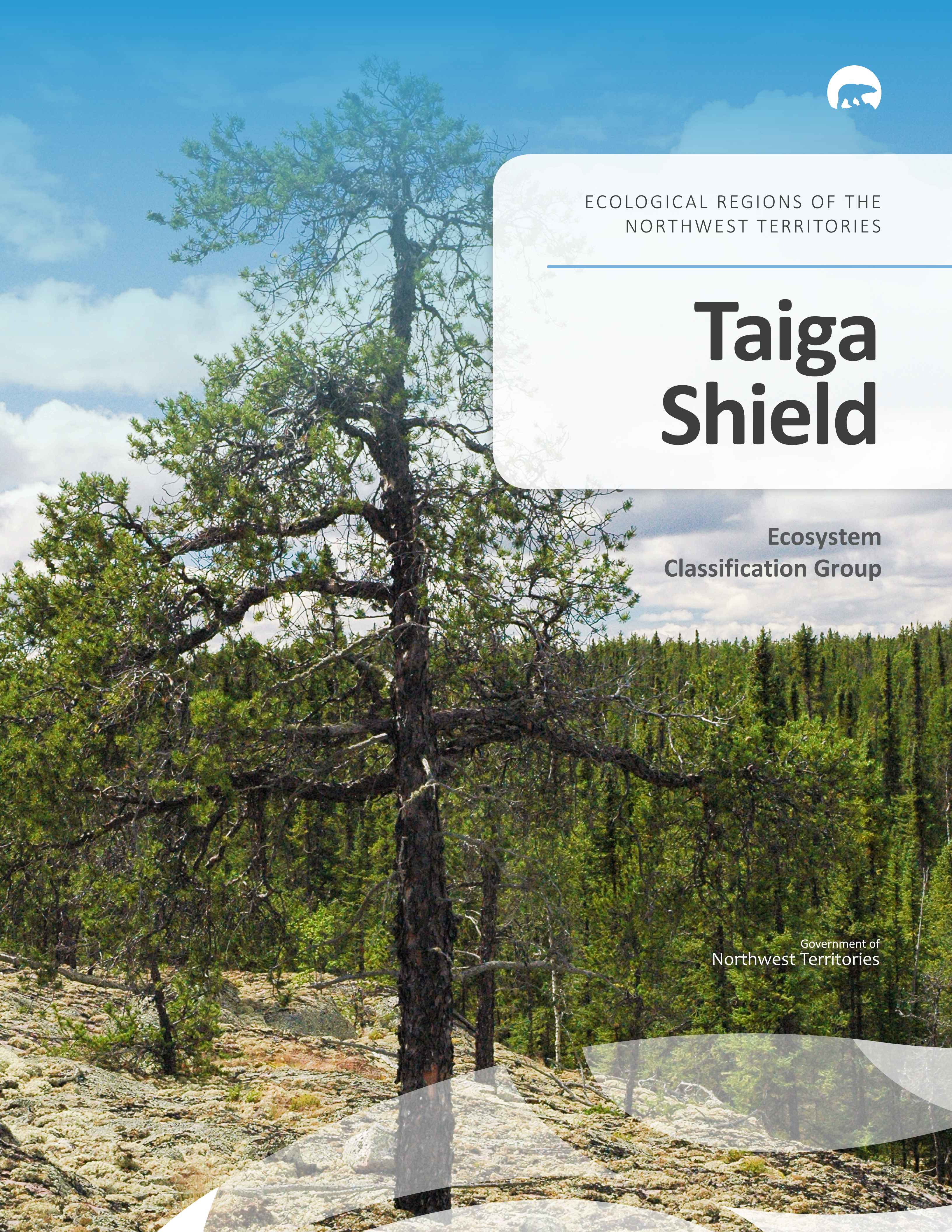

ECOLOGICAL REGIONS OF THE NORTHWEST TERRITORIES

Taiga Shield

Ecosystem Classification Group

Government of
Northwest Territories

Department of Environment and Natural Resources
Government of the Northwest Territories

2008

ECOLOGICAL REGIONS OF THE
NORTHWEST TERRITORIES

TAIGA SHIELD

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Web Site: http://www.enr.gov.nt.ca

For more information contact:
Department of Environment and Natural Resources
P.O. Box 1320
Yellowknife, NT X1A 2L9
Phone: (867) 920-8064
Fax: (867) 873-0293

About the cover: The small digital images in the inset boxes are enlarged with captions on pages 24 (*Taiga Shield High Subarctic (HS) Ecoregion*), 44 (*Taiga Shield Low Subarctic (LS) Ecoregion*), 66 (*Taiga Shield High Boreal (HB) Ecoregion*) and 78 (*Taiga Shield Mid-Boreal (MB) Ecoregion*). Aerial images and main cover image: Dave Downing, Timberline Natural Resource Group. Ground images and plant images: Bob Decker, Government of the Northwest Territories.

Document images: Except where otherwise credited, aerial images in the document were taken by Dave Downing, Timberline Natural Resource Group, and ground-level images were taken by Bob Decker, Government of the Northwest Territories.

Members of the Ecosystem Classification Group

Dave Downing	Ecologist, Timberline Natural Resource Group, Edmonton, Alberta.
Bob Decker	Forest Ecologist, Forest Management Division, Department of Environment and Natural Resources, Government of the Northwest Territories, Hay River, Northwest Territories.
Bas Oosenbrug	Habitat Conservation Biologist, Wildlife Division, Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, Northwest Territories.
Charles Tarnocai	Research Scientist, Agriculture and Agri-Food Canada, Ottawa, Ontario.
Tom Chowns	Environmental Consultant, Powassan, Ontario.
Lane Feschuk	GIS Specialist, Timberline Natural Resource Group, Edmonton, Alberta.

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Four of the report's co-authors (from left to right, Bob Decker, Bas Oosenbrug, Charles Tarnocai and Dave Downing), with James (Jim) Peterson (far right) who passed away on April 15, 2008. We are grateful for his hospitality, good-natured humour and knowledge of the Point Lake area. This photo was taken on the last day of the 2006 field survey (August 1, 2006) at Point Lake, Northwest Territories.
Photo: Jim Archibald.

Preface

The Taiga Shield, the ancient bedrock heartland of northern Canada, arcs west from Labrador to the eastern shores of Great Bear Lake. The erosive forces of wind, water and ice have worn down what once were high mountain ranges a billion years ago to rolling bedrock that is blanketed in some areas by clay, sand, gravels and boulders sorted and deposited by receding glaciers. Lakes and rivers are a prominent feature of the Shield. Boreal and Subarctic climates that change from north to south and east to west are modified by bedrock and glacial landforms to produce diverse landscapes with distinctive vegetation and soil features.

Broad-scale vegetation cover and geological features provide, in part, the basis for defining and understanding the climatic and physiographic patterns that control vegetation and soil distribution. Both plant communities and soils develop in response to *abiotic factors* such as latitude, elevation and parent materials that affect temperature, moisture, light and nutrient conditions, and *biotic factors,* for example, competition between species, or individual species tolerances to climatic conditions. The relative influence of each factor at any place in the landscape is determined by the interaction of atmospheric and landscape attributes – climate, topography, parent materials and biotic elements – all acting over time, as described by Major (1951) and Jenny (1941) for vegetation and soils, respectively. These attributes can be delineated and represented as abstract ecological map units and may be described at various scales.

At the global scale, the *Biome* or *Vegetation Zone* is recognized (Walter 1979, Scott 1995, Commission for Environmental Cooperation 1997). At the national scale in Canada, *Ecozones, Ecoregions* and *Ecodistricts* are described (Ecological Stratification Working Group 1995). The Northwest Territories has modified the Canadian national scale and classification framework to match the multi-level continental ecosystem classification framework – *Ecological Regions of North America* – developed by the Commission for Environmental Cooperation in 1997. The Canadian and continental systems are outlined in Section 1 of this report.

The value of regional ecosystem classification systems as a foundation for sustainable resource management has been recognized since the 1960s in Canada. Ecosystem classifications provide a means of presenting and understanding biophysical patterns in a geographic context and a common basis for communication. The Government of the Northwest Territories has used the national ecosystem classification framework since 1996 as the basis for identifying candidate protected areas, forest management planning, wildlife habitat management and environmental impact assessment and mitigation. In 2004, in response to increasing development pressures in the Mackenzie River Corridor, the 1996 Taiga Plains Ecozone was evaluated. A series of workshops in 2004 – 2006 and an intensive survey of the entire Taiga Plains in 2005 led to significant changes to the 1996 map, and a revised map and report were produced in early 2007 (Ecosystem Classification Group 2007).

The same approach was followed in 2006 for the 1996 Taiga Shield Ecozone that borders the Taiga Plains to the east. A variety of spatial data sources including Landsat imagery, digital elevation models, hydrology, permafrost, bedrock and surficial geology, soils and interpolated climate models were brought together within a geographic information system. This information allowed participants to view landscapes and existing mapped ecosystem units from a number of different perspectives. A core element of the Taiga Shield classification was the detailed and comprehensive work done by S. W. Bradley, J.S. Rowe, C. Tarnocai and G.R. Ironside for the Lockhart River mapsheet (Bradley *et al.* 1982). Their map units, descriptive information and classification approach were used with a few modifications for about 60 percent of the Taiga Shield within the Northwest Territories.

Air and ground verification of the proposed changes was an integral part of the revision process. In the summer of 2006, an intensive float plane and helicopter survey was undertaken throughout the entire Northwest Territories Taiga Shield between the Northwest Territories – Nunavut border, the Northwest Territories – Saskatchewan border, the eastern boundary of the Taiga Plains, and the southern boundary of the Southern Arctic (tree line). Over 25,000 km of transects were flown and a detailed and large-scale record of landscape features was captured in over 15,000 geographically referenced digital images accompanied by text commentaries; site, vegetation and soil information was also collected from 44 ground plots. Both the photographs and thematic maps derived from the commentaries proved to be indispensable for the revision process.

This report and the accompanying map (Appendix 4) provide a summary of ecoregions within the Taiga Shield. Better spatial information and an improved understanding of climate and landscape patterns and processes through intensive aerial surveys have resulted in the delineation of 25 Level IV[1] ecoregions within the Taiga Shield, compared with four described by the Ecological Stratification Working Group in 1995.

The report integrates currently available information about climatic, physiographic, vegetation, soil and wildlife attributes to characterize each of the ecoregions within the Taiga Shield in a format that is suited to both technical and non-technical users. For this purpose, it has been organized into four sections.

- Section 1 defines the continental ecosystem classification framework as applied to the Taiga Shield and its relationship to the national classification system that is applied across much of Canada. The climatic and physiographic factors that exert major influences on landscapes are also discussed.
- Section 2 provides further details on the methods employed in the review and refinement of the 1996 Canadian Ecological Framework towards the *Ecological Regions of North America* framework.
- Section 3 describes the Level II Taiga Shield Ecoregion and the four Level III ecoregions and 25 Level IV ecoregions occurring within it.
- Section 4 describes the mammals and birds found in the four Level III ecoregions.

The report concludes with a list of cited references, common and scientific names of plants mentioned in the text (Appendix 1), a summary of dominant vegetation and flora from Bradley *et al.* (1982) (Appendix 2), a summary of changes from the 1996 mapped version of Ecozones and Ecoregions for the Taiga Shield to the current version (Appendix 3), a page-size map and legend for the Taiga Shield (Appendix 4) and a glossary of useful terms (Appendix 5). A larger foldout map (scale = 1:1,500,000) of the Taiga Shield Ecological Regions is provided in a map pocket at the back of printed copies of this report.

[1] Ecoregion definitions are provided in Section 1.

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Section 1: Concepts, Climates, and Landscapes

1.1 Introduction

This section explains the system that classifies the Northwest Territories into ecologically meaningful units based on climate, physiography and vegetation patterns. Section 1.2 provides an overview of the North American continental ecosystem classification system, a comparison to the related Canadian framework, and its application to the Northwest Territories. Section 1.3 reviews mapping concepts, including the practical aspects of applying the ecosystem classification scheme to the Northwest Territories. Section 1.4 explains how climatically distinct regional land areas are delineated (Level III ecoregions, defined in Section 1.2.3). Section 1.5 explains how these regional areas are divided into units characterized by vegetation and physiography (Level IV ecoregions, defined in Section 1.2.4), how units are named, and how they are described.

1.2 Classification Framework

The recognition that climate and landforms influence biotic processes differently from place to place and at all scales encouraged the development of an integrated climate and landform-based ecosystem classification approach in Canada; this system has been under development since the 1960s. The Subcommittee on Biophysical Land Classification (Lacate 1969) developed the first nationally applied multi-level definition of landscapes using these criteria. The Canada Committee on Ecological Land Classification (CCELC) was formed in 1976 and the Ecoregions Working Group was established shortly afterwards. The mandate of this working group was to develop the concept and hierarchy for the *Ecoclimatic Regions of Canada* (Ecoregions Working Group, 1989). The CCELC further defined classification elements and the methods for mapping them (Wiken and Ironside 1977); CCELC developed a multi-level classification framework, shown in Table 1 (Marshall *et al*. 1996; Commission for Environmental Cooperation 1997).

From 1996 to early 2006, this national scheme was employed to delineate and describe ecosystem units within the Northwest Territories (Ecological Stratification Working Group 1995; Downing *et al*. 2006). Subsequent discussions with other experts in Canada and the United States in 2006 indicated the value of integrating the Northwest Territories ecosystem classification framework with the continental *Ecological Regions of North America*[2], and ecosystems of the Taiga Plains and the Taiga Shield are described as units within that classification.

Like the Canadian system, the North American continental framework is a multilevel, nested system for delineating and describing ecosystems; the Government of the Northwest Territories uses this information for planning and reporting purposes. Currently, the top four levels of the continental framework as applied to the Taiga Shield of the Northwest Territories are Level I ecoregions, Level II ecoregions, Level III ecoregions and Level IV ecoregions.

1.2.1 Level I Ecoregions

North America includes 15 broad, Level I ecological regions (ecoregions) that provide the backdrop to the ecological mosaic of the continent, and provide context at global or intercontinental scales (Commission for Environmental Cooperation 1997). These ecoregions are similar in scale and scope to the global *biomes* (e.g., Walter 1979) and are mapped at a scale of about 1: 50,000,000. There are three Level I ecoregions within the Northwest Territories. The Taiga Ecoregion and Northwestern Forested Mountains Ecoregion occupy the area between the 60th parallel and tree line. The Tundra Ecoregion occurs north of tree line. The Level II Taiga Shield Ecoregion lies entirely within the Level I Taiga Ecoregion.

1.2.2 Level II Ecoregions

Level II ecoregions are useful for national and sub-continental overviews of physiography, wildlife, and land use (Commission for Environmental

[2] Further information available at the Commission for Environmental Cooperation website: http://www.cec.org/files/pdf/BIODIVERSITY/eco-eng_EN.pdf and http://www.epa.gov/wed/pages/ecoregions/ecoregions.htm

Cooperation 1997). They are more or less equivalent to the Canadian *ecozone*, defined as "areas of the earth's surface representative of large and very generalized ecological units characterized by interactive and adjusting abiotic and biotic factors … the ecozone defines, on a sub-continental scale, the broad mosaics formed by the interaction of macro-scale climate, human activity, vegetation, soils, geological, and physiographic features of the country." (Ecological Stratification Working Group 1995). They are nested within Level I ecoregions and are represented at a scale of between 1:5,000,000 and 1:10,000,000.[3] There are currently 18 Level II ecoregions within Canada and eight Level II ecoregions within the Northwest Territories.

Level II ecoregions in the Northwest Territories span a broad range of climatic and physiographic conditions. Boundaries are recognized by major changes in physiography (e.g., the well-defined bedrock boundary between the Taiga Plains and the Taiga Shield Ecoregions) and/or climate (e.g., the change from cold continental climates in the Taiga Shield Ecoregion to very cold polar climates in the Southern Arctic Ecoregion).

1.2.3 Level III Ecoregions

Level III ecoregions are approximately equivalent to the Canadian *ecoprovince* (Ecological Stratification Working Group 1995) or *ecoclimatic region* (Ecoregions Working Group 1989). In this document, Level III ecoregions are characterized by regional climatic differences as defined at the ecoclimatic region level in *Ecoclimatic Regions of Canada* (Ecoregions Working Group 1989). The Level III ecoregion framework recognizes four major climatic divisions within the Level II Taiga Shield Ecoregion, and provides an organizing framework within which Level IV ecoregions having similar climatic regimes can be logically discussed. Level III ecoregions are mapped at a scale of 1:2,000,000 to 1:5,000,000; there are currently 62 Level III ecoregions in Canada and 17 Level III ecoregions in the Northwest Territories. There are four Level III ecoregions within the Taiga Shield. In Section 1.4, these ecoregions are named and their climatic attributes are briefly discussed; more details are provided in Section 3.

1.2.4 Level IV Ecoregions

Level IV ecoregions are subdivisions of the Level III ecoregions. They are characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soil, water and fauna (Marshall *et al.* 1996). Level IV ecoregions have been variously defined, depending on the landscape and the classification objectives, as "total landscape ecoregions" (physiography – vegetation), "habitat ecoregions" (wildlife habitat – vegetation – physiography), "soil ecoregions" (soil – vegetation) or "ecoclimatic ecoregions" (ecologically effective macroclimate as expressed by vegetation) (Ecoregions Working Group 1989).

The degree to which climate, physiography, vegetation and soils can be used to define a particular ecoregion depends on its geographic location and the information available. Although climate data have been collected at only two stations within the Northwest Territories Taiga Shield for a long enough period to be useful, there is sufficient information to delineate and describe Level III and Level IV ecoregions according to climatic, terrain and biological criteria. Bradley *et al.* (1982) have described and mapped vegetation, soil, bedrock and surficial geology in sufficient detail to adequately describe many of the Level IV ecoregions. Other information sources include existing surficial geology maps, good-quality satellite imagery, terrain models, properly geo-referenced digital photographs and observed relationships between climate and climate surrogates such as permafrost and wetland forms, forest cover, tree species distribution and climatic conditions. Level IV ecoregions are usually represented at a scale of 1:250,000 to 1:1,500,000. There are 25 Level IV ecoregions within the Taiga Shield.

[3] At the scales of mapping *at each level* of the ecoregion hierarchy, the smallest mapping unit is about two square centimeters; this is usually the smallest area that reasonably represents a significant difference between adjacent map units.

Table 1. Northwest Territories classification framework and comparison to Canada's National Classification Framework, the latter modified from Marshall *et al.* (1996).

Northwest Territories/Continental Ecosystem Classification	Canadian Ecosystem Classification Equivalent	Description
Level I Ecoregion *(Taiga)*	**Ecoclimatic Province** (Ecoregions Working Group 1989) – parts of the Boreal and Subarctic Climatic Ecoprovinces	*Global – Continental:* Scale 1:50,000, 000. Equivalent to global biomes. Used as the first level of stratification for international planning and management initiatives.
Level II Ecoregion *(Taiga Shield)*	**Ecozone**	*Territorial – National*: Scale 1:30,000,000. Subdivision of global biomes. Used for national state-of-environment tracking.
Level III Ecoregion *(High Subarctic, Low Subarctic, High Boreal, Mid-Boreal)*	**Ecoprovince** (Canada Committee on Ecological Land Classification) or **Ecoclimatic Region** (Ecoregions Working Group 1989, Bradley *et al. 1982*)	*Regional*: In the Northwest Territories (Taiga Shield), Level III ecoregions are defined by regional climatic differences within Level II ecoregions. Equivalent to Ecoclimatic Regions defined in *Ecoclimatic Regions of Canada* (Ecoregions Working Group 1989). Scale 1:2,000,000 – 1:10,000,000.
Level IV Ecoregion (25 in Taiga Shield, nested within each of four Level III ecoregions above)	**Ecoregion** (**Ecodistricts** of Bradley *et al.* 1982**)**	*Regional*: Broad recurring vegetation and landform patterns within a regional climatic framework. In the Northwest Territories, physiographic characteristics (e.g., plains, hill systems) and geographic features (e.g., major rivers or lakes) are combined to subdivide Level III ecoregions into Level IV ecoregions. Scale 1:250,000 – 1:1,500,000.
No current equivalent in continental system	**Ecodistrict**	*Subregional:* Subdivisions of an ecoregion based on distinctive landform differences. Ecodistricts, ecoregions and ecozones are defined for all provinces and territories in Canada in the national system. In the Northwest Territories, the ecodistrict might be equivalent to one Soil Landscape (SLC) polygon (refer to Section 1.2.5 for discussion), or might include two or more SLC polygons. Scale 1:50,000 – 1:250,000.
	Ecosection	*Subregional:* More specific delineation of recurring landform and vegetation patterns, usually with reference to major community type groups or soil subgroups. Typically represented as complexes. Used for regional and subregional integrated resource planning. An SLC polygon with vegetation attributes linked to physical characteristics could be regarded as an ecosection. Scale 1:20,000 – 1:50,000.
	Ecoelement	*Local:* Scale 1:20,000 –1:50,000. May be mapped at the operational level ("ecosites", "site series") for example, forest resources inventory.
	Ecosite	*Local:* Scale <1:10,000. Usually a single vegetation type on a single soil type and site, but could be complexed in boreal landscapes. Employed where very detailed information is required (e.g., detailed pre-harvest assessments, special features delineation).

1.2.5 Further Divisions of Level IV Ecoregions

Two additional classification levels form part of the ecosystem classification framework in the Northwest Territories. The *ecodistrict* is a finer physiographic subdivision of the Level IV ecoregion, and provides the framework within which climatic models were developed (Agriculture and Agri-Foods Canada 1997); these climatic models are further discussed in Section 1.4. Ecodistricts and Level IV ecoregions may also include one or more smaller units. "*Soil Landscapes of Canada (SLC) polygons*" are described by a standard set of attributes such as surface form, slope class, general texture and soil type, water table depth, permafrost and lake area. SLC polygons may contain one or more distinct soil landscape components and may also contain small but highly contrasting inclusion components. The location of these components within the polygon is not defined.

Neither the ecodistrict nor the SLC level of classification is presented in this report or on the map. Ecodistrict units do, however, provide general climatic information, and SLC map units provide information that is used to describe the parent geologic materials, soils and wetland/upland proportions within each Level IV ecoregion. SLC polygons are an element of the digital coverage from which the Taiga Shield ecosystem classification was generated. The ecodistrict and SLC levels of classification are generally represented at scales of about 1:50,000 to 1:250,000.

1.2.6 Long-term Value of the Taiga Shield Ecosystem Classification

The 2008 Taiga Shield ecosystem classification is a reasonable approximation of Northwest Territories biophysical patterns given the climatic and biophysical information available at the time of publication. It is based partly on past climatic trends that are not necessarily representative of future trends (refer to Section 1.4.1). It is likely that current ecological classification concepts will change in response to new information, climate change, improved analytical techniques, and revised viewpoints on how national and global classifications ought to be presented. This document and the accompanying map will serve both as a framework for current resource management and as a benchmark against which future ecosystem changes can be assessed.

1.3 Mapping Concepts and Landscape Descriptions

The classification scheme adopted for the Northwest Territories and presented in Section 1.2 (Table 1) illustrates how landscapes are logically divided into nested units that reflect the ecological relationships between climate, topography, parent materials and biota. The approach starts with the largest landscape complex (Level I global to continental scale). Level II, III and IV ecoregions are nested within these, and are recognized as discrete units by vegetation and landform patterns at increasingly large scales. Level III and Level IV ecoregions cover areas of hundreds to thousands of square kilometres and encompass considerable complexity. The spatial delineation and description of any of these units depends on the mapper's concept of what constitutes an ecologically meaningful pattern and the information available to support this conclusion.

The mapping process is therefore inherently subjective, and mapped units and their descriptions are based on the best empirical information available at the time, a reasonable compromise between differing viewpoints, and the acknowledgement that map units are abstract representations of real-world landscapes. For example, boundaries between Level I, II and III ecoregions are shown as sharp lines on a map or in a GIS database, but are not always so well defined in nature. Clearly visible features such as the Taiga Shield – Taiga Plains bedrock interface are readily observed and mapped, but where climatic differences are the boundary criterion, boundaries between map units are more correctly viewed as broad transition zones perhaps tens of kilometres in width.

Despite the conceptual nature of ecosystem classification, an explicit and logical system can be developed through the application of consistent rules for mapping, naming and describing units. The criteria for mapping discrete units are provided in Sections 1.2, 1.4 and 1.5, and are further explained where appropriate in Section 3.

1.4 How Level III Ecoregions are Defined

The Taiga Shield includes four major Level III ecoregions, each influenced to different degrees by climatic factors discussed below in Section 1.4.1 and summarized in Table 2; a map of Level III and Level IV ecoregions in the Taiga Shield is provided in Appendix 4. Although climate patterns have been modeled at the ecodistrict level (Agriculture and Agri-Foods Canada 1997), only two long-term stations within the Northwest Territories portion of the Taiga Shield are available to calibrate the model. Level III ecoregions have therefore been defined with reference to certain landscape and vegetation features that are considered to be representative of climatic regimes (Section 1.4.2). The analyses published by Bradley *et al.* (1982) for the Lockhart River Mapsheet provided valuable insights into the landscape and vegetation features particularly in the southern half of the Taiga Shield within the Northwest Territories. The Agriculture and Agri-foods Canada ecodistrict climate model was used as a general check on the validity of the conclusions.

The four Level III ecoregions occurring in the Taiga Shield are, from north to south, the Taiga Shield High Subarctic (HS) Ecoregion, the Taiga Shield Low Subarctic (LS) Ecoregion, the Taiga Shield High Boreal (HB) Ecoregion and the Taiga Shield Mid-Boreal (MB) Ecoregion. These Level III ecoregions are matched to the Ecoclimatic Regions defined by the Ecoregions Working Group (1989) and to the ecoregions defined by Bradley *et al.* (1982) for the Lockhart River area. The field surveys conducted in 2006 helped to refine these boundaries. Climate, soil and vegetation characteristics of these ecoregions are summarized in Table 2 with reference to these features. Representative examples of permafrost, wetland and forest cover features within each Level III ecoregion from north to south are shown in Figures 5 through 15.

1.4.1 Climatic Factors

Climate can be generally defined as the cumulative long-term effects of weather, involving the processes of heat and moisture exchange between the earth and atmosphere. In the Northwest Territories, climate is affected by several factors. The interaction of these factors produces climatic zones (Level III ecoregions) that are recognizable by certain landform and vegetation patterns.

Climates throughout the Northwest Territories are profoundly influenced by several factors.

- **Latitude**
  As latitude increases, the incident angle of the sun's rays decrease. For example, in Fort Smith at the southern limits of the Taiga Shield in the Northwest Territories (latitude 60°13'N) at mid-day on December 21, the sun is 6.3 degrees above the horizon. On the same day at the northern limits of the Taiga Shield (top of Hornby Bay on Great Bear Lake (latitude 66°11'N) the sun is only 0.4 degrees above the horizon. Figure 1 is a conceptual view of relative sun angles at these two locations on June 21 and December 21. A decrease in sun angle produces a corresponding decrease in the amount of solar energy that is further reduced by the longer passage the sun's rays must take through the atmosphere at higher latitudes; less photosynthetic energy is available to plants. Figure 2 shows the decrease in average daily global solar radiation (the amount of radiation incident at the top of the atmosphere[4]) with increase in latitude, modeled from Ecodistrict Climate Normals provided by Agriculture and Agri-Foods Canada (1997). The amount of incident solar radiation also influences the annual temperature regime of an area; Figure 3 shows how mean annual temperature decreases with increasing latitude.

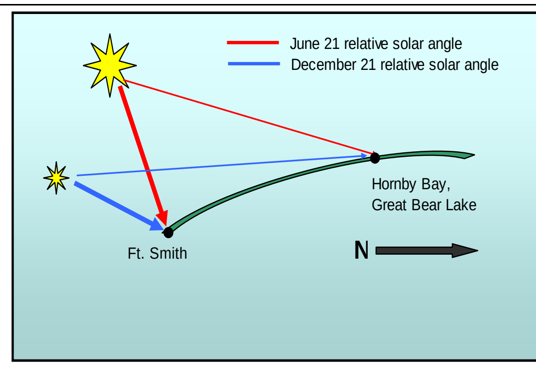

Figure 1. Relative sun angles at different locations at the winter and summer solstice.

- **Albedo**
  Albedo is defined as the ratio of the amount of solar radiation reflected by a body to the amount incident on it, commonly expressed as a percentage (Klock *et al.* 2000). Coniferous forest cover has a low albedo, and reflects about nine percent of incident sunlight (Eugster *et al.* 2000), whereas snow and ice

[4] This amount exceeds the solar radiation incident at the ground surface for various reasons, including particulate matter and clouds in the atmosphere, and the albedo of incident surfaces.

cover reflect considerably more incident sunlight. Extensive ice-covered areas (e.g., Great Slave and Great Bear Lakes that do not become completely ice-free until June) increase albedo, as does cloud cover. The interaction of low solar inputs and high albedo produce the array of permafrost and vegetation features distributed across the Taiga Shield.

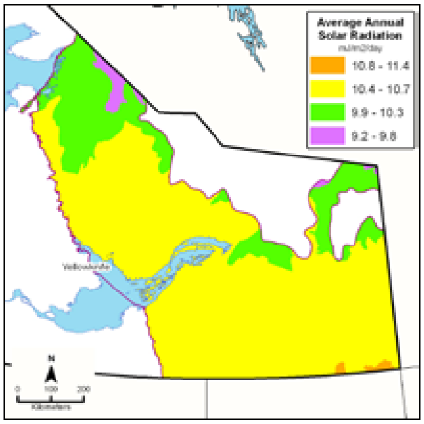

Figure 2. Decreasing average annual solar radiation with increasing latitude in the Taiga Shield (units are mJ/m^2/day).

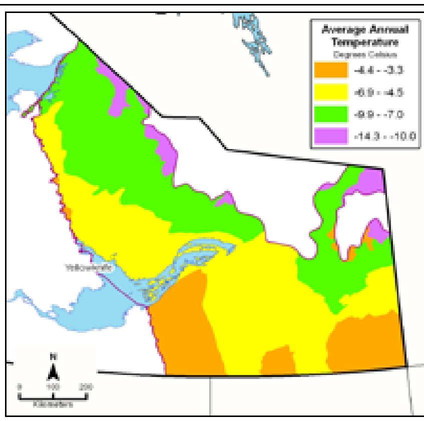

Figure 3. Decreasing average annual temperature with increasing latitude in the Taiga Shield (units are degrees Celsius).

- **Regional and global circulation patterns**
Tundra regions are dominated by a cold dry Arctic air mass, whereas the northwestern boreal forest is more influenced by the warm moist Pacific air mass (Bryson 1966). General north to south circulation patterns in the atmosphere redistribute heat, without which arctic and subarctic regions would experience a net annual energy loss. They also redistribute moisture. The flow aloft is determined by two features: an upper low that is usually over the central Arctic Islands during the summer and that intensifies and moves to northern Foxe Basin during the winter; and the Aleutian Low/Pacific High. The northwesterly flow aloft in winter holds cold Arctic high pressure systems across the Northwest Territories and often drives these systems south into the Prairies (Klock *et al.* 2000).

- **Topography**
Climatic models show a general decrease in mean annual precipitation with increasing latitude, (Figure 4). Mountain ranges across Alaska, the Yukon and the Northwest Territories strip much of the moisture from frontal systems, and together with the lower water-holding capacity of cold air, results in lower mean annual precipitation at higher latitudes.

Regional elevational trends together with latitude appear to have some influence on temperature regime. The terrain rises in a stepwise fashion east and northeast of Great Slave and Great Bear Lakes; above about 300 mASL, features characteristic of the colder High Subarctic ecoclimate occur, such as polygonal peat plateaus and patterned ground. The relict white spruce forests of the Thelon Valley occur north of a higher-elevation treeless plain, and probably developed under more favourable temperature conditions in lower valley positions (Bradley *et al.* 1982; Timoney 1995).

- **Lake effects**
The climatic effects of Great Bear Lake and Great Slave Lake, the largest and fifth largest freshwater lakes entirely within Canada, respectively, likely affect regional climates, because they have a huge capacity to store heat. They melt slowly in spring, and the lake waters remain cold during the summer; consequently, the lower atmosphere is stable, inhibiting cloud formation and allowing more solar radiation to strike the lake surface and heat the water. The cold lake waters also control air temperatures, limit the amount of daytime heating on lands adjacent to the larger lakes, and consequently affect vegetation and permafrost development. In the fall and winter, there is a slow release of stored heat compared to the much more rapid release experienced by thousands of smaller lakes; freeze-up often does not occur until late November, and atmospheric instability as a result of liberated heat leads to high evaporation and precipitation[5]. Non-forested lowlands are also found on the downwind side of large lakes, where cold winds blowing across the ice create a tundra-like microclimate (Scott 1995).

[5] Further information at: http://www.usask.ca/geography/MAGS/Achievement_e.html

- **Climate change**

  Northern environments are highly sensitive to climate change (Eugster *et al.* 2000). Zoltai (1995) presents evidence indicating that permafrost zones were considerably further north 6,000 years ago in the Holocene Warm Period than they are at the present time. Woo *et al*. (1992) suggest that mean annual surface temperatures may increase by 4°C in Northern Canada in future; Tarnocai *et al*. (2004) indicated that the depth of thaw penetration into permafrost is sensitive to past temperature change and has responded measurably to recent major climatic events. Bradley *et al.* (1982) suggest that some landscape features considered diagnostic of subarctic climates in the Taiga Shield could be relicts of past climates. Northern ecosystems have historically been highly dynamic and will undoubtedly continue to be so. This ecosystem classification should be viewed as the present-day representation of a dynamic Arctic – boreal system and a useful benchmark against which to compare future environmental states.

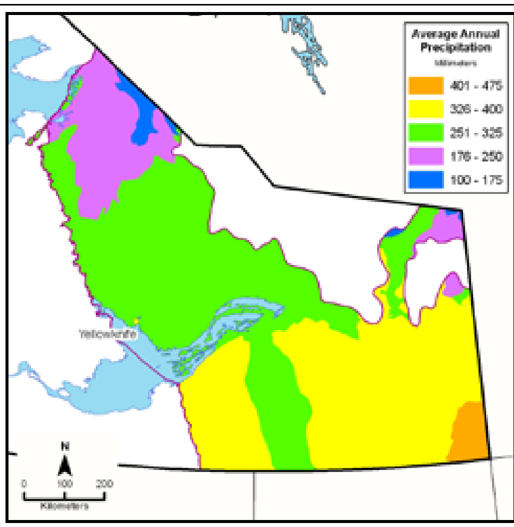

Figure 4. Decreasing mean annual precipitation with increasing latitude in the Taiga Shield (units are mm).

1.4.2. Landscape Features

Level III ecoregions are defined by permafrost and vegetation characteristics that indicate climatic influences (Table 2), along with basic GIS-derived information such as total land and water area and elevation ranges. Regional geologic and hydrologic features are also useful descriptors.

The landscape features most useful for differentiating Level III ecoregions in the Taiga Shield are those visible on Landsat images, augmented by aerial digital photographs taken at known locations (refer to Section 2 for a discussion of methods). Bradley *et al.* (1982) referenced permafrost features, forest cover (tree distribution, composition and growth form), and wetland types in their classification of the Lockhart River area; field observations in 2006 confirmed these features as useful across the remainder of the Taiga Shield within the Northwest Territories.

Permafrost features include peat plateaus, polygonal peat plateaus and patterned ground (nonsorted circles and earth hummocks). Forest cover features include canopy composition (e.g., jack pine forest, trembling aspen – white spruce mixed-wood forest, black spruce – lichen forest) and canopy closure (open vs. closed canopy). Trembling aspen and jack pine[6] indicate climatic trends by their presence or absence. Tree form and distribution of black and white spruce indicate the relative severity of low and high subarctic climates. Other indicators referenced by Bradley *et al.* (1982) include the extent of black and yellow lichen cover on uplands, the width and areal extent of shore fens and floating fens and the presence and abundance of variegated pond lily colonies in shallow water areas. The above-listed permafrost features are defined in the glossary of terms (Appendix 5). Some of the features useful for detemining the approximate boundaries between Level III ecoregions are shown in Figures 5 through 15.

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[6] The production of viable jack pine seeds is significantly influenced by climate at the northern limits of the species range, and at least three growing seasons with sufficiently high temperatures are required for the successful maturation of viable jack pine seeds (Despland and Houle 1997).

Table 2. Climate and landscape characteristics of four Level III Ecoregions within the Taiga Shield, Northwest Territories.

Distinguishing Characteristic	**Level III Ecoregion**			
	Taiga Shield High Subarctic (HS)	*Taiga Shield Low Subarctic (LS)*	*Taiga Shield High Boreal (HB)*	*Taiga Shield Mid-Boreal (MB)*
Temperature regime [1,2]	Very short, cool summers; frost common except in July and August; very cold winters, mean annual temperature minus 4°C to minus 9°C.	Short, cool summers, very cold winters, mean annual temperature minus 3.5°C to minus 9°C.	Short, cool summers, very cold winters, with persistent snow cover; mean annual temperature minus 3°C to minus 6°C.	Warm, moist summers; very cold and snowy winters; mean annual temperature minus 3°C to minus 4°C.
Precipitation patterns [1,2]	Average annual precipitation 270-390 mm, summer-high precipitation pattern	Average annual precipitation 230-430 mm; summer-high precipitation pattern.	Average annual precipitation 280-360 mm; summer-high precipitation pattern.	Average annual precipitation 330-360 mm; summer-high precipitation pattern.
Relative insolation [1]	10-11 $mJ/m^2/day$.	10-11 $mJ/m^2/day$.	10.5-11 $mJ/m^2/day$.	10.5-11 $mJ/m^2/day$.
Characteristic permafrost features, peatlands, and soils[3]	<u>Widespread permafrost, continuous near the boundary with the Level III Southern Arctic Ecoregion.</u> Patterned ground and nonsorted circles are the most common permafrost forms, with polygonal peat plateaus in wet depressions. Shore fens and floating fens are uncommon and limited in extent. Permafrost depth 30 cm. Cryosols are the dominant soils, with Brunisols on coarse-textured materials.	<u>Widespread permafrost</u> Organic landforms are limited in extent because terrain is hummocky to rolling bedrock or thin bouldery till. Peat plateaus are the most common permafrost-affected peatland type; shore fens and floating fens also occur, but are less extensive than in the Mid-Boreal and High Boreal ecoclimatic regions. Soils are Brunisols on mineral soil or Organic and Organic Cryosolic soils in peatlands.	<u>Discontinuous permafrost</u>. Organic landforms are not common because terrain is hummocky to rolling bedrock or bouldery till. Common peatland types are peat plateaus, peat palsas, floating fens and shore fens. There are no polygonal peat plateaus or patterned ground. Brunisols, Organic soils and Organic and mineral Cryosols are common soils.	<u>Discontinuous permafrost</u>. Peat plateaus occupy hollows within and between bedrock exposures, with permafrost at greater than 60 cm, and with large collapse scars. No polygonal peat plateaus or patterned ground. Common peatland and wetland types include peat plateaus, palsas, floating fens and shore fens. Brunisols, Organic soils and Organic Cryosols are common soils; Luvisols are associated with lacustrine deposits.
Characteristic forest cover[3]	Open, usually stunted black and white spruce woodlands, the latter species associated with somewhat more nutrient-rich soils. At the northern boundary with the Southern Arctic (Low Arctic) ecoclimatic region (defined by <u>tree line</u>), trees occur in small stands only along lakeshores, lower slopes, eskers and gullies. Jack pine and trembling aspen are absent.	Open, low-growing black spruce forests with lichen and shrub understories are dominant. Jack pine stands are less extensive than in the Mid-Boreal or High Boreal ecoclimatic regions.	Young jack pine stands are common on recently burned outwash and bedrock; elsewhere, closed black spruce stands with lichen and shrub understories are dominant; paper birch or dwarf birch regeneration on recent burns.	Closed-canopied mixed-wood forests of aspen, white spruce and jack pine, the latter dominant on coarse-textured outwash, eolian deposits, till and fractured bedrock.
Other distinguishing features[3]	Lichen-dominated till plains are characteristic of the northeastern portion of the Taiga Shield HS Ecoregion.	At the Low Subarctic – High Subarctic boundary, hilltops and islands in lakes are treeless and vegetated by shrub tundra communities.	The increasing occurrence of aquatic plants, particularly variegated pond lily in shallow lakes, is associated with High Boreal and Mid-Boreal ecoclimatic regions on the Taiga Shield.	The higher vigour and diversity of upland and wetland communities in the Mid-Boreal ecoclimatic region readily distinguishes it from the High Boreal ecoclimatic region.

[1] Data generalized from *Canadian Ecodistrict Climate Normals* (Agriculture and Agri-Foods Canada 1997)
[2] Information obtained from *Ecoclimatic Regions of Canada* (Ecoregions Working Group 1989)
[3] Information obtained from Bradley *et al.* (1982, Table 1) and 2006 field observations.

Figure 5. In the Level II Southern Arctic Ecoregion, treeless tundra prevails. This highland area east of the Thelon River shows frost-patterned ground (polygonal cracks) on the tops of till drumlins; the black and yellow tones are produced by a carpet of lichens, and the green areas between the drumlins are sedge – shrub wetlands with thin peat layers.

