

The Athabasca Watershed

The Athabasca River watershed is the area of land that captures all precipitation (rain, hail, and snow) that eventually drain into the Athabasca River. Together with the area of land within Alberta that drains into Lake Athabasca, they form the Athabasca watershed within Alberta. As water flows downhill over and through land our activities on land eventually affect rivers, streams, lakes, wetlands and ocean. Whatever we do upstream affects water and land downstream. Therefore, the **watershed** is the appropriate land unit for managing our activities so that the land, water, and wildlife remain healthy.

The Athabasca River begins from the melting snow and ice of the Columbia Glacier in Jasper National Park (headwaters) and travels about 1500 km northeast across Alberta and drains into Lake Athabasca¹. Lake Athabasca flows into the Slave River and joins McKenzie River that eventually flows into the Arctic Ocean. As the Athabasca River travels through its length, it also goes through a large change in elevation; from 1062 m at Jasper² that drops to about 205 m at its mouth in Lake Athabasca³.

The Athabasca River is the second largest river in Alberta, next to the Peace River. The Athabasca River flow is monitored at three points along the river by Water Survey of Canada⁴. The mean annual discharges in cubic decameters ($\text{dam}^3 = 1000$ cubic meters) at the three locations are: 2,790,000 dam^3 at Jasper; 13,600,000 dam^3 at Athabasca; and 20,860,000 dam^3 at Fort McMurray^{4,5}. There are no water control structures or dams on the Athabasca River¹.

The confluence of the Peace and Athabasca Rivers with Lake Athabasca forms a vast wetland called the Peace-Athabasca delta. It is one of the world's ecologically significant wetlands and has the designations of a Ramsar Convention wetland and a United Nations Education, Scientific and Cultural Organization (UNESCO) World Heritage Site⁶. It is recognized internationally as an important habitat for nesting and a staging ground for the migration of waterfowl, including the internationally threatened species, the whooping crane. It is also a habitat for the native wood and imported plains buffalo¹.

The Athabasca watershed within Alberta is approximately 159,000 square kilometers^{1,7} which is about 24% of Alberta. In order to prepare a plan for the sustainable management of the watershed, it can be divided into 10 smaller watersheds or sub-watersheds⁸. These are smaller watersheds that drain either into smaller rivers, or lakes that eventually flow into the Athabasca River (McLeod, Pembina, La Biche, Lesser Slave, Clearwater) or riverside land corridors that drain into specific points of the Athabasca River itself (Upper Athabasca, Central Athabasca-Upper, Central Athabasca-Lower, and Lower Athabasca)(Figure 1). A small portion of Lake Athabasca sub-watershed within Alberta was added since

its sustainable management is also tied to that of the Athabasca River watershed. The majority of the area of Lake Athabasca watershed is in Saskatchewan and a small portion lies in the Northwest Territory⁷.

A sub-watershed approach provides the opportunity for local people to identify their sub-watershed issues and solutions to those issues. This is also called the “placed-based approach” and benefits from local knowledge as well as traditional ecological knowledge.

In 2001, the Athabasca watershed had a population of 154,097 people, or 5% of the provincial population⁹. The Athabasca River Basin includes all or parts of 22 rural or regional municipalities and includes a city, 12 towns, and 14 Aboriginal settlements¹.

