quality. The index can be used to show relative differences in water quality between rivers, between sites on the same river (e.g., upstream and downstream of developed areas), and over time. Such differences can highlight degradation or improvement that may have a human cause.

North Saskatchewan River

Water quantity in the North Saskatchewan River is not seen as a serious limiting factor for development and growth in the region.

The North Saskatchewan River experiences large changes in water quality not only between seasons within a year but also between years. These changes are the result of a complex mix of natural and man-made inputs, compounded by wide seasonal fluctuations in run-off and flows.

Generally, many water quality variables in the North Saskatchewan River have improved in recent decades due to improved practices and especially wastewater treatment. The treatment of municipal sewage is much better now than in the past, and municipal effluent loads of nutrients, oxygen consuming material and bacteria have dropped considerably. This is further helped by management of seasonal flows in the North Saskatchewan River by means of the two upstream reservoirs, which help maintain generally well oxygenated water over the low-flow winter season.

Despite these improvements, nutrient enrichment or nutrient loading[117] remains an important issue. Treated sewage is still the largest point-source of some nutrients on an annual basis, but industries, storm and combined sewers, and urban tributaries also contribute significantly.

[117] The response of a body of water to the addition of excessive nutrients, such as algal bloom or reduction of the water's oxygen levels.

With the majority of the North Saskatchewan River's flow coming from sub-basins upstream (areas that are somewhat less modified by human development) of the Industrial Heartland and the Capital Region, the water supply serving the Capital Region is considered to be of good quality by the Devon monitoring site. The Industrial Heartland and Capital Region include the river reach between monitoring stations at Devon and Pakan. This combined area supports a population of over one million people and contains a large portion of Alberta's industrial resource processing industry. Because of the current and expected intensity of development and impacts in this reach, a cumulative effects management system has been established to better manage these pressures.

In order to deal with the intensity of development, a Water Management Framework was developed for the Industrial Heartland and Capital Region in 2007.[118] This management framework focuses on water quality of the river reach between Devon and Pakan. The framework is intended to help minimize the impact of development by maintaining or improving water quality and engaging municipal and industrial stakeholders in evaluating options for efficient water use and effluent management. This framework is currently being implemented and includes the development of seasonally based maximum allowable loads for select contaminants released into the North Saskatchewan River.

Because of improvements in wastewater treatment, invertebrates that require good water quality are now more common throughout the Industrial Heartland and Capital Region than in past decades. For example, the Lake Sturgeon, currently classed as a threatened species, occurs in low numbers in the North Saskatchewan River and mostly below Devon through to Saskatchewan. No sturgeons have been found in the Sturgeon River, presumably because of changes in water quality, possibly flow and the levels of disturbances. Figure 26 on page 106 shows the decrease in nutrient level (phosphorous) downstream of the Capital Region (Pakan) between 1988 and 2008, and the effect of implementing Biological Nutrient Removal (BNR) at the wastewater treatment plants.

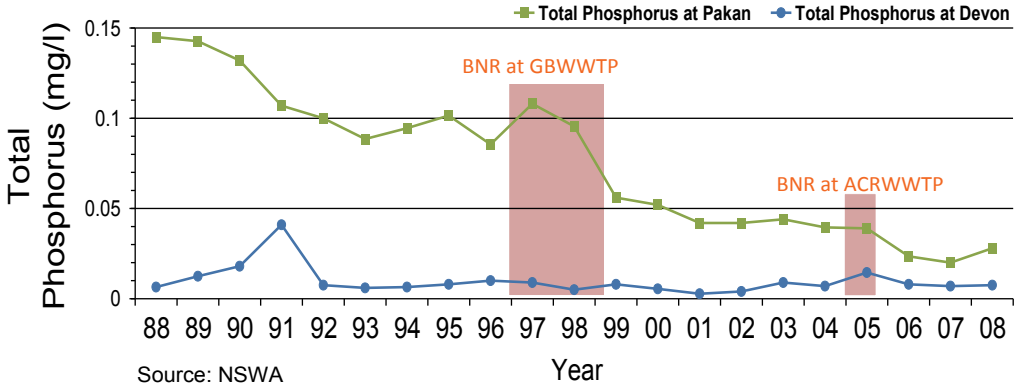
Despite these improvements, nutrient enrichment remains an important issue in this reach of the river. Treated sewage is still the largest point-source for some nutrients on an annual basis, but industries, storm and combined sewers, and urban tributaries also contribute significantly.