Figure 6. Nonsorted circles are common across the Taiga Shield in the Taiga Shield HS Ecoregion. They are indicative of cold climates with active permafrost where frost action pushes boulders, gravels and finer soils upward. The light-coloured tones are frost-heaved mineral soil; the green tones are shrubs.

Figure 7. The broad boundary between the Level II Southern Arctic Ecoregion and the Taiga Shield HS Ecoregion is defined by tree line, south of which tree growth begins. Trees are often restricted to sheltered locales, such as this shallow valley where they are afforded some protection from icy winter winds and where well-drained bouldery and sandy soils provide suitable growth conditions.

Figure 8. Treeless polygonal peat plateaus occur in low, wet areas throughout the Taiga Shield HS Ecoregion and the northern parts of the Taiga Shield LS Ecoregion. The brownish colouration indicates eroding peat surfaces, due to melting permafrost and drier conditions on the polygons; Bradley *et al.* (1982, p. 133) regard this trend as indicative of climate change.

Figure 9. A typical landscape in the Taiga Shield HS Ecoregion shows sparse spruce woodlands on hillsides, lower slopes and valleys and tundra on hilltops and exposed slopes.

Figure 10. The transition from the Taiga Shield HS Ecoregion to the Taiga Shield LS Ecoregion is marked by a change from treeless to treed hilltops, denser tree growth, and the appearance of shoreline aquatic vegetation (narrow light green bands around lakes).

Figure 11. Peat plateaus with scattered trees, lichen-covered palsas underlain by permafrost (gray tones), and collapse scars where the permafrost has melted and sedge – cotton-grass fens have developed (brownish tones), are common throughout the Taiga Shield LS Ecoregion. They are not as extensive as peat plateaus in the Taiga Plains LS Ecoregion.

Figure 12. Forest cover in the Taiga Shield LS Ecoregion tends to be continuous, but the density of trees is dependent on the proportion of exposed bedrock. Lightning-caused fires become more frequent because the incidence of convective storms increases with warmer summers and because forests are dense enough to burn over large areas.

Figure 13. The bright green hues of young jack pine stands are a dominant feature of the Taiga Shield HB Ecoregion. Jack pine reproduction and growth is more vigorous in the warmer High Boreal climates, and lightning-caused fires frequently burn huge areas.

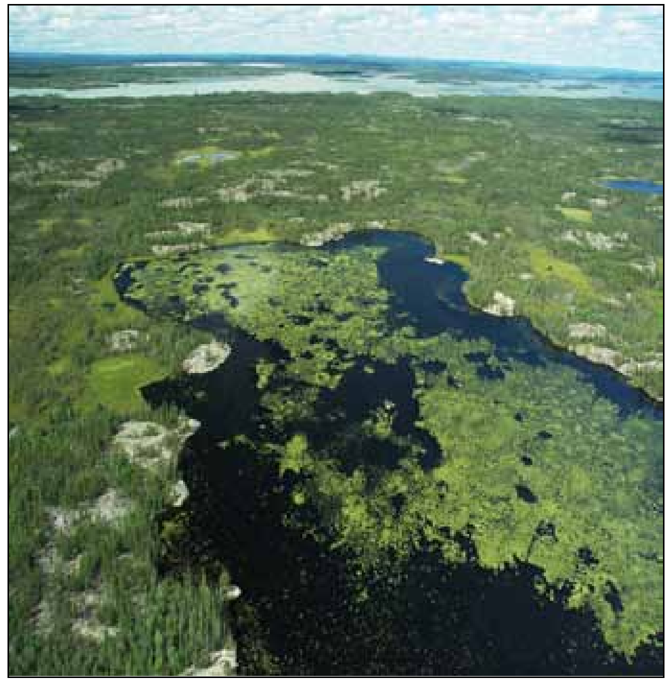


Figure 14. Emerald green floating and shore fens and dense colonies of variegated pond lily growing in shallow ponds are easily seen features that help to distinguish the warmer Taiga Shield HB Ecoregion from the colder Low Subarctic ecoregions to the north and east. Wetlands such as these are most extensive where there are lacustrine or alluvial deposits, such as the low-elevation terrain between Great Slave and Great Bear Lakes.

Figure 15. The Taiga Shield MB Ecoregion is the only Ecoregion that has extensive stands of pure trembling aspen (light green tones), mixed-wood forests of trembling aspen and white spruce and tall, dense white spruce forests (dark tones). It is differentiated from the Taiga Plains Slave Lowland MB Ecoregion to the west by the occurrence of Precambrian bedrock outcrops (light pinkish-tan tones in foreground), on which jack pine, black spruce and paper birch grow.

1.5 How Level IV Ecoregions are Defined

Level IV ecoregions are the most detailed mapped units presented in this report. Each ecoregion is consistently named with reference to three descriptive components:

- **First component –** geographic location, usually defined by a feature of local or regional significance, such as a lake, river or landform;
- **Second component –** one of five landform types (hills, lowlands, plains, uplands, valley); and
- **Third component –** the ecoclimate, expressed as a two-letter code following the naming conventions outlined in *Ecoclimatic Regions of Canada* (Ecoregions Working Group 1989)[7]. This component also indicates its linkage with the Level III ecoregion within which it occurs.

For example, the Slave Plain MB Ecoregion occurs on the low-elevation complex of bedrock, lacustrine and alluvial deposits east of the Slave River, and is the only Level IV ecoregion in the Level III Taiga Shield Mid-Boreal (MB) Ecoregion. The Radium Hills LS Ecoregion occurs on pronounced bedrock exposures along the southeast shore of Great Bear Lake and is one of 10 Level IV ecoregions in the Level III Taiga Shield Low Subarctic (LS) Ecoregion.

Level IV ecoregions are defined by vegetation, soil and landform characteristics that, taken together, differentiate one ecoregion from another. The *reference site* is the vegetation – landform – soil combination that succinctly describes the central concept of a Level IV ecoregion. It is conventionally regarded as a site with "deep, well- to moderately well-drained, medium-textured soils, with neither a lack nor an excess of soil nutrients or moisture, and neither exposed nor protected from climatic extremes" (Strong and Leggat 1992; Ecoregions Working Group 1989). Sites meeting these criteria are considered to reflect the regional climate. For example, in the Slave Plain MB Ecoregion, a reference site would be associated with trembling aspen and mixed trembling aspen – white spruce stands on deep, moderately fine-textured soils of average moisture and nutrient status.

Level IV ecoregions are influenced by different factors depending on geographic location, and this definition of reference site does not always fit well with the most commonly occurring vegetation – landform – soil combination. For example, in the bedrock-dominated Radium Hills HS Ecoregion in the northwest corner of the Taiga Shield, deep, medium-textured soils are uncommon. The most commonly occurring vegetation – landform – soil combinations there are black spruce and lichen on thin soils over bedrock and rock lichen communities on bare bedrock exposures.

The five landforms that constitute the second component of ecoregion names in the Taiga Shield have definite associations with landscape position, topographic variability, parent materials and probable hydrologic processes, all of which modify the effects of regional climates. These landforms are described in alphabetical order below.

- *Hills* are prominences rising generally no more than about 500 m above the surrounding areas. They may have gentle to abrupt slopes; slope steepness and aspect along with bedrock substrates near or at the mineral soil surface can strongly influence vegetation development. Drainage patterns are well developed relative to those of the surrounding lowlands. In the Northwest Territories Taiga Shield, this term is used to name ecoregions that are higher than the surrounding terrain and that often have distinctive bedrock features.
- *Lowlands* are lands of low relief at the lower levels of regional elevation; they receive water inputs from adjacent higher terrain. They are typically imperfectly- to poorly-drained, have a high coverage of wetlands, and are nearly level; slightly elevated areas that support upland forests are subject to flooding in wet years. There may be extensive areas of exposed bedrock that are generally of low relief.
- *Plains* are extensive, typically level to hummocky areas. They differ from lowlands because they are not necessarily at lower elevations in the regional sense and because they tend to have more topographic variation.
- *Upland* is a general term for an area that is higher than its surroundings — sometimes several hundred metres higher — but that is not a plateau. Uplands usually have undulating to hummocky terrain, a higher coverage of well-drained sites than lowlands or plains, and a lower coverage of wetlands.
- *Valley* includes any low-lying area bounded by uplands, hills or plains and traversed by a river.

[7] The "Subhumid" descriptor for High Boreal and Mid-Boreal ecoclimates as described in *Ecoclimatic Regions of Canada* was dropped for the sake of brevity, but is implied.

Section 2: Methods

2.1 Introduction

The 2008 Taiga Shield ecosystem classification was developed through a consultative process that involved representatives from the Government of the Northwest Territories, Environment and Natural Resources (ENR) and the Government of Canada (Agriculture and Agri-Food Canada). Revisions to the classification system were based upon previous concept development work applied to the Level II Taiga Plains Ecoregion (Ecosystem Classification Group 2007) and an ecosystem classification framework provided by Bradley *et al.* (1982).

The revision process employed a variety of spatial data sources including Landsat imagery, digital elevation models, hydrology, permafrost, bedrock and surficial geology, soils and interpolated climate models that were displayed on a common base within the ESRI ArcGIS 9.1® geographic information system platform. This provided an efficient way to view landscapes from various perspectives, a process that would have been much more challenging in 1996 when the Ecological Stratification Working Group developed the first ecosystem classification. Air and ground verification of the proposed changes was an integral part of the revision process. Section 2 presents in general terms the GIS processes and data employed, the field data collection methods, and the process by which concepts, GIS-based data and field information was integrated to produce the final map and report.

2.2 GIS Processes

2.2.1 Information Assembly

ESRI ArcGIS® 9.1 was the principal GIS software used to manage the spatial datasets. All datasets were transformed to a common projection (Lambert Conformal Conic, NAD 83 Datum) and maintained in an ArcGIS® 9.1 Geodatabase. Other software packages used to create and manipulate spatial data were ArcInfo® 8.3 (Unix), ArcInfo® 9.1 (PC) and ArcView® 3.2. A brief description of spatial themes is provided below.

Soil Landscapes of Canada

The initial ecoregion framework for this project was the Soil Landscapes of Canada spatial database as modified by ENR using the Soil Carbon Digital Database of Canada. This dataset was supplied as a polygon shapefile.

Digital Elevation Model (DEM)

This dataset is derived from Canadian Digital Elevation Data (CDED) files and consists of an ordered array of ground elevations at regularly spaced intervals. The source digital data for CDED at a scale of 1:250,000 are extracted from the hypsographic and hydrographic elements of the digital National Topographic Data Base. This dataset was supplied by ENR as a TIFF file with a ground resolution of 125 metres.

Ecoclimatic Regions of Canada

The Ecoclimatic Regions of Canada Digital Database consists of an ArcInfo coverage with associated Polygon Attribute Table.

Ecological Classification of the Lockhart River Map Area

The map units (ecodistricts) presented by Bradley *et al.* (1992) that were also part of the 1995 National Ecoregions and Ecodistricts polygon database were incorporated in the Taiga Shield coverage.

Peatlands

Peatlands of Canada digital map and database information was extracted directly from Tarnocai *et al.* (2005).

Satellite Imagery

Digital Landsat 7 ETM imagery was supplied by Environment and Natural Resources (ENR) as 3 band geoTIF orthorectified images in 543 band combination. The imagery was acquired during the months of June through September from 1999 to 2002. For some areas where ENR images were not available, Landsat 7 Orthorectified Imagery over Canada, Level 1 was downloaded from GeoBase® (http://www.geobase.ca).

2.2.2 Map Production and Database Update

All map products were created with ArcGIS® 9.1, utilizing the extensions 3D Analyst™ and Spatial Analyst™ for 3D surface visualization and analysis. Using these tools and the 125 metre raster DEM, several new feature themes were created:

- Contours at 25, 50 and 100 metre intervals;
- Hillshade raster themes of various sun angles and directions; and
- Vertical exaggeration of datasets to enhance surface variations in the landscape.

Two map products formed the basis for ecoregion analyses:

1) DEM theme maps consisting of a hillshade raster overlaid with 100 metre contours, SLC polygons and base features (hydro, transportation); and

2) Landsat 7 maps with 100 metre contours, SLC polygons and base features (hydro, transportation).

Each of these two basic theme maps could then be overlaid with any other theme as required. The general working map scale was 1:500,000. Scales ranging from 1:100,000 to 1:750,000 were used as required.

Spatial and database updates to the modified SLC digital coverage were carried out in ArcGIS® ArcMap™. This environment provided the ability to incorporate various dataset file formats (vector, raster) and allowed for spatial editing based on the underlying themes.

2.3 Field Data Collection

An intensive aerial reconnaissance of the entire Taiga Shield within the Northwest Territories was undertaken in July and early August 2006. Representatives of Environment and Natural Resources (Government of the Northwest Territories), Agriculture and Agri-Food Canada, and Timberline Natural Resource Group participated. Flight lines were planned in advance to cover the area to the degree possible given aircraft and fuel supply limitations. The aerial survey spanned a total of 26 days, of which 25 days were suitable for flying. A Cessna 185 fixed-wing aircraft on floats was used for flights in early July; a Eurocopter AS350 B2 Astar rotary-wing aircraft was used for flights in mid-July to early August. Aerial traverses totalled over 25,000 km. A Hewlett-Packard® notepad computer with ArcPad® software was used for navigation. With this system, the planned flight lines, Landsat imagery and provisional ecoregion lines could be simultaneously viewed, and a Garmin CS76® global positioning system (GPS) unit with an external antenna provided real-time location information.

Information collected during aerial traverses included:

- Digital images, captured with a Nikon D70s® six megapixel single-lens reflex camera;

- Geographic locations (waypoints), collected at the same time as digital images using a Garmin CS76® GPS unit, along with track logs of the entire route; and

- Comments referenced to waypoint and digital photo numbers that included photo direction and free-form remarks about landform, vegetation, permafrost and other features.

Over 15,000 geo-referenced digital images were collected along with accompanying comments. On average, a geo-referenced image was collected and a comment recorded every two to three km, or about every 30 seconds.[8] Figure 16 shows the flight lines flown in July 2006; the Level III ecoregion theme is shown to illustrate transect coverage across each ecoregion. Level III ecoregions are described in Sections 1.4 and 3.4.

Approximately 60 ground stops were made, and plots were established at 44 of these stops where basic site, soil and vegetation information was collected, along with representative geo-referenced digital images. Most of the ground stops were made during helicopter traverses when access to more points was possible.

2.4 Post-field Data Review and Mapping

2.4.1 General Procedures

Digital images were organized by flight line and date to facilitate their use. All of the digital information themes outlined in Section 2.2 and Section 2.4.2 were brought together on the ArcGIS 9.1® platform and manipulated to produce different views of landscapes that provided insights into processes and patterns. In addition, the flight lines were overlaid on the thematic map layers and the digital images and associated comments were reviewed to develop a better idea of vegetation, permafrost and landform patterns than could be achieved with the other digital information alone. Ecoregion boundaries were finalized and ecoregion descriptions were completed with reference to the conceptual framework agreed upon by Territorial and Federal government representatives. On-screen line adjustments were made using software editing tools.

[8] The geo-referenced digital image location indicates the point at which the image was collected, not the image centre, as most of the images were collected in directions other than directly below the aircraft.

2.4.2 Information Sources Used to Describe Ecoregions

A number of standard information sources were consulted during preparation of the ecoregion descriptions and are briefly discussed below.

Geology and Geomorphology

Three Geologic Survey of Canada (GSC) maps and one Northwest Territories Geoscience Office map provided most of the information for the Taiga Shield; these included the *Glacial Map of Canada* (Prest *et al.* 1967), *Surficial Materials of Canada* (Fulton 1995), *Geological Map of Canada* (Wheeler *et al.* 1997) and the *Slave Craton: Interpretive Bedrock Compilation*; *Northwest Territories Geoscience Office* (Stubley 2005). Soil Landscape of Canada (SLC) polygon attributes provided further geomorphology information.

Soils

The Canadian System of Soil Classification (Soil Classification Working Group 1998) is the authority for soil nomenclature. Bradley *et al.* (1982) described soils within many of the Taiga Shield Level IV ecoregions in the southern and eastern part of the Taiga Shield., and Day (1972) described soils along the Slave River. Elsewhere, Soil Landscape of Canada (SLC) polygon delineations were used to determine typical soils within ecoregions.

Vegetation

Extensive detailed plot sampling was not undertaken during the field verification stage of the 2006 Taiga Shield program. Most vegetation descriptions are therefore very general, and have been compiled from information collected over a sparsely distributed plot network and digital photographs collected along aerial transects. Bradley *et al*. (1982) prepared lists of the dominant flora and vegetation for each of the High Subarctic, Low Subarctic, High Boreal and Mid-Boreal ecoclimatic regions; Appendix 2 provides a summary of species and vegetation community type lists and the conceptual vegetation – landscape relationships described in their report *An Ecological Land Survey of the Lockhart River Map Area, Northwest Territories*. The dominant vegetation types they described are referenced in many of the Level IV ecoregion descriptions.

Common and scientific vascular plant names used throughout this report generally follow *NWT Species 2006 – 2010* (Working Group on General Status of NWT Species 2006). A list of common and scientific plant names is provided in Appendix 1.

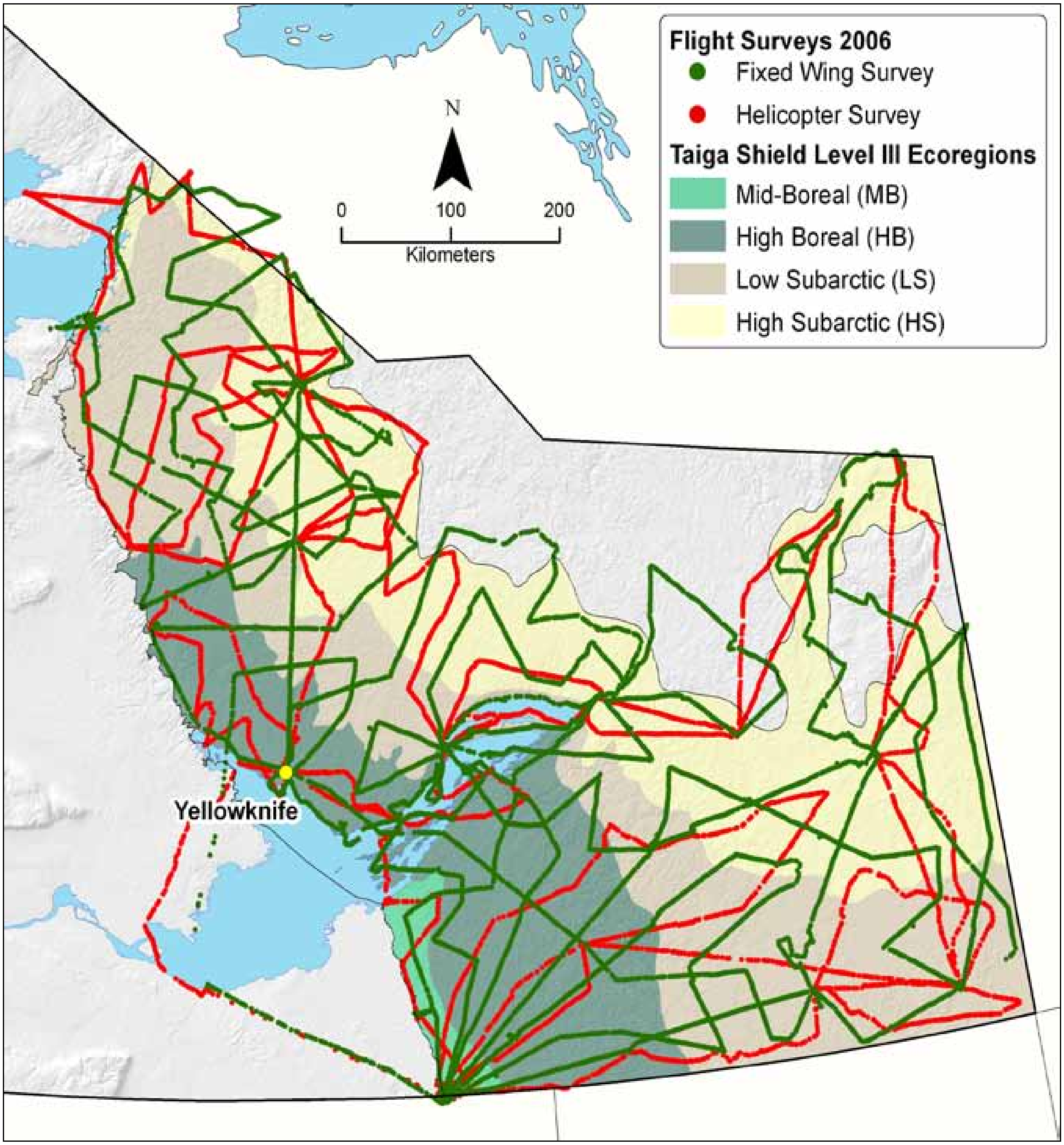


Figure 16. Transects flown during Julyand August 2006. Each red and green transect line is a series of dots; each dot indicates an individual digital photo location. A detailed map of the underlying Taiga Shield ecosystem classification is provided in Appendix 4 and descriptions are presented in Section 3.

Section 3: Level III and Level IV Ecoregions of the Taiga Shield

3.1 Introduction

The Level II Taiga Shield Ecoregion, four Level III ecoregions and 25 Level IV ecoregions are described in this Section. Section 3.2 provides an overview of the Level II Taiga Shield Ecoregion. Section 3.3 describes the relationship between the Taiga Shield and adjacent Level II Ecoregions. Section 3.4 presents detailed discussions of each Level III ecoregion and the Level IV ecoregions nested within them. The Level IV ecoregions are organized in approximately the order of their occurrence on the map, reading from top to bottom within each Level III ecoregion.

The map unit codes on the ecosystem classification map (Appendix 4) were determined in part by the existing framework of the continental *Ecological Regions of North America (*discussed in Section 1.2). The section numbers correspond to the map unit codes; for example, Section 3.4.1 presents attributes of the Level III Taiga Shield HS Ecoregion, and Section 3.4.1.1 presents attributes of the Level IV Radium Hills HS Ecoregion that is nested within the Taiga Shield HS Ecoregion.[9]

Map unit codes and section numbers are not sequential (i.e., 3.4.5 follows 3.4.1) because the intervening map unit code numbers (3.4.2, 3.4.3 and 3.4.4) are assigned to other Level III ecoregions in Quebec and Labrador in the continental *Ecological Regions of North America* framework. The 25 Level IV ecoregions are named and assigned section numbers and map codes as follows:

Taiga Shield High Subarctic (HS) Ecoregion (3.4.1)

3.4.1.1 Radium Hills HS
3.4.1.2 Coppermine Upland HS
3.4.1.3 Point Upland HS
3.4.1.4 Snare Plain HS
3.4.1.5 Mackay Upland HS
3.4.1.6 Thelon Valley HS
3.4.1.7 Whitefish Plain HS
3.4.1.8 Sid Plain HS
3.4.1.9 Dubawnt Plain HS

Taiga Shield Low Subarctic (LS) Ecoregion (3.4.5)

3.4.5.1 Radium Hills LS
3.4.5.2 Calder Upland LS
3.4.5.3 Camsell Plain LS
3.4.5.4 Great Slave Upland LS
3.4.5.5 East Arm Upland LS
3.4.5.6 Porter Upland LS
3.4.5.7 Wignes Plain LS
3.4.5.8 Abitau Upland LS
3.4.5.9 Dubawnt Plain LS
3.4.5.10 Selwyn Upland LS

Taiga Shield High Boreal (HB) Ecoregion (3.4.6)

3.4.6.1 Great Slave Upland HB
3.4.6.2 Great Slave Lowland HB
3.4.6.3 East Arm Upland HB
3.4.6.4 Rutledge Upland HB
3.4.6.5 Nonacho Upland HB

Taiga Shield Mid-Boreal (MB) Ecoregion (3.4.7)

3.4.7.1 Slave Plain MB

3.2 The Taiga Shield

The Level II Taiga Shield Ecoregion extends across Canada from Labrador west to the Northwest Territories, northern Saskatchewan and northeastern Alberta, and is part of the broad continental Level I Taiga Ecoregion. Within the Northwest Territories, the Taiga Shield covers 330,082 km^2, about 29 percent of the Northwest Territories continental or mainland land mass. It is dominated by the remnants of Precambrian mountains and volcanoes that have been eroded and polished by wind, water and ice over billions of years to form bedrock plains and rugged bedrock hill systems. Most of the bedrock is Archean (over 2.5 billion years old) or Paleoproterozoic (1.6 – 2.5 billion years old), and the oldest rocks on Earth occur near the Acasta River in the northwest corner of the Taiga Shield. Figure 17 shows the distribution of bedrock by age class across the Northwest Territories Taiga Shield.

Glaciers have covered most of the Taiga Shield, leaving behind extensive glacial till deposits that mantle the bedrock to the east and northeast and occur as discontinuous, usually bouldery till veneers elsewhere. Eskers are common especially in the eastern half of the Northwest Territories Taiga Shield and are the present-day evidence of fast-flowing glacial rivers that originated on or beneath the ice, transporting sands and gravels and depositing them in sinuous ridges tens of metres high and tens of kilometres in length. Part of Glacial Lake McConnell, an enormous postglacial lake that once covered much of the Taiga Plains, also flooded the shores

[9] The Level III unit names for the 2008 Northwest Territories Taiga Shield classification have been changed to incorporate climatic and physiographic factors. For example, unit 3.4.1 is labeled as the "Kazan River and Selwyn Lake Uplands" on the *Ecological Regions of North America* map, but as the "Taiga Shield High Subarctic (HS) Ecoregion" in the present ecological classification.

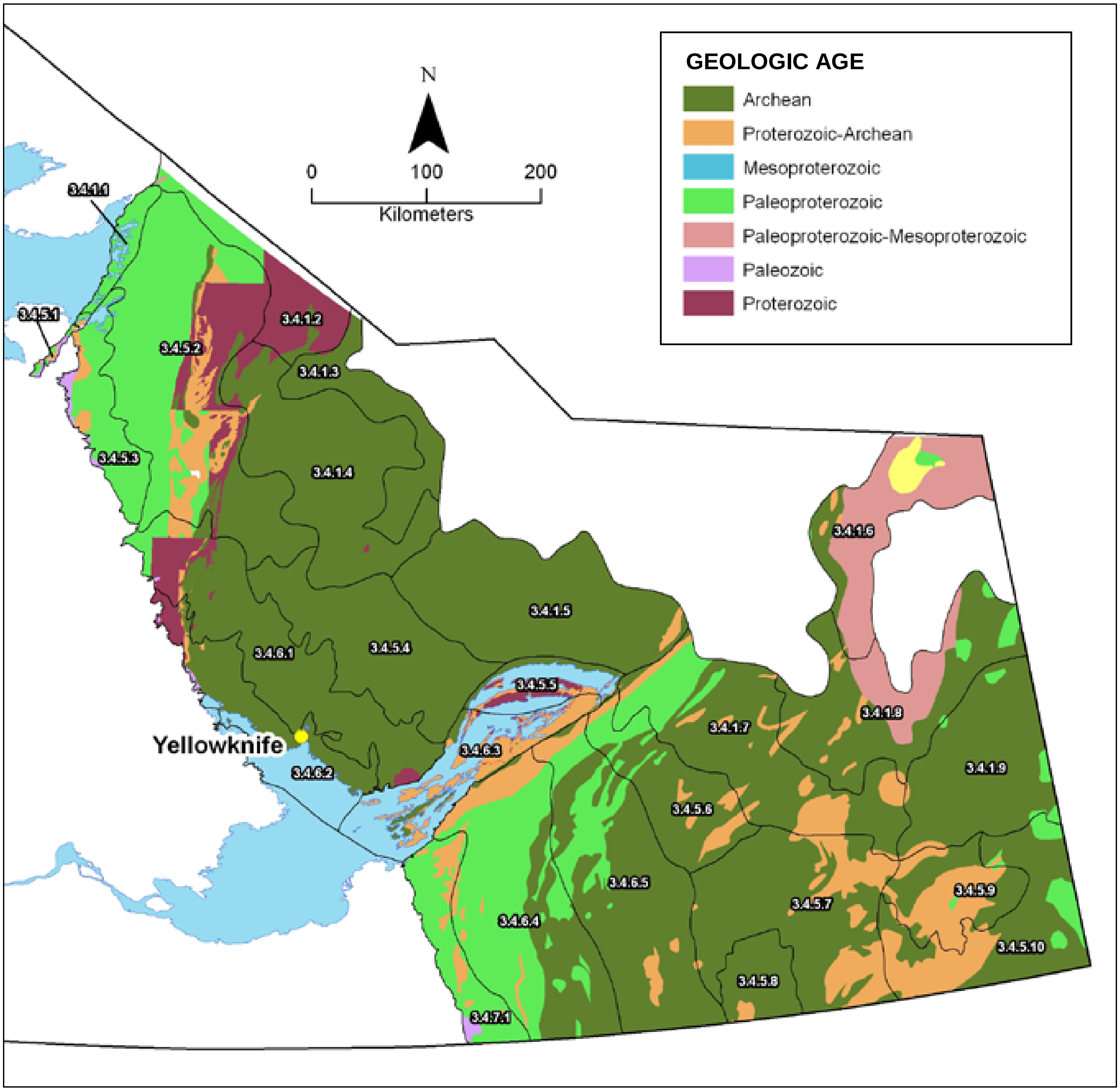


Figure 17. Bedrock geology of the Northwest Territories Taiga Shield showing major geologic age classes. (sources: Wheeler *et al.* 1997; Stubley 2005). Black lines are Level IV ecoregion lines; see Appendix 4 for Level IV ecoregion map codes and Section 3 for descriptions.

Archean: 2.5-4 billion years before present (BP);
Proterozoic – Archean complex: 544 million years – 4 billion years BP*;*
Mesoproterozoic: 1 – 1.6 billion years BP*;*
Paleoproterozoic: 1.6 – 2.5 billion years BP;
Paleoproterozoic – Mesoproterozoic complex: 1 – 2.5 billion years BP;
Paleozoic: <=544 million years BP;
Proterozoic: 544 million – 2.5 billion years BP.

of Great Slave Lake and surrounding Taiga Shield landscapes to a depth of almost 100 m above the current lake level. Glacial Lakes Thelon and Hyper-Dubawnt[10] similarly flooded extensive lowland Shield areas around the present-day Thelon River and Dubawnt Lake. Flowing glacial ice polished bedrock and left deep grooves, moulded till into elongated features (drumlins and flutings), and pushed frost-shattered bedrock into large boulder piles. Figure 18 shows the distribution of glacial landforms within the Northwest Territories Taiga Shield.

Nearly 200,000 lakes ranging in size from Great Slave Lake down to ponds less than 100 ha occupy the eroded and faulted landscapes of the Taiga Shield within the Northwest Territories. Most of the smaller lakes are isolated or are connected to others via small local drainage systems, but some of the larger lakes, such as Point Lake, Nonacho Lake and Artillery Lake, are part of regional drainage systems. The Taiga Shield drains to the Arctic Ocean via Great Slave and Great Bear Lakes and Canada's largest river, the Mackenzie River, and to Hudson Bay via the Thelon and Dubawnt River systems.

The Taiga is sometimes called "the land of little sticks", where long, cold winters and short cool summers limit tree growth and produce large areas of permanently frozen soil. Climate varies throughout the Taiga Shield for reasons described in Section 1, and four main climatic – physiographic divisions (Level III ecoregions) defined by vegetation and permafrost features occur within it. Timoney *et al.* (1993) described how plant species occurrence and community composition are strongly related to soil pH, moisture, texture and latitude. All tree species in the Taiga Shield are adapted to a fire environment and reproduce most successfully from seed on exposed mineral soil. Fire cycles described in the Beverly and Qamanirjuaq Caribou Management (1994) technical report are shorter in Mid-Boreal climates than they are in High Subarctic climates.

The Level III Taiga Shield Mid-Boreal (MB) Ecoregion has the mildest climates and occupies the extreme southwest corner of the Taiga Shield; permafrost is discontinuous to sporadic, and species-rich mixed-wood forests and wetlands are common on lacustrine deposits. Frequent fire cycles enable short-lived trembling aspen and paper birch to reproduce much more profusely as fire stimulates root and stump sprouting.

The Taiga Shield High Boreal (HB) Ecoregion is slightly cooler, occurring at somewhat higher elevations to the east of the Taiga Shield MB Ecoregion and at lower elevations bordering the north shore of Great Slave Lake and in the East Arm. Permafrost is discontinuous. Jack pine forests are extensive on coarse, nutrient-poor soils where intense crown fires 80 – 140 years apart maximize seed rain from serotinous cones that are retained in the crowns for decades and require heat for release.

The Taiga Shield Low Subarctic (LS) Ecoregion occupies the southeast quadrant of the Taiga Shield and the gentle step-like bedrock plateaus to the north and east of Great Slave Lake; permafrost features are common. Closed to open canopied slow-growing black spruce forests with low species diversity and a lichen-dominated understory are the dominant cover where soils are deep enough to support vegetation; rock lichen communities with scattered black spruce occur on exposed bedrock. Jack pine and trembling aspen are uncommon except in warm, well-drained locales. Fire patterns are usually characterized by low intensity surface burns with intervals exceeding 140 years. These conditions favour black spruce regeneration.

The Taiga Shield High Subarctic (HS) Ecoregion forms a wide crescent across the upper third of the Taiga Shield. Continuous permafrost indicated by features such as polygonal patterned ground is widespread. Black spruce is the dominant tree species, but its distribution is limited to favourable locations and treeless shrub or lichen-dominated tundra occupies much of the landscape. Fire intervals often exceed the normal lifespan of trees which require fire for successful regeneration. The areal extent of burns is strongly related to tree cover (Timoney and Wein 1991). Fires larger than 200 hectares are rare (Amiro *et al.* 2001). This regime favours white spruce which has the greatest longevity, and is more capable of invading small burns (Viereck 1973). Its seed withstands colder temperatures than other conifers (Frazer 1971, Black and Bliss 1980, Despland and Houle 1997) and it is often the dominant tree near tree line.

Soil development in the Taiga Shield is related to climate and to local moisture and drainage conditions. Brunisolic soils are widespread throughout the region, often on coarse-textured, well- drained soils. Regosolic soils have little or no horizon development and are associated with newly deposited materials, such as those found on river terraces; these soils are also distributed throughout the region. Gleysolic soils occur on imperfectly- to poorly-drained mineral soils and are most common adjacent to lakes and in low-lying areas. Cryosolic soils are perennially frozen and either affected by cryoturbation (Turbic Cryosols), or non-cryoturbated (Static Cryosols). In the Mid-Boreal and High Boreal ecoclimatic regions, they occur mainly with frozen peatlands (Organic Cryosols). Cryosols occur in both mineral and organic materials to the north as climates become colder.

[10] This name reference to the glacial lake surrounding present-day Dubawnt Lake was provided by Bradley *et al.* (1982).

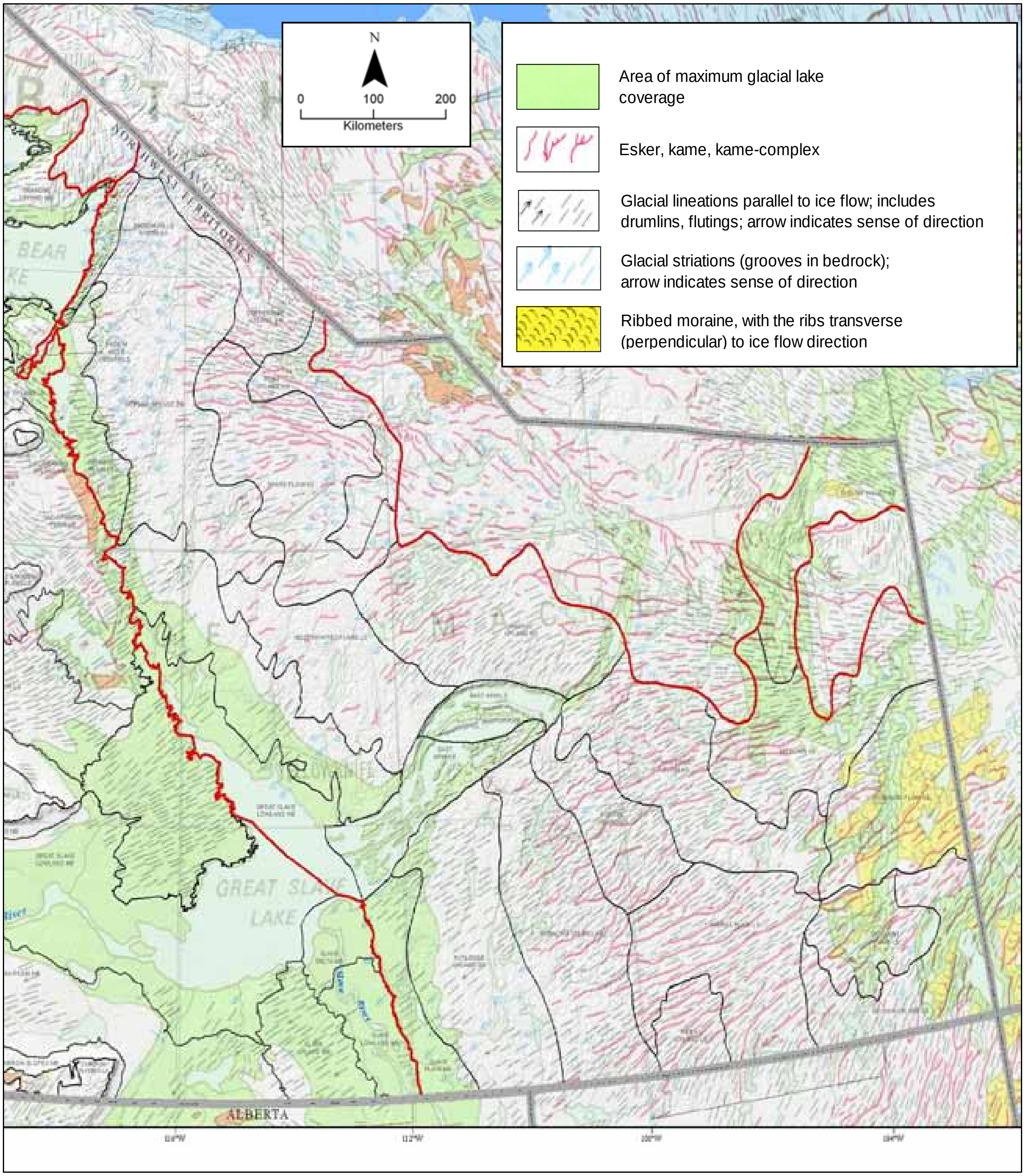


Figure 18. Glacial map of the Northwest Territories Taiga Shield**.** (source: Prest *et al.* 1967). Taiga Shield bounded in red. Black lines are Level IV ecoregion lines; see Appendix 4 for Level IV ecoregion codes and Section 3 for descriptions.

3.3 Relationship to Other Level II Ecoregions

The Taiga Shield in the Northwest Territories is surrounded by two Level II ecoregions; to the north lies the Southern Arctic Ecoregion and to the west, the Taiga Plains Ecoregion (Figure 19). The sharpest boundary lies between the Taiga Shield and Taiga Plains Ecoregions and is defined by the westward extent of Precambrian granites that are characteristic elements of the Taiga Shield. An abundance of small lakes, the tendency for drainage systems to be local rather than regional, and much less extensive peatlands are all related to bedrock-controlled Shield landscapes that contrast strongly with the adjacent Taiga Plains. Figures 20, 21 and 22 show the main differences in stream patterns, lake densities and peatland coverage, respectively, between the Taiga Plains and the Taiga Shield.

The Taiga Shield – Southern Arctic Ecoregion boundary is defined by tree line[11], north of which trees are usually restricted to isolated patches along rivers, on coarse-textured deposits and on south-facing slopes where the growing season is long enough to permit conifer survival. This boundary is somewhat arbitrary. In the northern half of the Taiga Shield High Subarctic (HS) Ecoregion, extensive treeless shrub and lichen tundra areas dominate the uplands, with small groves or open woodlands of black or white spruce in sheltered valleys and on lower slopes and lakeshores. In the southern half, there is a transition from patchy forests to more continuous stands.

3.4 Level III and Level IV Ecoregion Descriptions

Each Level III and Level IV ecoregion description in Section 3 begins with a one or two sentence overview statement and a summary outlining the distinguishing ecosystem characteristics. Climate statistics (mean annual temperature, mean temperatures of the warmest and coldest months, mean annual precipitation, wettest and driest months, mean annual daily solar radiation input, mean daily solar radiation input in June and December) are summarized at the Level III ecoregion level; for most Level IV ecoregions there is insufficient information to provide a meaningful summary. Where information is available, local climatic influences are discussed.