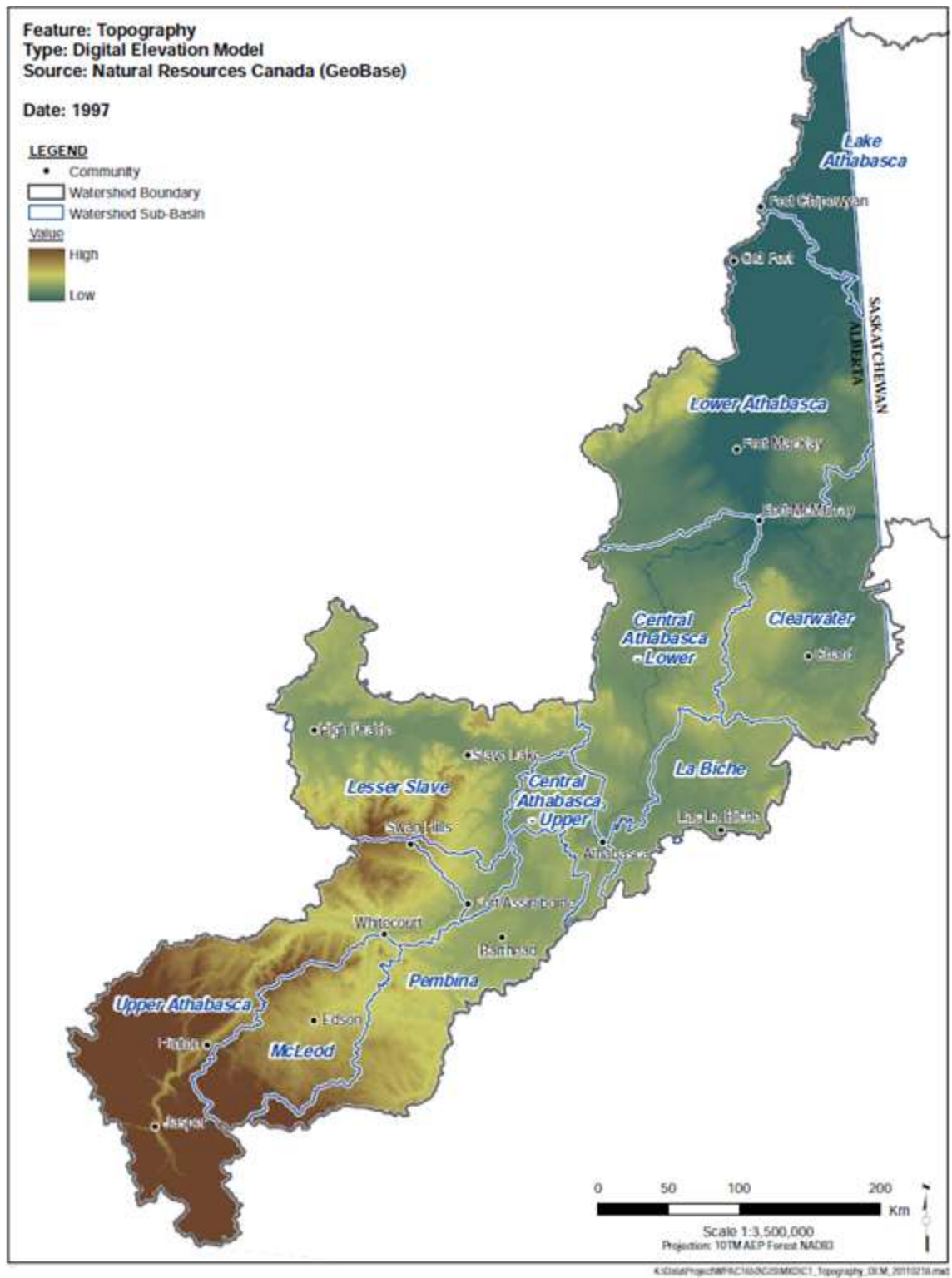


Figure 1. The 10 subwatersheds of the Athabasca watershed in Alberta. The colours show the change from high elevation (dark brown) at Jasper to low elevation towards Lake Athabasca (dark blue-green).

The ecology of the Athabasca watershed is diverse as a result of different natural regions within the watershed. Ecology refers to the inter-relationships between living organisms (plants, fungi, microorganisms, and animals (includes humans) and their non-living environment (air, rocks/minerals/soil, water, weather/climate). A natural region is a large ecological unit that combines similar climate, topography, geology, vegetation and wildlife¹⁰. There are four natural regions in the Athabasca watershed: Rocky Mountain, Foothills, Boreal Forest, and Canadian Shield (Figure 2). The central and lower areas of the watershed are mainly Boreal Forest while the upper are Foothills and Rocky Mountain natural regions. A very small area of Canadian Shield natural region is situated north of Fort Chipewyan.