Battle River Basin

In the Battle River Basin, impacts on water quality are a significant issue. Due to the low flow rates that occur throughout much of the year, the river is particularly vulnerable to contaminant loading. There are also concerns with nutrient loading, in particular phosphorus and nitrogen. Based on available

[118] Government of Alberta ESRD (2007), *The Water Management Framework for the Industrial Heartland and Capital Region*; Edmonton, AB. 38pp.

Figure 26: Phosphorous levels in the North Saskatchewan River, upstream (Devon) and downstream (Pakan) of the Capital Region, 2008



Source: NSWA

water quality data, phosphorus is likely the main contributor to degraded water quality in the Battle River, as excessive phosphorus contributes to an over-growth of nuisance algae and plants. This nutrient loading is primarily due to discharge of municipal wastes and agricultural runoff.

The Battle River is fairly typical of other prairie-fed river systems that see increased demands for dealing with man-made wastes by way of dilution and flushing. For example, pH levels and fecal coliform counts sometimes exceed guidelines. The end result is an impaired ability for the river to support a diversity of aquatic life generally associated with a healthy aquatic ecosystem.

The Prairie Provinces Water Board has set Water Quality Objectives for various indicators for both the North Saskatchewan River and the Battle River at the point where the rivers cross the border into Saskatchewan.[119] The board's water quality mandate is to facilitate management that encourages protection and restoration of the aquatic system.

A draft Approved Water Management Plan for the Battle River Basin was created in 2011 to provide direction for the management of surface water in the basin. Key aspects of the draft plan include an allocation limit that would close the basin to new licences once the limit is reached, enabling transfers from existing licences, establishing a water conservation objective, and enabling holdbacks water transfers. This draft plan has yet to be fully reviewed.

[119] Prairie Provinces Water Board (2009), *The 1969 Master Agreement on Apportionment and By-laws, Rules and Procedures*. Regina. 78 pp.

Lakes and Waterways

The North Saskatchewan Region has some of the most heavily used recreational lakes in Alberta. Many lakes in the region are naturally shallow, turbid[120], warm, alkaline[121], and support a variety of aquatic animals and plants. Most of the lakes in the region experience recreational and agricultural pressures. Recreation currently represents the most significant pressure on lakes in the region. While agricultural and land-use impact many lakes, water quality is also affected by boating, cottage development, land-use conversions, unmaintained sewage treatment systems, shoreline modifications and shoreline modifications. Blue-green algal blooms due to excessive external nutrient enrichment have led to water quality warnings on some important recreation lakes in recent years.

Wetlands

Wetlands play an integral role in supporting Alberta's environment, economy and human well-being. Their functions and benefits are diverse, complex and occur at multiple levels. Wetlands are a significant aquatic ecosystem component of the region. Their value and importance to watershed health are increasingly recognized and include improving water quality, providing water storage and flood reduction, enhancing groundwater recharge, and providing habitat for a range of plants and animals.

The Government of Alberta, in partnership with Ducks Unlimited Canada, has been undertaking an inventory of wetlands across the province. Within the region, the inventory is nearly complete with approximately 85-90 per cent coverage. The inventory is using aerial photography and satellite imagery to allow for both wetland delineation and classification. Figure 27 on page 108 shows the extent of wetlands in the region.

Wetlands in the region are diverse and abundant, and are ranked by the international conservation community as some of the most significant in North America. Wetlands in the region and adjoining area of Saskatchewan represent the core of the Canadian Prairie Pothole Region, an area that ranks in highest continental priority based on exceptional densities and numbers of breeding waterfowl and other wetland birds.[122] Some of the highest documented losses of wetlands in the Canadian Prairies (60-70 per cent) have occurred in this same area. These losses have been the result of multiple development pressures including agricultural, industrial, transportation, commercial and urban development [123].

The estimated annual wetland loss rates are 0.3-0.5 per cent of the remaining wetland area.[124] In addition to outright loss, various forms of degradation also affect the ecological integrity and function of wetlands.

[120] Turbid or turbidity is the muddiness or haziness in lake water created by stirring up sediment on the lake bottom or by surface runoff entering the lake.

[121] Alkaline lakes are generally higher in saline (salt) and have a pH between 7 and 10.

[122] Alberta NAWP (2012), *North American Waterfowl Management Plan*; available at http://abnawmp.ca/media/uploads/NAWMP_2012_Revision_Final_1.pdf

[123] Boychuk, L. et al. (2009), Unpublished data from Ducks Unlimited Canada.