Within each Level III and Level IV ecoregion, the following attributes are described:

- Total area and elevation range (source: GIS spatial data);
- Area and size-class distribution of lakes and major rivers (source: GIS spatial data provided by Government of the Northwest Territories). Used to produce the bar chart included with each Level III ecoregion;
- Peatland areas (source: Peatlands of Canada 2005 produced by Tarnocai *et al.* 2005). Used to produce the bar chart included with each Level III ecoregion;
- General description of ecoregion characteristics;
- Discussion of geology and geomorphology, including dominant surficial landforms and parent material characteristics and underlying geologic features that influence ecosystems (sources: Soil Landscapes of Canada polygon attributes within ecoregions, surficial and bedrock geology maps and 2006 digital photographs and field observations);
- Discussion of soil features. Soils are only described to the Great Group level because this reflects the degree of reliability in the available data, and because Great Groups can be reasonably related to major physiographic features and drainage characteristics (sources: Bradley *et al.* 1982; Soil Landscapes of Canada polygon attributes within ecoregions; and 2006 field observations);
- Discussion of typical vegetation for the ecoregion (sources: 2006 digital photographs, a small sample plot dataset, and for many Level IV ecoregions, vegetation classifications provided by Bradley *et al.* (1982));
- Discussion of water and wetland features;
- Discussion of notable features (sources: Government of the Northwest Territories staff and 2006 digital photographs and field visits);
- Descriptive photographs are included with each ecoregion on facing pages.

Ecozones and Ecoregions of Canada descriptions (Ecological Stratification Working Group 1995) were reviewed and incorporated as appropriate.

A glossary of terms used within this report is provided in Appendix 5.

[11] Scott (1995) summarizes the work of several researchers; the commonly accepted definition of tree line is the boundary between tundra where trees do not take tree growth form and forest, where trees are typically over 3 m tall. The tree line as drawn by Timoney *et al.* (1992) was chosen as the boundary between the Taiga Shield Ecoregion and the Southern Arctic Ecoregion as it corresponded well with aerial observations made during the 2006 field survey.

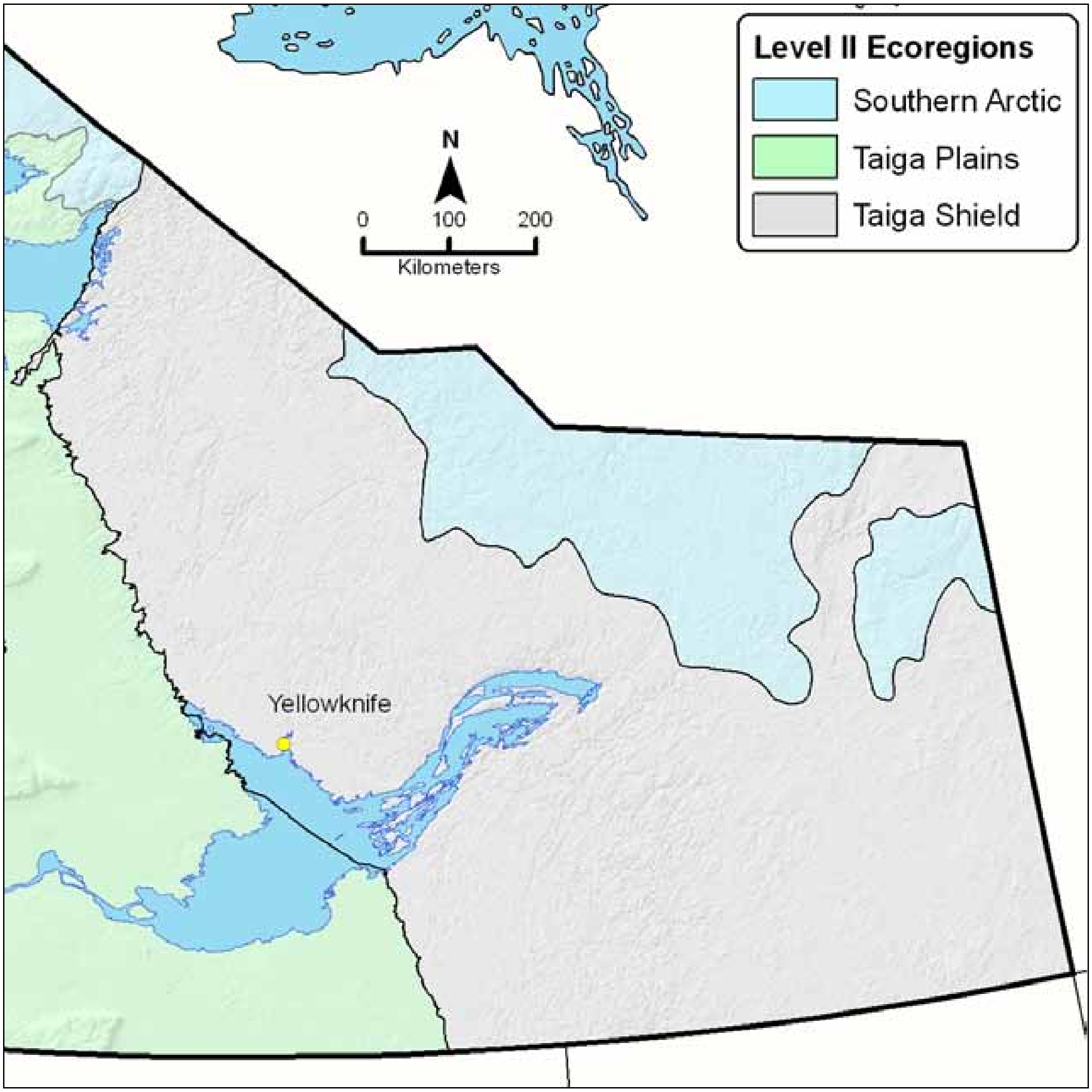


Figure 19. Taiga Shield and neighbouring Level II Ecoregions.

Figure 20. Stream pattern and density differences between Taiga Plains (left of orange line) and Taiga Shield (right of orange line), north arm of Great Slave Lake**.**

Figure 21. Lake density differences between Taiga Plains (left of orange line) and Taiga Shield (right of orange line), north arm of Great Slave Lake**.**

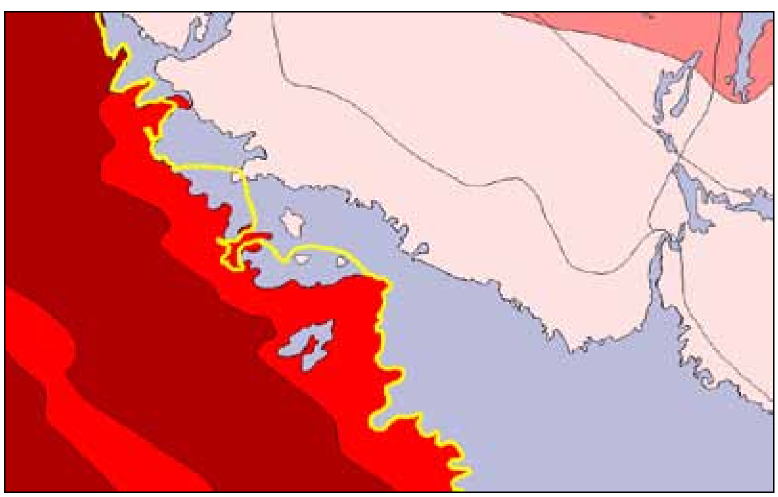


Figure 22. Peatland cover differences between Taiga Plains (left of yellow line) and Taiga Shield (right of yellow line), north arm of Great Slave Lake. (Source: Tarnocai *et al*. 2005). Light pink = <6% peatlands; red = >25% peatlands, dark red = >50% peatlands.

3.4.1 TAIGA SHIELD HIGH SUBARCTIC (HS) ECOREGION

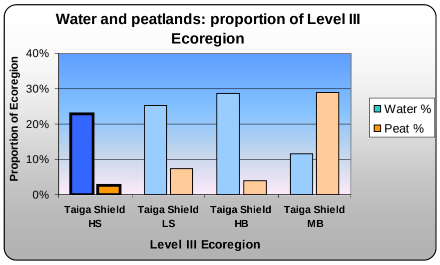
Till, outwash and bedrock parent materials in the Taiga Shield High Subarctic (HS) Ecoregion are forested by stunted and open white spruce, black spruce and larch woodlands with understories of ground birch, willow, northern Labrador tea, cotton-grass, moss and lichen. Very open white spruce woodlands with ground covers of bog cranberry, red bearberry, black crowberry, ground birch, moss and reindeer lichens are more typical of somewhat drier sites (above). Low shrub tundra consisting of ground birch and willow, along with mountain avens, lichen and cotton-grass tussocks is common on hilltops and higher elevation areas. The landscape is dotted with thousands of pothole lakes and numerous larger water bodies, and is crisscrossed by eskers and rivers. Cryosols and Brunisols are common soils, the latter associated with coarse-textured and/or well-drained surficial materials.

The narrow, widely spaced spires of stunted black and white spruce are typical of forested areas within the northwestern portion of the Taiga Shield HS Ecoregion. They have understories of ground birch, willow, bog cranberry, bog bilberry, shrubby cinquefoil, Arctic white heather, red bearberry, black crowberry, mosses and lichens. Bogs are usually treeless with ground birch, willow, bog cranberry and lichen cover. Sedge-dominated shore fens occur around the perimeters of shallow ponds.

Black crowberry (*Empetrum nigrum)* is a wide-ranging circumpolar species of tundra and forest. This low-growing, matted evergreen shrub is common in the Taiga Shield HS Ecoregion on sandy, gravelly and acidic soils. The shiny purplish-black berries are edible.

3.4.1 TAIGA SHIELD HIGH SUBARCTIC (HS) ECOREGION

Overview: *The Taiga Shield HS Ecoregion arcs across the northern third of the Taiga Shield. Landscapes are dominated by bedrock and discontinuous permafrost in the western half, and bouldery till blankets and sandy to gravelly outwash further east. Open spruce woodlands and polygonal peat plateaus are typical upland and wetland vegetation types.*



Total area: 124,262 km^2 (38% of Taiga Shield). Ecoregion shown in red.

General Description

The Level III Taiga Shield HS Ecoregion occupies the northern third of the Taiga Shield within the Northwest Territories; it is over 900 km from northwest to southeast and includes nine Level IV ecoregions. Its northern boundary with the Level II Southern Arctic Ecoregion approximates the tree line. Tundra cover on hilltops and islands, and nearly treeless polygonal peat plateaus distinguish this ecoregion from the Taiga Shield LS Ecoregion to the south. Landforms range from bouldery till plains and uplands in eastern parts of the Ecoregion to till veneers and fractured bedrock further west; outwash plains and eskers are common throughout. Open spruce woodlands on lower slopes and valleys, shrub tundra communities on upper slopes and hilltops and scattered polygonal peat plateaus and sedge marshes in low wet areas are common vegetation types.

Climate

There are no permanent, long-term climate data collection stations in the Taiga Shield HS Ecoregion. The climate is characterized as High Subarctic by the Ecoregions Working Group (1989) and Bradley *et al.* (1982) Polygonal peat plateaus are the dominant wetland form, nonsorted circles and patterned ground become common near the northern boundary, and increasingly suppressed tree growth to the north reflects a progressively shorter growing season, less available photosynthetic energy and more xeric soil moisture conditions (Timoney *et al.* 1993). Climatic statistics have been modelled over large areas using limited data from other areas; climate models at the ecodistrict level for that portion of the Taiga Shield within the Northwest Territories (Agriculture and Agri-Food Canada 1997) provide the following general statistics. The mean annual temperature ranges from –4 to –9^{o}C. The mean temperature in January, the coldest month, ranges from –27 to –30^{o}C, and from 13 to 16 ^{o}C in July, the warmest month. Mean annual precipitation is between 270 and 390 mm, with the wettest period in June through September; about 60 percent falls as rain and 40 percent as snow. The models indicate that conditions become colder and drier from southeast to northwest across the Ecoregion. The mean annual daily solar input (refer to Section 1.4.1 for further explanation) ranges between 10 and 11mJ/m^2/day, with low values of 0.6 to 1.1 mJ/m^2/day in December and highs of 21.5 to 22 mJ/m^2/day in June.

Topography, Geology, Soils, and Hydrology

The Taiga Shield HS Ecoregion is a complex of till plains and Precambrian bedrock outcrops. The Ecoregion reaches maximum elevations of over 500 m in the northwest, decreasing to elevations of less than 200 m in the Thelon Valley. Although local variations are generally less than 100 m, the terrain can be rugged in bedrock-dominated areas. Granitoid, intrusive and metamorphic bedrock plains and hills characterize the northwest third of the Ecoregion. Coarse-textured till veneers with bedrock outcrops occur in the central third; drumlinized and fluted, generally bouldery till plains with scattered bedrock outcrops are typical of the southeastern third. Outwash plains and esker complexes are common throughout the Ecoregion. Peatlands cover less than five percent of the Ecoregion, but numerous lakes occupy nearly a quarter of the total area. Permafrost is continuous along the northern boundary and discontinuous elsewhere. Soils are dominantly Brunisols (unfrozen) and Turbic Cryosols (perennially frozen, affected by cryoturbation. Minor occurrences of Organic Cryosols are associated with wetlands.

Vegetation

Tree line is determined by the interaction of climatic factors and local site conditions. Black spruce is less tolerant of cold climates than white spruce, but it is more tolerant of nutrient-poor conditions (Timoney 1995). Tree line plunges steeply southward across the Taiga Shield HS in response to the prevalence of nutrient-poor sandy parent materials, and the dominant tree species on poor sites is black spruce. At tree line, trees are restricted to sheltered locales and well-drained soils. Climatic variations over decades influence conifer seed production and seedling survival; vegetative reproduction and the shelter of established tree stands allow trees to persist or increase during unfavourable periods (Szeicz and MacDonald 1995). South of tree line, open, stunted spruce woodlands with lichen and shrub understories are typical of lower slopes and valleys; shrub and lichen tundra communities occupy upper slope and crest positions. Rock barrens account for a significant area in the northwest portion of the Ecoregion. Fires in the southern third of the Ecoregion have produced extensive areas of regenerating dwarf birch. Jack pine is absent from this Ecoregion, and trembling aspen occurs only as stunted individuals on south-facing slopes. Appendix 2 summarizes the major plant community types.

3.4.1.1 Radium Hills HS Ecoregion

Overview: *The Radium Hills HS Ecoregion rises sharply from the eastern shores of Great Bear Lake; steep, sparsely vegetated rock barrens, ancient beach ridges and deep fiords are its main features.*

Summary:

- High-relief Precambrian Shield bedrock hills with deep fiords.
- Sparse vegetation on thin soils and in bedrock fractures in upper slope positions, and open conifer forests and wetlands in lower slope positions and level areas.

Total area: 2,019 km^2 (1.6% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 350 (150-500)

General Description

The Radium Hills HS Ecoregion is a narrow spine of Precambrian bedrock rising high above the shores of Great Bear Lake and deeply dissected by steep-walled fiords. It averages 20 km wide and is about 150 km long from north to south, reaching a maximum elevation of 500 m at the north end. Its eastern border with the Calder Upland LS Ecoregion and Camsell Plain LS Ecoregion is clearly defined by a transition from rugged bedrock hills to bedrock plains. The cold waters of Great Bear Lake influence the local climate and vegetation. Forests or shrub communities are restricted to soil pockets in bedrock fractures or thin till veneers and wetlands are uncommon except in the far northern reaches of the Ecoregion.

Geology and Geomorphology

Volcanic and intrusive Precambrian bedrock makes up most of the Radium Hills HS Ecoregion. Low-elevation bedrock plains with thin lacustrine or till deposits in fractures or as veneers on bedrock are characteristic of the northernmost areas. The southern two-thirds has more rugged terrain, with hills exceeding 300 m. It is comprised of frost-fractured cliff faces, bouldery rubble and coarse glacial till on upper slopes. Fine-textured lacustrine and coarse-textured outwash veneers occupy lower slopes and depressions between bedrock outcrops. Gravelly and bouldery beach ridges well above the current lake level attest to the former depth of Glacial Lake McConnell and subsequent isostatic rebound that has elevated the old shorelines.

Soils

Coarse-textured Brunisols are the dominant soil group, and soil development is lacking on bedrock outcrops. Organic Cryosols occur in wet depressions.

Vegetation

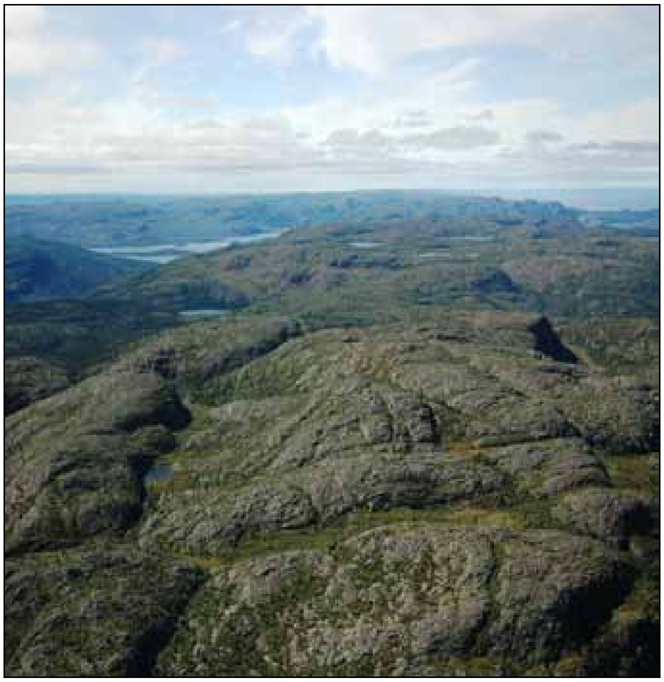
Vegetation cover within the Radium Hills HS Ecoregion is strongly controlled by parent material. Over much of the Ecoregion, exposed bedrock hilltops and upper slopes support mainly rock lichen communities; vascular plants (ferns and other herbs, mosses, shrubs and black or white spruce) are restricted to fractures or local depressions where sufficient moisture is available. Trembling aspen is uncommon, occurring as stunted groves on southerly slopes in the extreme south of the Ecoregion. In lower slope positions throughout the Ecoregion and on the bedrock plains in the northernmost part, open spruce – shrub woodlands with bilberry, mountain cranberry, black crowberry, common and red bearberry, dwarf birch, green alder, lichens and mosses occur as small patches of a few hectares in area. Peat plateaus, polygonal peat plateaus and horizontal fens with sedges, cotton-grasses, Labrador tea and other low shrubs develop in wet depressions.

Water and Wetlands

The Radium Hills HS Ecoregion is unique within the Taiga Shield because of the deep, cold fiords that dissect it. Wetland types are mainly small treeless polygonal peat plateaus and sparsely treed peat plateaus that are restricted to local wet depressions and cover less than five percent of the Ecoregion. In the northernmost corner, however, sedge and shrub dominated horizontal fens with thin peat layers are common and cover between 20 and 30 percent of the local area.

Notable Features

The cliffs and rugged terrain are used as nesting sites for several species of raptors including Bald Eagles, Golden Eagles, Peregrine Falcons and Rough-legged Hawks.



Most of the Radium Hills HS Ecoregion is a landscape of bedrock hills, deep fiords and very sparse vegetation.

The northern end of the Ecoregion is a bedrock plain with thin till or lacustrine veneers, open white spruce – dwarf birch woodlands, and wetlands (light green tones).

Stunted aspen groves (light green tones in centre of image) occur at the extreme south of the Ecoregion on south-facing till-covered slopes.

White spruce forests with scattered paper birch and an understory of common bearberry, juniper, common Labrador tea, green alder and water birch grow on thin tills on lower slope positions.

3.4.1.2 Coppermine Upland HS Ecoregion

Overview: *The Coppermine Upland HS Ecoregion is a complex of rolling bedrock hills, till plains and old lakebed and river sediments at the northernmost reaches of the Taiga Shield within the Northwest Territories.*

Summary:

- Till veneers and exposed bedrock in the northern half, with silty fluvial and lacustrine blankets and terraces along the Coppermine River.
- Open white spruce – shrub woodlands in sheltered locales and on valley slopes, polygonal peat plateaus and fens in depressions, and exposed treeless bedrock hilltops.

Total area: 7,873 km^2 (6.3% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 475 (325-550)

General Description

The Coppermine Upland HS Ecoregion is an undulating to rolling landscape of exposed Precambrian bedrock overlain by bouldery till blankets and veneers; in the south and along the Coppermine River, glaciofluvial and glaciolacustrine deposits are common. The Ecoregion extends eastward past the Northwest Territories – Nunavut boundary and would include uplands immediately adjacent the Coppermine River north to tree line. It has less exposed bedrock and more upland permafrost features than the adjacent Calder Upland LS Ecoregion at lower elevations to the west, and less exposed bedrock and bouldery tills than the Mackay Plain HS Ecoregion to the east. Glacial till, silty and calcareous lacustrine deposits and sandy outwash plains occur throughout, interspersed with gently rolling exposed bedrock. Treeless shrub-dominated plains and open mixed spruce woodlands usually occur on glacial deposits, with lichen communities on exposed bedrock. Polygonal peat plateaus and horizontal fens are common but not extensive wetland types.

Geology and Geomorphology

Precambrian sedimentary bedrock underlies much of the southern half of the Coppermine Upland HS Ecoregion. Intrusive and volcanic bedrock is predominant in the north half adjacent to the Nunavut border. Although bouldery till veneers and low rolling bedrock exposures are typical of most of the Ecoregion, there are thicker till blankets towards the southwest. Glaciolacustrine and glaciofluvial terraces and blankets occur along the Coppermine River valley. Small drumlin fields and striations in polished bedrock exposures indicate a northwest – southeast ice flow direction. Permafrost features including earth hummocks, nonsorted circles and patterned ground characteristic of the High Subarctic – Low Arctic transition are common throughout, but are especially evident on outwash deposits in the northern part. Glaciofluvial and glaciolacustrine deposits tend to be calcareous in this Ecoregion; this attribute is uncommon within the Taiga Shield.

Soils

Upland soils are permafrost-affected Turbic and Static Cryosols. Regosols and Brunisols are associated with recently deposited, well-drained alluvium. Organic Cryosols and Organic soils occur with polygonal peat plateaus and horizontal fens.

Vegetation

Open white spruce woodlands with an understory of mountain cranberry, red bearberry, dwarf birch, green alder, mosses and lichens occupy sheltered sites such as valley slopes and coarse-textured outwash materials that warm up quickly during the short growing season; the best forest growth is in the southern part, often in association with medium- to fine-textured soils on lower slopes. Mountain avens, a calciphytic shrub, is dominant on calcareous soils and is restricted to this area of the Taiga Shield (Timoney *et al*. 1993). White spruce is the dominant conifer in this Ecoregion, where calcareous soils promote its growth under rigorous climatic conditions. Treeless upland bedrock – till areas support complexes of rock lichen, heath – lichen grass and shrub – heath communities described by Bradley *et al*. (1982) (refer to Appendix 2). Polygonal peat plateaus are vegetated by lichen – dwarf birch – northern and common Labrador tea – peat moss communities with scattered black spruce; sedge – peat moss communities occupy small internal collapse scars.

Water and Wetlands

The Coppermine River flows northward through the Ecoregion and cuts down through silty glaciolacustrine deposits. Redrock Lake, part of the Coppermine River drainage, is the largest named lake. Peat plateaus, polygonal peat plateaus and horizontal fens are the most common and extensive wetland types.

Notable Features

Silty calcareous soils along the Coppermine River support the growth of diverse plant communities on the lacustrine flats and the eroding banks.

Rolling bedrock, bouldery till and sparse tree growth are typical of the southern part of the Coppermine Upland HS Ecoregion.

Relatively good tree growth (denser tree stands in this image) may be associated with fine-textured glaciolacustrine or eolian deposits on lower slope positions in the south.

An ancient river valley with outwash terraces between gently rolling bedrock valley walls west of the Coppermine River at the north end of the Ecoregion. Note the frost crack patterns in the outwash terraces (midground) and the absence of trees.

The northern portion of the Coppermine Upland HS Ecoregion is often used by barren-ground caribou during mid- to late summer migrations.

3.4.1.3 Point Upland HS Ecoregion

Overview: *The Point Upland HS Ecoregion is a land of rugged bedrock exposures and undulating to gently rolling, sparsely treed bouldery till plains.*

Summary:

- Rolling bedrock in the north, with gentler bedrock plains and till deposits in the southern two-thirds.
- Largely treeless; tree growth restricted to favourable microhabitats.

Total area: 7,531 km^2 (6.1% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 450 (400-500)

General Description

The Point Upland HS Ecoregion is a largely treeless landscape of exposed Shield bedrock and very bouldery till plains. Its northeastern boundary is defined by tree line, north of which is the Level II Southern Arctic Ecoregion. The Coppermine Upland HS Ecoregion forms its northern boundary, and the Snare Plain HS Ecoregion surrounds it to the west and south. The landscape is rugged and bedrock-dominated in the northern half, but the topography south of Point Lake is less rugged and bouldery till deposits overlie bedrock in many places. Glaciolacustrine and outwash deposits and eskers occur along and to the south of the present-day shores of Point Lake and Lake Providence. Patterned ground and nonsorted circles are common, the former most clearly visible in glacial outwash deposits and the latter occurring with glaciolacustrine and till deposits. Treeless shrub- or sedge-dominated areas are extensive, with trees mainly in sheltered areas or on fine-textured sloping soils; polygonal peat plateaus or horizontal fens are uncommon.

Geology and Geomorphology

Bedrock geology is complex, with rolling granitic bedrock prevalent in the northern third of the Ecoregion, and a mix of metamorphic and sedimentary bedrock plains in the southern two-thirds. Till deposits occur between bedrock knobs in the northern third and are more continuous across the plains of the southern two-thirds. Tills are usually very bouldery but include sufficient fine silty materials for the development of nonsorted circles and solifluction terrain. Silty glaciolacustrine veneers and terraces and coarse-textured outwash deposits occur along and south of Point Lake and Lake Providence.

Soils

Mineral soils are Turbic and Static Cryosols. Soils are thin or absent on exposed bedrock. Organic Cryosolic soils are associated with horizontal fens and polygonal peat plateaus.

Vegetation

Much of the Point Upland HS Ecoregion is treeless shrub or sedge tundra; bilberry, mountain cranberry, black crowberry, red bearberry, dwarf birch, lichens and sedges are common species. Calciphytic shrubs, legumes and bryophytes are common species on calcareous soils in this area of the Taiga Shield (Timoney *et al.* 1993). Tree growth is dependent on local conditions. Wet shorelines and lower slopes typically support stunted groves of white or black spruce with shrubby understories. Open white spruce – dwarf birch – willow stands are associated with silty glaciolacustrine materials that are not very acidic and that occur on lower slopes. In well-drained bouldery ravines and similar locales, where soils probably warm quickly in the spring, relatively tall white spruce – green alder communities can develop. Wetlands are treeless and dominated by lichen and northern Labrador tea (polygonal peat plateaus) or by sedges and cotton-grasses (horizontal fens). Lowland polygon fens with thin peat deposits become more common close to tree line.

Water and Wetlands

Point Lake is the largest water body in the Ecoregion, and is part of the Coppermine River drainage. Lake Providence is connected through the Coppermine River to Point Lake and also lies within the Ecoregion. Wetlands are scattered and cover less than ten percent of the total land area.

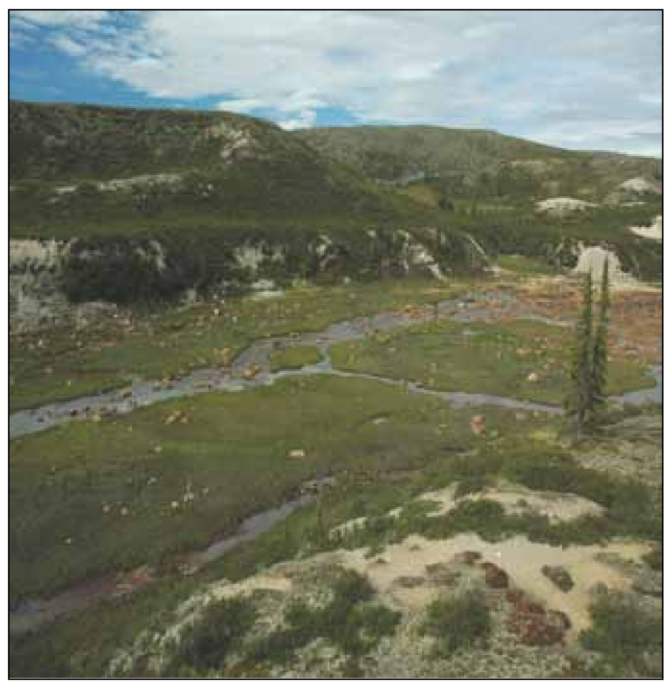
Notable Features

Esker complexes and cold springs, such as those in the glacial meltwater channel locally known as "Esker Valley" near Point Lake, provide highly diverse habitats for both plants and animals.

A vast treeless bouldery till plain underlain by granitic bedrock occurs in the central part of the Point Upland HS Ecoregion. Nonsorted circles with shrubby margins (small netlike features in the foreground) are indicative of permafrost activity.

Krummholz tree colonies and nonsorted circles occur on lower slope positions and along shorelines. The gray-coloured centres of the nonsorted circles are unvegetated because of frost churning.

Open white spruce woodlands grow on pockets of soil in a sheltered bouldery ravine. The largest trees in this stand are about 14 m tall and 140 years old. Green alders, the main understory shrub, fix nitrogen and contribute to better tree growth, as does a somewhat better water supply and well-drained, somewhat warmer soil conditions in the ravine during the short growing season.



"Esker Valley" south of Point Lake shows the diversity of environments in this esker complex within a glacial meltwater channel.

3.4.1.4 Snare Plain HS Ecoregion

Overview: *The Snare Plain HS Ecoregion occupies a hummocky to nearly level bedrock plain with bouldery till blankets, outwash deposits and eskers, and is vegetated by open conifer woodlands in the south and west and shrub tundra in the north and east.*

Summary:

- Rolling exposed bedrock in the south and west portions with bouldery till plains, outwash deposits, eskers and wetlands elsewhere.
- Shrub tundra and upland permafrost features to the north and east and open conifer woodlands to the south and west indicate a transitional climate.

Total area: 19,785 km^2 (16% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 450 (350-500)

General Description

The Snare Plain HS Ecoregion has landscapes that reflect a complex glacial history, and it has elements of both the High Subarctic and Low Subarctic ecoclimates. It is bordered by the tundra-dominated Point Upland HS Ecoregion to the northeast and the forested Calder Upland LS Ecoregion and Great Slave Upland LS Ecoregion to the west and south. The west and southwest portions of the Ecoregion are mainly exposed hummocky to rolling granitic and metamorphic Precambrian bedrock with till and outwash deposits in low-lying areas. The rest of the Ecoregion is mainly a level to undulating bouldery till plain; outwash deposits and eskers are common and locally extensive. Upland permafrost features such as patterned ground and nonsorted circles are common in the north and east parts of the Ecoregion and less common in the south and west, reflecting the transition from High Subarctic to Low Subarctic climate conditions. Polygonal peat plateaus occur throughout the Ecoregion, indicating the prevailing High Subarctic climatic influence. Shrub and sedge tundra with isolated pockets of trees is typical of the north and east; continuous open conifer woodland with a shrub and lichen understory dominates the south and west. Wetlands are more widespread and extensive in this Ecoregion than in adjacent High Subarctic ecoregions.

Geology and Geomorphology

Granitic and metamorphic Precambrian bedrock underlies most of the Ecoregion and outcrops are common in the south and west. Bouldery till deposits between exposed bedrock in the south and west become continuous till plains with fewer bedrock outcrops to the north and east. Sandy to gravelly outwash terraces and eskers are widespread; glaciolacustrine veneers occur mainly in the north half of the Ecoregion. Nonsorted circles and patterned ground are indicative of past and current permafrost activity on mineral soils.

Soils

Turbic Cryosols are widespread across the Ecoregion, with Brunisols on coarse-textured outwash or esker deposits and Organic Cryosols in fens and polygonal peat plateaus.

Vegetation

The north half of the Snare Plain HS Ecoregion is mostly shrub or sedge tundra, with bilberry, mountain cranberry, black crowberry, red bearberry, dwarf birch, lichens and sedges as common species. Small groves of white spruce occupy lower slope positions and shorelines or are scattered along coarse-textured outwash deposits. Towards the south, tree growth becomes more continuous, and black spruce – shrub – lichen woodlands are prevalent, with shrub tundra and rock lichen communities on exposed hilltops and bedrock. To the south and west, fire becomes a more significant natural disturbance, and paper birch appears as a successional species. Treeless polygonal peat plateaus with lichen and northern Labrador tea cover are the most extensive wetland type.

Water and Wetlands

Snare Lake, Rawalpindi Lake, Jolly Lake, Roundrock Lake, and Reindeer Lake are the largest named lakes in the Ecoregion. The Snare and Yellowknife Rivers drain the Ecoregion to the south and west. The low-lying terrain associated with level till plains and thousands of small lakes has promoted the development of widespread and locally extensive wetlands; most are polygonal peat plateaus but horizontal and northern ribbed fens are also common. Close to tree line, lowland polygon fens with thin peat deposits are relatively common.

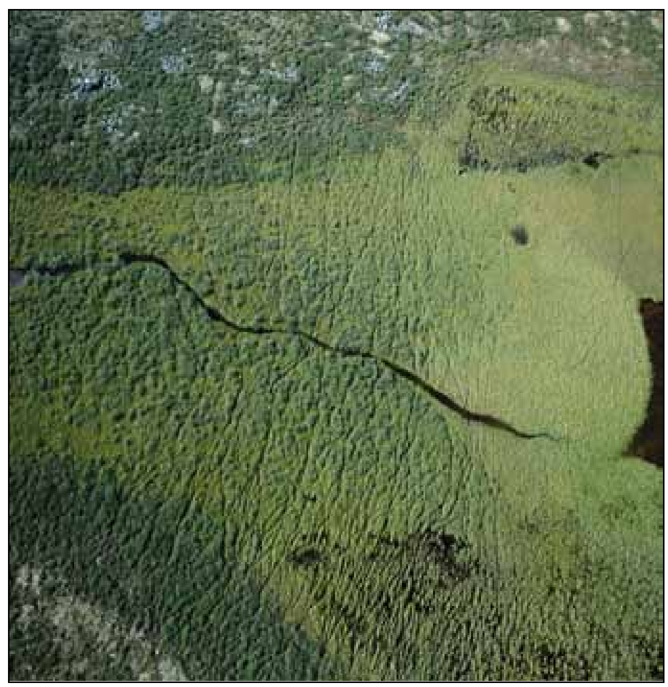
Notable Features

The Snare Plain HS Ecoregion likely has the highest wetland area of any High Subarctic ecoregion in the Taiga Shield and proportionately more esker and outwash terrain than other High Subarctic ecoregions west and north of Great Slave Lake. Extensive caribou trails observed on aerial surveys in 2006 indicate the importance of this area to caribou. The oldest rocks in the world – the Acasta Gneisses, estimated at just over four billion years – are found near the Acasta River at the north end of this Ecoregion.

A sandy to gravelly esker and outwash complex (the whitish raised areas) with a few trees crosses an extensive nearly level and treeless till plain in the northern part of the Snare Plain HS Ecoregion.

The recent burn in the midground (brownish-black patch), extensive open black spruce – lichen woodlands and the light green shrubby sedge fens are all indicative of somewhat better growing conditions in the southwest.

Bedrock beneath the overlying till blanket has been forced to the surface and broken by frost action. The larger boulders are two to five metres across.



Sedge and shrub fens record the movements of caribou herds for years after their passage. Dense caribou trail networks are widespread throughout the Snare Plain HS Ecoregion.

3.4.1.5 Mackay Upland HS Ecoregion

Overview: *The Mackay Upland HS Ecoregion is a low-relief bedrock plain with till veneers and blankets; the southern third is covered by a mosaic of conifer woodlands and shrub tundra, and the northern two-thirds by shrub tundra with scattered, stunted trees.*

Summary:

- Rolling and eroded till veneers and blankets over bedrock in the south, hummocky till uplands in the north.
- Open spruce woodlands in the southern third of the Ecoregion and shrub tundra with scattered tree groves along lakeshores and in sheltered areas in the northern two-thirds.

Total area: 21,390 km^2 (17.2% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 400 (250-500)

General Description

The Mackay Upland HS Ecoregion[12] is a topographically variable landscape, with mainly level to gently rolling terrain except in the southeast along the East Arm of Great Slave Lake, where rugged bedrock hills occur. The northern boundary is defined by tree line and the Level II Southern Arctic Ecoregion. Bedrock exposures are common throughout the Ecoregion, and are partly covered by bouldery till veneers and blankets in most places; outwash deposits and eskers occur throughout, but are not extensive. On deeper tills, upland permafrost features such as nonsorted circles are common. Shrub tundra dominates the northern two-thirds of the Ecoregion; in the southern third, open black and white spruce woodlands occupy slopes and low areas. Small treeless polygonal peat plateaus or horizontal sedge fens are scattered throughout.

Geology and Geomorphology

Most of the exposed or underlying Precambrian bedrock is granitic, with some minor sedimentary and metamorphic bedrock elements along the western, northern and southern boundaries. Till veneers and blankets cover much of the Ecoregion, and are typically bouldery and coarse-textured (sandy loams to loamy sands). Small outwash terraces and eskers are scattered throughout. Rugged bedrock exposures occur in the southeastern corner north of East Arm and west of Artillery Lake. Lacustrine and beach ridge deposits along the shores of Artillery Lake indicate the past influence of Glacial Lake McConnell. Nonsorted circles are prevalent throughout the Ecoregion on deeper till blankets and indicate past or present permafrost activity; patterned ground also occurs and is most clearly observed on outwash deposits.

Soils

Soils belong to the Wolverine Lake association (Bradley *et al.* 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granitic rocks. Organic Cryosols are associated with wetlands.

Vegetation

Shrub tundra and open spruce woodlands are the two most common upland cover types. In the southern third of the Ecoregion, woodlands occur on mid to lower slope positions, with shrub tundra or rock lichen communities on local elevations or on exposed bedrock; trees also grow along bedrock fractures, and trees grow relatively well on deeper till blankets or deposits adjacent to streams. Common understory plants are dwarf birch, mountain cranberry, northern and common Labrador tea, red bearberry and lichens. Two indicators of somewhat warmer climates, shore fens along pond boundaries and stands of paper birch, occur in a few places. In the northern two-thirds of the Ecoregion, shrub or sedge tundra with bilberry, mountain cranberry, black crowberry, red bearberry, dwarf birch, lichens and sedges is the dominant cover, and stunted black spruce grows in small clumps in sheltered locales and along lakeshores. Small, treeless polygonal peat plateaus with lichen and northern Labrador tea and sedge fens are widely scattered throughout the Ecoregion. Lowland polygon fens with thin peat deposits become more common close to tree line.

Water and Wetlands

Over 30 percent of the total area is occupied by lakes, of which 14 are over 50 km^2 in area; Mackay, Walmsley, Artillery and Camsell Lakes are the largest of these. The Hoarfrost and Lockhart Rivers and numerous small tributaries and isolated streams drain into East Arm. Wetlands are generally small and scattered, but locally extensive polygonal peat plateaus and horizontal fens occur in the southwestern corner.

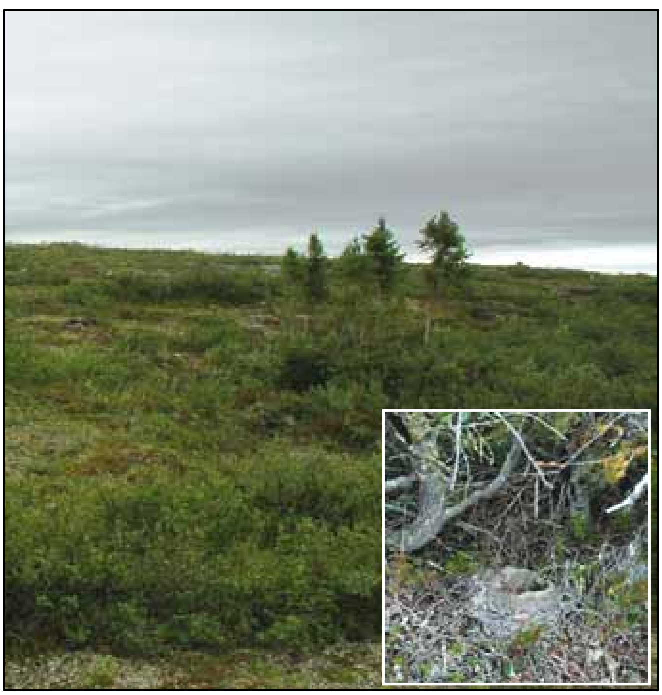
Notable Features

Eskers are a common landform feature throughout the Ecoregion. They provide optimal denning habitat for tundra wolves, barren-ground grizzly bears, coloured foxes, Arctic foxes and Arctic ground squirrels.

[12] This Ecoregion is an aggregate of the Rivett-Goodspeed Ecodistrict and the Mackay-Walmsley Ecodistrict of Bradley *et al.* (1982), from which much of the descriptive information is derived.

In the northwest part of the Mackay Upland HS Ecoregion, the terrain is gently undulating and bedrock is mantled by bouldery till blankets. Shrub tundra is dominant, and trees grow only along lakeshores and in drainages or sheltered locales.

Rolling bedrock with open black spruce – lichen forests and thin till veneers occurs in the southwestern part of the Ecoregion; the bright green shore fens along pond margins indicate a transition to somewhat warmer climates. The East Arm of Great Slave Lake is in the background.



Small tree groves in the shrub tundra provide important shelter habitat for wildlife, such as this robin's nest found within one such grove.