The Central Mixedwood sub-region of the Boreal Forest natural region (Figure 2) is home to an extensive peatland ecosystem (muskeg)¹¹. Peatlands are wetlands with at least 40 cm of peat¹¹. Peat is made up of partially decomposed plant remains – usually from mosses and grass-like plants called sedges. Peatlands provide several ecosystem functions such as water quality improvement, water storage, runoff and stream flow regulation, and habitat for many wildlife species. Peatlands store carbon (as peat) but emit the greenhouse gas methane. In terms of ‘global warming potential’ many peatlands are neither carbon sink nor source¹².

Moving from the headwaters down to Lake Athabasca, the climate in the Athabasca watershed becomes colder (Figure 3) and drier or lesser precipitation (Figure 4).

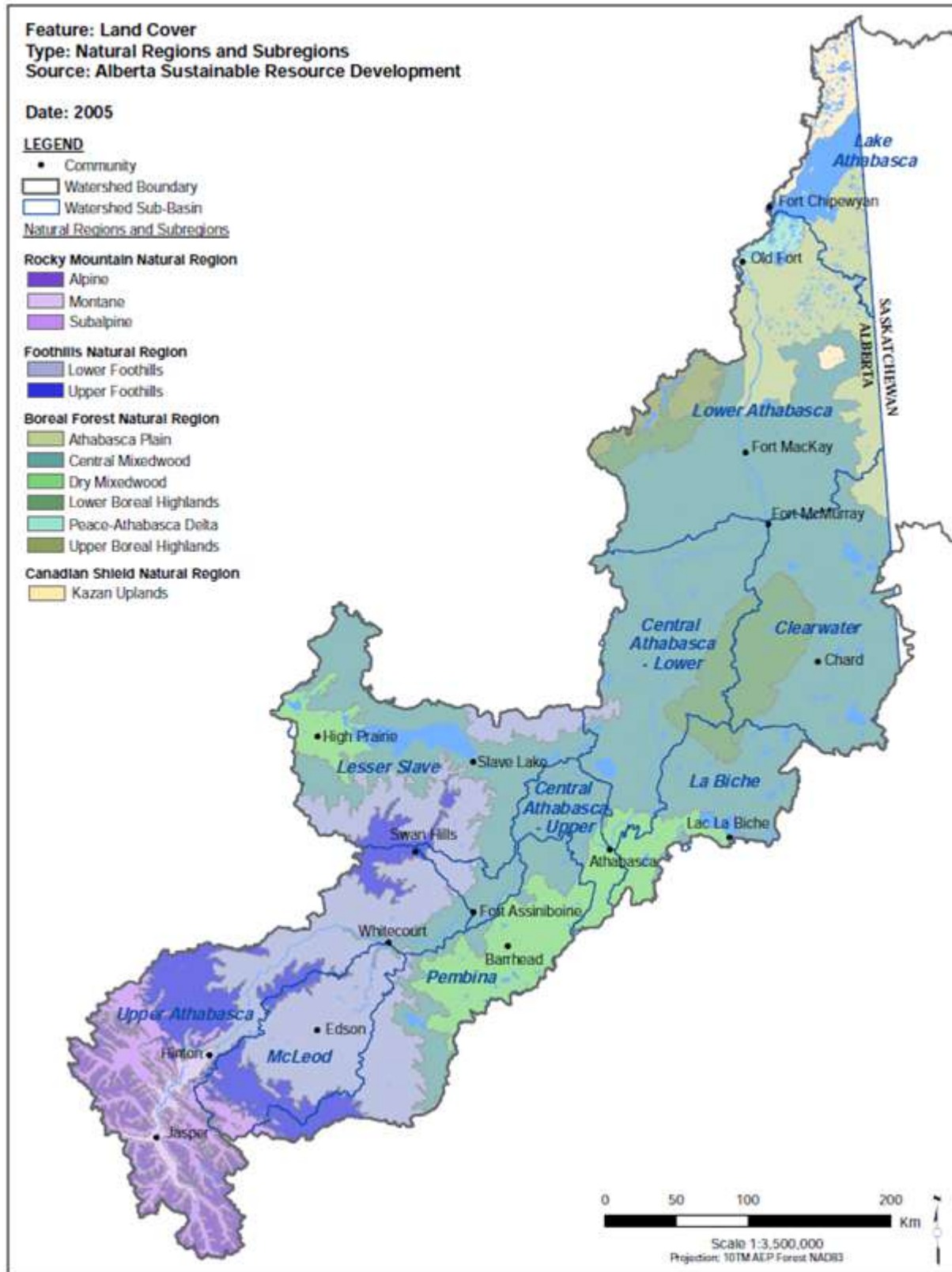


Figure 2. Natural regions and subregions in the Athabasca watershed.