[124] Watmough, MD and MJ Schmoll (2007), *Prairie and Northern Region Habitat Monitoring Program Phase II: Recent Trends in the Prairie Habitat Joint Venture, Environment Canada Technical Report 493.*

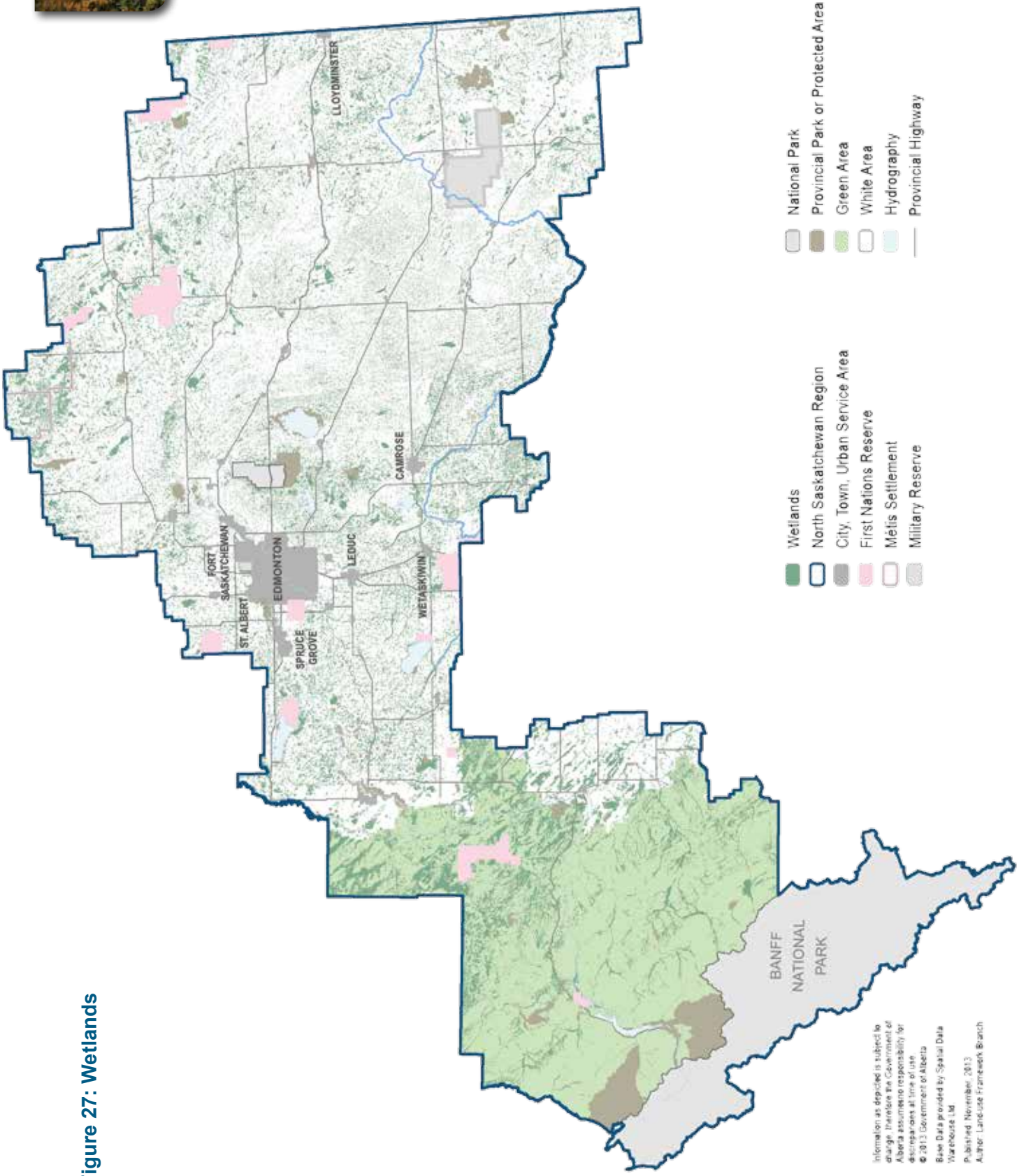


Figure 27: Wetlands

Groundwater

The Edmonton-Calgary Corridor is the most populated area of Alberta and contains more water wells per square kilometre than any other part of the province. Groundwater quantity is a significant concern for residential and small-scale users in this area. In addition, the use of multi-stage hydraulic fracturing for the development of both conventional and unconventional oil and gas reserves and associated use of groundwater is projected to increase in the North Saskatchewan planning region, particularly in the western portion. Currently the predominant application of this process in Alberta has been for increasing recoveries from conventional oil reservoirs and has mostly used nitrogen rather than water. Still, significant public concern exists regarding the potential impact of this activity on groundwater quality. Several policies are being advanced by the Government of Alberta to guide and reduce the risk from these activities.