The Lockhart River drops over 200 m from the end of Artillery Lake to the end of East Arm and cascades through rough and broken bedrock, producing spectacular rapids and waterfalls such as Tyrell Falls.

3.4.1.6 Thelon Valley HS Ecoregion

Overview: *Forested valleys surrounded by treeless till plains at higher elevations characterize the Thelon Valley HS Ecoregion.*

Summary:

- Bouldery till plains with extensive glaciofluvial deposits.
- Open, treeless tundra surrounds the forested lower valley and terraces of the Thelon River.

Total area: 12,543 km^2 (10.1% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 250 (125-325)

General Description

The Thelon Valley HS Ecoregion[13] includes the Thelon River floodplain and valley and the surrounding uplands. It is bounded on the east and west by the higher-elevation uplands of the Southern Arctic Ecoregion, and to the south lie the nearly treeless uplands of the Sid Plain HS Ecoregion. The Ecoregion is geologically variable; drumlinized bouldery till, gravelly beach ridges and coarse-textured outwash plains occur throughout, with local areas of finer-textured glaciolacustrine deposits in the northern half. Upland and wetland tundra communities are dominant on higher terrain and at the northernmost end of the Ecoregion, with widely scattered stunted trees growing singly or in small groves on coarse-textured materials and in sheltered areas. A unique feature of the Ecoregion is the occurrence of vigorous and diverse white spruce forests that occur on the valley slopes and floor of the Thelon River below about 300 mASL.

Geology and Geomorphology

Most of the Thelon Valley HS Ecoregion is underlain by a broad, low-relief Precambrian sedimentary bedrock plain, with a thin crescent of undulating to gently rolling metamorphic bedrock along the westernmost border. Level to gently undulating bouldery till plains and coarse-textured, sandy to gravelly outwash deposits are the most common landforms, the latter prevalent along the Clarke and Hanbury Rivers. Two large eskers run east – west across the Ecoregion south of the Clarke River. In the northern third of the Ecoregion, silty glaciolacustrine blankets are locally extensive. Gravelly beach ridges throughout the Ecoregion indicate that Glacial Lake Thelon filled the present river valley and extended some distance into the adjacent uplands. Till drumlins, elongated in the direction of glacial ice flow, occur on the uplands. Polygonal patterned ground, nonsorted circles and polygonal peat plateaus indicate current and past permafrost activity.

Soils

Soils on deep, stony mostly non-calcareous sandy-textured till deposits derived mainly from reddish Dubawnt sandstones are assigned to the Coldblow Lake association (Bradley *et al.* 1982). They are Brunisols and Gleyed or Brunisolic phases of Turbic Cryosols. Brunisolic soils of the Hoarfrost association develop on glaciofluvial and stony ice-contact parent materials. Organic Cryosols occur with permafrost-affected lowland organic terrain.

Vegetation

Diverse vegetation communities in the Thelon Valley HS Ecoregion have developed in response to topography, parent materials and microclimates. Lichen – grass – shrub communities occur on very dry, exposed hilltops, shrub communities on midslope positions and bogs or fens in low-lying wet areas, with only a few scattered trees on coarse soils or in sheltered areas. Relatively tall and vigorous white spruce stands with larch, balsam poplar and shrubby understories occur on sandy to clayey fluvial deposits along the valley sides and on lower fluvial terraces. Timoney (1995) suggested that lower elevations, protected valley slopes, fine-textured parent materials, and the absence of large deep lakes that have a local chilling effect on summer temperatures could explain the occurrence of these stands. Dense willow shrublands colonize recently flooded or ice-scoured fluvial terraces along the Thelon River. A grove of trembling aspen is reported to occur at the junction of the Hanbury and Thelon Rivers (Hall, in Timoney (1995)).

Water and Wetlands

The Thelon River and its main tributaries, the Hanbury and Clarke Rivers, flow through the Ecoregion. Eyeberry Lake is the largest water body. Wetlands are eroding polygonal peat plateaus, northern ribbed fens, horizontal fens and lowland polygon fens; they are generally small and scattered, but are more extensive on broad plains in the extreme northeast.

Notable Features

The dense groves of spruce on valley walls and river terraces throughout the Ecoregion represent an unusual extension of tree line northward into the tundra. The close proximity of forest and tundra habitats has resulted in an area that is biologically diverse and includes many boreal plant and animal species that occur well north of their main range. A large active pingo occurs just to the north of the Northwest Territories-Nunavut border within the Thelon Valley; a smaller pingo lies within the Ecoregion.

[13] This Ecoregion is equivalent to the Thelon Ecodistrict of Bradley *et al.* (1982), from which much of the descriptive information is derived.

A landscape of low bouldery till drumlins and sandy eskers is typical of uplands in the Thelon Valley HS Ecoregion. Black, wiry lichens grow on the till hilltops, with shrublands and spruce woodlands on the moister lower slopes.

Spruce forests grow on banks near the intersection of the Thelon and Clarke Rivers. The taller trees are 14 to 16 m in height and may exceed 30 cm in diameter. One average white spruce aged within the stand in the foreground was approximately 110 years old.

This shrub-covered hill on the sparsely treed fine-textured floodplain of the Thelon River in the extreme northeast of the Ecoregion is a developing pingo, an ice-covered mound forced upward by frost action.

Sandy to gravelly glaciofluvial deposits are extensive along the Clarke and Hanbury Rivers; note several gravelly terraces and old channels along the Clarke River and whitish, windblown sand deposits in the upper third of the image.

3.4.1.7 Whitefish Plain HS Ecoregion

Overview: *The Whitefish Plain HS Ecoregion is a low-relief landscape of undulating to hummocky till plains with shrub and lichen tundra in the northern half and open black spruce woodlands in the southern half.*

Summary:

- Undulating to hummocky till over much of the area, some extensive glaciofluvial deposits, and more rugged bedrock-dominated terrain in the westernmost portion.
- Open lichen – shrub tundra in the northern half, with open black spruce – lichen woodlands in the southern half.

Total area: 19,880 km^2 (16% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 425 (300-450)

General Description

The Whitefish Plain HS Ecoregion[14] is a level to hummocky till plain, with rugged exposed bedrock in the westernmost portion, large eskers, and widespread, sometimes extensive outwash deposits. This Ecoregion has deeper glacial deposits and less exposed bedrock than the Mackay Upland HS Ecoregion to the northwest. Till blankets are deeper in the Sid Plain HS Ecoregion to the northeast. The Dubawnt Plain HS Ecoregion to the east has extensive boulder fields and more exposed bedrock. The Wignes Plain LS Ecoregion and Porter Upland LS Ecoregion to the south have warmer climates as indicated by forest and wetland characteristics. Lichen and shrub tundra on tills with scattered spruce stands in protected areas are dominant across the northern half. In the southern half, open black spruce – lichen woodlands are the prevalent cover type. Wetlands are uncommon.

Geology and Geomorphology

Most of the Ecoregion is underlain by Precambrian metamorphic bedrock. Intrusive formations are exposed in the westernmost part, and a small area of Precambrian sedimentary bedrock lies underneath and west of Rennie Lake. Most of the Ecoregion is mantled by coarse-textured till that has been moulded into drumlins and flutings by glacial ice. Braided eskers wind across the eastern part of the Ecoregion. Outwash occurs throughout, with the most extensive deposits in the Snowdrift River valley. Patterned uplands and polygonal peat plateaus that have developed on organic deposits are evidence of extensive past and current permafrost influences.

Soils

Soils belong to the Wolverine Lake association (Bradley *et al*. 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granitic bedrock. Organic Cryosols are associated with wetlands.

Vegetation

Shrub – lichen tundra and open black spruce woodlands are the two most common upland cover types. In the southern half of the Ecoregion, black spruce – lichen woodlands occur on mid- to lower-slope positions, with shrub tundra or rock lichen communities on local elevations or on exposed bedrock. Common understory plants are dwarf birch, mountain cranberry, northern and common Labrador tea, red bearberry and lichens. In the northern half of the Ecoregion, shrub or lichen tundra with bilberry, mountain cranberry, black crowberry, red bearberry, dwarf birch, yellow lichens and sedges forms the dominant cover. Black and white spruce stands are restricted to lower slopes, coarse-textured eskers, outwash and fluvial deposits. In the westernmost portion near the east end of East Arm, the occurrence of shore fens, treed peat plateaus, paper birch and widely scattered jack pine and mixed-wood stands indicates a transition toward Low Subarctic/High Boreal climates. Small, treeless polygonal peat plateaus with lichen and northern Labrador tea and sedge fens are widely scattered throughout the Ecoregion.

Water and Wetlands

Whitefish, Lynx, Tent, Eileen, Rennie and Firedrake Lakes are the largest lakes in the Ecoregion. The Taltson and Snowdrift Rivers drain to the southwest and west, respectively. Wetlands occupy less than five percent of the Ecoregion.

Notable Features

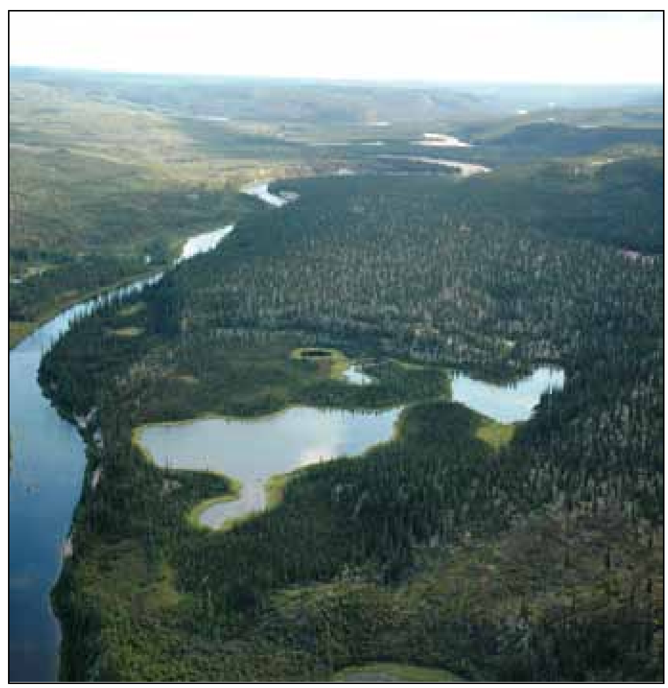
The combination of varied terrain and landforms found along the Snowdrift River valley, the rugged bedrock hills to the west, the transition from forested areas to nearly treeless areas, and numerous well-developed esker – outwash complexes throughout, creates a physically and biologically diverse landscape. A striking feature of this Ecoregion is the prevalence of treeless polygonal peat plateaus, many of which are eroding due to recession of ice wedges in the fissures which have subsequently exposed the dark brown peat along the polygon margins and high-centered surfaces (Bradley *et al*. 1982).

[14] This Ecoregion is an aggregate of the Tent-Firedrake and Sifton-Whitefish Ecodistricts of Bradley *et al.* (1982), from which much of the descriptive information is derived.

Glacially streamlined till drumlins with permafrost-affected lichen- and shrub-covered patterned ground on top and scattered trees in sheltered areas and at slope bases are typical of the east and north parts of the Whitefish Plain HS Ecoregion.

At the western end of the Ecoregion, thin till veneers on rolling and hilly bedrock terrain support continuous forest, with shrub tundra and rock lichen communities on bedrock.

This image shows low ice-scoured exposed bedrock (gray tones on left) and part of an extensive esker/outwash complex (light tones on right), just north of Rennie Lake. Woodlands are associated with warmer and moister sites such as lower esker slopes.



The Snowdrift River meanders across a broad valley filled with sandy and gravelly outwash deposited when a large glacial river flowed through a bedrock-confined channel. The flat tree-covered area in the midground is an old glaciofluvial terrace.

3.4.1.8 Sid Plain HS Ecoregion

Overview: *The Sid Plain HS Ecoregion occupies a gently northeast-sloping landscape of low-relief till deposits crisscrossed by large braided esker – outwash complexes; lichen – shrub tundra is characteristic, with sparse forests only on favourable sites.*

Summary:

- Gently sloping till plains with large esker – outwash complexes and patterned ground.
- Lichen and shrub tundra is dominant across the Ecoregion, with sparse tree cover in low areas and on coarse-textured parent materials.

Total area: 17,952 km² (14.4% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 350 (250-425)

General Description

The Sid Plain HS Ecoregion[15] is a gently northeast-sloping till plain distinguished from neighbouring High Subarctic ecoregions to the south, east and west by the dominance of tundra vegetation throughout; its northern boundaries are defined by the treeless uplands of the Southern Arctic and the Thelon Valley HS Ecoregion. Low-relief coarse-textured till drumlins and fluted till deposits with a few ice-scoured bedrock exposures occupy most of the Ecoregion. Sinuous eskers and associated outwash plains cross it from east to west. Lichen-dominated tundra on very dry and exposed till crests and upper slopes is typical, with shrub tundra on moister sites and sparse tree growth in sheltered locales and coarse-textured soils. Wetlands are uncommon.

Geology and Geomorphology

Precambrian metamorphic bedrock underlies most of this Ecoregion with sedimentary bedrock in the northeast part. Ice-scoured bedrock outcrops occur in a few places, mainly in the eastern third where till deposits are somewhat thinner. Till drumlins and flutings indicate the east to west direction of ice movements during the last glaciation. Gravelly and sandy eskers are a prominent feature of this Ecoregion, and at least five major esker – outwash complexes cross the Ecoregion. Beach ridges indicate the former levels of Glacial Lake Thelon and surround several lakes in the northeastern part of the Ecoregion. Patterned ground indicative of past or current permafrost activity is common on till deposits throughout, and nonsorted circles are mainly associated with finer-textured tills and outwash in the northeast part of the Ecoregion.

Soils

Soils belong mainly to the Lynx Lake association (Bradley *et al.* 1982) and are noncalcareous loamy sand and stony Brunisols that have developed on sandstone-derived glacial tills. Organic Cryosols are associated with wetlands.

Vegetation

The dominant vegetation type throughout the Sid Plain HS Ecoregion is lichen and shrub tundra. The crests and upper slopes of till deposits are covered with black and yellow lichens and low-growing shrubs to a depth of a few centimetres; dry conditions on well- to rapidly-drained till materials retard the growth of most vascular plants, and windborne ice crystals damage exposed plant tissues in winter. On low-lying terrain that is moister and sheltered from winter winds, taller shrub-dominated communities and open black and white spruce woodlands develop. The uneven terrain and variable parent materials of eskers and outwash plains provide many different microhabitats ranging from dry and relatively warm locales on southerly slopes to wetter and relatively cold areas in depressions and northerly slopes. Vegetation communities on eskers and outwash deposits are correspondingly diverse as slope and aspect influences tree vigour and plant species composition.

Water and Wetlands

There are a number of large lakes within the Ecoregion; Mosquito, Mary, Sid, Gravel Hill and Mantic Lakes occupy a semicircular low plain in the northeast, and Lynx, Howard and Damant Lakes occur along the Sid Plain – Whitefish Plain border. The Ecoregion is drained by the Elk, Thelon and Dubawnt Rivers. Less than one percent of the Ecoregion is occupied by wetlands.

Notable Features

The extensive esker – outwash terrain, a large area of pitted outwash between Sid and Mary Lakes and broad expanses of lichen – shrub tundra provide excellent habitat for barren-ground grizzly bears, tundra wolves, coloured foxes and Arctic ground squirrels.

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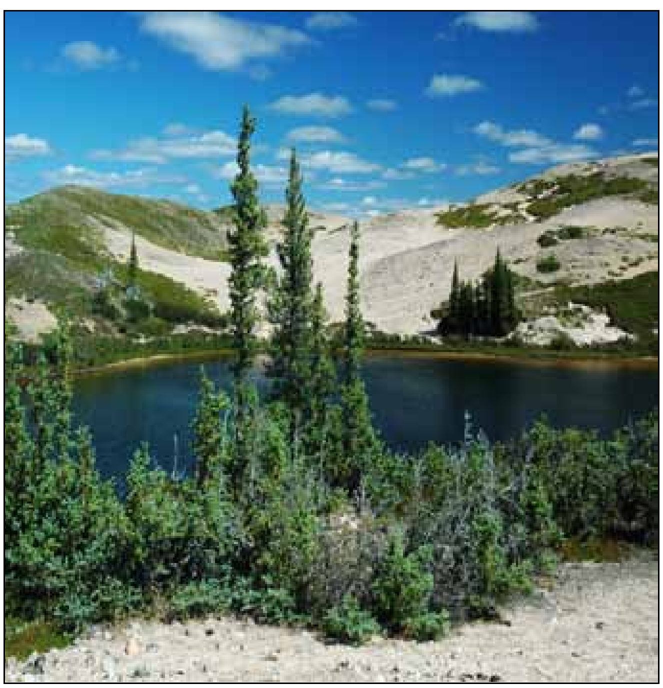
[15] This Ecoregion is part of the Tyrell-Sid Ecodistrict of Bradley *et al.* (1982), from which much of the descriptive information is derived.

Till drumlins with lichen tundra are common near the centre of the Sid Plain HS Ecoregion. The inset is a close-up of the dominant wiry black lichen of the genus *Cornicularia* that gives a greyish-black tint to the drumlin ridge tops. The dark green areas between the drumlins are sedge fens.

In the northeast part of the Ecoregion, typical landscapes are bouldery till veneers over gently rolling ice-scoured bedrock with shrub and lichen tundra and a few trees in low-lying areas.



Eskers provide a wide range of habitats – warm southerly lower slopes with enough moisture for trees, upper slopes that support only low shrubs and lichens, wetlands and aquatic environments. Caribou, muskoxen, wolves and other wildlife species use eskers for travel, feeding and nesting and denning sites.

Aspect and slope are important determinants of tree growth in the High Subarctic. The white spruce on the left-hand image grows on a steep north-facing esker slope exposed to winter winds and is 225 years old and less than 5 m tall. The spruce on the right-hand image grows on a moist, warm and relatively protected southerly esker slope just a few metres away and is only 110 years old and 9 m tall.

3.4.1.9 Dubawnt Plain HS Ecoregion

Overview: *The Dubawnt Plain HS Ecoregion includes bouldery till blankets and veneers on gently sloping bedrock as well as locally extensive outwash, and vegetation grades from lichen – shrub tundra in the north to open black spruce woodlands in the south.*

Summary:

- Hummocky and extremely bouldery till plains in the eastern half and less bouldery till plains in the western half, with some locally extensive esker – outwash complexes.
- Lichen – shrub tundra and rock lichen communities are dominant in the north half of the Ecoregion and on extremely bouldery till; open black spruce woodlands are characteristic of slopes and valleys in the south.

Total area: 15,289 km^2 (12.3% of Taiga Shield HS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 350 (275-425)

General Description

The Dubawnt Plain HS Ecoregion[16] slopes gently to the northeast and includes a diverse array of terrain types, including sandy and gravelly low-relief hummocky till in the western half, extremely bouldery and hummocky till blankets and veneers with some ice-scoured bedrock exposures in the eastern half, outwash and esker complexes, and scattered finer-textured lacustrine deposits along the Dubawnt River. Its northern boundary is defined by a shift to less bouldery till and a higher proportion of lichen – shrub tundra in the Sid Plain HS Ecoregion. To the west, the Whitefish Plain HS Ecoregion has more subdued landforms, and to the south, the Dubawnt Plain LS and Selwyn Upland LS Ecoregions have vegetation and landscape patterns characteristic of warmer Low Subarctic climates. Lichen and shrub tundra is dominant in the north, grading to open black spruce – lichen woodlands on lower slopes and in valleys in the southern half. Wetlands are uncommon, and are most extensive in the southwest part of the Ecoregion.

Geology and Geomorphology

The Ecoregion is underlain by gently sloping low-relief Precambrian metamorphic bedrock. The eastern half of the Ecoregion is part of a vast ribbed till plain that was deposited at the terminus of the last receding ice sheet, and that is characterized by extremely bouldery and hummocky till with numerous lakes. Extensive outwash and esker deposits blanket the till hummocks in a few places. The till becomes less bouldery and more subdued to the west, and patchy glaciolacustrine veneers occur near lakes along the Dubawnt River drainage. Patterned ground occurs throughout the Ecoregion, but nonsorted circles are less common and occur mainly in the northeast part of the Ecoregion.

Soils

Soils belong mainly to the Lynx Lake association (Bradley *et al.* 1982) and are noncalcareous loamy sand and stony Brunisols that have developed on sandy tills. Organic Cryosols are associated with wetlands.

Vegetation

Lichen – shrub tundra and open black spruce woodlands are the two most common upland cover types. In the northern half of the Ecoregion, shrub or lichen tundra or rock lichen communities on boulder fields form the dominant cover. Black and white spruce stands are restricted to lower slopes, coarse-textured eskers, outwash and fluvial deposits. In the southern half of the Ecoregion, black spruce – lichen woodlands occur on mid- to lower-slope positions, with shrub tundra or rock lichen communities on local elevations or on exposed bedrock. These stands are frequently burned in the southernmost part of the Ecoregion.

Water and Wetlands

Boyd and Casimir Lakes and the eastern shores of Firedrake Lake occupy the slightly higher southwest and east-central plain; the lower plains to the northeast include Barlow, Carey and Kamilukuak Lakes. The Ecoregion drains to the northeast through the shallow and bouldery Dubawnt River. Wetlands occupy about two percent of the total area, mainly in the southwest part of the Ecoregion. Polygonal peat plateaus are the most common wetland form.

Notable Features

The Dubawnt Plain HS Ecoregion contains the largest area of ribbed till terrain in the Northwest Territories.

[16] This Ecoregion is part of the Tyrell-Sid Ecodistrict of Bradley *et al.* (1982), from which much of the descriptive information is derived.

Extremely bouldery ribbed till hummocks and numerous lakes are typical of the eastern Dubawnt Plain HS Ecoregion.

Outwash deposits and eskers (the sinuous ridge from top to bottom of this image) cover bouldery till in places. Caribou often use eskers as travel routes through bouldery and broken terrain.

Fires become a more significant factor in black spruce – lichen woodlands in the southwestern corner of the Ecoregion. Recent burns are grey patches in the midground.

Polygonal peat plateaus (light tones) and black spruce – larch fens (dark tones) occur on finer-textured lacustrine deposits on the plains surrounding Carey Lake along the northwestern boundary of the Ecoregion.

3.4.5 TAIGA SHIELD LOW SUBARCTIC (LS) ECOREGION

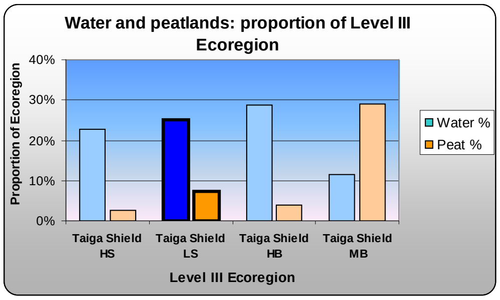
Open black spruce – lichen woodlands and closed black spruce forests, shown in the upper half of the image, are typical of well-drained sites in the Taiga Shield Low Subarctic (LS) Ecoregion. Understory ground cover is usually lichen-dominated, with bog cranberry, bog bilberry, black crowberry, common Labrador tea and mosses. Bouldery, discontinuous till veneers and exposed bedrock terrain is dominated by lichen communities and trees are scattered or absent. Peatlands, shown in the lower half of the image, are vegetated by ericaceous shrubs, heaths, lichens, sphagnum mosses and a variety of sedges in wetter depressions; black spruce and larch are stunted and scattered. Sandy outwash plains and south-facing esker slopes are dry and often support patchy species-poor vegetation communities with open black spruce, white spruce and birch woodlands. Northerly esker slopes are moister and can support denser white and black spruce stands and more diverse understories. Brunisols are the most common soil type on well-drained sites. Organic Cryosols and Gleysols are typical soils of poorly-drained sites.

Open woodlands and denser, slow-growing black and white spruce forests with understories of ground birch, Labrador tea, mosses and lichens are widespread across much of the Taiga Shield LS Ecoregion.

The bog bilberry (*Vaccinium uliginosum*), a low, much-branched shrub, is found throughout the Taiga Shield. It grows on acidic, dry to moist sites, and can be a prolific berry producer in the southern parts of its range.

3.4.5 TAIGA SHIELD LOW SUBARCTIC (LS) ECOREGION

Overview: *The Taiga Shield LS Ecoregion extends from northwest to southeast in a broad band across the Taiga Shield. Level to rolling and hilly bedrock with thin bouldery till veneers, open black spruce stands and large burned areas are characteristic landscapes.*



Total area: 114,414 km^2 (35% of Taiga Shield). Ecoregion shown in red.

General Description

The Level III Taiga Shield LS Ecoregion spans over 1000 km, extending from the northwestern to southeastern borders of the Taiga Shield within the Northwest Territories. It is more than 200 km wide at its northwest and southeast limits, but has an average width of about 80 km in the central portion and is only 20 km wide at it narrowest point. It includes ten Level IV ecoregions. Toward its northern boundary, polygonal peat plateaus become more common and are indicative of cold climates that are transitional between Low Subarctic and High Subarctic. Tundra replaces forest cover on hilltops and on islands in lakes, also denoting colder climates. Along its southern boundary with the Taiga Shield HB Ecoregion, shore fens along lakeshores and jack pine stands become more extensive. Most of the Ecoregion north of Great Slave Lake is comprised of exposed bedrock with discontinuous bouldery coarse-textured till veneers. Deeper bouldery till blankets are more common south of Great Slave Lake. Coarse-textured outwash deposits occur throughout the Ecoregion. On the deeper till deposits, black spruce – lichen woodlands and extensive post-fire regenerating stands of paper birch and dwarf birch are characteristic. North of Great Slave Lake, thin soils or exposed bedrock limit the development of forests, and outwash plains, bedrock fractures and thin till veneers support discontinuous black spruce stands.

Climate

Fort Reliance is the only station from which climate data have been collected over long periods within the Taiga Shield LS Ecoregion, and climate statistics are therefore determined through interpolated models using the limited available data. Peat plateaus and slow-growing open conifer stands across most of the region are indicative of a Low Subarctic climate, as defined by the Ecoregions Working Group (1989) and Bradley *et al.* (1982). Climate models (Agriculture and Agri-Food Canada 1997) provide the following general statistics for the Taiga Shield within the Northwest Territories. The mean annual temperature ranges from –3.5 to –9.0^{o}C. The mean temperature in January, the coldest month, ranges from –27 to –29.0^{o}C, and from 11.0 to 16.0^{o}C in July, the warmest month. Mean annual precipitation is between 230 and 430 mm, with the wettest period in June through October; about 60 percent falls as rain and 40 percent as snow. The models indicate that climates become colder and drier towards the northwest, with the highest precipitation predicted for the Abitau Upland, a high-elevation area along the Northwest Territories – Saskatchewan border. The mean annual daily solar input (refer to Section 1.4.1 for further explanation) ranges between 10 and 11 mJ/m^2/day, with low values of 0.8 to 1.4 mJ/m^2/day in December and highs of 21.5 to 22 mJ/m^2/day in June.

Topography, Geology, Soils, and Hydrology

The Taiga Shield LS Ecoregion is characterized by thin, discontinuous till veneers and blankets overlying complex Precambrian intrusive, granitoid and sedimentary rocks north of Great Slave Lake, and by deeper till deposits overlying Precambrian metamorphic, sedimentary and intrusive bedrock south of Great Slave Lake. Drumlin fields are extensive and conspicuous landforms in the southeastern portion of the Ecoregion. Peatlands cover between five and 10 percent of the total area, and the most extensive occurrence is in the southeast, where nearly treeless polygonal peat plateaus are common. Soils are mainly Brunisols on uplands and Organic Cryosols in peatlands. About 25 percent of the total area is covered by water, mostly as lakes less than 500 ha; the East Arm of Great Slave Lake and Hottah Lake are the two largest water bodies.

Vegetation

South of Great Slave Lake where till deposits are relatively deep, open black spruce stands with a shrubby understory of dwarf birch, northern and common Labrador tea and lichens are the primary upland vegetation type on areas that have not recently burned. Dwarf birch – spruce stands are extensive on recently burned areas, with jack pine on coarse-textured materials as far north as 64^o N latitude. North of Great Slave Lake, black spruce – lichen forests occur in discontinuous patches between rock exposures, with rock lichen communities on bedrock exposures. Bogs, collapse scar fens and nearly treeless lichen – Labrador tea – Sphagnum moss communities occur in association with permafrost features such as peat plateaus and polygonal peat plateaus. Shore fens (floating wetlands along lakeshores) are more common in the northwest part of the Ecoregion than elsewhere. Appendix 2 summarizes the major plant community types.

3.4.5.1 Radium Hills LS Ecoregion

Overview: *The Radium Hills LS Ecoregion is a rugged, narrow and sparsely vegetated bedrock hill system extending south from McTavish Arm on Great Bear Lake.*

Summary:

- High-relief Precambrian Shield bedrock with scattered till and lacustrine veneers on lower slopes and local valleys
- Sparse plant cover on thin soils and in bedrock fractures in upper slope positions, and scattered, small conifer forests and wetlands in fractures and lower slope positions.

Total area: 470 km^2 (0.4% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 350 (150-475)

General Description

The Radium Hills LS Ecoregion is an elongated and very narrow hill system that extends southwest about 70 km from the southernmost corner of McTavish Arm on Great Bear Lake; it averages less than 10 km wide and is the smallest Level IV ecoregion within the Northwest Territories Taiga Shield. It is distinct from the neighbouring Radium Hills HS Ecoregion because its climate is warmer and less affected by the cold waters of Great Bear Lake as indicated by the sporadic occurrence of trembling aspen groves. It is also mostly surrounded by land and not as deeply dissected by fiords as the Radium Hills HS ecoregion. It is comprised of pronounced Precambrian bedrock exposures that are clearly distinct from the sedimentary plains of the surrounding Taiga Plains Level IV Great Bear Upland LS Ecoregion. Its northeastern border with the Taiga Shield Camsell Plain LS Ecoregion is clearly defined by a transition from rugged bedrock hills to subdued bedrock plains. The development of forest, shrub communities and wetlands is restricted to soil pockets in bedrock fractures or thin till veneers.

Geology and Geomorphology

Intrusive Precambrian bedrock makes up most of this Ecoregion. The entire Ecoregion is rugged terrain, with hills rising over 300 m above the surrounding terrain and very localised till and lacustrine deposits in fractures and lower slope positions.

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Soils

Coarse-textured Brunisols are the dominant soils on glacial deposits, but soil development is discontinuous over most of the Ecoregion because bedrock barrens are predominant. Organic Cryosols occur in wet depressions

Vegetation

The exposed bedrock hilltops and slopes that characterize most of the Radium Hills LS Ecoregion support mainly rock lichen communities. Vascular plants (ferns and other herbs, mosses, shrubs and black or white spruce) are restricted to fractures or local depressions where sufficient soil and moisture is available. The distribution of trembling aspen as small groves in this Ecoregion indicates a transition to warmer climates away from Great Bear Lake. Shore fens around the margins of small ponds indicate a similar trend.

Water and Wetlands

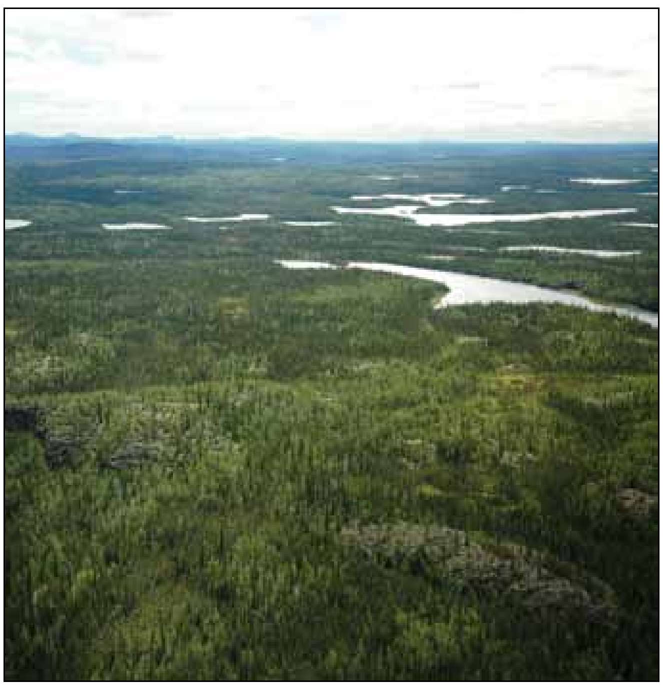
Great Bear Lake and Tuchay Lake are the major water bodies, occurring at the northern and southern ends of the Ecoregion, respectively.

Notable Features

Almost all of this hilly, elongated Ecoregion protrudes into the lower-elevation Taiga Plains. The cliffs and rugged terrain provide suitable habitat that may be used as nesting sites for several species of raptors including Bald Eagles, Golden Eagles, Merlins, Peregrine Falcons and Gyrfalcons.

McTavish Arm on Great Bear Lake forms a scenic backdrop to the rugged northern hills of the Radium Hills LS Ecoregion.

The southern hills of the Taiga Shield's Radium Hills LS Ecoregion are completely surrounded by the Taiga Plains.



Bedrock forms a nearly level plain to the immediate east of the hilly Radium Hills LS Ecoregion.

Small aspen stands (light green tones in centre of image) on south-facing till or outwash deposits away from the immediate influence of Great Bear Lake are indicative of somewhat warmer climates.

3.4.5.2 Calder Upland LS Ecoregion

Overview: *Hummocky to rolling bedrock with discontinuous bouldery till and outwash, and open spruce – shrub and regenerating birch stands typify the Calder Upland LS Ecoregion.*

Summary:

- Hummocky to rolling or hilly bedrock with discontinuous bouldery till is typical of most of the Ecoregion.
- Closed to open mixed spruce – shrub – moss – lichen stands on unburned sites, with dwarf birch and paper birch regeneration on extensive burned areas.
- The largest Level IV Ecoregion in the Northwest Territories Taiga Shield.

Total area: 31,611 km^2 (27.6% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 350 (175-500)

General Description

The Calder Upland LS Ecoregion is the largest Level IV ecoregion in the Northwest Territories Taiga Shield; it slopes to the west in a stepwise manner from a maximum elevation of over 500 mASL adjacent to the Coppermine Upland HS Ecoregion to a minimum elevation of about 200 mASL adjacent to the Camsell Plain LS Ecoregion. The dominant landform in the Ecoregion is a hummocky to rolling or occasionally hilly bedrock upland with discontinuous bouldery till veneers and scattered sandy and gravelly outwash deposits. Bouldery till plains and more extensive outwash occupies a belt about 20 km wide along the eastern border with the Snare Plain HS and Coppermine Upland HS Ecoregions. Forest cover is highly variable, responding to a combination of topographic, parent material, fire history and climatic factors. The occasional occurrence of jack pine and aspen and the increased occurrence of peat plateaus in the southern part of the Ecoregion are both indicative of a transition to warmer High Boreal climates. Polygonal peat plateaus are common along the central and northeastern border and indicate a transition to colder High Subarctic climates.

Geology and Geomorphology

Precambrian intrusive, volcanic and sedimentary bedrock is the dominant geologic feature, and much of the Ecoregion is rolling, hummocky or hilly exposed bedrock. Discontinuous bouldery till veneer deposits in fractures and on lower slopes and depressions between exposed rock outcrops are common throughout the Ecoregion, as are small sandy to gravelly outwash deposits and eskers. Thicker bouldery till occurs in a belt about 20 km wide along the eastern border and in places, east – west oriented flutings and drumlins indicate the direction of glacial ice flow.

Soils

Turbic Cryosols and Brunisols are likely associated with till and outwash deposits. Organic Cryosols occur with polygonal peat plateaus and peat plateaus.

Vegetation

Topographically diverse bedrock exposures, till deposits and outwash materials together with a history of burning particularly in the southern half of the Ecoregion and a transitional climatic regime along the eastern and southern borders produces a highly variable forest cover. Rock lichen communities similar to those described by Bradley *et al.* (1982) cover many bedrock exposures. White spruce and calciphytic shrubs, sedges and mosses occur on calcareous parent materials. Small black and white spruce stands with ericaceous shrubs, dwarf birch and lichens and mosses occur on thin till deposits; these stands are more extensive and somewhat denser on bouldery till blankets. Very open white spruce – dwarf birch – lichen communities are associated with outwash. Dwarf birch and paper birch are widespread on regenerating burns. Along the eastern border and to the north, shrub tundra communities occupy hilltops and upper slopes; treeless polygonal peat plateaus occupy wet depressions.

Water and Wetlands

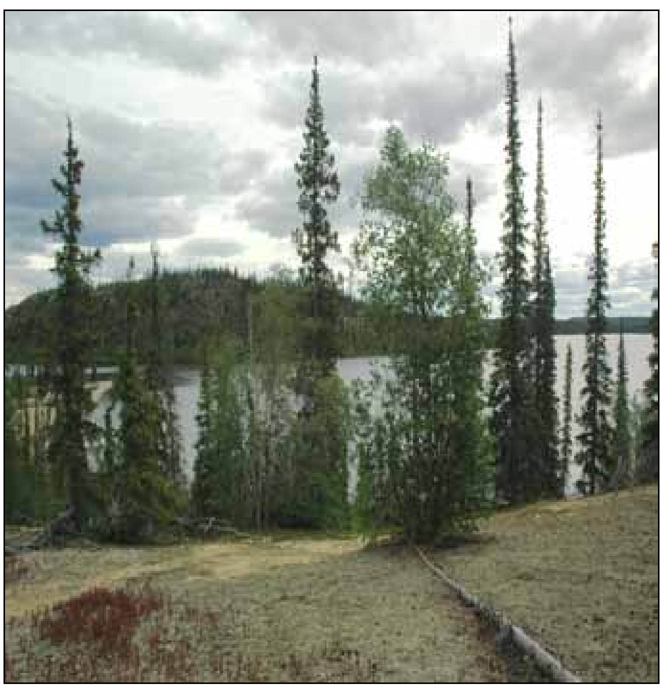
The Calder Upland LS Ecoregion has over 18,000 lakes of which 13 cover more than 50 km^2, including Samandre, Wentzel, Exmouth, Acasta, Ingray and Black Lichen Lakes. The Wopmay, Calder, Acasta and Emile Rivers drain the Ecoregion to the west and south. Peat plateaus and shore fens are common to the south and west and polygonal peat plateaus are more common to the east and north.

Notable Features

The vast expanses of spruce – lichen woodlands in the Calder Upland LS Ecoregion contain what has been in recent years the southerly and northerly extent respectively of the Bluenose East and Bathurst caribou herd wintering ranges.

Open spruce – dwarf birch – lichen woodlands on bouldery till blankets in the northeast part of the Calder Upland LS Ecoregion mark the transition to High Subarctic climates.

Rolling and hummocky bedrock exposures with discontinuous till veneers, patchy spruce – shrub – lichen forests or regenerating paper birch – dwarf birch on till veneers, and peat plateaus in depressions are typical of the central part of the Ecoregion.



Windblown outwash sands near the centre of the Ecoregion at Wopmay Lake are vegetated by a variety of low shrubs and lichens. White spruce that attain heights of up to 20 metres are over 200 years old.

Open jack pine stands occur on thin till and bedrock near the southern boundary of the Ecoregion.

3.4.5.3 Camsell Plain LS Ecoregion

Overview: *The Camsell Plain LS Ecoregion is dominated by low-elevation, low-relief bedrock exposures interspersed with till, glaciolacustrine, glaciofluvial and organic deposits and vegetated by black spruce – moss – lichen forests.*

Summary:

- Ice-scoured bedrock exposures with bouldery till veneers and blankets, glaciolacustrine and outwash materials, and scattered organic deposits.
- Open black spruce forests occur on till and lacustrine deposits and in rock fractures, with locally extensive birch regeneration and treed peat plateaus; jack pine occurs in the extreme south.

Total area: 6,471 km^2 (5.7% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 200 (150-325)

General Description

The Camsell Plain LS Ecoregion occupies the northern half of a narrow low-lying area between Great Bear Lake and Great Slave Lake. It is bordered on the west by the higher-elevation Lac Grandin Plain LS Ecoregion of the Taiga Plains, and on the east by the higher-elevation and more rugged Calder Upland LS Ecoregion of the Taiga Shield. Low-relief ice-scoured Precambrian bedrock exposures are the dominant landform, but bouldery till veneers and blankets are common. Beach ridges well above present-day lake levels attest to the past influence of Glacial Lake McConnell; finer-textured glaciolacustrine deposits occur more commonly in the southern half. Sandy outwash plains and a few small eskers are scattered throughout. Peat plateaus and shallow lakes with shore fens and floating aquatic vegetation are more evident to the south, and together with the occurrence of scattered jack pine stands indicate the influence of warmer High Boreal climates.

Geology and Geomorphology

Low-relief ice-scoured Precambrian intrusive and volcanic rocks are exposed throughout the Ecoregion. The northern half has the most exposed bedrock, while bouldery till veneers and finer-textured lacustrine deposits are more extensive in the south. Sandy and gravelly outwash plains are limited and a few small eskers are scattered throughout. Most of the Ecoregion was flooded by Glacial Lake McConnell. As it drained and the ice sheets melted, bouldery beach ridges were left well above the current lake levels.

Soils

Turbic Cryosols and Brunisols are likely associated with till and outwash deposits, the latter probably more common in the southern half. Organic Cryosols occur with peat plateaus and Organic soils with horizontal and floating fens.