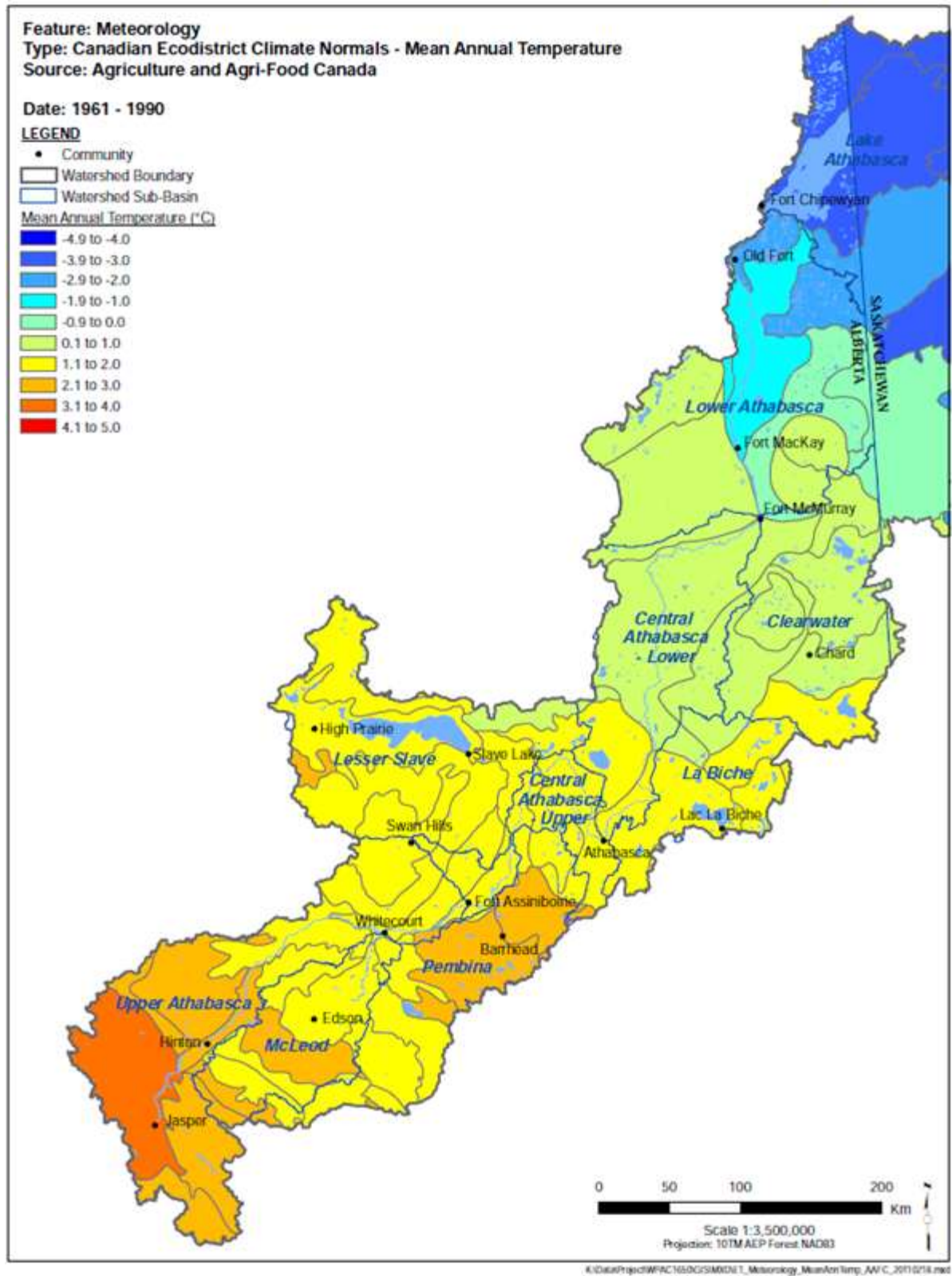


Figure 3. Mean Annual Temperature in the Athabasca watershed. It is warmer in the southern areas than in the northern areas of the Athabasca watershed.