The region is located in the western Canadian Sedimentary Basin, which consists of a thick package of sedimentary rocks overlain by a thin veneer of unconsolidated deposits. The western basins are important areas of regional groundwater recharge and baseflow to the North Saskatchewan River. Groundwater in the central basins is under increasing demand due to agricultural, energy, and industrial and municipal development. Groundwater in the eastern basins is generally less available as the reservoir of usable groundwater becomes thinner.

Regional groundwater assessments have been completed within the region to produce maps of groundwater yield and quality for each county. In addition, a monitoring program called the Groundwater Observation Well Network has been established province wide. The amount of groundwater potentially available in each type of aquifer varies depending on the geological makeup of the area.

Beginning in 2009, the Alberta Geological Survey (AGS) and the Government of Alberta worked together to map groundwater in the Edmonton-Calgary Corridor (ECC). This work resulted in the Edmonton-Calgary Corridor Groundwater Atlas[125], which examines the fresh groundwater within the ECC, based on its geological, hydrological and hydrochemical properties.

Groundwater quality in the North Saskatchewan River Basin can best be represented by looking at the variability in total dissolved solids throughout the area. Changes in quality occur naturally as the water moves through geologic materials. As groundwater makes its way deeper into the bedrock aquifers, mineralization increases and ion exchange occurs. In east-central Alberta where the amount of annual precipitation is comparatively low and the evaporation rate is high, the total dissolved solids concentration is high. In areas with higher precipitation and lower evaporation rates, such as western

[125] Barker, AA, JTF Riddell, SR Slattery, LD Andriashek, H Moktan, S Wallace, S Lyster, G Jean, GF Huff, SA Stewart and TG Lemay (2011), *Edmonton-Calgary Corridor Groundwater Atlas*; Energy Resources Conservation Board, ERCB/AGS Information Series 140, 90p.

Alberta, groundwater in surface deposits typically has a low total dissolved solids concentration.

There are several concerns related to groundwater in the North Saskatchewan Region. For example, extensive industrial development in the Industrial Heartland has resulted in localized effects to groundwater quality. Anticipated growth in the area's economic activity may increase the risk of further effects.

Climate Variability

Both the North Saskatchewan and the Battle rivers are susceptible to regional climate variability, an important factor in the management of water in both the Battle River and North Saskatchewan watersheds. Annual yields of snowmelt and glacier melt water from headwater regions of the North Saskatchewan River could be affected. An analysis of precipitation data has shown a decline in both rain and snow amounts. As the Battle River is highly dependent on rain and snowfall in the basin, such changes in precipitation can be expected to impact flows in the river.

Groundwater, lakes and wetlands in the region may also be affected by changing precipitation patterns.

The region's climate is part of the larger global climate system, which is affected by world-wide trends in greenhouse gases from naturally occurring events and human activities.

Alberta's climate change strategy acknowledges human-caused greenhouse gas emissions are contributing to global climate change and that Alberta, by virtue of the industries based in the province, is responsible for 35 per cent of Canada's industrial greenhouse gas emissions.[126]

The main groups of human activities that produce greenhouse gases are:

1. Coal and petroleum-based fuels related to:
    - heating homes, businesses and other facilities;
    - electrical generation;
    - transportation (tail pipe emissions);
    - process heat for chemical and petrochemical refining and production;
    - waste gas flaring.

[126] Government of Alberta ESRD (2008), *Alberta's Climate Change Strategy 2008*; available at www.environment.alberta.ca/0909.html

2. Methane and other hydrocarbon gases that result from oil and gas production facilities, pipelines, shipping and handling facilities, and open pit coal mines.
3. Development that disrupts and eliminates existing natural features which remove and store carbon, such as wetlands.
4. By-products of human digestion and agriculture in the form of methane and other gases that result from decomposition in landfills, sewage treatment and holding systems, and from the digestive systems of livestock.