Vegetation

There are subtle north – south trends in the vegetation of the Camsell Plain LS Ecoregion that probably indicate a transition from colder Low Subarctic conditions in the north to warmer High Boreal climates in the south as well as a change in parent materials. Mixed black and white spruce stands with shrub, moss and lichen understories occur throughout the Ecoregion. The proportion of paper birch regeneration increases to the south. In the southern half of the Ecoregion, many of the shallow lakes are surrounded by sedge shore fens and their surfaces are partly covered by the broad green leaves of variegated pond lily; these lake and wetland features are characteristic of High Boreal ecoregions to the south. Jack pine stands grow on outwash and bedrock in the extreme south of the Ecoregion.

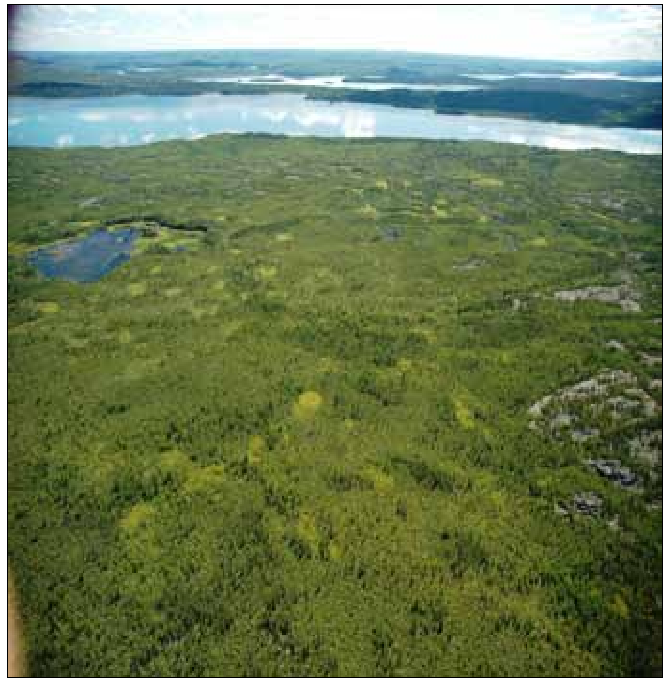
Water and Wetlands

Over 40 percent of the Ecoregion is covered by water; Hottah and Hardisty Lakes are the largest, and occupy the north and south ends of the Ecoregion. A deep fiord of Great Bear Lake marks the extreme northern border. Polygonal peat plateaus are rare and peat plateaus with open black spruce – lichen cover and large collapse scars are common.

Notable Features

The Camsell Plain LS Ecoregion includes some excellent examples of ancient beach ridges left behind when Glacial Lake McConnell flooded both Great Bear Lake and Great Slave Lake and the lowlands between them to a depth of about 100 m above the present-day lake levels.

Nearly level bedrock plains with ice-polished rock, black and white spruce and paper birch woodlands and scattered wetlands are typical of the northern Camsell Plain LS Ecoregion.



Open black spruce – larch wetlands and shrubby fens occur with finer textured lacustrine and till deposits between low bedrock exposures in the southern part of the Ecoregion.

Remnant gravelly and bouldery beach ridges (striped pattern at centre of image) far above the current levels of Hottah Lake and Great Bear Lake indicate the former depth of Glacial Lake McConnell and the degree to which the land surface rebounded following deglaciation.

Fine textured glaciolacustrine materials and warmer climates at lower elevations and latitudes support the development of shore fens, floating aquatic vegetation, and deciduous stands that grow sufficiently well to support beaver colonies (note lodge at centre of image).

3.4.5.4 Great Slave Upland LS Ecoregion

Overview: *The Great Slave Upland LS Ecoregion is a complex of rough, broken bedrock with discontinuous till and sparse forests and gently rolling till plains with more extensive forests.*

Summary:

- Southwest-sloping upland with two main plateaus, their edges broadly defined by two northwest – southeast belts of rugged bedrock and discontinuous bouldery till at the 300 m and 400 m contours.
- Gently undulating to rolling till and bedrock plains with low bedrock exposures occur on the plateaus.
- Black spruce and paper birch are the main tree species, occurring as open, discontinuous woodlands with dwarf birch and lichen on bedrock and outwash, and in denser stands on till deposits.

Total area: 15,431 km^2 (13.5% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 375 (275-450)

General Description

The Great Slave Upland LS Ecoregion is a southwest-sloping bedrock-dominated landscape including two broad plateaus. The plateau edges are delineated by northwest – southeast trending belts of exposed bedrock ranging from rugged low hills to gently rolling ice-scoured bedrock plains. The plateaus are gently undulating, bouldery till plains with low-relief exposed bedrock and locally extensive outwash deposits that occur mainly to the north and east. The Ecoregion is bounded to the north by the higher-elevation, colder Snare Plain HS and Mackay Upland HS Ecoregions. The Great Slave Upland HB Ecoregion to the south has a warmer climate and less pronounced topography. Scattered black spruce woodlands grow on bedrock outcrops; denser black spruce forests occur on till veneers and blankets, and white spruce woodlands are common on outwash. Jack pine stands are relatively common in the lower-elevation southern part.

Geology and Geomorphology

Precambrian granitoid bedrock is prevalent in the eastern and western third of the Ecoregion, with sedimentary bedrock in the central third. Exposed bedrock is the dominant feature along the broad gently sloping elevation breaks at about 300 mASL and 400 mASL, ranging from gently rolling and hummocky terrain to rugged local hill systems. The plateaus above the elevation breaks are blanketed by bouldery tills and where bedrock is exposed, it is generally low-relief and ice-scoured. Sandy to gravelly outwash plains and a few small eskers occur in the northern and eastern halves. Organic deposits are numerous in places but limited in extent.

Soils

Soils likely belong to the Porter Lake association of Bradley *et al*. (1982). These soils are dominantly well-drained Brunisols on stony, noncalcareous sandy loam to loamy sand till derived from granitic rock. Soils in the northeast part of the Ecoregion may be affected by frost action (Turbic Cryosols) where the parent materials are thin (less than one metre deep over bedrock).

Vegetation

In areas where exposed bedrock is dominant, open-canopied and discontinuous black spruce – dwarf birch woodlands grow along bedrock fractures and on discontinuous till pockets between bedrock exposures. Till plains on the plateaus have more continuous spruce – dwarf birch cover. Low-intensity surface fires have produced paper birch – dwarf birch – black spruce stands across extensive areas. White spruce – dwarf birch – lichen woodlands are common on outwash deposits. Open jack pine stands grow on outwash and on bedrock exposures in the south half of the Ecoregion. In the extreme northeast, polygonal peat plateaus and the occurrence of tundra on hilltops reflect the transition to colder High Subarctic climates.

Water and Wetlands

Gordon, Smoky, Beniah and Thistlethwaite Lakes are the largest of several lakes with areas greater than 50 km^2; there are thousands of smaller lakes. The Yellowknife, Cameron and McCrae Rivers drain through the Ecoregion to the south and west. Small peat plateaus are common, and shore fens occur around some lakes.

Notable Features

The Ecoregion contains important winter range for barren-ground caribou. Although the area has been used mostly by caribou belonging to the Bathurst Herd, recent satellite tracking studies have indicated some usage by other caribou herds such as Bluenose East and Ahiak.

Hummocky glacially polished bedrock, bouldery till veneers and black spruce forests are typical of the plateau areas in the Great Slave Upland LS Ecoregion.

Bouldery till plains (foreground and background) and outwash (midground) forested by a mixture of regenerating paper birch and dwarf birch (foreground, light green) and black spruce (background, dark green) occur along the northern boundary of the Ecoregion.

Thousands of square kilometres of the Taiga Shield are blanketed by thin bouldery tills over bedrock, here shown with paper birch and dwarf birch on an old burn.

Jack pine stands occur on bedrock, outwash and till in the southern part of the Ecoregion.

3.4.5.5 East Arm Upland LS Ecoregion

Overview: *The East Arm Upland LS Ecoregion includes the northern half of East Arm, Great Slave Lake; rugged bedrock, sparse forests and the deep waters of Great Slave Lake characterize this landscape.*

Summary:

- Rugged bedrock slopes define the narrow northern section, curved and tilted bedrock layers of the Pethei Peninsula are the main landmass to the south, and together these enclose the deep, cold waters of McLeod Bay that modify the local climate.
- Over half of the area is water.
- Open slow-growing white and black spruce woodlands generally grow in bedrock fractures or very thin soils over bedrock.

Total area: 4,650 km^2 (4.1% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 200 (150-425)

General Description

The East Arm Upland LS Ecoregion[17] includes the northern half of the East Arm of Great Slave Lake. A rugged bedrock slope three to six kilometres wide forms its northern border, rising about 200 m from the northern lakeshore to meet the Great Slave Upland LS Ecoregion to the west and Mackay Upland HS Ecoregion to the north and east. Pethei Peninsula[18] occupies the largest land area, and gently curves parallel to the north shore; it is over 100 km long and from seven to 20 km wide. Slopes along the north shore and Pethei Peninsula enclose the deep, cold waters of McLeod Bay. The dominant terrain feature on Pethei Peninsula is exposed ice-polished bedrock; discontinuous till veneers are more common in the east half of the Peninsula. Mixed black and white spruce or regenerating paper birch are the dominant forest cover types; composition and density depends on fire and parent material distribution.

Geology and Geomorphology

The north slopes of East Arm Upland LS Ecoregion are composed of rugged, south-facing crystalline and sedimentary Precambrian bedrock. Bouldery till and sandy outwash deposits are discontinuous and scattered. The Pethei Peninsula consists of fine-grained intrusive – volcanic and mixed Precambrian bedrock; bedrock generally dips gently to the south, and erosion on the north side has produced spectacular steplike cliffs. Discontinuous bouldery till veneers occur throughout the Peninsula in topographic lows between bedrock exposures, and are more extensive in the eastern half. Bouldery beach ridges well above the current lake levels indicate the former levels of Glacial Lake McConnell; a few silty lacustrine deposits occur in sheltered bays where wave erosion is minimal.

Soils

Much of the Ecoregion is exposed bedrock and soils are thin or absent. Lithic-phase noncalcareous sandy and silty Brunisols are likely most common on till veneers (less than one metre of till) over bedrock.

Vegetation

Open black and white spruce forests with dwarf birch, northern and common Labrador tea, common and red bearberry, lichens and mosses occur across the Ecoregion. Tree growth can be extremely slow on bedrock or thin tills. Large areas of Pethei Peninsula are vegetated by fire-successional paper birch stands. Jack pine stands occur on the mainland portion of the more southerly East Arm Upland HB Ecoregion and indicates the influence of more moderate climates. Average temperatures during the growing season in the East Arm and particularly in the East Arm Upland LS Ecoregion are probably somewhat colder than elsewhere on Great Slave Lake.[19]

Water and Wetlands

Great Slave Lake covers over half of the Ecoregion; there are a few small lakes on Pethei Peninsula. Many streams flow down the north slopes and into Great Slave Lake from the adjacent uplands, and most have numerous rapids and waterfalls. McLeod Bay is one of the last areas to freeze over (Klock *et al*. 2000) and one of the last areas to thaw, often retaining some ice cover until late June; a recent satellite image (July 7, 2004) shows residual ice near the mouth of the Lockhart River. Wetlands are very uncommon.

Notable Features

Much of the East Arm is part of a proposed national park. Great Slave Lake, the deepest lake in Canada and sixth deepest in the world, reaches its maximum depth of approximately 615 m just south of Pethei Peninsula in Christie Bay.

[17] This Ecoregion is part of the East Arm Mid-Boreal Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

[18] The area referred to in this report as Pethei Peninsula also includes Kahochella Peninsula and Douglas Peninsula.

[19] Environment Canada climate normals for 1971-2000 show that the mean annual temperature and the mean monthly temperatures for May through September were lower in Fort Reliance at the east end of East Arm than they were at Yellowknife Airport just north of the main lake.

The Hoarfrost River cuts deeply into rugged bedrock slopes along the north shore of the East Arm Upland LS Ecoregion.

This east-looking view across the north edge of Pethei Peninsula clearly shows the southward dip of bedrock layers and the high proportion of exposed bedrock.

The Lockhart River enters Great Slave Lake at the extreme east end of the Ecoregion, and has deposited a large sandy underwater delta nearly 2 km wide, surrounded by outwash plains with open white spruce forests.

Thin, dry, nutrient-poor soils on bedrock and a subarctic climate restrict tree growth. This white spruce on Pethei Peninsula east of Wildbread Bay is 14 m tall and over 450 years old.

3.4.5.6 Porter Upland LS Ecoregion

Overview: *The Porter Upland LS Ecoregion is a gently sloping bedrock plain mostly blanketed by bouldery till and outwash with open black spruce – lichen forests and extensive young fire-successional jack pine and paper birch stands.*

Summary:

- Bouldery till and outwash are dominant on the southern two-thirds, with more rugged bedrock-dominated topography in the northern third.
- Black spruce – lichen and fire-successional jack pine and paper birch stands are the dominant vegetation cover.

Total area: 9,674 km^2 (8.5% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 375 (300-425)

General Description

The Porter Upland LS Ecoregion[20] is a gently north-sloping low-relief plain with thin bouldery till deposits overlying Precambrian metamorphic rock. Rugged, hummocky to rolling bedrock with thin till veneers is typical of the northern third of the Ecoregion, with thicker bouldery till blankets and some extensive hummocky outwash plains across the southern two-thirds. It is crossed by a number of northeast – southwest trending linear bedrock faults and meltwater channels that are occupied by long, narrow lakes or major rivers. Its northern boundary lies along the MacDonald Fault, a prominent geological feature defining the south shore of the East Arm of Great Slave Lake. The Nonacho Upland HB Ecoregion to the west occurs at lower elevations and has a higher proportion of exposed bedrock. The Wignes Plain LS Ecoregion to the south has more subdued terrain, deeper till deposits, less exposed bedrock and lakes that are shallower and not so well aligned along faults. Its climate is milder than that of the Whitefish Plain HS Ecoregion to the east as indicated by forest composition and permafrost features. Black spruce, jack pine and paper birch stands are the dominant forest cover. Wetlands are locally common.

Geology and Geomorphology

Most of the Ecoregion is underlain by low-relief Precambrian metamorphic bedrock; paleo-intrusive rocks occur in the northern third and in small areas near Porter and Manchester Lakes, and are associated with more rugged, hilly terrain. Most of the Ecoregion is mantled by bouldery, often hummocky till except in the northern third where till is discontinuous. Undulating to hummocky sandy outwash plains are common throughout and cover extensive areas in the vicinity of glacial meltwater channels such as those occupied by Porter Lake and the Snowdrift River. Small eskers occur with outwash; there are a few areas of drumlinized till indicating an east – west ice flow direction during the last glaciation.

[20] This Ecoregion is part of the Porter-Wignes Low Subarctic Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

Soils

Soils belong to the Porter Lake association (Bradley *et al.* 1982), and are noncalcareous sandy loam Brunisols that have developed on tills derived from granites. These soils are thinnest in the northern third where there is more exposed bedrock. Organic Cryosols (Dymond Lake association) occur throughout the Ecoregion and are most common and extensive on till and outwash blankets south of Gray Lake.

Vegetation

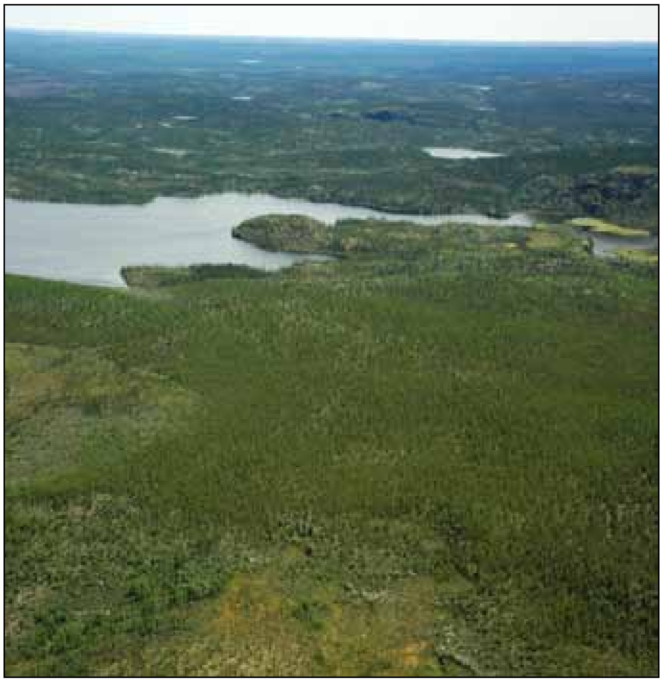
At the regional scale, vegetation patterns within the Porter Upland LS Ecoregion are relatively simple. Open black spruce – Labrador tea – dwarf birch – lichen communities are dominant on till and outwash, along with white spruce – lichen stands. Much of the Ecoregion has burned in the recent past, and is now vegetated by young jack pine and paper birch forests with understories of dwarf birch, Labrador tea and lichens. Peat plateaus with scattered, stunted black spruce and an understory of lichen, common and northern Labrador tea, cloudberry and alpine bilberry are common throughout and occasionally extensive in the southern half of the Ecoregion.

Water and Wetlands

Gray Lake, the east arm of Nonacho Lake, and Porter, Manchester and Doran Lakes are the largest water bodies in the Porter Upland LS Ecoregion. The Snowdrift River cuts through the northern corner of this Ecoregion. The Taltson River flows west through Gray and Nonacho Lakes. Horizontal fens and peat plateaus are common and locally extensive on till and outwash plains south of Nonacho Lake.

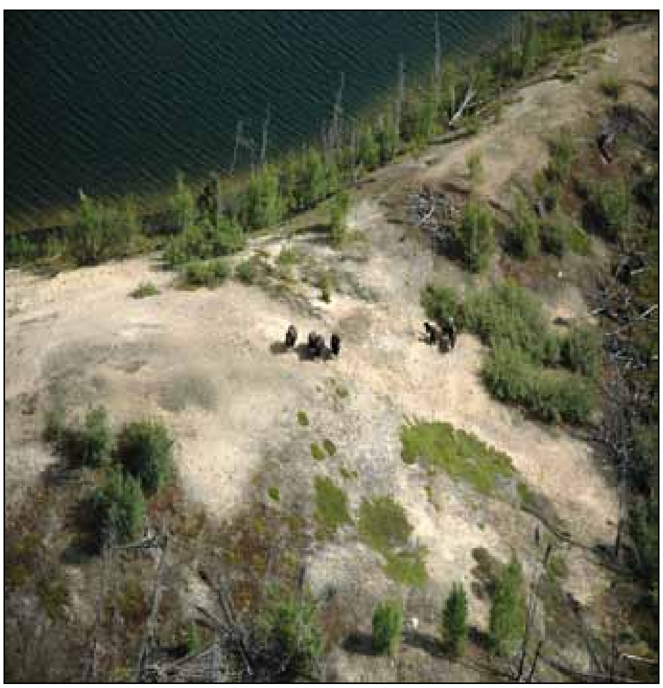
Notable Features

The spruce – lichen woodlands typical of this Ecoregion provide important winter range for several herds of barren-ground caribou that have in recent years included the Bathurst, Ahiak and Beverly herds. Muskoxen have also expanded their distribution dramatically in recent years from areas further north and east. Small numbers now occur in scattered locations within the Ecoregion.



This landscape is typical of much of the Porter Upland LS Ecoregion. In this image, bouldery till and outwash deposits are forested by jack pine (light green foreground) and black spruce – lichen (dark green, background). There are only a few bedrock exposures.

Low bedrock hills with exposed bedrock, thin bouldery tills and open black spruce stands are common in the northern third of the Ecoregion. The thin linear feature in the lake is a small esker connecting two outwash plains.



Muskoxen, such as this small herd observed on an esker just northeast of Porter Lake (July 2006), have only recently expanded their range southward into the Porter Upland LS Ecoregion.

The open black spruce – lichen woodland is the most common forest cover type in the Northwest Territories Taiga Shield. Here, it occurs on bouldery till with the occasional stunted paper birch and scattered low shrubs.

3.4.5.7 Wignes Plain LS Ecoregion

Overview: *The Wignes Plain LS Ecoregion is a level bouldery till plain with many large, shallow lakes, outwash and esker deposits, open black spruce – lichen stands, vast burned areas regenerating to jack pine and dwarf birch, and widely distributed wetlands.*

Summary:

- Bouldery, hummocky, and occasionally drumlinized till plain with hummocky outwash and long, narrow eskers.
- Open black spruce – lichen communities are dominant, but there are very large burns throughout regenerating to jack pine (south and west) and dwarf birch – spruce (north and east).

Total area: 20,230 km^2 (17.7% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 450 (375-550)

General Description

The Wignes Plain LS Ecoregion[21] is a nearly level bouldery till plain underlain by Precambrian metamorphic bedrock that is seldom exposed. Its northern boundary with the Porter Upland LS Ecoregion is marked by a transition to somewhat shallower till and more linear lake and river systems. The lower-elevation Nonacho Upland HB Ecoregion to the west has a higher proportion of exposed bedrock. The higher-elevation Abitau Upland LS Ecoregion embedded in the southwest corner has well-developed till drumlin fields.[22] Along its northern and eastern boundaries with the Whitefish Plain HS Ecoregion, the absence of jack pine and the appearance of treeless polygonal peat plateaus indicate a transition from Low Subarctic to High Subarctic climates. Black spruce – lichen forests are the dominant cover type, with jack pine stands in the south and west. Wetlands surround many till and outwash deposits.

Geology and Geomorphology

Most of the Ecoregion is underlain by low-relief Precambrian metamorphic bedrock; paleo-intrusive rocks occur in the eastern third. Most of the Ecoregion has a deep layer of bouldery and hummocky till that has been streamlined into drumlin forms by glacial ice in a few places; bedrock exposures are uncommon except toward the west. Local hummocky and sandy outwash deposits are complexed with till throughout the Ecoregion. Eskers also occur less frequently than in areas to the north; they are generally narrow, but often wind through till and outwash deposits for several kilometres.

Soils

Soils belong to the Porter Lake association (Bradley *et al*. 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granites. Organic Cryosols (Dymond Lake association) occur throughout the Ecoregion with treed peat plateaus.

Vegetation

Open black spruce – Labrador tea – dwarf birch – lichen forests are dominant on till and outwash; stand densities appear generally higher to the south, possibly due to somewhat milder climates. Recent fires have produced dense, young jack pine stands in southern and western areas. To the north and east, long intervals between intense crown fires might have caused local extinctions of jack pine, and dwarf birch and black spruce are the primary regenerating species. Wetland communities occupy treed peat plateaus and fens.

Water and Wetlands

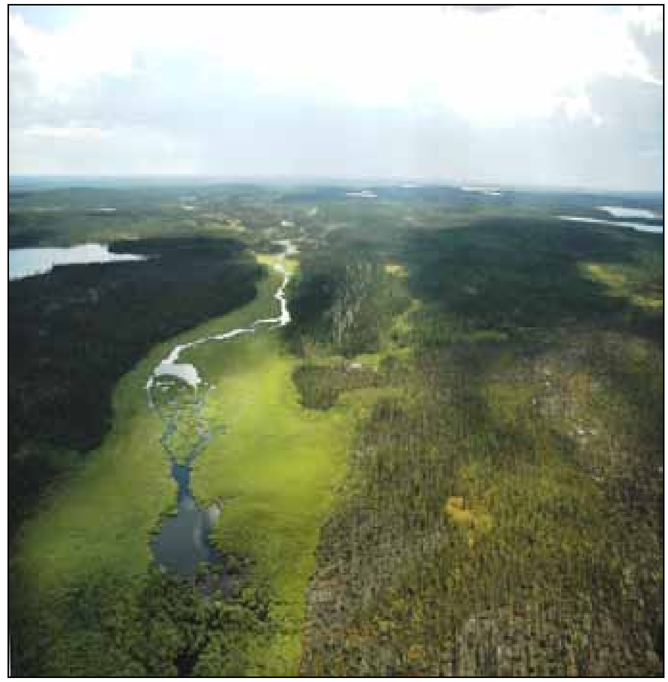
Wignes, Scott, Burstall, Beauvais, Gardiner, Desmarais, Ivanhoe, Labyrinth, Odin and Coventry Lakes are the largest lakes and are all shallow, with irregular bouldery and sandy shorelines. Shallow bays are often dotted with large boulders. The main rivers are the Thoa River that flows west through the Ecoregion; and the Dubawnt River that flows northeast. Peat plateaus, shore fens, horizontal fens and northern ribbed fens cover locally extensive areas throughout the Ecoregion except in the northeast.

Notable Features

This Ecoregion is large and climatically diverse, with a trend to colder conditions to the north and east and warmer climates to the southwest. Ospreys often use small protruding offshore boulders in lakes and shallow ponds as nesting sites in this Ecoregion, which likely supports the highest breeding population of Ospreys in the Northwest Territories.

[21] This Ecoregion is part of the Porter-Wignes Low Subarctic Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

[22] The Eynard Lake Upland Landscape Area in Saskatchewan described in *Ecoregions of Saskatchewan* (Acton *et al*. 1998), is its southern extension.

	
The nearly treeless polygonal peat plateau (light-coloured area in the centre of the image) between drumlinized till hummocks indicates the start of a transition from Low Subarctic to High Subarctic climates in the northeast corner of the Wignes Plain LS Ecoregion.	In this image from the central Wignes Plain LS Ecoregion (west of the image to the left), the transition to somewhat warmer summers and longer growing seasons is indicated by wetlands such as the bright green shore fens and horizontal fens.
	
The southern third of the Ecoregion is characterized by extremely bouldery hummocky till and sandy outwash with extensive burns and jack pine regeneration.	Stick nests like this one on a large boulder in a shallow lake are common in the Wignes Plain LS Ecoregion. These offshore boulders provide secure Osprey nesting platforms.

3.4.5.8 Abitau Upland LS Ecoregion

Overview: *Higher-elevation till drumlin fields, black spruce – paper birch – jack pine stands and thousands of lakes are distinguishing features of the Abitau Upland LS Ecoregion.*

Summary:

- The highest elevation ecoregion in the Northwest Territories Taiga Shield
- Till drumlin fields and thousands of interspersed lakes, with some outwash and esker deposits.
- Open, slow growing black spruce – lichen stands with paper birch and jack pine on recent burns.

Total area: 4,376 km^2 (3.8% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 500 (475-575)

General Description

The Abitau Upland LS Ecoregion[23] is a hummocky, drumlinized bouldery till plain underlain by Precambrian metamorphic bedrock. It is the highest elevation Ecoregion in the Northwest Territories Taiga Shield. It is blanketed by more extensive till drumlin fields than the surrounding Wignes Plain LS Ecoregion. There is less exposed bedrock than the lower-elevation Nonacho Upland HB Ecoregion to the west.[24] Sandy outwash deposits and narrow eskers are distributed throughout the Ecoregion. Black spruce – lichen forests are the dominant cover type, but jack pine and paper birch are common on burns. Wetlands often surround till and outwash deposits.

Geology and Geomorphology

Precambrian metamorphic bedrock underlies most of the Ecoregion, with a small area of intrusive rock to the south and west of Dunvegan Lake. Bedrock exposures are uncommon and are typically ice-polished. The most prominent landscape features are extensive fields of bouldery till drumlins; these are usually cigar-shaped and aligned in a northeast to southwest direction, and are best developed between Abitau and Dunvegan Lakes. Narrow bouldery to sandy eskers show a similar orientation, and some extend for many kilometres in discontinuous segments. Hummocky to level sandy outwash deposits are scattered throughout.

Soils

Soils belong to the Porter Lake association (Bradley *et al.* 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granites. Brunisols of the Odin Lake association occur on outwash. Organic Cryosols (Dymond Lake association) occur throughout the Ecoregion with treed peat plateaus. Cryoturbated mineral soils were noted during July 2006 surveys in the southern part of the Ecoregion.

Vegetation

Open black spruce forests are dominant on till and outwash. Tree growth is slow because of acidic, nutrient-poor dry sandy soils and subarctic conditions. Understories are species-poor, with lichens, bilberry, dwarf birch, water birch, black crowberry, willows and very few herbs. Some drainages support locally improved tree growth, and white spruce – paper birch communities develop. Burns are vegetated by jack pine and paper birch stands with dwarf birch and water birch as common associates. Peat plateaus are characterized by open, stunted black spruce, Labrador tea and lichens. Sedges, willows, dwarf birch and larch occur with horizontal and northern ribbed fens.

Water and Wetlands

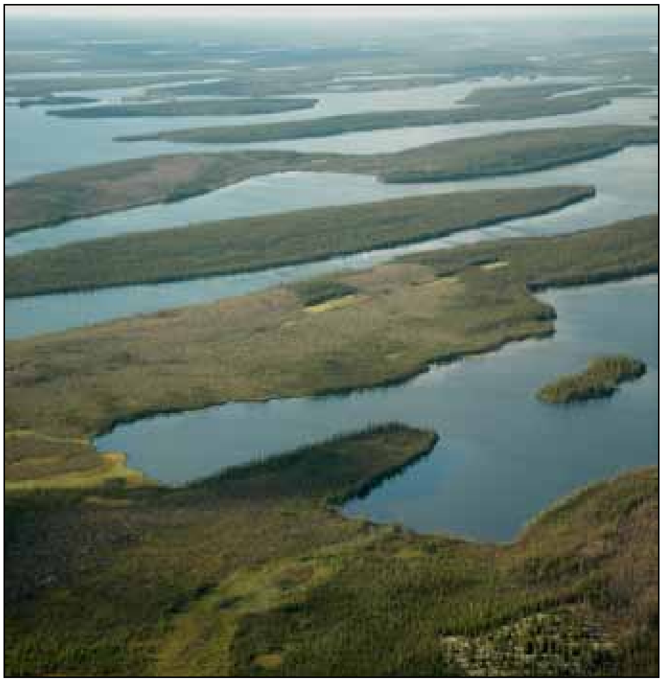
Dunvegan, Abitau, Penzance and Tite Lakes are the largest water bodies; their shorelines are intricately patterned by the surrounding till drumlin fields. The Ecoregion straddles a watershed divide; the Dubawnt River flows to the east, the Thoa River to the northwest, and the Abitau River to the west. Wetlands are most extensive in the north half and west of Dunvegan Lake.

Notable Features

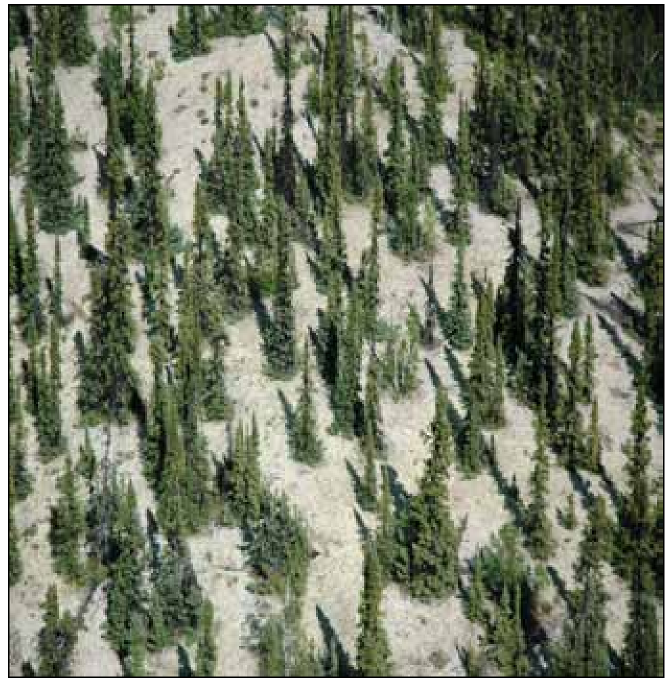
The relatively high-elevation Abitau Upland LS Ecoregion contains well-developed till drumlin fields. Like the Wignes Plain LS Ecoregion, this Ecoregion is characterized by a high density of Osprey stick nests on boulders in lakes.

[23] This Ecoregion is the Abitau-Dunvegan Low Subarctic Ecodistrict of Bradley *et al.* (1982), from which much of the descriptive information is derived.

[24] The Dunvegan Lake Upland Landscape Area in Saskatchewan, described in *Ecoregions of Saskatchewan* (Acton *et al*. 1998), is its southern extension.



The Abitau Upland LS Ecoregion is characterized by cigar-shaped till drumlins forested by open, low-canopied black spruce stands and often surrounded by lakes and wetlands.



Typical Low Subarctic stands include black spruce, paper birch and the occasional white spruce with a light-coloured lichen understory and only a few dwarf shrubs.

The tallest black spruce trees at this survey plot in the southern part of the Ecoregion are well over 200 years old and only 6 to 8 m tall. Sandy, nutrient-poor soils and cold climates restrict tree growth and limit understory diversity to lichens and a few low shrub species.

The "ribs" of this sedge-dominated northern ribbed fen are perpendicular to water flow (left to right in this image). This type of fen is supplied with more nutrient-rich waters than peat plateaus or black spruce bogs.

3.4.5.9 Dubawnt Plain LS Ecoregion

Overview: *A level to gently undulating bouldery till plain with large treeless polygonal peat plateaus and open black spruce – lichen woodlands characterizes the Dubawnt Plain LS Ecoregion.*

Summary:

- Level to gently undulating lowland till plain that has a high proportion of organic terrain and includes narrow, long eskers and numerous outwash deposits.
- Low-canopied open black spruce – lichen woodlands on uplands, and treeless polygonal peat plateaus on organic terrain.

Total area: 7,639 km^2 (6.7% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 375 (350-425)

General Description

The Dubawnt Plain LS Ecoregion[25] is a nearly level to gently undulating lowland plain that slopes gently to the northeast. It has a higher proportion of water and wetlands than any other Taiga Shield ecoregion except the Slave Plain MB Ecoregion. Polygonal peat plateaus indicative of cold climates that are transitional between Low Subarctic and High Subarctic surround many of the large, shallow lakes that cover almost 30 percent of the Ecoregion. Uplands are level to gently undulating bouldery till plains crossed by northeast to southwest trending sandy eskers. Outwash deposits are common. Low-canopied, open black spruce – lichen woodlands are the dominant upland cover.

Geology and Geomorphology

The southern two-thirds of the Ecoregion is underlain by Precambrian sedimentary bedrock that is almost entirely mantled by glacial and organic deposits. Most of the Ecoregion was covered by Glacial Lake "Hyper-Dubawnt" (Bradley *et al*. 1982), and its extent coincides with that of present-day organic deposits that can be several metres thick. The upland till plains are bouldery, and there are extremely bouldery ribbed till deposits in the extreme north, a continuation of those occupying a vast area in the Dubawnt Plain HS Ecoregion to the north. Narrow eskers that sometimes exceed 30 km in length cross in a northeast to southwest direction, and sandy outwash plains are common.

Soils

Soils belong to the Porter Lake association (Bradley *et al.* 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granites. Organic Cryosols (Dymond Lake association) occur extensively throughout the Ecoregion with polygonal peat plateaus.

Vegetation

Open low-canopied black spruce – lichen woodlands cover most of the till plains, and some large burned areas are regenerating to dwarf birch and black spruce.[26] Hilltops are mostly treed, indicating a more moderate climate than the Dubawnt Plain HS Ecoregion to the north where hilltops are treeless. Treeless polygonal peat plateaus are lichen-dominated, with common and northern Labrador tea and cloudberry. Treeless polygonal peat plateaus are extensive adjacent to large lakes, possibly because cold winter winds carrying abrasive ice crystals that retard tree growth can blow unchecked across the lake surfaces and onto the shorelines.

Water and Wetlands

Numerous large shallow and often boulder-studded lakes (Wholdaia, Anaunethad, Smalltree, Rowley, Flett, Snowbird and Sherwood Lakes) cover nearly 30 percent of the Ecoregion. Most are surrounded by polygonal peat plateaus. The Dubawnt River drains the Ecoregion to the northeast through Wholdaia Lake. This Ecoregion has a higher proportion of organic terrain than most others in the Taiga Shield.

Notable Features

This Ecoregion, and notably Wholdaia Lake, has traditionally been an important caribou wintering area.

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[25] This Ecoregion is part of the Wholdaia-Selwyn Low Subarctic Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

[26] Jack pine was not noted during 2006 aerial surveys.

Much of the Dubawnt Plain LS Ecoregion is a flat to gently undulating bouldery till plain interspersed with large treeless polygonal peat plateaus. The gray tones in the distance are regenerating burns.

Horizontal fens, peat plateaus and somewhat better forest growth occurs in the southernmost part of the Ecoregion.

This esker is one of several large eskers that wind from northeast to southwest across till plains and shallow lakes in the northern half of the Ecoregion.

Polygonal peat plateaus with peat banks 3 to 5 metres high are sloughing into the water along the western shores of Flett Lake as the permafrost melts back.

3.4.5.10 Selwyn Upland LS Ecoregion

Overview: *Gently rolling till plains in the north, hummocky and bouldery till plains in the south, mixed black spruce – lichen woodlands throughout and extensive burns characterize the Selwyn Upland LS Ecoregion.*

Summary:

- Gently undulating till veneers and blankets over bedrock in the north half, with rolling to hummocky till blankets and veneers in the south half.
- Black spruce – lichen woodlands are continuous in the south but become patchy in the north due to colder climates; much of the area has recently burned.

Total area: 13,860 km^2 (12.1% of Taiga Shield LS Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 400 (325-525)

General Description

The Selwyn Upland LS Ecoregion[27], a gently undulating to hummocky bedrock-controlled landscape that is mostly covered by bouldery till veneers and blankets, occupies the southeast corner of the Northwest Territories. It is bordered on the west by the higher-elevation Wignes Plain LS Ecoregion and on the north and northeast respectively by the lower and wetter Dubawnt Plain LS Ecoregion and the colder Dubawnt Plain HS Ecoregion.[28] North of Kasba Lake, the Ecoregion is mainly an undulating bouldery till plain with outwash and a mixture of black spruce woodlands, shrub tundra and treeless polygonal peat plateaus. Elsewhere, the Ecoregion is a hummocky, bouldery till plain with outwash, black spruce woodlands, treed peat plateaus and horizontal fens.

Geology and Geomorphology

Precambrian intrusive bedrock underlies the eastern third of the Selwyn Upland LS Ecoregion, with sedimentary and metamorphic rock under the central and western areas; bedrock exposures are common. Most of the Ecoregion is mantled by bouldery till that is mainly gently undulating in the north and hummocky in the south; some till hummocks have been streamlined by ice movement and weakly developed drumlins indicate a northeast – southwest flow. Beach ridges and fine-textured lacustrine deposits in the eastern half of the Ecoregion are evidence that a large glacial lake once covered the area. Extremely bouldery and hummocky deposits in the northeast section are outliers of very large ribbed till deposits in the Dubawnt Plain HS Ecoregion and in Nunavut. Outwash is common, as are narrow eskers that trend northeast – southwest.

Soils

Soils belong to the Porter Lake association (Bradley *et al.* 1982) and are noncalcareous sandy loam Brunisols that have developed on tills derived from granites. Organic Cryosols (Dymond Lake association) occur extensively throughout the Ecoregion with peat plateaus and polygonal peat plateaus.

Vegetation

Vegetation patterns are influenced by climatic variability, fire and topography. North of Kasba Lake, discontinuous black spruce – lichen woodlands on lower slopes, shrubby tundra on hilltops, polygonal peat plateaus in depressions and on poorly drained level areas, and dwarf birch regeneration on burns are all indicative of colder conditions. Fire intervals of less than 60 years may cause local extinction of black spruce (Le Goff and Sirois 2004) and dwarf birch regeneration on burns may be the result of lack of seed source or unfavourable soil conditions for trees. The vegetation south and west of Kasba Lake is a complex of open black spruce woodlands, extensive burns, peat plateaus and horizontal fens. Jack pine and paper birch are locally common species along with dwarf birch. Shore fens and scattered variegated pond lily colonies in shallow lakes are common in the southern half of the Ecoregion.

Water and Wetlands

The larger lakes in the Selwyn Upland LS Ecoregion include Kasba Lake along the eastern border, Atzinging Lake, Obre Lake, Selwyn Lake, Ingalls Lake and the southern tip of Snowbird Lake. Many lakes show a northeast-southwest orientation and are shallow and boulder studded in places, affording good nesting sites for Osprey and other raptors. Eroding polygonal peat plateaus occupy locally extensive areas to the east and north; in the western third, treed peat plateaus and horizontal sedge fens are widespread.

Notable Features

This Ecoregion and surrounding landscapes include important winter habitat for several herds of barren-ground caribou that in recent years has probably included the Bathurst, Ahiak, Beverly and Qamanirjuaq herds.

[27] This Ecoregion is part of the Wholdaia-Selwyn Low Subarctic Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

[28] It lies adjacent to the Robins Lake Upland, Striding River Upland, and Nueltin Lake Plain Landscape Areas in Saskatchewan, described in *Ecoregions of Saskatchewan* (Acton *et al*. 1998).

In the northeast part of the Selwyn Upland LS Ecoregion, forest cover is patchy on bouldery till veneers; upper slopes and crests are vegetated by low shrubs and lichens, with open black spruce woodlands on lower slopes and protected locales and polygonal peat plateaus on poorly drained flats.