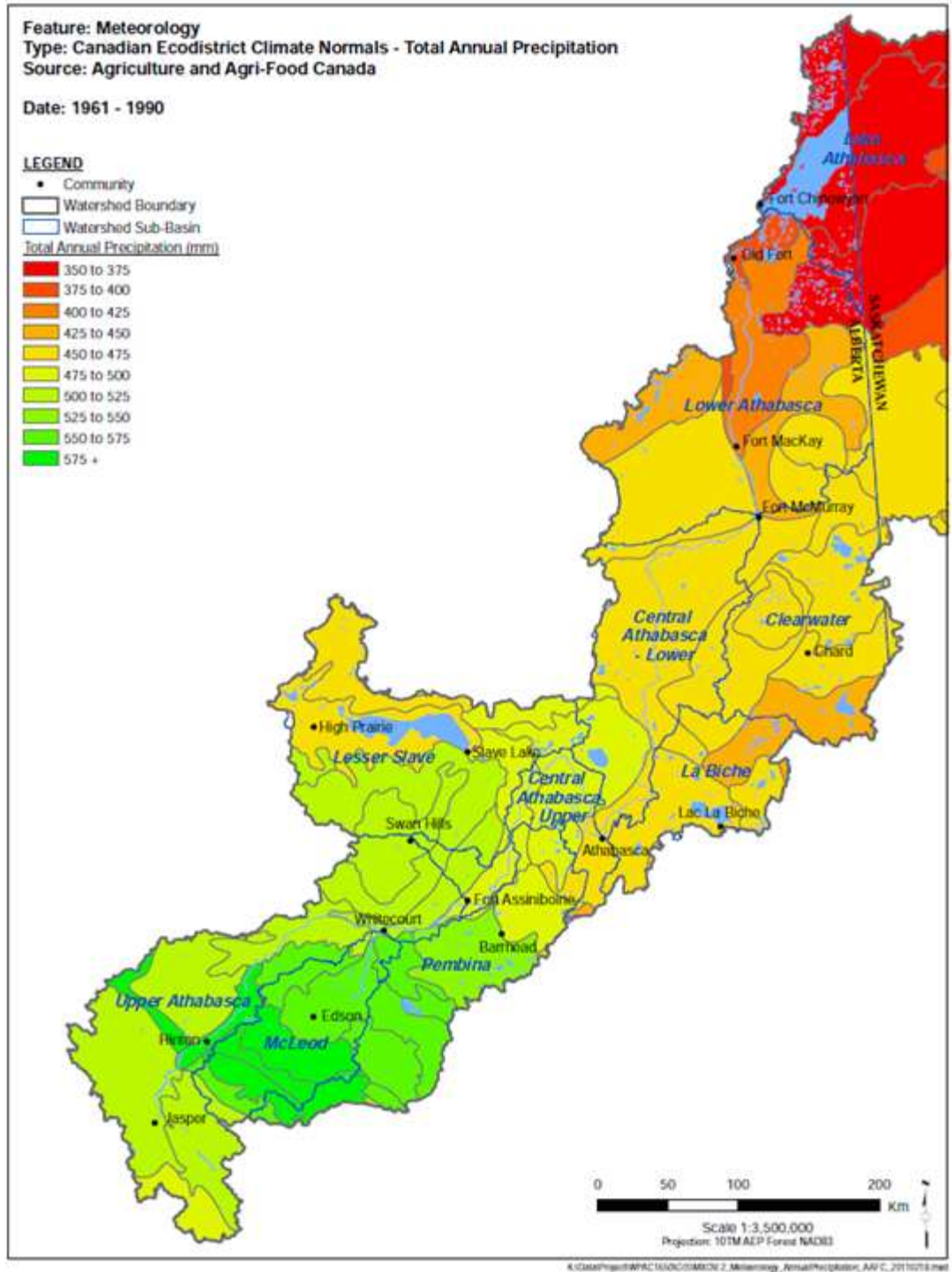


Figure 4. There is greater amount of rain and snow in the Rocky Mountain and Foothills (higher elevation) than in Boreal Forest and Canadian Shield natural regions (lower elevation).

Human development activities in the Athabasca watershed have generated some important environmental concerns. The Athabasca watershed contains several human settlements, including Fort McMurray, Hinton, Whitecourt, Edson, Jasper, and Athabasca, which all have municipal wastewater treatment plants discharging into the Athabasca River. Other important human settlements are Barrhead, Westlock, Lac La Biche, Slave Lake, and Swan Hills. Economic activity in the upper portion of the watershed is dominated by forestry, agriculture, and tourism as well as three active coal mines and one closed coalmine in the Edson/Hinton area. There are five pulp and paper mills in the upper half of the watershed. Forestry occurs throughout the watershed, while oil sands developments dominate the lower portion of the watershed. Sand and gravel extraction is also active in the Athabasca watershed. Uranium mining on the northeast part of the watershed that extends in Saskatchewan may increase in the future. Unmanaged recreational activities are increasingly causing stress in several areas of the watershed.

The total allocation of surface and groundwater in the watershed in 2005 was 849,639 dam³. In 2005, the petroleum sector accounted for 68 % and the other industrial sector accounted for another 17 % of total allocations. The municipal (7%) and other sectors (5%) accounted for most of the remaining allocations. However, not all water allocations are utilized fully.