In the southern part of the Ecoregion, warmer conditions allow the development of more continuous black spruce – lichen and black spruce – moss communities on bouldery till. The gray area in the mid- and background is a recent burn, and the greenish-gold lowland vegetation in the foreground is associated with horizontal fens and collapse scars in peat plateaus.

Jack pine regeneration is common on recent burns in the south and west part of the Ecoregion. The taller trees are jack pine; smaller black spruce and shrubs such as dwarf birch and green alder occur between them.

Relatively good forest growth like this narrow black spruce – paper birch stand is limited to places where water, nutrients and temperature are favourable, such as along stream channels.

3.4.6 TAIGA SHIELD HIGH BOREAL (HB) ECOREGION

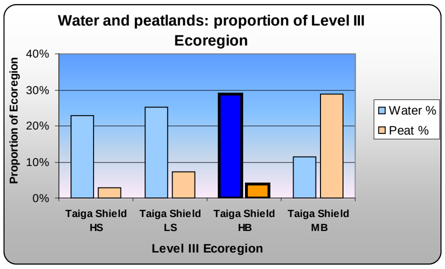
Uplands of exposed bedrock or discontinuous till veneers are typical landforms across much of the Taiga Shield High Boreal (HB) Ecoregion. Dense to open black spruce and jack pine forests with bog cranberry, common Labrador tea, lichen and moss understories are widespread; deep soils and adequate moisture promote diverse communities. Paper birch is the dominant deciduous species. White spruce and aspen are generally restricted to warm, moist well-drained sites where nutrients are not limiting. Lichen communities, open lichen woodland or shrubby woodlands prevail on exposed bedrock or thin till or outwash veneers. Bogs and fens with black spruce, larch, paper birch, Labrador tea, bog cranberry, red bearberry, cloudberry, sedges and peat mosses occupy cold, wet, poorly drained sites. Shore fens, such as the one surrounding the pond in the midground, are common. Brunisols and Regosols are common soils on imperfectly- to well-drained sites. Organic Cryosols and Gleysols are associated with poorly-drained wet sites.

Closed-canopied black spruce and jack pine forests with scattered stands of white spruce and paper birch are typical of the Taiga Shield HB Ecoregion. Areas of exposed bedrock (foreground) with little or no soil are characterized by patchy lichen, moss, grass and low shrub communities.

The bog or mountain cranberry (*Vaccinium vitis-idaea*) is a low, mat-forming evergreen shrub that favours sunny, acidic, and dry to moist sites. It is common throughout the Taiga Shield.

3.4.6 TAIGA SHIELD HIGH BOREAL (HB) ECOREGION

Overview: *The Taiga Shield HB Ecoregion occupies the eastern third of the Taiga Shield; it is bedrock-dominated with jack pine and mixed spruce forests on rock outcrops, thin bouldery till, and outwash.*



Total area: 84,767 km^2 (26% of Taiga Shield). Ecoregion shown in red.

General Description

The Level III Taiga Shield HB Ecoregion extends south from 64^o N latitude to the Alberta – Northwest Territories border, a distance of about 650 km, and includes five Level IV ecoregions. North of Great Slave Lake, the Ecoregion is about 80 to 100 km wide from its western boundary with the Level II Taiga Plains Ecoregion to its eastern boundary with the Level III Taiga Shield LS Ecoregion, and occurs at elevations of 300 mASL or less. South of Great Slave Lake, the Ecoregion is about 150 to 200 km wide; the land rises gently to the east and reaches elevations of over 500 mASL in the southeast corner. Exposed bedrock plains and undulating to hilly bedrock uplands are the dominant landscape feature, with thin bouldery till veneers mainly in the lowland areas between Great Slave Lake and Great Bear Lake. Jack pine stands occupy large areas with high fire frequency; black spruce – shrub – lichen stands are dominant where fires are less frequent. White spruce and trembling aspen forests are common in low-elevation areas to the west where nutrient and water supplies are adequate. Peat plateaus and shore and floating fens are scattered throughout.

Climate

Yellowknife is the only station from which climate data have been collected over long periods within the Taiga Shield HB Ecoregion, and climate statistics are therefore determined through interpolated models using the limited available data. The extensive occurrence of jack pine, the development of mixed-wood stands along the western third of the Ecoregion, the absence of polygonal peat plateaus and the presence of more extensive shoreline and aquatic vegetation communities provides supporting evidence for comparatively warm conditions. Climate models (Agriculture and Agri-Food Canada 1997) provide the following general statistics. The mean annual temperature ranges from –3 to –6^{o}C. The mean temperature in January, the coldest month, ranges from –26 to –28^{o}C, and from 15 to 16^{o}C in July, the warmest month. Mean annual precipitation is between 280 and 360 mm, with the wettest period in June through November; about 50 percent falls as rain and 50 percent as snow. The mean annual daily solar input (refer to Section 1.4.1 for further explanation) ranges between 10.5 and 11.0 mJ/m^2/day, with low values of 1.0 to 1.5 mJ/m^2/day in December and highs of 21.5 to 22.0 mJ/m^2/day in June.

Topography, Geology, Soils, and Hydrology

South of Great Slave Lake, the land rises from about 200 mASL along the western boundary to over 500 mASL in the southeast corner. North of Great Slave Lake, elevations range from about 100 mASL to 300 mASL. Nearly level to rolling and hilly Precambrian granitoid, intrusive and metamorphic crystalline bedrock is the dominant landform, with thin bouldery coarse-textured till veneers over much of the area and somewhat deeper till deposits in the southeast. Eskers and outwash deposits occur mainly in the southeast on higher terrain and are not widespread elsewhere. Fine-textured, relatively nutrient-rich lacustrine deposits have accumulated in low-lying areas between bedrock exposures at lower elevations along the west side of the Ecoregion. Brunisols are the most common soils, with Regosols and Gleysols near streams and lakes. Peatlands cover less than five percent of the Ecoregion, but lakes account for nearly one-third of the area, and Great Slave Lake is the largest water body.

Vegetation

Bradley *et al.* (1982) describe two major upland vegetation types associated with bedrock and discontinuous glacial deposits in the High Boreal ecoclimatic region on the Taiga Shield – lichen woodland and moss forest. Lichen woodland/rock lichen woodland with jack pine, black spruce and paper birch occurs on thin soils over bedrock, in bedrock fractures and on well-drained coarse-textured outwash deposits. Moss forest, typically with a moderately dense black spruce canopy that favours the development of a feathermoss understory, occurs on deeper, moister soils; mixed or pure forests of white spruce, trembling aspen and paper birch also occur on moderately moist sites. Fire has had a major influence on the Taiga Shield HB Ecoregion. Large expanses are forested with closed canopy conifers and young jack pine and paper birch stands. Black spruce stands occur on areas that have longer fire-return intervals; stand size is determined by the extent and depth of till deposits on bedrock. Mixed-wood stands of white spruce and aspen are common on lacustrine and fluvial materials in the low-elevation areas. Rock lichen communities colonize bare bedrock and include several species of lichens and a few dryland mosses. Black spruce and jack pine occur in shallow depressions or in fractures that hold water and together with lichens and low shrubs form sparsely treed rock lichen woodland. The bright green hues of shoreline and floating fens and the abundance of variegated pond lily colonies in shallow water are characteristic of this Ecoregion. Appendix 2 summarizes the major plant community types.

3.4.6.1 Great Slave Upland HB Ecoregion

Overview: *The Great Slave Upland HB Ecoregion is a nearly level bedrock plain with thin discontinuous till veneers, scattered outwash and lacustrine deposits, and a mosaic of black spruce woodlands and jack pine and paper birch regeneration on burned areas.*

Summary:

- Bedrock dominated landscape, mostly level with a few hill systems
- Black spruce and jack pine forests grow in rock fractures and on discontinuous till and lacustrine deposits between bedrock exposures

Total area: 18,609 km^2 (22% of Taiga Shield HB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 250 (160-450)

General Description

The Great Slave Upland HB Ecoregion is a gently southwest-sloping bedrock plain between about 200-300 mASL. It extends northeast from the shores of the East Arm to the more rugged terrain of the Great Slave Upland LS Ecoregion and the Calder Upland LS Ecoregion. Its southwestern boundary is defined by the lower elevation bedrock plains of the Great Slave Lowland HB Ecoregion. The dominant landscape type is a fractured bedrock plain with subdued topography, but there are a few local prominences that reach elevations of 450 mASL between Faber and Basler Lakes in the northernmost part, and more pronounced rolling terrain along the border with the Great Slave Upland LS Ecoregion and in a small area just east of Strutt and Slemon Lakes. Most of the Ecoregion was covered by Glacial Lake McConnell, and discontinuous wave-washed bouldery till or variable-textured lacustrine and glaciofluvial materials have been deposited in rock fractures and between rock outcrops. Trembling aspen, jack pine paper birch and spruce occur as forested patches separated by rock exposures. Small peat plateaus, shore fens and floating fens are common throughout the Ecoregion in wet depressions and along lakeshores.

Geology and Geomorphology

The southeastern third of the Ecoregion is underlain by Precambrian sedimentary rock, but the remainder is mainly fractured and dissected granite. Glacial Lake McConnell reached a maximum elevation of about 280 mASL (Kerr and Wilson 2000) and a combination of wave-washed tills, variable-textured glaciolacustrine sediments and glaciofluvial materials occur as thin, discontinuous deposits between rock outcrops and in fractures over much of the Ecoregion.

Soils

Variable-textured Brunisols are the dominant soils on glacial deposits between bedrock exposures and in fractures, but there is no soil development on bare bedrock exposures. Organic Cryosols occur with peat plateaus and Organic soils and Gleysols in wet depressions with shore fens and floating fens.

Vegetation

Forests are discontinuous and occur between or on rock outcrops where there is a sufficiently thick mineral or organic substrate. Lichen woodland/rock lichen woodland with jack pine, black spruce and paper birch occurs on thin soils over bedrock, in bedrock fractures, and on well-drained coarse-textured outwash deposits. Moss forests, typically with a moderately dense black spruce canopy that favours the development of a feathermoss understory, occur on deeper, moister soils; mixed or pure forests of white spruce, trembling aspen and paper birch also grow on moderately moist sites. Peat plateaus have open black spruce – low shrub – lichen communities on the palsas and sedge – moss fens in the collapse scars. Shore fens and floating fens include sedges, cotton-grasses, shrubs and mosses.

Water and Wetlands

Numerous large lakes (Faber, Zinto, Saddle, Basler, Kwejinne, Mazenod, Labrishe, Bigspruce, Slemon, Wheeler, Awry, Duncan, Desparation, Harding, Campbell, Watta, Buckham, Mystery and Blatchford Lakes) occupy over 30 percent of the area. Several major rivers (Snare, Wecho, Yellowknife, Cameron and Beaulieu Rivers) all drain south across the Ecoregion into Great Slave Lake. Peat plateaus and fens are common in lowlands and around shallow lakes. Lakes in this Ecoregion are transitional between those occupying the former basin of Glacial Lake McConnell and higher elevation areas. Lakes within the basin are shallow and silty, whereas lakes at higher elevations are deep and clear.

Notable Features

A small outlier population of Harlequin Ducks, a species normally associated with Cordilleran (mountainous) areas far to the west, breeds in this Ecoregion.

This image from the approximate centre of the Great Slave Upland HB Ecoregion is typical. The incised bedrock plain supports a mosaic of discontinuous patchy black spruce, jack pine, paper birch and white spruce forests.

Bedrock hills to 450 mASL occur in the northern part of the Ecoregion. Lower slopes with deeper till blankets support spruce and feathermoss forests, and lakes tend to be deep and clear.

Bouldery till and sandy outwash support open, shallow-rooted stands of jack pine, white spruce and paper birch with sparse low shrub and lichen understories. Common bearberry is the main species in the light green forest floor mats.

The transition to lower-elevation warmer High Boreal climates is marked by the increasing occurrence of bright green shore and floating sedge fens on shallow, silty lakes, and the improved growth of trees such as the white spruce stands in the midground.

3.4.6.2 Great Slave Lowland HB Ecoregion

Overview: *The Great Slave Lowland HB Ecoregion borders Great Slave Lake, and is a low-elevation, nearly level bedrock plain with silty discontinuous till and lacustrine deposits between outcrops and a diverse array of forest types and wetlands.*

Summary:

- Nearly level low-elevation granitic bedrock plain with discontinuous till and lacustrine deposits between outcrops.
- Mixed conifer and conifer – deciduous forests on and between rock outcrops.
- Shore and floating fens and peat plateaus in wet depressions.

Total area: 11,040 km^2 (13.0% of Taiga Shield HB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 175 (160-200)

General Description

The Great Slave Lowland HB Ecoregion occupies the low-elevation level terrain adjacent to the North Arm of Great Slave Lake and the Level II Taiga Plains Ecoregion. The slightly higher and more rugged Great Slave Upland HB Ecoregion surrounds it to the east and north; a line across the western tip of the islands in East Arm forms the southeastern boundary. The dominant landscape is a level plain composed of low-relief Precambrian granites that were glaciated and subsequently flooded by Glacial Lake McConnell, leaving behind discontinuous till and lacustrine veneers and blankets between bedrock outcrops and in rock fractures. Patchy conifer, mixed-wood and deciduous forests with relatively diverse understories occur between rock exposures, on thin soils over bedrock, and in fractures; jack pine and aspen stands are widespread, indicating the influence of High Boreal climates. Wetlands are common.

Geology and Geomorphology

Low-relief Precambrian granites are the dominant terrain feature throughout the Ecoregion, with some sedimentary deposits around Russell Lake in the north and Hearne Lake in the south. The entire area was once covered by thick ice and later flooded by Glacial Lake McConnell to a depth of about 100 m. A combination of wave-washed tills, variable-textured glaciolacustrine sediments, and glaciofluvial materials occur as thin, discontinuous deposits between rock outcrops and in fractures over much of the Ecoregion and surrounding areas (Kerr and Wilson 2000).

Soils

Variable-textured Brunisols are the dominant soils on glacial deposits between bedrock exposures and in fractures. Organic Cryosols occur with peat plateaus and Organic soils and Gleysols in wet depressions with shore fens and floating fens.

Vegetation

Forests are discontinuous and occur between or on rock outcrops where there is a sufficiently thick mineral or organic substrate. The influence of the milder High Boreal ecoclimate across this Ecoregion is indicated by the widespread occurrence of jack pine and aspen, the relatively vigorous growth of white spruce and birch in moist areas, locally extensive shrubby and sedge fens, dense variegated pond lily colonies on shallow ponds, and peat plateaus with large collapse scars.

Water and Wetlands

Great Slave Lake is a major influence on the Great Slave Lowland HB Ecoregion. It meets the bedrock uplands along a complex shoreline with deep shallow bays and surrounds numerous small, mostly treeless islands. Russell, Mosher, Marian and Stagg Lakes are the largest lakes to the northwest; Prosperous, Jennejohn, Defeat and Hearne Lakes are the largest lakes to the south. The lower portions of the Marian, Snare, Stagg, Yellowknife and Beaulieu Rivers flow through the Ecoregion and drain into Great Slave Lake. Peat plateaus, shore fens and floating fens are common throughout but become a prominent feature closer to Great Slave Lake.

Notable Features

Shallow bays, marshes and lakes with rich and diverse aquatic and shoreline vegetation are common features of this Ecoregion and provide excellent habitat for numerous aquatic bird species. The waters of the inshore bays and islands of the North Arm are ice-free here earlier than elsewhere on Great Slave Lake, allowing birds to nest sooner and improve breeding success. Early-season open water also makes the area particularly important as a spring staging area for numerous migrating aquatic birds that nest further inland, especially waterfowl.

The low-relief bedrock plains, bright green floating and shore fens, pond lily colonies and mixed conifer – deciduous forests in this image are typical of the Great Slave Lowland HB Ecoregion. The grayish-white patches are exposed bedrock.

Along the shores of Great Slave Lake, extensive floating sedge fens often develop in shallow bays. The pinkish-gray hummocks are exposed bedrock.

Active beaver colonies are common throughout the Ecoregion, and encourage the development of extensive ponds and wetlands. The two gray dome-shaped structures at the edge of the central sedge island are large beaver lodges.

Jack pine can take root in very small crevices or in shallow pockets of soil on bedrock, where growth is limited by available water. Lichens and drought-tolerant mosses are abundant on bare rock.

3.4.6.3 East Arm Upland HB Ecoregion

Overview: *The East Arm Upland HB Ecoregion is a complex of nearly flat to hilly bedrock islands and peninsulas blanketed by discontinuous lacustrine deposits and supporting a diverse mosaic of plant communities.*

Summary:

- There are two main terrain types within the Ecoregion – the islands to the west and a hilly peninsular landmass extending north from the prominent McDonald Fault to the east.
- Bedrock, silty lacustrine deposits and scattered outwash plains provide diverse growing conditions that support a variety of forest and wetland types.

Total area: 10,302 km^2 (12.2% of Taiga Shield HB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 200 (160-375)

General Description

The East Arm Upland HB Ecoregion[29] includes the Simpson Islands of Great Slave Lake and a complex hilly peninsula containing many shallow bays and lakes in the eastern half of the Ecoregion. The southern boundary of the Ecoregion is clearly defined by the McDonald Fault and the southern shoreline of East Arm. To the north, Christie Bay separates it from the East Arm LS Ecoregion. Fine-textured lacustrine deposits blanket many of the low-lying areas, especially on the eastern peninsula. Coniferous, mixed-wood, and deciduous forests, rock lichen communities on bedrock, and scattered wetlands occur across the Ecoregion.

Geology and Geomorphology

An undifferentiated complex of mixed-origin Precambrian bedrock is the dominant feature, with granitic exposures along the prominent McDonald Fault to the south and the rugged Simpson Islands. Bedrock layers often tilt down to the southeast within the East Arm and break along vertical fractures producing tall cliffs such as those on the north side of Redcliff Island. Glacial Lake McConnell covered almost the entire East Arm to an elevation of 280 mASL (Kerr and Wilson 2000), leaving behind fine-textured glaciolacustrine blankets that are most extensive on interior lowlands of the larger islands and across the eastern peninsula. Outwash deposits are not widespread but can be locally extensive, such as those that form large terraces and plains in the Snowdrift River valley.

Soils

Soils on lacustrine materials belong to the Redcliff Island association (Bradley *et al.* 1982) and are moderately well- to poorly-drained, noncalcareous, clay loam to clay-textured permafrost-affected Orthic and Gleysolic Turbic Cryosols. Soils on thin till deposits over bedrock belong to the Nonacho Lake association; they are well-drained, sandy loam-textured noncalcareous Brunisols (Bradley *et al.* 1982). There is no soil development on exposed bedrock.

Vegetation

Fine-textured lacustrine deposits interspersed with bedrock exposures, topographic variability, and a High Boreal ecoclimate together provide suitable conditions for the development of diverse plant communities. Spruce – lichen woodlands, jack pine communities, and low-growing shrubs and lichens occur in fractures, on thin tills over bedrock and on outwash plains. Spruce – shrub – moss communities or regenerating jack pine – paper birch – shrub stands occupy locally extensive areas on lacustrine materials. The occurrence of jack pine, trembling aspen and broad sedge-dominated fens on lakes indicates a Mid-Boreal ecoclimatic influence on the western part of the Ecoregion.

Water and Wetlands

The most important water body is Great Slave Lake. Large lakes occurring within the eastern peninsula include McDonald, Fairbairn, Wilson, Stark and Murky Lakes and Lac Duhamel. Some of these lakes are turquoise-coloured because of suspended lacustrine silts. The Snowdrift River flows into the Ecoregion from the south. Peat plateaus are small and scattered. Horizontal sedge fens, shore fens and floating fens can be locally extensive in shallow bays and around lakes.

Notable Features

The East Arm of Great Slave Lake contains very deep water areas where warm upwellings may remain ice-free during winter. The islands of the East Arm provide key nesting sites for several species of colonial nesting gulls, terns and jaegers. Cliffs are common and provide optimal nesting sites for birds of prey.

[29] This Ecoregion is included within the East Arm Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

Exposed bedrock and thin lacustrine veneers on the eastern tip of Blanchet Island support black spruce – shrub – moss forests and peat plateaus. Terrain and vegetation patterns shown in this image are typical of many of the islands found in the western portion of the Ecoregion.

The eastern peninsulas are a complex of bedrock plains and hills, with lacustrine blankets on the lower-elevation plains. In this image taken northeast of McDonald Lake, mixed-wood stands, jack pine, black and white spruce, and sedge fens are all visible.

Cliffs are common throughout much of the Ecoregion. Spectacular exposures, such as these along the southeast side of Redcliff Island, occur on some of the islands and peninsulas.

The Snowdrift River flows across the Ecoregion and into Great Slave Lake; the light-coloured area in the foreground is sparsely treed white spruce – black spruce – jack pine lichen woodland on a sandy outwash terrace that was deposited thousands of years ago by glacial meltwaters.

3.4.6.4 Rutledge Upland HB Ecoregion

Overview: *The Rutledge Upland HB Ecoregion includes hummocky bedrock ridges and plains with thin, discontinuous bouldery till veneers; almost the entire area has burned in the recent past, resulting in extensive areas of jack pine regeneration.*

Summary:

- Gently sloping hummocky bedrock upland with thin discontinuous till deposits is typical over most of the Ecoregion.
- Very extensive fires have produced a landscape that is dominated by jack pine regeneration.

Total area: 22,679 km^2 (27% of Taiga Shield HB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 325 (175-425)

General Description

The Rutledge Upland HB Ecoregion is a southwest-sloping hummocky bedrock landscape.[30] Its eastern border with the higher-elevation Nonacho Upland HB Ecoregion is defined by metamorphic rock ridges that parallel the Taltson River and by a transition to deeper till deposits over bedrock. Its western boundary with the lower-elevation Slave Plain MB Ecoregion is at the approximate inundation limits of Glacial Lake McConnell.[31] The steep bedrock hills above the shoreline of the East Arm Upland HB Ecoregion form its northern boundary. Thin bouldery till deposits occur in fractures, bedrock depressions and low areas between extensive bedrock outcrops. Jack pine and black spruce stands occur as discontinuous stands on shallow soils on and between bedrock knobs. To the west, pockets of lacustrine materials underlie locally extensive wetlands and black spruce – moss forests. Till veneers mantle bedrock in the southeastern corner and allow the development of more continuous forest cover. Wetlands are more common in this Ecoregion than in other Taiga Shield High Boreal ecoregions.

Geology and Geomorphology

The western two-thirds of the Ecoregion is dominated by hummocky Precambrian intrusive bedrock, and the eastern third is mainly ridged to hummocky metamorphic rock. Bouldery till deposits are found only in fractures, bedrock depressions and between bedrock exposures. Till veneers overlie bedrock in the southeast corner. Lacustrine deposits occur in pockets along the western border of the Ecoregion at elevations below about 300 mASL, corresponding with the approximate maximum elevation of Glacial Lake McConnell.

Soils

Soils on till materials belong to the Nonacho Lake association (Bradley *et al.* 1982) and are well-drained, noncalcareous, sandy loam lithic phase (thin over bedrock) Brunisols. Weakly calcareous sandy to loamy Brunisols of the Fort Smith association are likely to occur with lacustrine deposits along the western border. Organic soils are assigned to the Taltson River association and are poorly drained Organic Cryosols.

Vegetation

Rock lichen, rock lichen woodland and moss forest communities are the main upland plant communities (Bradley *et al.* 1982; refer to Appendix 2). Vast areas are pine-dominated because of recent fires. Moss forests with a moderately dense black spruce, white spruce or jack pine canopy occur in areas with deeper, moister soils such as the thicker till deposits in the southeast and lacustrine pockets along the western boundary; these forests usually have a shrubby or feather moss understory.

Water and Wetlands

Lakes in the Rutledge Upland HB Ecoregion occupy rock fractures and tend to be long and narrow; the largest water bodies are Rutledge, Gagnon, Lady Grey, Thekulthili and Hill Island Lakes. The Taltson, Tazin and Rutledge Rivers drain the Ecoregion towards the west and south. Horizontal fens are common and locally extensive on areas where till veneers or lacustrine deposits are present. Peat plateaus with large collapse scars occur more often in the northeast and east at higher elevations.

Notable Features

This Ecoregion has a higher proportion of wetlands and exposed bedrock relative to Taiga Shield HB ecoregions. Bradley *et al.* (1982) suggest that dry bedrock upland terrain is susceptible to lightning-caused fires; extensive jack pine stands and recent burns attest to the active fire history of the Ecoregion. Although it has been used extensively by wintering barren-ground caribou in the past, use in years appears to have been intermittent. Recent fire history may have been a factor.

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[30] This Ecoregion is identical to the Rutledge-Pilot Ecodistrict of Bradley *et al.* (1982).

[31] The Uranium City Upland Landscape Area in Saskatchewan, described in *Ecoregions of Saskatchewan* (Acton *et al.* 1998), is its southern extension.

	
This typical landscape in the Rutledge Upland HB Ecoregion shows exposed hummocky bedrock, sparse jack pine and black spruce forests, rock-walled lakes, and scattered wetlands.	In the southeast corner of the Ecoregion, thicker till deposits mantle the bedrock and allow the development of more continuous jack pine and black spruce forests and horizontal fens (light green patches in the left midground).
	
Ice-polished bedrock knobs have fractures and shallow bowl-shaped depressions that hold enough lichen and leaf litter or thin bouldery till deposits to allow the development of patchy jack pine and black spruce forests.	The Taltson River flows west and southward across hundreds of kilometres of Shield bedrock to the Slave Plain MB Ecoregion, where it turns north to parallel the bedrock boundary between the Taiga Shield and Taiga Plains and empties into Great Slave Lake.

3.4.6.5 Nonacho Upland HB Ecoregion

Overview: *The Nonacho Upland HB Ecoregion is a hummocky, gently sloping bedrock landscape mantled by bouldery till veneers and outwash deposits and forested by extensive and continuous black spruce and jack pine stands.*

Total area: 22,137 km^2 (26.1% of Taiga Shield HB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 425 (250-500)

Summary:

- Gently sloping hummocky bedrock upland with a bouldery till blanket mantling the bedrock; sandy eskers and outwash deposits are common in the eastern half.
- Continuous till blankets allow the development of extensive jack pine and black spruce forests.

General Description

The Nonacho Upland HB Ecoregion is a southwest-sloping hummocky bedrock landscape blanketed by bouldery sandy-textured tills and outwash.[32] Its western border with the lower-elevation Rutledge Upland HB Ecoregion is defined by metamorphic rock ridges that parallel the Taltson River, and by an increasing proportion of exposed bedrock and patchy forest cover. To the east, reduced jack pine occurrence and an increase in esker and outwash landforms mark the boundary with the Porter Upland LS and Wignes Plain LS Ecoregions. The McDonald Fault forms its northern border.[33] Relatively continuous mineral soils have promoted the development of extensive, unbroken black spruce and fire-successional jack pine stands.

Geology and Geomorphology

Most of the Ecoregion is underlain by Precambrian metamorphic bedrock, but there is a band of sedimentary bedrock across the northern third that underlies all of the larger lakes. The terrain over most of the Ecoregion is hummocky to hilly, but the north central portion is more subdued. Till veneers and blankets mantle the bedrock over most of the Ecoregion, and some drumlinized till forms occur in the southeast portion. Sandy outwash plains and a few eskers along the eastern half of the Ecoregion mark the western boundary of an extensive network of eskers and outwash deposits that are prominent landscape features further to the east and north.

Soils

Soils on till materials belong to the Nonacho Lake association (Bradley *et al.* 1982) and are well-drained, noncalcareous, sandy loam Brunisols. Organic soils are assigned to the Taltson River association and are poorly drained Organic Cryosols.

Vegetation

Moss forest communities are dominant across the Ecoregion on till veneers and blankets (Bradley *et al.* 1982) and are characterized by a black spruce canopy of variable density and a shrubby or feather moss understory. Young jack pine and paper birch are frequent associates in recently burned areas. Rock lichen and rock lichen woodland communities are also present (see Appendix 2). Outwash deposits and eskers support a mix of black and white spruce, jack pine, paper birch, low shrubs and lichen.

Water and Wetlands

The largest water bodies are associated with sedimentary bedrock across the northern third of the Ecoregion, and include Nonacho, Hjalmar, Taltson, Halliday, Thekulthili, Sparks and Powder Lakes. Whirlwind Lake is the only large lake that occurs in the south. The largest rivers include the Snowdrift, Taltson, Thoa and Abitau Rivers that flow westerly through the Ecoregion. Wetlands are small and cover only about two percent of the total upland area.

Notable Features

The fire interval of this Ecoregion is conducive to the development of extensive jack pine forests. Muskoxen have recently expanded their range from the northeast into the northern end of the Ecoregion, an area for which there is no historical record of their occurrence.

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[32] This Ecoregion is identical to the Nonacho-Whirlwind Ecodistrict of Bradley *et al.* (1982), from which most of the descriptive information is derived.

[33] It extends into Saskatchewan for a short distance as the Territories Upland Landscape Area, described in *Ecoregions of Saskatchewan* (Acton *et al*. 1998).

Hummocky to rolling low till-covered bedrock hills in the southern part of the Nonacho Upland HB Ecoregion are typical landforms; the light green tones are regenerating jack pine, and the dark green tones are black spruce.

Mainly level to gently rolling till plains occur south and west of Nonacho Lake; black spruce forests dominate this landscape, with some paper birch and locally extensive jack pine stands where there have been more frequent fires.

The Snowdrift River flows north along steep-walled valleys defined by rock fractures; the valley walls are forested by sparse black and white spruce woodlands with scattered paper birch.

Sandy outwash terraces south of Nonacho Lake near the eastern border of the Ecoregion support a very open woodland with jack pine (foreground), stunted trembling aspen, white spruce, common bearberry, bog cranberry and lichens.

3.4.7 TAIGA SHIELD MID-BOREAL (MB) ECOREGION

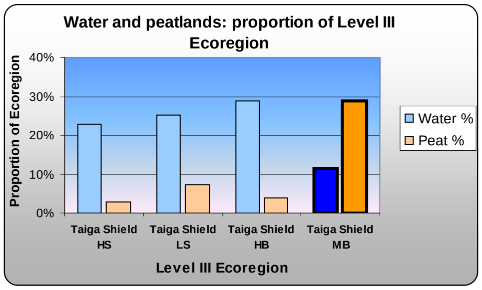
Moist to wet, fine-textured and fertile lacustrine and alluvial soils surround granitic bedrock knobs in the Taiga Shield Mid-Boreal (MB) Ecoregion. Dense mixed-wood and pure deciduous and conifer stands with diverse understories develop on these soils. The dry exposed rock knobs (whitish patches in the foreground and background) have scattered jack pine and black spruce, and are usually lichen covered. Imperfectly- to poorly-drained wet sites support dense to open forests of black spruce, larch and paper birch with shrub, lichen and moss understories. Marshes, shrub fens and sedge fens are common and extensive. Brunisolic and Regosolic soils are associated with well-drained sites, and Gleysols and Organic soils are found on poorly-drained mineral and organic deposits.

Mixed or pure forests of aspen, white spruce, jack pine, balsam poplar, paper birch, black spruce and larch occur on upland sites throughout the Taiga Shield MB Ecoregion. Diverse and lush shrub and herbaceous understories typically include willow, green alder, wild sarsaparilla, bunchberry, prickly rose, bog cranberry and common Labrador tea.

Wild red raspberry (*Rubus idaeus*), a small to medium-sized shrub, favours open woodlands, riverbanks, clearings and burns. It occurs throughout the Taiga Shield but is most common in the Taiga Shield MB Ecoregion.

3.4.7 TAIGA SHIELD MID-BOREAL (MB) ECOREGION

Overview: *The Taiga Shield MB Ecoregion in the extreme southwest corner of the Northwest Territories Taiga Shield has a relatively warm climate, reflected by vigorous mixed-wood, deciduous and coniferous forests and extensive wetlands within a complex of low bedrock exposures and lacustrine or alluvial deposits.*



Total area: 6,639 km^2 (2% of Taiga Shield). Ecoregion shown in red.

General Description

The Level III Taiga Shield MB Ecoregion occupies a small area in the extreme southwest of the Northwest Territories Taiga Shield, and includes one Level IV ecoregion. It occupies the westernmost part of a former bay of Glacial Lake McConnell, which has over time partially filled with fine-textured lacustrine and alluvial materials. Exposed Precambrian Shield bedrock is characteristic of this Ecoregion and differentiates it from the climatically and ecologically similar Level IV Slave Lowland MB Ecoregion of the Taiga Plains to the west.

Climate

The Taiga Shield MB Ecoregion is classified as having a Mid-Boreal climate (Ecoregions Working Group 1989, Bradley *et al.* 1982). Fort Smith is the only station close to the Taiga Shield, and climate models developed by Agriculture and Agri-Food Canada (1997) for the area that includes the Ecoregion provide the following statistics. The mean annual temperature is –3.5°C. The mean temperature in January, the coldest month, is –22°C, and the mean temperature is 16°C in July, the warmest month. Mean annual precipitation is between 330 and 360 mm, with the wettest period in May through October; about 60 percent falls as rain and 40 percent as snow. The mean annual daily solar input (refer to Section 1.4.1 for further explanation) lies between 10 and 11 mJ/m^2/day, with low values of 1 to 1.2 mJ/m^2/day in December and highs of between 21 and 22 mJ/m^2/day in June.

Topography, Geology, Soils, and Hydrology

Rolling bedrock plains with small pockets of lacustrine sediments in low areas are the dominant landform in the northern half. Towards the south, bedrock exposures become lower and more widely separated, and near Fort Smith they are only present as scattered islands on a level lacustrine and fluvial plain. Peatlands cover nearly a third of the Taiga Shield MB Ecoregion, in sharp contrast to other Level III ecoregions within the Taiga Shield that average about five percent.

Vegetation

Productive mixed-wood, deciduous and coniferous stands occur on imperfectly- to well-drained lacustrine and fluvial deposits and are most extensive in the southern half of the Ecoregion. Jack pine and black spruce grow as scattered individuals or in small stands on shallow soils over bedrock, along bedrock fractures or on outwash sands. High water tables in the southern half support extensive wetland development. Appendix 2 summarizes the major plant community types.

3.4.7.1 Slave Plain MB Ecoregion

Overview: *The Slave Plain MB Ecoregion is a low-relief, low-elevation bedrock plain with lacustrine, alluvial, and organic deposits that support vigorous deciduous, mixed-wood and coniferous forests and extensive sedge and shrub fens.*

Summary:

- Low-relief bedrock plain with lacustrine, alluvial and organic deposits between outcrops.
- Diverse and vigorous mixed-wood, white spruce and aspen forests on drier sites between outcrops, jack pine and black spruce woodlands on rock outcrops and horizontal fens on wet sites.

Total area: 6,639 km^2 (100% of Taiga Shield MB Ecoregion). Ecoregion shown in red.	**Average elevation (range) mASL:** 200 (160-275)

General Description

The Slave Plain MB Ecoregion[34] is a low-elevation, low-relief bedrock plain paralleling the Slave River and is the southwestern-most Level IV ecoregion in the Northwest Territories Taiga Shield. Its western boundary separates the Taiga Shield from the Taiga Plains, which has similar vegetation and parent materials but no bedrock outcrops. A slight increase in elevation and a rapid decrease in the occurrence and extent of mixed-wood forests and horizontal fens mark its eastern boundary with the Rutledge Upland HB Ecoregion. The northern boundary of the Ecoregion is the south shore of the East Arm of Great Slave Lake.[35] Diverse and vigorous mixed-wood, coniferous and deciduous stands grow on rich, moist alluvial and lacustrine deposits, with black spruce or jack pine woodlands on bedrock and extensive willow – sedge fens on wet lowland sites.

Geology and Geomorphology

The dominant bedrock type in the Ecoregion is Precambrian intrusive rock; sedimentary rock underlies Tsu and Thubun Lakes. All but the hilly southwestern corner of the Ecoregion was inundated by Glacial Lake McConnell. The Slave and Taltson Rivers deposit fine-textured alluvial and lacustrine materials between rock outcrops in western portions. Bedrock exposures are islands surrounded by lacustrine, alluvial and organic deposits in the southwest corner, but rolling bedrock plains become a dominant feature from Tsu Lake north, towards the eastern border, and in the low hill system in the southeast corner.

Soils

Soils on lacustrine materials belong to the Fort Smith association of sand to loam textured calcareous Brunisols (well-drained sites) and Gleysols (poorly drained sites) (Bradley *et al.* 1982). Soils on alluvial materials belong to the Norberta association of sandy-textured calcareous Regosols. Taltson River (peat) soils occur with peat plateaus, but permafrost is uncommon.

Vegetation

In the southwest corner where moist, calcareous lacustrine and alluvial deposits are most extensive, stands of tall white spruce, mixed aspen – spruce and pure trembling aspen and balsam poplar occupy upland sites; southern boreal understory species such as low-bush cranberry, twinflower and northern bedstraw are common associates. To the north and east, these stands become patchier as bedrock exposures increase, and rock lichen woodlands with stunted black spruce, jack pine, low shrubs and lichens become more common. Horizontal sedge and willow fens are also most extensive in the southwest corner.

Water and Wetlands

The three largest water bodies in the Ecoregion are the Thubun Lakes, Deskenatlata Lake and Tsu Lake. The Taltson River drains westward across the Ecoregion and parallels its western boundary northward to Great Slave Lake. Wetlands are a prominent feature, covering over 50 percent of the area south of Tsu Lake.

Notable Features

The greatest diversity of vegetation and wildlife in the Northwest Territories Taiga Shield likely occurs along the ecotone where the west side of this Ecoregion meets the east boundary of the Taiga Plains Slave River Lowland MB Ecoregion.

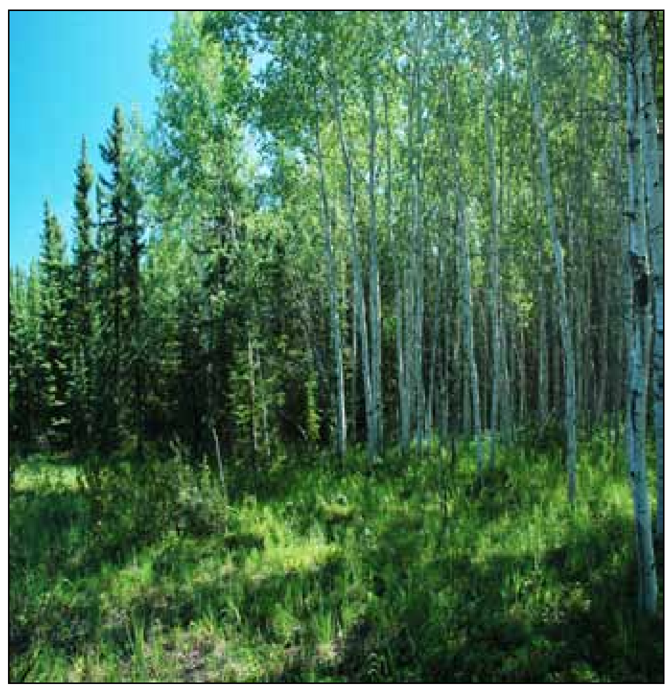
[34] This Ecoregion contains the Tsu-Slave Ecodistrict of Bradley *et al.* (1982), from which some of the descriptive information is derived.

[35] Mid-Boreal climates appear to influence the southern islands of East Arm as indicated by patchy deciduous and mixed-wood forests.

The Slave Plain MB Ecoregion includes a diverse array of plant communities This landscape just east of Fort Smith in the southwest corner is a mosaic of light green sedge – willow fens, tall trembling aspen and white spruce forests, and small bedrock islands with jackpine and lichen communities.

The northern half of the Ecoregion is bedrock dominated, and wetlands and forests are patchy. This recently burned landscape includes bright green floating sedge fens, trembling aspen stands, and jack pine – lichen woodlands on bedrock knobs.

The southwest corner of the Ecoregion is more rugged terrain, with a mix of deciduous, mixed-wood and white spruce forests on lacustrine veneers and jack pine on bedrock outcrops.



Trembling aspen stands in the Slave Plain MB Ecoregion are similar to those found further south in the Boreal forest, with low-bush cranberry, prickly rose, green alder, and a variety of grasses and forbs.

Ground-nesting Savannah Sparrows are summer breeding residents of the Taiga Shield. They occur in open country habitats such as meadows, marshes, bogs, shrublands and tundra. *Photo: J. Nagy.*

Common Ravens range throughout the Taiga Shield. They are especially abundant in and around communities where their omnivorous diet and resourcefulness enable them to thrive. *Photo: D. Downing.*

Arctic Terns breed throughout the Taiga Shield. They are most common in tundra areas and are famous for their yearly round trip migrations of up to 40,000 kilometers to and from Arctic breeding grounds and Antarctic wintering areas. *Photo: A. Hall.*

Red squirrels range throughout Canada's boreal coniferous forests. In the Taiga Shield, they occur wherever sufficient coniferous trees are present to provide necessary habitat. *Photo: T. VanDam.*

Timber wolves establish and maintain territorial home ranges and rely heavily on moose. Transient tundra wolves depend largely on migratory barren-ground caribou. Both types occur in the Taiga Shield.
Photo: GNWT.

The Taiga Shield provides important habitat for barren-ground caribou, especially winter range for most of the herds found in the Northwest Territories. The survival and abundance of many other wildlife species are dependent on this "keystone" species. *Photo: A. Gunn.*

Section 4: Mammals and Birds of the Taiga Shield

The diversity, abundance and distribution of animals are all highly dependent upon plant communities that provide essential habitat requirements; water is also critical for some species. Climate, landforms and distribution of water bodies strongly influence plant community development and species composition. The climate of the Taiga Shield is severe. It is relatively dry, mostly subarctic and characterized by short cool summers and long cold winters. The landforms are dominantly rolling terrain with frequent Precambrian granite exposures to the south and west and extensive coarse, boulder-studded glacial till deposits to the north and east. Soils are discontinuous in bedrock-dominated areas and even where they occur on thick tills, are often thin, poorly developed, acidic and frozen at depth throughout much of the short growing season. These conditions restrict plant diversity and subsequently affect the birds and mammals that depend upon the habitats they provide. Biodiversity and biomass are lower in the Taiga Shield than in the adjacent, more productive and fertile Taiga Plains. However, the Taiga Shield and the Taiga Plains both comprise an ecological transition through several biomes (Boreal, Taiga and Tundra), which acts to enhance the overall species richness of these Ecoregions. Many forest-dwelling boreal birds and mammals, which are at their northerly limit at tree line within the Taiga Shield, have ranges that overlap those of species that are more typically found in the tundra habitats further north. None of the birds or mammals known from the Taiga Shield is unique to the larger Taiga Biome.

At least 50 species of mammals are found in the Taiga Shield, and barren-ground caribou are one of the most characteristic species. The open forests with their abundance of arboreal and ground lichens provide optimal wintering habitat that is used regularly by several large herds of barren-ground caribou, numbering in the hundreds of thousands. A noteworthy feature of the Taiga Shield is that it contains the largest concentration of long, sinuous, well-developed eskers in Canada. These ecologically diverse areas are often used as travel corridors by many mammal species, and because of the easy digging, they are particularly favoured as denning sites for foxes, wolves, wolverines, barren-ground grizzly bears and Arctic ground squirrels.

More than 200 species of birds are thought to occur regularly in the Taiga Shield and at least 30 more are occasional or accidental visitors. Less than 15 percent of species reside year-round, and a few are winter residents from the Arctic. The majority of birds that breed in the Taiga Shield migrate south for the winter, often to tropical or subtropical destinations.

Numerous lakes and wetlands are a dominant feature of the Taiga Shield and strongly influence the population size and distribution of many birds. It is an important breeding area for a diverse assemblage of aquatic birds that includes gulls, terns, loons, ducks, grebes, shorebirds and the most northerly breeding population of pelicans on the continent. In spring, open water areas such as the North Arm of Great Slave Lake and the Thelon River valley are especially important as staging areas for thousands of migrating waterfowl and other aquatic migratory birds that nest in Arctic tundra areas further north.

For this report, historical and current literature on the abundance and distribution of mammals and birds was reviewed and summarised for each of the Taiga Shield's Level III ecoregions (High Subarctic, Low Subarctic, High Boreal, and Mid-Boreal). Exploration parties headed by well-known early explorers such as Hearne (1795), Franklin (1823) and Back (1836) included skilled naturalists who recorded wildlife sightings. In the 1860's an American zoologist, Robert Kennicott inspired many of the Hudson's Bay Company factors and native residents throughout the Mackenzie region to collect wildlife specimens for the Smithsonian Institution. This effort resulted in an advancement of knowledge, unparalleled neither before nor since. Several naturalists subsequently travelled through the area and recorded detailed wildlife observations for governments and museums. However, they were generally restricted to common travel routes, and coverage of the area was limited. Realizing these limitations, Preble (1908), Seton (1908, 1912), Wheeler (1912) and others relied extensively on the local knowledge of the aboriginal people to help delineate the distribution and abundance of species in areas beyond the travel routes. Information gathered in more recent years has reconfirmed much of the historical information, and also revealed some disappearances and range extensions of species.

A number of references, although not cited in the following discussion, provided useful background information. These include: Alexander *et al.* (1991); Anderson (1947); Baker (2003); Bangs (1900); Barr (1991); Crête *et al.* (2001); Critchell-Bullock (1930); Goldman (1935); Hall (1951); Hall and Cockrum (1953); Hanbury (1904); Hoare (1930); Howell (1938); King (1936); Krutzech (1954); Lariviere (2003); LeGoff and Sirois (2004); MacFarlane (1908); Macoun and Macoun (1904); Melquist *et al.* (2003); Morris *et al.* (1958); Pike (1892); Pohle (1920); Powell *et al.* (2003); Schwartz *et al.* (2003); Svendsen (2003); Swainson and Richardson (1831); Trauger and Bromley (1976); Tyrrell (1896, 1902); Van Ballenberghe (1985); Van Zyll de Jong (1983); and Yenson and Sherman (2003).

4.1 Mammals of the Taiga Shield High Subarctic (HS) Ecoregion

The seasonal ranges of several major barren-ground caribou populations occur within the Taiga Shield HS Ecoregion, including the Bluenose East, Bathurst, Ahiak, Beverly and Qamanirjuaq herds. Any portion of this Ecoregion may be used as wintering range, depending on the year and the herd. Large numbers of caribou regularly move through during spring and fall migrations between other wintering ranges further south and the tundra calving grounds to the north. From late fall to early winter, much of the breeding range for many of these caribou occurs in this Ecoregion, and it is also part of the summer range that may temporarily be used by large numbers of caribou.

Prior to the early 1980s, muskoxen could only be found in the Thelon Valley within the Ecoregion. Since then their range has expanded dramatically and although the population is low, they are widespread throughout much of the Ecoregion east of Great Slave Lake. Elsewhere, they currently appear to be transient or absent. Within the Ecoregion, muskoxen are still most common in the Thelon Valley; however they appear to have experienced a significant population decline here in recent years (A. Hall *pers. comm*.).

Moose populations are generally low (Frame *et al*. 2004), except in the Thelon Valley where moose arrived only recently. They are most common along river valleys and other riparian areas where willows are abundant (Kelsall 1972). They may migrate along river valleys into the tundra in the summer, remaining until snow depth renders forage unavailable (Barry 1961, Jacobson 1979).

The Taiga Shield HS Ecoregion is a transitional zone for bears. Black bears are present but more common in more heavily forested areas to the south. The range of barren-ground grizzly bears also extends into this Ecoregion. Populations have expanded into the Thelon Valley (A. Hall *pers. comm*.) and other areas bordering the Southern Arctic. These bears are more abundant further north into the tundra (McLoughlin *et al.* 2002).

Lynx appear occasionally when snowshoe hare populations irrupt, or after hare declines compel them to travel great distances in search of food (Poole 1994). Although tundra wolves migrate with the large caribou herds to wintering grounds below the tree line, they do not typically follow caribou to the tundra calving grounds in spring (Kelsall 1968). Seasonal caribou movements, as well as the abundance of ideal denning conditions in the form of eskers and other sandy locations, make the Ecoregion particularly important as denning habitat for tundra wolves. Although red (coloured) foxes are common and widespread, Arctic foxes are not abundant (Jacobson 1979).

The sparse tree cover and extensive open areas throughout the Taiga Shield HS Ecoregion does not represent good marten habitat. Five kilometres of unforested land is generally considered to be a barrier to marten dispersal (Gibilisco 1994). Kelsall (1951) collected a specimen from tree line, east of the Coppermine River. Mink occur sporadically where there is adequate prey around waterbodies and other wetlands. Otters are widespread in the Ecoregion and are commonly associated with river systems and open rapids during winter that provide ready access to fish. Northern otter populations may rely on semi-aquatic mammal burrows for winter denning, and access under the ice. Reid *et al.* (1994) suggested that the northern limit of otter distribution might be limited by beaver distribution. Wolverines thrive where large concentrations of ungulates provide carrion as a source of food (Kelsall 1982), and Mulders (2001) found caribou to be the primary food item for wolverines in this region. Least and short-tailed weasels occupy diverse habitats and their abundance varies with small mammal prey populations.

Beavers depend on woody deciduous vegetation near watercourses. Habitat conditions for these animals in the forest – tundra transition are generally marginal (Baker and Hill 2003). They exist in the Taiga Shield HS Ecoregion as scattered populations limited by a food supply that can be easily exhausted. Beavers colonized several rivers in the Thelon Valley in the 1970’s and 1980’s, and then disappeared (Norment *et al.* 1999). Muskrats may be widespread beyond tree line in water bodies that do not freeze to the bottom (Erb and Perry 2003). Porcupines, which require woody vegetation, were reported east of Lynx Lake (Banfield 1951) and may be expanding their range at tree line (Norment *et al*. 1999). Red squirrels occur where closed canopy tree cover exists (Yahner 2003). They have been noted at Artillery Lake (Clarke 1940, Banfield 1951), and the Thelon River (Norment *et al.* 1999). Arctic ground squirrels thrive wherever permafrost or extensive bedrock does not prevent burrowing (Harrington *et al.* 1962).

Information on the distribution of mice, voles or lemmings in the forest – tundra transition is sparse; their populations may be very unstable. At Fort Reliance, there have been reports of deer mice, meadow voles and heather voles (Banfield 1951).

Snowshoe hares are restricted to sites where there is adequate forest and tall shrub cover. Arctic hares are locally or occasionally abundant in open tundra habitats (Kelsall 1968).

The only shrews likely to occur in the Taiga Shield HS Ecoregion are masked shrews and barren-ground shrews.

Bats have never been reported in the Taiga Shield HS Ecoregion, but could be expected because they are highly mobile. According to Banfield (1974), hoary bats may extend their range to tree line.

Barren-ground grizzly bears are widely distributed throughout tundra habitats of the Southern Arctic; the subarctic, particularly the Taiga Shield HS Ecoregion, is transitional range for this species. *Photo: A. Hall.*

Tundra wolves depend largely on migratory barren-ground caribou, and occur throughout much of the Taiga Shield; they use the Taiga Shield HS Ecoregion extensively during the denning season. *Photo: G. Grambo.*

Muskoxen are widespread in the Taiga Shield HS Ecoregion, east and southeast of Great Slave Lake. They make use of productive sedge and grass meadows throughout the year. *Photo: G. Grambo.*

Several major herds of barren-ground caribou regularly migrate through the Taiga Shield HS Ecoregion during spring and fall, to and from tundra calving areas in the Southern Arctic. *Photo: D. Downing.*

Arctic hares are restricted to open tundra habitats of the Taiga Shield HS Ecoregion. Their range extends throughout the tundra portions of the Northwest Territories and includes the islands in the Northern Arctic. *Photo: D. Fast.*

The range of Arctic ground squirrels extends south into the subarctic regions of the Taiga Shield. They are most common in the HS Ecoregion and locally abundant where permafrost and bedrock are limited and allow burrowing. *Photo: G. Grambo.*

4.2 Mammals of the Taiga Shield Low Subarctic (LS) Ecoregion

The Taiga Shield LS Ecoregion provides important habitat, particularly winter range, for barren-ground caribou. Wintering barren-ground caribou of the Bathurst Herd regularly use the central portion of the Ecoregion. The Bluenose East Herd winters mainly in the northwestern portion of the Ecoregion, while the Ahiak and Beverly herds share wintering ranges mostly southeast of Great Slave Lake. The distribution and numbers of wintering caribou within the Ecoregion can be highly variable from year to year (Gunn 2001). Large numbers of barren-ground caribou may also move through the Ecoregion during spring and fall migrations, between other wintering ranges further south and the tundra calving grounds in the Southern Arctic. In some years, depending upon the timing of the fall migrations, breeding activity for many caribou may take place within the Ecoregion. In summer, caribou occasionally use areas bordering the Taiga Shield HS Ecoregion along the northern boundary.

Muskoxen are uncommon in the Ecoregion. Their present distribution appears to be confined to the east end of Great Slave Lake and extends southeast. Recent muskox sightings have been made near Porter Lake, along the Taltson River to the east, and in the southeast corner of the Northwest Territories between Snowbird and Kasba Lakes. Where muskoxen occur below tree line, snow depths in early winter may be a limiting factor (Gunn and Adamczewski 2003). In historic times, muskoxen were present southeast of Great Bear Lake (Simpson 1843).

Moose are not abundant in the Taiga Shield LS Ecoregion. The dominance of coniferous landscapes likely contributes to a low overall moose density (Jacobson 1982). Where moose do occur, they are found most often in riparian areas with willow thickets, and in burns with abundant birch and tall deciduous shrub regeneration.

Black bears are scattered throughout the Taiga Shield LS Ecoregion, especially in the valleys of former glacial rivers (Jacobson 1979). Barren-ground grizzly bears have large home ranges centred mainly in the tundra (McLoughlin *et al.* 2002). They are occasional transients within the Ecoregion.

Much of the Taiga Shield LS Ecoregion is considered poor lynx habitat. Lynx become more abundant when snowshoe hare populations reach peak numbers. Both timber and tundra wolves can be found in the Ecoregion. Because moose occur at low density within the Ecoregion, resident packs of timber wolves range widely throughout the Ecoregion when barren-ground caribou are not available. Tundra wolves depend largely on the migratory barren-ground caribou, and follow them (Walton *et al.* 2001) in and out of the region. They are most common during late fall and winter when caribou frequent the Ecoregion in greatest numbers.

In late winter and early spring, tundra wolves move north through the Ecoregion to establish denning territories near its outer periphery and beyond. Red (coloured) foxes are common and occupy a broad range of habitats. Arctic foxes make variable use of forested areas, and small numbers may occasionally winter within the Ecoregion, most likely scavenging wolf kills.

The Taiga Shield LS Ecoregion provides good marten habitat. Marten are likely common, particularly in upland forests. Water bodies and other wetlands within the Ecoregion provide optimal habitat for mink. Otters are likely widespread in the Ecoregion and found wherever river systems with open rapids during winter occur that can provide ready access to fish. Wolverines are scattered at densities that are probably high for this species in forested habitats but lower than in tundra areas further north. Least and short-tailed weasels are dispersed across diverse habitats, and their abundance depends on small mammal populations.

The Ecoregion provides marginal habitat for beavers, due to the predominance of coniferous vegetation and scarcity of aspen. They occur near watercourses where deciduous vegetation predominates. Muskrats require shallow waters that contain herbaceous vegetation, and that do not freeze completely to the bottom. Porcupines occur throughout the forests of the Ecoregion but are likely uncommon. Red squirrels are abundant and widespread, especially in dense coniferous forests. Northern flying squirrels are probably at their range limit at the northern edge of continuous forest (Wells-Gosling and Heaney 1984). Arctic ground squirrels are uncommon.

Meadow voles are common and widespread in open habitats throughout the Ecoregion. Red-backed voles are common inhabitants of spruce forests. Northern red-backed voles are found mostly north of Great Slave Lake, whereas southern red-backed voles are restricted to areas south of the lake. Deer mice occur in wooded habitats. Northern bog lemmings, heather voles, tundra voles, and taiga voles are also present but their status is unknown. Brown lemmings are tundra inhabitants and occur more commonly further north.

Snowshoe hares are common where there is adequate forest and tall shrub cover. Arctic hares are generally restricted to open tundra habitats, but may occasionally move to forested cover during winter (Best and Henry 1994).

Masked shrews, water shrews and Arctic shrews may be the only insectivorous mammals present, but information on their distribution and abundance is lacking.

Hoary bats are the only species whose range could possibly extend as far north as this Ecoregion.

Muskoxen have only recently expanded their range southward into the Taiga Shield LS Ecoregion and small numbers are now found near the east end of Great Slave Lake and to the southeast. *Photo: G. Grambo.*

During the fall migration and rut, barren-ground caribou extensively use the open shrubland habitats that are more common along the northern edge of this Ecoregion. *Photo: G. Grambo.*

Tundra wolves use eskers and other sandy ridges for denning. They follow migrating caribou as these move to their wintering ranges in the Low Subarctic and further south. *Photo: R. Gau.*

Red or coloured foxes are common and widespread inhabitants of the Taiga Shield LS Ecoregion. They occupy a variety of habitats and favour sandy areas to dig dens and rear their young. *Photo: R. Kennedy.*

Marten are widely distributed throughout the Taiga Shield. They are locally common in upland forests of the Taiga Shield LS Ecoregion and are largely dependent on small rodents such as red-backed voles.
Photo: T. VanDam.

Short-tailed weasels are widespread throughout the Taiga Shield. They occupy a variety of habitats and are more abundant when small mammal populations upon which they prey are high. *Photo: A. Hall.*

4.3 Mammals of the Taiga Shield High Boreal (HB) Ecoregion

Abundant arboreal and ground lichens in the Taiga Shield HB Ecoregion provide optimal winter forage for barren-ground caribou. Range use is highly variable, but portions of the Ecoregion can be an important part of the wintering ranges for both of the Bathurst and Beverly caribou herds. Occasionally caribou will move onto these ranges as early as late fall, a period of time that coincides with the breeding season, or rut. In spring, groups of bulls often linger in the area, long after the pregnant cows have migrated to the tundra calving grounds far to the northeast.

Woodland, or boreal caribou have occasionally been observed in the Taiga Shield HB Ecoregion north of Great Slave Lake. They have never been reported east of this Ecoregion, although no apparent physical or ecological barriers prevent them from extending their range east of the adjacent Taiga Plains.

Wood bison are relatively common in the adjacent Taiga Plains HB Ecoregion at the northwest end of Great Slave Lake and have recently expanded their range into the Taiga Shield HB Ecoregion. Small numbers are occasionally observed in the lush sedge lowlands along the northeast side of Great Slave Lake, south toward Yellowknife. These bison have almost certainly followed the highway corridor from the west into this wet meadow habitat and may not be permanent residents. Soper (1941) included the area from the North Arm to Yellowknife Bay as historic bison range.

The Taiga Shield HB Ecoregion, especially the Great Slave Lowlands with its fertile lacustrine soils, numerous shallow lakes and abundant lush lowland meadows, contains good moose habitat. However, overall moose density is quite low (Jacobson 1982) as the area is subject to high hunting pressure (Treseder and Graf 1995). South of Great Slave Lake, moose are relatively common with densities highest in riparian areas and regenerating burns.

Muskoxen have been reported near the community of Lutselk'e, along the Snowdrift River (Bradley *et al.* 2001). There are also anecdotal reports of muskoxen from the south shore of Great Slave Lake between Lutselk'e and Fort Resolution, as well as near Nonacho Lake.

Black bears are common in the Ecoregion, with numbers highest in productive lowlands where food resources are greatest. Barren-ground grizzly bears occasionally wander into the Ecoregion from their normal range further north.

Lynx thrive when snowshoe hare populations periodically achieve high densities. Both timber and tundra wolves are found in the Taiga Shield HB Ecoregion. The resident timber wolves require large territories as they depend mainly on moose for food throughout the year, unless caribou migrate into the Ecoregion.

As obligate predators of ungulates, wolves require minimum ungulate densities in order to maintain viable populations (Messier 1984). Where alternate ungulate prey is lacking, wolves may not fully colonize an area if moose densities are low (Messier and Crête 1995). Although tundra wolves generally maintain summer territories and dens near tree line, in fall and winter they follow the movements of barren-ground caribou. They occur in the Ecoregion whenever caribou are present. Coyotes are uncommon. They have recently established a breeding population in Yellowknife (Cluff 2006). Red (coloured) foxes are common and widespread. During winter, Arctic foxes may move into forested habitats to scavenge carrion (Jacobson 1979).

The Taiga Shield HB Ecoregion provides optimal habitat for marten, which are common throughout spruce forests. Mink are also common near water bodies and other wetlands that provide suitable habitat. Otters are restricted to fish-bearing streams. Wolverines probably exist at fairly high densities, relative to other forested areas. Least weasels and short-tailed weasels are dispersed throughout diverse habitats; the latter are most common and widespread throughout the Ecoregion. Rosatte and Lariviere (2003) reported that striped skunk distribution reaches the southerly parts of the Ecoregion, and occasionally transient animals arrive from adjacent areas in Alberta and Saskatchewan.

Beavers and muskrats are widespread in the Ecoregion but not particularly common except in the productive lowlands along the northeast side of Great Slave Lake. Porcupines are uncommon and they are widely scattered throughout the Ecoregion. Red squirrels are abundant and widespread residents of dense forests. Northern flying squirrels range into the Ecoregion south of Great Slave Lake (Banfield 1974) and may extend north almost to Yellowknife. Arctic ground squirrels occasionally appear in open habitats north of Great Slave Lake.

Deer mice, meadow jumping mice, meadow voles, heather voles, taiga voles and northern bog lemmings occur at variable densities throughout the Ecoregion. Northern red-backed voles are present north of Great Slave Lake, while southern red-backed voles occur south of the lake.

Snowshoe hares are widespread primarily in early successional forest, and periodically become very abundant.

Masked shrews, water shrews, Arctic shrews and pygmy shrews occur throughout the Ecoregion, while dusky shrews may reside south of Great Slave Lake. Their populations likely undergo wide fluctuations.

Hoary bats likely occur throughout the Ecoregion. Little brown bats, big brown bats and northern long-eared bats may occasionally range north from Alberta or Saskatchewan.

Moose range throughout the Taiga Shield but are more abundant in early regenerating burns, young deciduous-dominated forests and riparian willow habitats of the boreal forest. *Photo: D. Fast.*

The open conifer — lichen forests typical of the Taiga Shield HB Ecoregion provide important wintering habitat for herds of migratory barren-ground caribou. *Photo: A. Gunn.*

Timber wolves are resident in the more southern portions of the Taiga Shield. They use large home ranges to hunt moose and other prey year-round, unless caribou winter in the region. *Photo: A. Hall.*

Mink occupy habitats near streams, lakes and wetlands. They prey largely on small mammals and fish, but are capable of killing waterfowl and other prey larger than themselves. *Photo: R. Kennedy.*

Beavers occur throughout the Taiga Shield HB Ecoregion but are most common in productive lowlands. They prefer aspen and poplar but also make use of willow, birch and alder as a food supply when the former are not available. *Photo: R. Kennedy.*

Red squirrels are abundant and widespread throughout forest habitats of the Taiga Shield; closed-canopied coniferous forests of the Taiga Shield HB Ecoregion are particularly favoured. *Photo: R. Kennedy.*

4.4 Mammals of the Taiga Shield Mid-Boreal (MB) Ecoregion

The winter distribution of barren-ground caribou occasionally extends as far west as the Taiga Shield MB Ecoregion. In almost every decade there has been some intermittent use. The size of migratory caribou herds has been known to change by several orders of magnitude and over relatively short periods of time (Couturier *et al.* 1996, Van Ballenberghe 1985). When high population numbers cause food shortages, caribou compensate by temporarily expanding their range, but ultimately populations decline when forage is depleted (Messier *et al.* 1988). Recent burns are generally voided by wintering caribou.

There seem to be no physical or ecological barriers to exclude woodland or boreal caribou from the Taiga Shield MB Ecoregion. There is however no evidence that the range of these caribou, which are relatively common in the mid-boreal areas of the Taiga Plains west of the Slave River valley, has ever extended this far east.

Extensive lush and productive wetlands, and other willow-dominated riparian habitats, along with a prevalence of mixed-wood and deciduous forests, provide excellent moose habitat. This is reflected by the high moose population within the Ecoregion (Jacobson 1979), which exists likely at a higher overall density than in any other ecoregion within the Taiga Shield.

Both mule deer and white-tailed deer are known to occur in the adjacent Taiga Plains. White-tailed deer have expanded their range and numbers in northern Alberta in recent years. Although observations of these ungulates in the southern Northwest Territories have increased in recent years, overall white-tailed deer numbers remain small. If deer are present within the Taiga Shield MB Ecoregion, they are likely exceedingly rare.

The extensive wetlands and prairies along the lower Slave River immediately west of the Taiga Shield MB Ecoregion supported a large bison population in the past. Bison numbers within that area of the Taiga Plains exceeded 2,000 animals in 1970. During those peak population years, bison used the small meadows lying between Precambrian bedrock outcroppings along the western edge of this Ecoregion. Since then, the population has experienced a dramatic decline and today numbers perhaps 200. The few remaining bison may range along the western border, although evidence indicating this area as part of their range is lacking.

Diverse, highly productive plant communities and food resources allow black bears to attain high numbers within the Ecoregion. Barren-ground grizzly bears are not known to range this far south.

The Taiga Shield MB Ecoregion provides excellent snowshoe hare habitat, and therefore lynx habitat, especially in early successional forest.

Lynx periodically reach high densities when snowshoe hare numbers irrupt. Timber wolves are likely common as their large territories extend eastward from the richer moose and bison habitats of the adjacent Taiga Plains. Coyotes are uncommon and are occasionally taken on traplines. Red (coloured) foxes are widespread in the Ecoregion, and Arctic foxes occasionally occupy forest habitats during some winters.

Marten are relatively common and widespread. Closely related and larger, fishers are found scattered and at low density. Within the Taiga Shield, they are at the northern limits of their range and are restricted to this Ecoregion and the southwest corner of the adjacent Taiga Shield HB Ecoregion. Mink are abundant near water bodies and other wetlands, whereas otters are more restricted to fish-bearing streams that contain fast-flowing sections that remain open throughout winter. Wolverines are scattered and probably occur at their lowest density within this Ecoregion of the Taiga Shield. Least and short-tailed weasels are dispersed across diverse habitats, and their abundance depends on small mammal populations. Least weasels may be sporadic or disjunct through most of their range (Svendsen 2003). Striped skunks are observed occasionally by trappers and are considered rare in the Ecoregion.

Beavers are widespread and abundant, especially near watercourses bordered by aspen forests. Muskrats achieve high densities in the extensive shallow water bodies containing lush herbaceous vegetation. Porcupines are scattered and infrequent. Red squirrels and northern flying squirrels are widespread in dense coniferous forests. Woodchucks are rare and probably occur only in southern parts of the Ecoregion. Least chipmunks have been reported east of the Slave River but only where this Ecoregion adjoins Alberta (Smith 1993).

Deer mice, meadow jumping mice, meadow voles, southern red-backed voles, heather voles, taiga voles, and northern bog lemmings occur in the Taiga Shield MB Ecoregion. Densities of these small rodents vary according to habitat and populations often fluctuate from year to year. As important prey species, their numbers influence the distribution of carnivores and raptors.

Insectivores likely include masked shrews, dusky shrews, water shrews, Arctic shrews and pygmy shrews. Numbers fluctuate greatly from year to year depending on food supplies.

The distribution of bats has not been well documented. They might travel through various habitats that they do not use for feeding, roosting or other biological functions (Gannon 2003). The range of hoary bats almost certainly extends into the Ecoregion. Little brown bats, big brown bats and northern long-eared bats may occasionally range north from Alberta or Saskatchewan.

Lynx range throughout forests of the Taiga Shield but are particularly abundant in the MB Ecoregion when their primary prey species, snowshoe hares, are at the peak of their cycle. *Photo: M. Bradley.*

Coyotes are uncommon in the Taiga Shield. They are locally abundant in and around communities, probably due to the greater protection they receive from timber wolves, their main competitor. *Photo: P. Baldwin.*

Productive lowlands and riparian areas of the Taiga Shield MB Ecoregion provide optimal moose habitat and support the highest density of moose within the Taiga Shield. *Photo: D. Fast.*

River otters are locally common in fish-bearing rivers and streams throughout the Taiga Shield, especially wherever strong currents or rapids keep sections of water open throughout the winter. *Photo: T. Daniel.*

Snowshoe hare numbers fluctuate greatly in approximately 10-year cycles. In years of high density they are an important prey species for a variety of predators, particularly lynx. *Photo: R. Kennedy.*

Muskrats thrive in the extensive wetlands and shallow lakes of the Taiga Shield MB Ecoregion. They feed on herbaceous vegetation, and are an important prey species for mink and various raptors. *Photo: D. Fast.*

4.5 Birds of the Taiga Shield High Subarctic (HS) Ecoregion

Detailed observations on bird life were recorded by Seton (1908), Wheeler (1921) and Blanchet 1925) as they traveled the region north of Great Slave Lake. Hornby (1934), Clarke (1940), Norment (1985), and Norment *et al.* (1999) focused on bird observations in the Thelon River area. Alex Hall (pers. comm.) provided recent information on birds for the eastern half of the Taiga Shield HS Ecoregion.

The Taiga Shield HS Ecoregion can be characterized as a zone of forest – tundra transition and contains avian habitats typically found in both forests and tundra. In some locales the tree line is distinct, but more often forest and tundra form an interspersed mosaic. It is unlikely that any of the resident birds are restricted to this Ecoregion. Black spruce-dominated forests are most extensive near the boundary with the adjacent and more southerly Taiga Shield LS Ecoregion. As closed-canopy forests transition northward to more open woodlands, arboreal habitats for forest-dwelling birds are reduced. Toward the northern limits of this Ecoregion, increasingly treeless areas consisting mostly of dwarf birch, ericaceous shrubs, tussock grass-sedge meadows and polygonal peat plateaus provide habitat for birds that typically occupy tundra habitats.

Suitable tall nesting trees are uncommon throughout much of the Taiga Shield HS Ecoregion. Bald Eagles and Ospreys compensate by using ground sites or in the case of the latter, exposed offshore boulders in lakes. Golden Eagles are more reliant on steep cliffs. Rough-legged Hawks and Gyrfalcons usually build their nests on cliffs, but trees may be used by Gyrfalcons if they are available. Other raptors such as Northern Harriers, American Kestrels and Merlins also breed in this Ecoregion. Peregrine Falcons are more common in tundra areas; they require nesting sites on steep cliffs or rubble slopes. Hawk Owls are forest denizens that occasionally venture further north. Short-eared Owls and Snowy Owls raise their young in tundra areas mostly north of this Ecoregion, but migrate through the area to wintering ranges further south.

Red-throated Loons, Pacific Loons and Yellow-billed Loons widely occur on many of the lakes; Common Loons are more abundant in forested areas further south. Horned Grebes have been reported from the Level IV Sid Plain HS Ecoregion. Sandhill Cranes, the only resident wading birds, nest mainly in tundra areas and mostly north of the Ecoregion.

Tundra Swans, Canada Geese and Greater White-fronted Geese breed throughout the Taiga Shield HS Ecoregion. Large numbers of non-breeding Canada Geese use the Thelon area to moult. Mallards, Northern Pintails, American Widgeons, and Green-winged Teals occupy shallow lakes and marshes. White-winged Scoters, Surf Scoters, Long-tailed Ducks, Common Goldeneye, Buffleheads, Common Mergansers and Red-breasted Mergansers are the typical resident diving ducks.

Spruce Grouse are the only boreal grouse present in this Ecoregion. Tundra-nesting Willow Ptarmigan and the much less common Rock Ptarmigan also occur in the area but the latter are more abundant as winter transients.

Lesser Yellowlegs, Spotted Sandpipers, and Common Snipe are commonly associated with more southerly climates but do travel this far north. They are widespread, and along with Semipalmated Plovers and American Golden Plovers, their summer residency is brief. Arctic-nesting Red-necked Phalaropes, Dunlins, Black-bellied Plovers, Semipalmated Sandpipers, Least Sandpipers, Baird’s Sandpipers and Pectoral Sandpipers stop briefly in the Ecoregion during migration. White-rumped Stilts, Buff-breasted Sandpipers, Whimbrels, Long-billed Dowitchers, Hudsonian Godwits, and Ruddy Turnstones are less frequently seen in the Ecoregion during their annual flights.

Bonaparte’s Gulls, Mew Gulls, Herring Gulls and Arctic Terns are widespread around lakes. Glaucous Gulls are occasional migrants from the Arctic coast. Parasitic Jaegers and Long-tailed Jaegers are common in tundra habitats.

Common Ravens, Gray Jays and Rusty Blackbirds are common in the Ecoregion. Much less common are American Crows and Red-winged Blackbirds.

The lack of trees generally restricts woodpecker populations. Of the various species of woodpeckers, ground-foraging Northern Flickers extend furthest into the forest – tundra transition areas.

The short warm season that restricts insect availability may limit opportunities for some insect-eating species such as vireos, and few flycatchers or swallows have been reported from the Taiga Shield HS Ecoregion. However Yellow-rumped Warblers, Blackpoll Warblers, Yellow Warblers, and Wilson’s Warblers, more common in the boreal forests to the south, may also be found here. While many larger species of birds may be predatory or scavenge carrion, small birds often use other strategies to exploit food resources in this environment. With their opportunistic feeding habits, Gray-cheeked Thrushes and American Robins occur throughout the Ecoregion. Northern Shrikes add small mammals and birds to their insect diet. Some species such as Lapland Longspurs and Smith’s Longspurs, and Bohemian Waxwings feed on insects when they are available, then switch to seeds and fruit during the other seasons.

Ground-foraging seed-eaters such as White-crowned Sparrows, Chipping Sparrows, Fox Sparrows, Savannah Sparrows, American Tree Sparrows, and Dark-eyed Juncos range north into the Taiga Shield HS Ecoregion. Harris’ Sparrows and Horned Larks breed throughout the Ecoregion, especially in shrub tundra. American Pipits prefers rocky landscapes, whereas longspurs nest in grass-sedge tussock tundra or meadows. Snow Buntings are common during migration, but seek arctic environments for summer range.

Tree seed-eaters such as Pine Grosbeaks, White-winged Crossbills and Boreal Chickadees are constrained to areas where patches of spruce forest occur. Common Redpolls are abundant year-round, while Hoary Redpolls are tundra nesters that return as common winter residents.

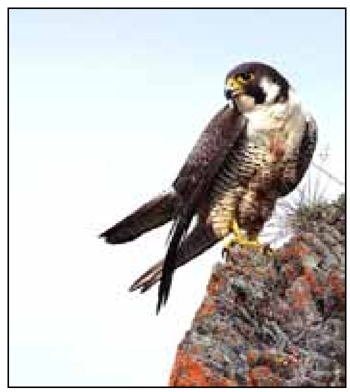
Harris Sparrows are widespread breeders throughout the forest – tundra transition and are particularly common in the Taiga Shield HS Ecoregion. *Photo: G. Grambo.*

Willow Ptarmigan breed in the tundra portions of the Taiga Shield HS Ecoregion. They are common winter residents in forested parts of the Taiga Shield. *Photo: D. Downing.*

Like many shorebirds, Stilt Sandpipers nest in the Arctic and are stop-over visitors in the Taiga Shield HS Ecoregion during migration. *Photo: J. Nagy.*

Tundra Swans nest in ponds and wetlands, mainly in tundra regions beyond the Taiga Shield. Small numbers breed in the Taiga Shield HS Ecoregion and to a lesser extent the Taiga Shield LS Ecoregion. *Photo: A. Hall.*

Gyrfalcons usually nest on cliffs, but will use trees when cliffs are unavailable. Note the Cliff Swallow mud nests in the upper right of the image. *Photo: A. Hall.*



Peregrine Falcons select steep cliffs or rubble slopes for nesting sites near wetlands that attract waterfowl and shorebirds. *Photo: G. Court.*

4.6 Birds of the Taiga Shield Low Subarctic (LS) Ecoregion

During their travels through the East Arm and into the Arctic, Seton (1908), Blanchet (1925), and Fairbairn (1921) recorded detailed observations of birds. East of Great Slave Lake, Decker (1982) mapped the distributions of some of the larger species. The Atlas of Saskatchewan Birds (Smith 1996) lists species for Saskatchewan's Dunvegan Lake Upland, Eynard Lake Upland, Robins Lake Upland, Striding River Upland, and Nueltin Lake Plain Ecoregions. These are relevant to the Northwest Territories Abitau Upland LS, Wignes Plain LS, and Selwyn Upland LS Level IV Ecoregions that border the Saskatchewan ecoregions and are their northern extensions.

Bald Eagles and Ospreys are closely associated with larger lakes and rivers where fish, their main food supply, are most abundant. Golden Eagles hunt for prey in hilly open woodlands. Northern Goshawks inhabit the forests, while Northern Harriers prefer marshes and other open wetlands. The distribution of Peregrine Falcons largely depends on the availability of steep cliff nesting sites and wetlands where prey, mainly shorebirds and waterfowl, are readily available. Horned Owls, Great Gray Owls, Boreal Owls and Northern Hawk Owls reside in the Taiga Shield LS Ecoregion year-round, while Short-eared Owls migrate south for the winter. Of the tundra-nesting birds of prey, Rough-legged Hawks commonly pass through during migration, and Gyrfalcons are occasional visitors.

Red-throated Loons, Pacific Loons and Common Loons occur on many of the lakes. Yellow-billed Loons appear as migrants from tundra nesting grounds. Horned Grebes, Pied-billed Grebes and Red-necked Grebes are at the northerly limits of their range. Belted Kingfishers depend largely on the availability of nesting sites in steep eroded banks near watercourses.

Tundra Swans, generally associated with the Central Arctic Flyway, are more abundant in the Taiga Shield LS Ecoregion, east of Great Slave Lake. Greater White-fronted Geese regularly pass through during spring and fall migrations. Canada Geese are both common migrants and breeding residents. Dabbling ducks known to occur in the Ecoregion include Mallards, Northern Pintails, American Widgeons, Northern Shovelers and Green-winged Teals. Greater Scaup, White-winged Scoters, Surf Scoters, Long-tailed Ducks, Common Goldeneye, Buffleheads, Common Mergansers and Red-breasted Mergansers are the resident diving ducks. Redhead and Canvasback diving ducks that occur in boreal habitats to the south and west have not been reported from this Ecoregion. Nor have American Bittern, American Coots, Yellow Rails or Sora Rails, all of which are known to occur in boreal wetlands, mostly south of Great Slave Lake. Sandhill Cranes are the only wading birds that have been reported in the Taiga Shield LS Ecoregion.

Spruce Grouse are likely the only boreal grouse species found in the Taiga Shield LS Ecoregion and occur wherever there are mature coniferous forests. Willow and Rock Ptarmigan that nest on the tundra are common winter residents.

Plovers and sandpipers associated with more southerly climates, such as Killdeer, Greater Yellowlegs and Marbled Godwits, are rare or absent. Widespread Lesser Yellowlegs, Spotted Sandpipers, and Common Snipe are exceptions. Although Semipalmated Plovers are generally more at home above tree line, they commonly breed in this Ecoregion. American Golden Plovers, Black-bellied Plovers, Red-necked Phalaropes, Dunlins, and Semipalmated Sandpipers, Least Sandpipers, Baird's Sandpipers and Pectoral Sandpipers pass through during migration to and from Arctic nesting sites. Other shorebirds such as White-rumped Sandpipers, Stilt Sandpipers and Buff-breasted Sandpipers, Long-billed Dowitchers, Whimbrels, Hudsonian Godwits and Ruddy Turnstones are less frequently seen during their seasonal movements.

Arctic Terns and Bonaparte's Gulls, Mew Gulls and Herring Gulls are widespread, while Ring-billed Gulls and California Gulls and Parasitic Jaegers are mainly restricted to Great Slave Lake.

Common Ravens, American Crows, Gray Jays, Rusty Blackbirds, and Red-winged Blackbirds occur in various habitats throughout the Taiga Shield LS Ecoregion.

The scarcity of aerial insect-feeding flycatchers, swallows, vireos, kinglets and nighthawks is a reflection of the limited season for flying insects within the Taiga Shield LS Ecoregion. Northern Shrikes supplement their insect diet with larger prey. Of the obligate insect eaters, only Yellow-rumped Warblers, Blackpoll Warblers, Yellow Warblers and Wilson's Warblers, as well as Cliff Swallows, Bank Swallows and Tree Swallows inhabit the Ecoregion. Omnivorous Gray-cheeked Thrushes and American Robins are quite common and are the only members of the thrush family that occur in the Ecoregion.

Northern Flickers are the most common members of the woodpecker family found in the Taiga Shield LS Ecoregion. Less common Three-toed Woodpeckers and Black-backed Woodpeckers are able to reside year-round because they feed on dormant insect larvae that overwinter under the bark of conifer trees.

Common seed-eaters that forage mostly close to the ground include American Tree Sparrows, Chipping Sparrows, Fox Sparrows, Savannah Sparrows, Swamp Sparrows and White-crowned Sparrows as well as the Dark-eyed Juncos. There are few suitable habitats for Lincoln Sparrows, White-throated Sparrows and Song Sparrows in the Taiga Shield LS Ecoregion. Omnivorous Harris' Sparrows, Horned Larks, and American Pipits, all more typical of the tundra, reside in the Ecoregion at the southern extent of their breeding range. Lapland Longspurs, Smith's Longspurs and Snow Buntings are transient migrants that nest in tundra areas beyond tree line. Common Redpolls, Pine Grosbeaks, White-winged Crossbills and Boreal Chickadees are tree seed-eaters and are abundant year-round. Other tree seed-eaters such as Pine Siskins, Purple Finches, Red Crossbills, Rose-breasted Grosbeaks and Black-capped Chickadees reside in adjacent boreal ecoregions, mostly south of Great Slave Lake, and do not appear to extend their range this far north. Hoary Redpolls are tundra nesters and common winter residents. Fruit sustains Bohemian Waxwings into the fall before they migrate further south in winter.