The Athabasca watershed is physically and ecologically diverse and endowed with natural resources (water, forests, coal, oil and gas, minerals, agricultural class soil) that generate economic wealth. The development of natural resources results in specific land uses and land use is key factor influencing surface water and groundwater quality.

References:

- ¹<http://arbri.athabasca.ca/basin/>
- ²http://en.wikipedia.org/wiki/Jasper,_Alberta
- ³http://en.wikipedia.org/wiki/Athabasca_River
- ⁴<http://www.ramp-alberta.org/river/hydrology/river+hydrology/athabasca+river.aspx>
- ⁵http://www.albertawater.com/index.php?option=com_content&view=article&id=655&Itemid=83
- ⁶<http://daac.ornl.gov/HYDROCLIMATOLOGY/guides/PAD.html>
- ⁷Meghan Mallon, Alberta Environment, personal communication
- ⁸Athabasca Watershed Council State of the Watershed Report: Phase 1, March 2011
- ⁹<http://www.water-matters.org/watershed/athabasca-river-basin>
<http://www.ags.gov.ab.ca/minerals/uranium/uranium.html>
- ¹⁰Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta. Compiled by Downing, D. J. and Pettapiece, W. W. Govern of Alberta. Pub. No. T/852.
- ¹¹Wilson, S., Griffiths, M. and Anielski, M. 2001. The Alberta GPI Accounts: Wetlands and Peatlands, Report #23, Pembina Institute for Appropriate Development.
- ¹²Roulet, N. T. 2000. Peatlands, carbon storage, greenhouse, gases, and the Kyoto Protocol: prospects and significance for Canada. *Wetlands*, 20(4):605-615.