White-crowned Sparrows are common breeders in the Taiga Shield LS Ecoregion. They forage for seeds and insects near the ground, and favour open woodland habitats, recently burned forest and shrubby areas. *Photo: C. Machtans.*

Yellow Warblers reside in shrubland and open woodlands, common habitats in the Taiga Shield LS Ecoregion. Because they rely on insects for food, these warblers must migrate south before summer's end. *Photo: C. Francis.*

Spruce Grouse inhabit the mature coniferous forest of the Taiga Shield LS Ecoregion. They are more widespread and their range extends further north than either Sharp-tailed Grouse or Ruffed Grouse. *Photo: D. Fast.*

Semipalmated Plovers may be found on beaches, lakeshores and shallow marshes of the Taiga Shield LS Ecoregion, mainly during migration. *Photo: J. Nagy.*

Red-throated Loons are the most widespread loons in the Taiga Shield, and they are most common in the Taiga Shield LS and HS Ecoregions. Loons require access to lakes deep enough to support adequate fish populations, but prefer to nest on small sheltered ponds and shallow marshy lakes. *Photo: R. Popko.*

Ospreys are particularly abundant in the Taiga Shield southeast of Great Slave Lake. The highest breeding densities occur in the Level IV Wignes Plain LS Ecoregion where they often use small protruding offshore boulders in lakes and shallow ponds as nesting sites. *Photo: D. Fast.*

4.7 Birds of the Taiga Shield High Boreal (HB) Ecoregion

Birds of the Taiga Shield HB Ecoregion in the vicinity of Yellowknife have been documented by Baird *et al.* (1884), Preble (1908), Bromley and Trauger (1981) in their Yellowknife regional checklist, the 2007 Yellowknife Spring Arrivals Database (Canadian Wildlife Service 2007), and the survey of colonial waterbirds on Great Slave Lake carried out by Sirois *et al*. (1995). Seton (1908) and Fairbairn (1931) travelled through the East Arm and compiled detailed avifauna records. A recent survey by Sirois *et al.* (1995) included eastern Great Slave Lake. Semenchuk (1992) and Smith (1996) tabulated systematic observations in the Tazin Upland Subregion/Ecoregion of Alberta and Saskatchewan respectively, for which the eastern part is the southerly extension of the Level IV Rutledge Upland HB Ecoregion, described in Section 3 of this report. Smith (1996) also compiled observations in the Level IV Nonacho Upland HB Ecoregion, which extends into Saskatchewan as the Tazin Lake Upland Ecoregion.

Ospreys and Bald Eagles occur throughout the Taiga Shield HB Ecoregion, mostly in association with the larger lakes and rivers, the latter being particularly abundant around Great Slave Lake. Northern Goshawks, Sharp-shinned Hawks, Red-tailed Hawks, American Kestrels and Merlins select forested habitats, while Northern Harriers prefer marshes and other open wetlands. Rough-legged Hawks are regular migrants to and from their breeding areas in the northern tundra, while Gyrfalcons and Snowy Owls are occasional visitors. Horned Owls, Great Gray Owls, Boreal Owls and Northern Hawk Owls are year-round residents.

The Level IV Great Slave Lowland HB Ecoregion, part of the larger Taiga Shield HB Ecoregion, is particularly important for water birds. The numerous shallow bays, lakes and ponds and accompanying lush aquatic shoreline vegetation provide optimal habitat for grebes and a large variety of other breeding aquatic birds, particularly dabbling ducks. It is also especially important as a staging area for many species of migratory birds, particularly in spring as the nearshore waters around the many rocky islands and shallow bays tend to open up earlier in spring than surrounding areas. Sandhill Cranes, Sora Rails, American Coots, American Bittern, and Red-winged Blackbirds use the extensive marshy shorelines. Loons and most diving ducks are associated with deeper offshore waters. The presence of a small population of Harlequin Ducks is an unusual outlier as it normally breeds on swift mountain streams much further to the west. Tundra Swans regularly stopover in the area during spring migration.

Most shorebirds that appear in the Taiga Shield HB Ecoregion are migrants that nest in the Arctic. Some, such as Upland Sandpipers, Short-billed Dowitchers, Wilson's Phalaropes, Marbled Godwits, Willets and American Avocets are occasional visitors from the south. Summer residents are Semipalmated Plovers, Killdeer, Lesser Yellowlegs, Spotted Sandpipers, Least Sandpipers, Common Snipe and Red-necked Phalaropes. Many islands such as the West Mirage and Trout Rock in the North Arm, and Simpson and Outpost Islands in the East Arm are densely populated by nesting gulls and terns. Mew Gulls, California Gulls, Herring Gulls, Common Terns, Arctic Terns and Caspian Terns are regular breeders on Great Slave Lake.

Coniferous forests, mostly black spruce and to a lesser extent jack pine, dominate the Taiga Shield HB Ecoregion. Spruce Grouse, Yellow-bellied Flycatchers, Boreal Chickadees, Swainson's Thrushes and Magnolia Warblers are common in black spruce forests. Tennessee Warblers prefers open woodland or dense coniferous forest edges. Because conifers do not bear heavy cone crops every year, there may be large annual population fluctuations of Purple Finches, Pine Grosbeaks, Red-winged Crossbills and White-winged Crossbills, all species that rely largely on conifer seeds. Western Tanagers are the sole representatives in Canada of a family of mostly tropical birds. They breed in northern coniferous forests, subsisting on a wide variety of fruit and insects.

Obligate insectivores such as flycatchers, swallows, vireos and most warblers depend on a short warm-season food supply that compels them to migrate south before the end of summer. Insect-feeding birds that supplement their diet with seeds or fruit are able to remain longer. For some that catch insects on the wing, such as Cliff Swallows, suitable nesting habitat is of primary importance. Nesting sites for some species are also provided by man-made structures or inadvertently by human disturbance. Swallows seek buildings and bridges, and Common Nighthawks are often found in gravel pits or other man-made clearings.

Short-eared Owls, Alder Flycatchers, Common Yellowthroats and Swamp Sparrows may occupy low shrubby bogs. Palm Warblers, Yellow-rumped Warblers, Rusty Blackbirds and Chipping Sparrows are common inhabitants of treed bogs with stunted open black spruce cover.

Yellow Warblers and Northern Waterthrushes prefer shrubby riparian habitats. During the fall, large numbers of Willow Ptarmigan migrate from the tundra and congregate in tall shrub riparian areas. Ducks such as Common Goldeneye, Common Mergansers and Buffleheads will often use tree cavities created by woodpeckers as nesting sites in riparian habitats.

Species usually associated with burns are often ground feeders and include Sharp-tailed Grouse, Northern Flickers, Olive-sided Flycatchers, Hermit Thrushes and Savannah Sparrows. Three-toed and Black-backed Woodpeckers forage for insects and larvae on burned trees with flaking bark, and American Kestrels use burned snags for nesting.

American Robins, Canada Jays, White-crowned Sparrows and Common Redpolls are ubiquitous throughout the Taiga Shield. As scavengers, Common Ravens and Herring Gulls owe much of their widespread abundance to human activities. Black-billed Magpies and House Sparrows are recent arrivals and permanent residents in and around Yellowknife.

Common Redpolls are year-round residents in many parts of the Taiga Shield HB Ecoregion. They are primarily seed-eaters that supplement their diet with insects in summer. *Photo: G. Grambo.*

Sharp-tailed Grouse prefer open shrubland. Their populations may increase dramatically after forest fires. During courtship, they congregate on dancing-grounds called “leks”. *Photo: M. Bradley.*

Lesser Scaup are diving ducks that nest in ponds, marshes and small lakes. The Level IV Great Slave Lowland HB Ecoregion is an important breeding area for these ducks, however continental populations have recently been in decline. *Photo: A. Levesque.*

Many islands in Great Slave Lake are important nesting sites for gulls and terns. Bonaparte’s Gulls are somewhat unusual however, in that they generally inhabit the smaller inland lakes and usually nest in trees. *Photo: A. Levesque.*

Northern Hawk Owls are year-round residents of various habitats. Less nocturnal than most other owls, they prey mainly on small mammals and insects. *Photo: G. Grambo.*

Bald Eagles eat mainly fish during the breeding season and nest in tall trees or on cliffs. They will also feed on carrion, such as that from wolf kills. *Photo: D. Fast.*

4.8 Birds of the Taiga Shield Mid-Boreal (MB) Ecoregion

The Taiga Shield MB Ecoregion contains the highest diversity of vegetation and avian habitats in the Taiga Shield. Its western boundary adjoins the productive mixed spruce–aspen forests and sedge–grass meadows of the adjacent Taiga Plains Slave River Lowlands, and is a species-rich ecotone. Reported bird observations have generally been limited to the shores of Great Slave Lake at the northern boundary of the Ecoregion, and near the community of Fort Smith close to the southwestern corner. The best documentation comes from the Fort Smith Spring Arrivals Database 2007, and the Christmas Bird Count. The NatureServe bird range maps compiled by Ridgely *et al.* (2007) were used for general distribution information. Erskine (1977) provided a detailed analysis of bird composition and abundance in the boreal habitats of Canada.

Bald Eagles and Ospreys frequently nest on the shorelines of Great Slave Lake and along the Taltson River where fish are readily available. Northern Goshawks, Sharp-shinned Hawks, Red-tailed Hawks, American Kestrels, Merlins and Northern Harriers also inhabit this Ecoregion. Rough-legged Hawks are migrants from their breeding range on the tundra. Horned Owls, Great Gray Owls, Boreal Owls and Northern Hawk Owls are year-round residents. Snowy Owls are occasional winter residents that appear during winters when lemming populations in the Arctic are low.

Common Loons nest on many of the lakes, while Red-throated Loons and Pacific Loons are rare migrants. Horned Grebes, Pied-billed Grebes, Red-necked Grebes and Eared Grebes are common in marshy lakes and ponds.

The many lowland wetlands within the Taiga Shield MB Ecoregion provide prime habitats for a large variety and abundance of dabbling ducks that includes Mallards, Gadwalls, Northern Pintails, American Widgeons, Northern Shovelers, Green-winged Teals and Blue-winged Teals. Diving ducks found on lakes within the Ecoregion include Ring-necked Ducks, Greater Scaup, Lesser Scaup, Canvasbacks, Redheads, White-winged Scoters, Surf Scoters, Common Goldeneye, Buffleheads, Common Mergansers and Red-breasted Mergansers. Long-tailed Ducks breed in the Arctic and are common spring visitors.

A colony of American White Pelicans nests on the granitic islands of the Slave River near Fort Smith, on the very edge of the Taiga Shield, and feeds on fish in the rapids. Pelicans forage northward along the rapids of the Taltson River to Oracha Falls. Some occasionally nest there, making this the most northerly breeding occurrence for pelicans in North America.

Sandhill Cranes, Sora Rails, American Coots, American Bittern, and Red-winged Blackbirds are common in marshy wetlands. Most shorebirds seen in this Ecoregion, such as White-rumped Sandpipers and Upland Sandpipers, are migrants that nest in the Arctic. Shorebirds that breed here include Semipalmated Plovers, Killdeer, Lesser Yellowlegs, Spotted Sandpipers, Least Sandpipers, Common Snipe and Red-necked Phalaropes. Mew Gulls, California Gulls, Herring Gulls, Common Terns and Arctic Terns breed mainly on Great Slave Lake. Others such as Bonaparte's Gulls and Black Terns nest more often on inland lakes.

Prolific seed-producing coniferous trees (spruce, jack pine and larch) are common. The availability of tree seed throughout the year allows birds such as seed-eating finches to live permanently in the Ecoregion. White spruce does not bear heavy cone crops every year. Purple Finches, Pine Grosbeaks, Red Crossbills and White-winged Crossbills that rely on these seeds may consequently experience large population fluctuations. Cape May Warblers, Bay-breasted Warblers, Tennessee Warblers, Evening Grosbeaks and Red-breasted Nuthatches increase markedly during spruce budworm outbreaks; some of these birds may be present only during major infestations.

Jack pine stands are relatively common in the Taiga Shield MB Ecoregion. Vertical structure in these stands is limited as they are typically even-aged and have a relatively uniform canopy and sparse understory. As a result, vertical habitats are poorly developed and bird diversity is correspondingly low. Common inhabitants of jack pine forests in this Ecoregion are canopy-dwelling and ground-nesting birds such as Hermit Thrushes, Ruby-crowned Kinglets, Yellow-rumped Warblers, Dark-eyed Juncos, White-throated Sparrows and Spruce Grouse.

The deciduous and mixed-wood forests of this Ecoregion contain the most favourable habitat for Ruffed Grouse in the Taiga Shield. Least Flycatchers, Black-capped Chickadees, Swainson's Thrushes, Black-and-white Warblers, American Redstarts and Chipping Sparrows are common in deciduous stands, as well as Yellow-bellied Sapsuckers that require deciduous trees for their food supply. Red-eyed Vireos are canopy specialists. Cedar Waxwings are at the northern limits of their range in this Ecoregion.

Insect-eating flycatchers, swallows, vireos and most warblers depend on a warm-season food supply that compels them to migrate from the Taiga Shield MB Ecoregion before the end of summer. Hairy Woodpeckers and Downy Woodpeckers that feed on dormant insect larvae in tree trunks are able to remain throughout the winter.

Edges between forests and open areas such as wetlands contain many of the most common, widespread and adaptable species such as American Robins, Northern Flickers and Song Sparrows. During the fall, Willow Ptarmigan migrate from the tundra and may congregate in large numbers along willow-lined borders of lakes and wetlands.

The Taiga Shield MB Ecoregion contains more birds that are adapted to frequent fire disturbances than does other parts of the Taiga Shield. Sharp-tailed Grouse populations increase markedly after forest fires stimulate the growth of shrubby vegetation. Three-toed Woodpeckers and Black-backed Woodpeckers prefer burned conifer forests that yield a good supply of insects and larvae. American Kestrels nest in snags. Other species often found in burns include ground-feeders such as Olive-sided Flycatchers, Hermit Thrushes and Savannah Sparrows.

Ravens are common throughout the Ecoregion. House Sparrows and European Starlings are recent arrivals and permanent residents in and around Fort Smith.

Black-and-white Warblers are found in mixed deciduous and coniferous, closed-canopy forest with a sparse shrub understory. They are the only warblers that creep up and down tree trunks in search of insects. *Photo: G. Grambo.*

Chipping Sparrows are one of the smallest sparrows and are widely distributed in North America. They range throughout the forested regions of the Taiga Shield and prefer nesting in conifer forests. *Photo G. Grambo*

Lesser Yellowlegs are widely distributed throughout boreal and taiga forests of the Northwest Territories. They are common in the Taiga Shield MB Ecoregion where habitat includes marshes, mudflats, shorelines, treed bogs, open boreal woodlands and burns.
Photo: C. Machtans.

Green-winged Teals, smallest of the dabbling ducks, are common breeders in the Taiga Shield MB Ecoregion. They forage on a wide variety of plant and animal matter, and nest mostly in shoreline areas with dense emergent vegetation. *Photo: R. Kennedy.*

The well-vegetated sedge, rush and cattail shorelines, along with extensive open water ponds and lakes typical of the extensive wetlands in the Taiga Shield MB Ecoregion, provide optimal breeding habitat for Horned Grebes. *Photo: R. Kennedy.*

The most northerly breeding population of American White Pelicans occurs in the Taiga Shield MB Ecoregion. The granitic islands and numerous rapids on the Slave River near Fort Smith provide important nesting and foraging habitat for these birds.
Photo: M. Bradley.

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Appendix 1. Plant Species List

For the reader's convenience, the following plant species list is sorted by both scientific and common name. Vascular plant scientific and common names follow *NWT Species 2006-2010* (Working Group on General Status of NWT Species (2006).

Scientific names are based on the Flora of North America[36]. Non-vascular plant names follow those given in *Alberta Plants and Fungi – Master Species List and Species Group Checklists* (Alberta Environmental Protection 1993).

Alnus viridis (Chaix.) DC.	green alder
alpine bilberry, bilberry	**Vaccinium uliginosum** L.
Aralia nudicaulis L.	wild sarsaparilla
Arctostaphylos rubra (Rehd. & Wils.) Fern)	red bearberry
Arctostaphylos uva-ursi (L.) Spreng.	common bearberry
balsam poplar	**Populus balsamifera** L.
Betula glandulosa Michx.	dwarf birch, ground birch
Betula occidentalis. Hook.	Water birch
Betula papyrifera Marsh.	paper birch, white birch
black crowberry	**Empetrum nigrum** L. ssp. **hermaphroditum** (Lge.) Böcher.
black spruce	**Picea mariana** (Mill.) BSP.
bunchberry, dwarf dogwood	**Cornus canadensis** L.
Calamagrostis canadensis (Michx.) Beauv.	reed bent-grass, bluejoint
Carex atherodes Spreng.	awned sedge
Carex spp.	sedges
Cassiope tetragona (L.) D. Don	mountain-heather, Arctic white heather
Chamaedaphne calyculata (L.) Moench	leatherleaf
Chamerion angustifolium (L.) Holub	fireweed
Cladina mitis (Sandst.) Hale & W. Culb.	reindeer lichen
Cladonia spp., **Cladina** spp**.**	lichens, reindeer lichens
cloudberry, baked-apple	**Rubus chamaemorus** L.
common bearberry	**Arctostaphylos uva-ursi** (L.) Spreng.
common Labrador tea	**Ledum groenlandicum** Oeder
common wild rose, woods rose	**Rosa woodsii** Lindl.
Cornus canadensis L.	bunchberry, dwarf dogwood
Cornus sericea L.	red osier dogwood
cotton-grass	**Eriophorum** spp.
Drepanocladus spp.	One of several mosses comprising wet moss peat
Drosera anglica Huds.	English sundew
Dryas integrifolia M.Vahl.	mountain avens (entire-leaved mountain avens)
dwarf birch, ground birch	**Betula glandulosa** Michx.
dwarf red raspberry, dewberry	**Rubus pubescens** Raf.
Empetrum nigrum L. ssp. **hermaphroditum** (Lge.) Böcher	black crowberry
Equisetum pratense Ehrh.	meadow horsetail
Equisetum spp.	horsetails
Eriophorum spp.	cotton-grass
fireweed	**Chamerion angustifolium** (L.) Holub.
fox-tail barley	**Hordeum jubatum** L.
Galium boreale L.	northern bedstraw
green alder	**Alnus viridis** (Chaix.) DC.
Hordeum jubatum L.	fox-tail barley
horsetails	**Equisetum** spp.
jack pine	**Pinus banksiana** Lamb.
junipers	**Juniperus** spp.
larch (tamarack)	**Larix laricina** (Du Roi) Koch
Larix laricina (Du Roi) Koch	larch (tamarack)
leatherleaf	**Chamaedaphne calyculata** (L.) Moench

[36] http://hua.huh.harvard.edu/FNA/. Information on vascular plant nomenclature sources provided by Suzanne Carrière, Government of the Northwest Territories, February 2007.

Ledum groenlandicum Oeder	common Labrador tea
Ledum palustre subsp. **decumbens** (Aiton) Hultén	northern Labrador tea, narrow-leaved Labrador tea
Linnaea borealis L.	twinflower
lichens, reindeer lichens	**Cladonia** spp., **Cladina** spp**.**
low-bush cranberry, squashberry	**Viburnum edule** (Michx.) Raf.
meadow horsetail	**Equisetum pratense** Ehrh.
mountain avens (entire-leaved mountain avens)	**Dryas integrifolia** M.Vahl.
mountain cranberry, rock cranberry, bog cranberry	**Vaccinium vitis-idaea** L.
mountain-heather, Arctic white heather	**Cassiope tetragona** (L.) D. Don
northern bedstraw	**Galium boreale** L**.**
northern Labrador tea, narrow-leaved Labrador tea	**Ledum palustre** subsp. **decumbens** (Aiton) Hultén
Nuphar variegata Durand	variegated pond lily
paper birch, white birch	**Betula papyrifera** Marsh
peat mosses	**Sphagnum** spp, **Drepanocladus** spp,.
Picea glauca (Moench) Voss	white spruce
Picea mariana (Mill.) BSP.	black spruce
Pinus banksiana Lamb.	jack pine
northern pitcher plant	**Sarracenia purpurea** L.
Plantago eriopoda Torr.	saline plantain
Populus balsamifera L.	balsam poplar
Populus tremuloides Michx.	trembling aspen
Dasiphora fruticosa (L.) Rydberg	shrubby cinquefoil
prickly rose	**Rosa acicularis** Lindl.
reed bent-grass, bluejoint	**Calamagrostis canadensis** (Michx.) Beauv.
red bearberry	**Arctostaphylos rubra** (Rehd. & Wils.) Fern)
red glasswort	**Salicornia rubra** A. Nels.
red osier dogwood	**Cornus sericea** L.
reindeer lichen	**Cladina mitis** (Sandst.) Hale & W. Culb.
Rosa acicularis Lindl.	prickly rose
Rosa spp.	wild and prickly rose
Rosa woodsii Lindl.	common wild rose, woods rose
Rubus chamaemorus L.	cloudberry, baked-apple
Rubus pubescens Raf.	dewberry, dwarf red raspberry
Salicornia rubra A. Nels.	red glasswort
saline plantain	**Plantago eriopoda** Torr.
Salix spp.	willows
Sarracenia purpurea L.	northern pitcher plant
sedges	**Carex** spp.
Shepherdia canadensis (L.) Nutt.	Canada buffaloberry, soapberry
shrubby cinquefoil	**Dasiphora fruticosa** (L.) Rydberg.
snowberry	**Symphoricarpos albus** (L.) Blake
soapberry, Canada buffaloberry	**Shepherdia canadensis** (L.) Nutt.
Sphagnum spp.	peat mosses
English sundew	**Drosera anglica** Huds.
Symphoricarpos albus (L.) Blake	snowberry
trembling aspen	**Populus tremuloides** Michx.
twinflower	**Linnaea borealis** L**.**
Vaccinium uliginosum L.	alpine bilberry, bilberry
Vaccinium vitis-idaea L.	rock cranberry, bog cranberry, mountain cranberry
variegated pond lily	**Nuphar variegata** Durand
Viburnum edule (Michx.) Raf.	squashberry, low-bush cranberry
water birch	**Betula occidentalis** Hook.
white birch, paper birch	**Betula papyrifera** Marsh
white spruce	**Picea glauca** (Moench) Voss
wild and prickly rose	**Rosa** spp.
wild sarsaparilla	**Aralia nudicaulis** L.
willows	**Salix** spp.

Appendix 2. Dominant Vegetation and Flora of theTaiga Shield, Northwest Territories

Bradley *et al.* (1982) conducted detailed soil and vegetation sampling at a number of sites throughout the Lockhart River Mapsheet and prepared summaries of the relationships between vegetation, flora, landscape position, and climatic regime based on these samples and a synthesis of their results with those of other researchers. The information presented below is abstracted from their report, *An Ecological Land Survey of the Lockhart River Map Area, Northwest Territories,* and includes a conceptual landscape diagram and the associated vegetation and flora within the Level III Taiga Shield High Subarctic, Taiga Shield Low Subarctic, Taiga Shield High Boreal, and Taiga Shield Mid-Boreal Ecoregions. Bradley *et al*. (1982) provided the following useful terms (Table 3) that define terrain types and the vegetation growth forms associated with them. These terms are combined into about 25 combinations that are shown in the conceptual landscape diagrams (Figures 23a through 23d) and species tables for each of the Level III Ecoregions on the following pages. Table 4 lists the broad vegetation types and the commonly associated plant species.

Table 3. Descriptive terms for terrain and growth form types of northern vegetation.

Terrain types		
Dry	Rock	Outcropping bedrock; a thin stony veneer may be present.
	Bog	A form of consolidated peatland, usually dominated by *Sphagnum* species; can be deep residual peat, or shallow and "turfy".
	Fen	Semi-consolidated wet peatland under the influence of groundwater, usually in drainage tracks through mineral soil or bog.
	Meadow	Wetland with a mucky substratum rather than a peat substratum as in "fen".
Wet	Marsh	Perennial wetland characterized by coarse emergent aquatic plants such as large sedges.

Forest and shrublands		
Dry	Woodland	Open areas with trees widely spaced so that the forest floor is exposed to sun and skylight; trees can be moderately tall.
	Forest	Trees close together so that the crowns form an almost continuous shading canopy.
	Shrub	Broadleaved deciduous medium to tall shrubs (birch, willow, and alders).
Wet	Shrub thicket	Riparian shrubland bordering water bodies and stream channels.

Low Vegetation		
Dry	Lichen	Lichen communities of exposed uplands and lowlands, from outcrop and drift ridges to open and wooded peatlands.
	Grass	Meaning "grass-like" and including not only true grass species (*Poa*, etc.) but also upland species of sedges (*Carex*).
	Herb	Meaning all non-woody (non-shrub) flowering plants, including grasses and sedges; an inclusive term compared to "grass" above.
	Heath	Dwarf ericoids, mostly small-leaved and evergreen or coriaceous (leathery-textured) such as northern and common Labrador tea, black crowberry, bearberry, bog cranberry, alpine bilberry etc.
Wet	Moss	Primarily feathermosses and those mosses preferring moist or shaded habitats (*Pleurozium, Hylocomium, Dicranum, Polytrichum, Aulacomnium* and occasionally *Sphagnum*).
	Sedge	Grass-like species associated with high water tables (sedges, cotton-grasses, rushes).

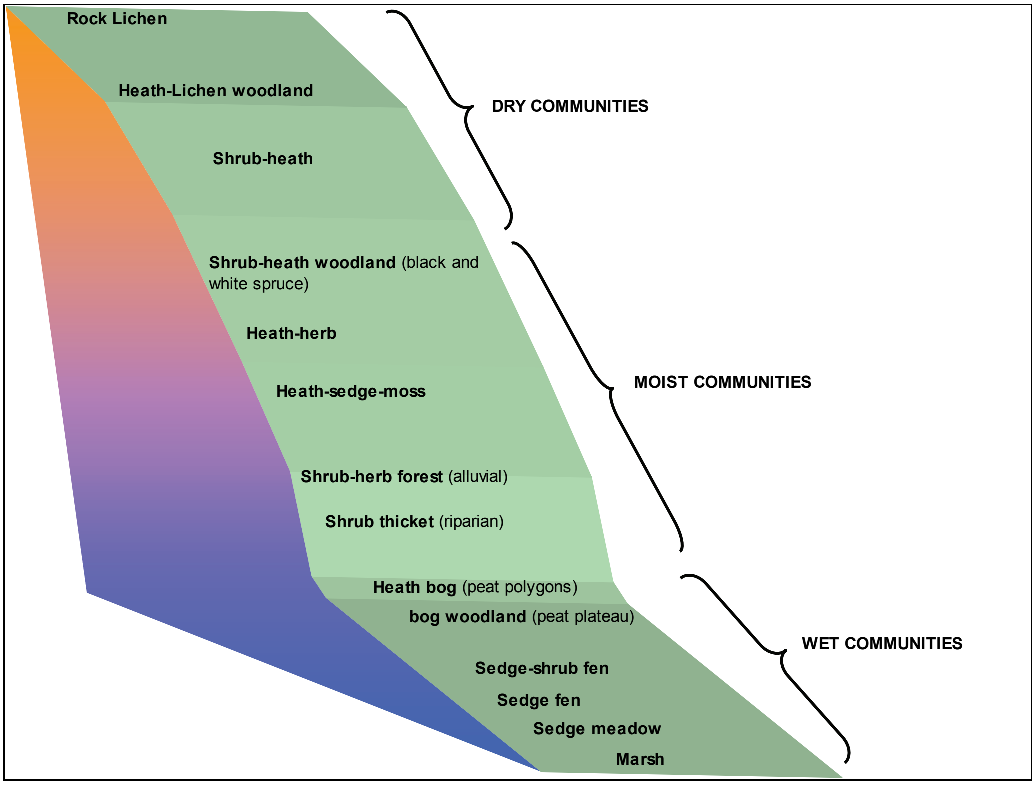

Figure 23a. Taiga Shield HS Ecoregion conceptual landscape.

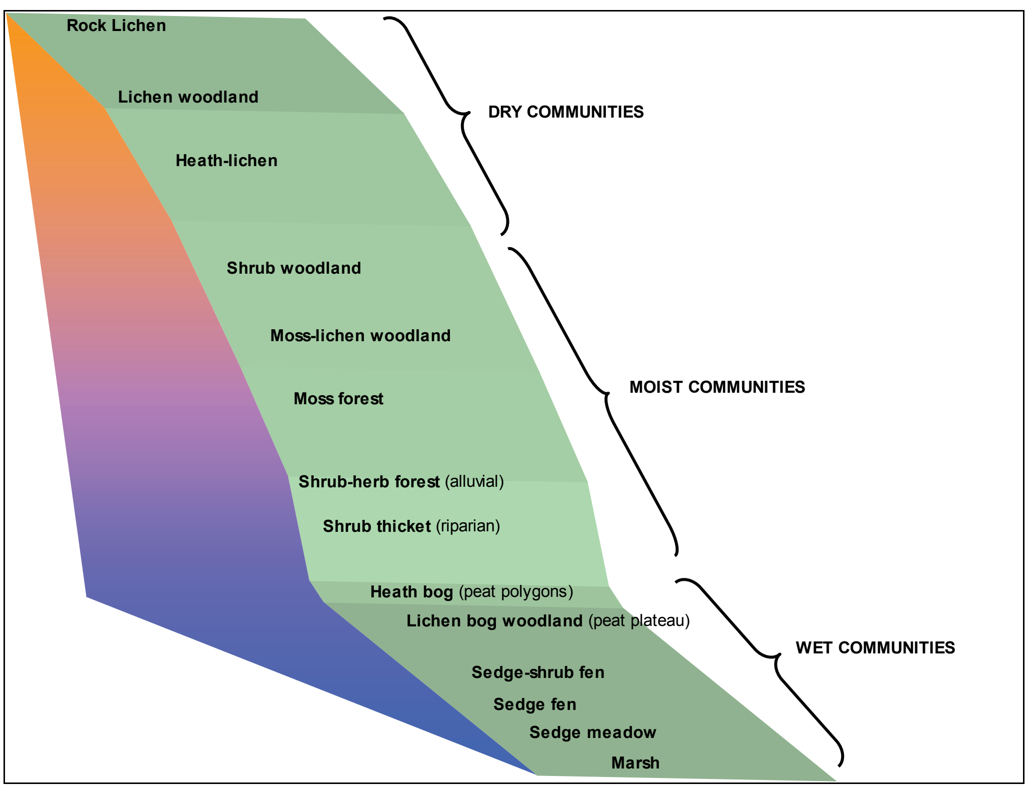

Figure 23b. Taiga Shield LS Ecoregion conceptual landscape.

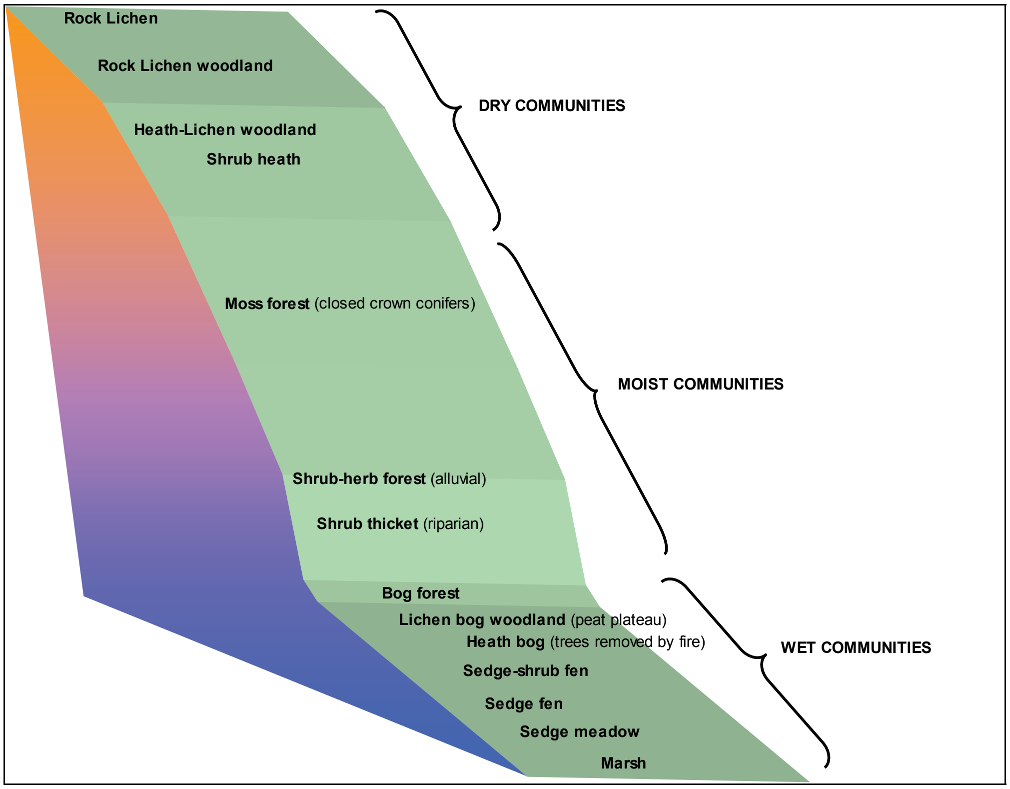

Figure 23c. Taiga Shield HB Ecoregion conceptual landscape.

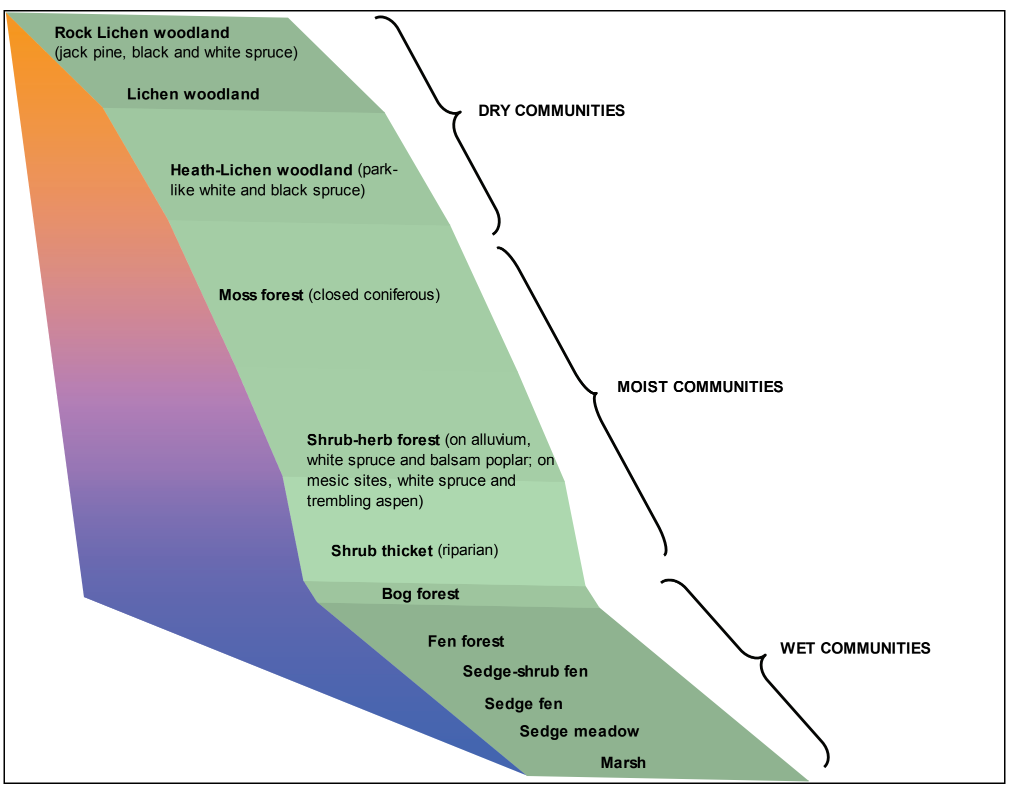

Figure 23d. Taiga Shield MB Ecoregion conceptual landscape.

Table 4. Broad vegetation types and commonly associated plant species of the Taiga Shield, Northwest Territories.*

Rock Lichen; Rock Lichen Woodland (similar except for *Picea mariana* and *Pinus contorta* in the latter)	**Shrub Heath; Shrub – Heath Woodland** (similar except for presence of *Picea mariana* and *Picea glauca* in woodland)
Lichens: *Cladina mitis, Cladina rangiferina* (reindeer lichens); *Actinogyra muhlenbergii, Parmelia centrifuga, Parmeliopsis hyperopta, Peltigera aphthosa, Peltigera polydactyla, Rhizocarpon geographicum.*	***Shrubs:*** *Betula glandulosa, Juniperus communis (Mid- and High Boreal), Vaccinium vitis-idaea, Ledum palustre ssp. decumbens, Ledum groenlandicum, Empetrum nigrum, Loiseleuria procumbens.* ***Lichens:*** *Cladina mitis, Cladina rangiferina, Cladonia uncialis, Cladonia amaurocreaea, Polytrichum piliferum, Ptilidium ciliare, Cetraria nivalis, Cetraria cucullata (High Subarctic), Alectoria nitidula (High Subarctic), Alectoria ochroleuca (High Subarctic), Stereocaulon paschale.*
Heath – Lichen – Grass	**Heath – Lichen; Heath – Lichen Woodland; Lichen woodland** (similar except for the relative abundance of heaths and the treelessness of Heath – Lichen)
Shrubs: *Ledum palustre ssp. decumbens, Vaccinium vitis-idea, Arctostaphylos alpina (High Subarctic).* ***Lichens:*** *Cornicularia divergens (= Bryocaulon divergens) (High Subarctic), Cetraria cucullata (High Subarctic), Cetraria nivalis.* ***Grasses and grasslike plants****: Calamagrostis purpurascens, Hierochloe alpina (High Subarctic), Luzula confusa (High Subarctic), Silene acaulis.*	***Trees:*** *Picea mariana, Picea glauca (on alluvium and outwash), Pinus banksiana (mainly High Boreal and Mid-Boreal), Betula papyrifera.* ***Shrubs:*** *Vaccinium vitis-idaea, Vacinium uliginosum, Ledum palustre ssp. decumbens, Loiseleuria procumbens, Arctostaphylos alpina (High Subarctic).* ***Mosses:*** *Polytrichum piliferum, Pleurozium schreberi.* ***Lichens:*** *Cetraria nivalis, Cladina mitis, Cladonia amaurocraea, Alectoria nitidula (High Subarctic), Alectoria ochroleuca (High Subarctic), Cornicularia divergens (= Bryocaulon divergens) (High Subarctic), Cetraria cucullata (High Subarctic), Stereocaulon paschale.*
Moss – Lichen Woodland; Moss forest (increasing tree density favours bryophytes over lichens; tree species in moderately close to closed stands on moist slopes)	**Heath – Lichen Bog; Bog Woodland** (higher cover of subarctic lichens on the open bogs than under woodland)
Trees: *Picea mariana, Picea glauca, Betula papyrifera.* ***Shrubs:*** *Vaccinium vitis-idaea, Ledum groenlandicum.* ***Mosses:*** *Pleurozium schreberi, Hylocomium splendens, Ptilidium ciliare, Dicranum spp.* ***Lichens:*** *Cladina rangiferina, Cladina stellaris, Cladina mitis.*	***Trees:*** *Picea mariana.* ***Shrubs:*** *Vaccinium vitis-idaea, Vacinium uliginosum, Ledum palustre ssp. decumbens, Ledum groenlandicum, Betula glandulosa, Andromeda polifolia, Empetrum nigrum.* ***Herbs:*** *Rubus chamaemorus.* ***Mosses:*** *Sphagnum fuscum, Sphagnum nemoreum.* ***Lichens:*** *Cetraria nivalis, Cladina mitis, Cladina stellaris, Cladonia amaurocraea, Cladonia uncialis, Cladonia deformis, Cetraria cucullata (High Subarctic).*
Shrub – herb Forest (on rich alluvium, trickle drainages – all species listed are typical of the Mid-Boreal or High Boreal ecoclimatic regions, but can occur in the Low Subarctic and High Subarctic)	**Sedge Fen**
Trees: *Picea glauca, Betula papyrifera.* ***Shrubs:*** *Salix bebbiana, Salix pyrifolia, Viburnum edule, Ribes triste, Rubus idaeus.* ***Herbs:*** *Equisetum pratense, Dryopteris spp., Rubus acaulis, Galium triflorum, Lycopodium annotinum.*	***Shrubs:*** *Andromeda polifolia, Ledum groenlandicum* ***Herbs:*** *Carex magellanica, Carex limosa, Carex rariflora, Eriophorum brachyantherum.* ***Mosses:*** *Sphagnum riparium, Sphagnum magellanicum, Sphagnum nemoreum, Aulacomnium palustre, Tomenthypnum nitens.*
Shrub Thicket	**Sedge Meadow; Marsh**
Shrubs: *Alnus viridis (=Alnus crispa), Salix planifolia, Salix bebbiana (High and Mid-Boreal only), Betula glandulosa*	***Shrubs:*** *Andromeda polifolia, Betula glandulosa, Vaccinium vitis-idaea.* ***Herbs:*** *Carex rotundata, Carex aquatilis, Carex membranacea, Eriophorum vaginatum (=Eriophorum spissum), Trichophorum caespitosum (=Scirpus caespitosus), Arctophila fulva.* ***Mosses:*** *Dicranum spp., Sphagnum spp.*

*Applies to all Level III ecoregions where the vegetation type occurs on the conceptual landscape diagram except where noted (e.g., High Subarctic following a species means its distribution is restricted to that ecoclimatic region). Latin names are as provided in Bradley *et al.* (1982).

Appendix 3. Changes to 1996 Ecozones and Ecoregions

Introduction

This Appendix summarizes the changes made to the 1996 version of the Taiga Shield Ecozone as defined by the Ecological Stratification Working Group (1996) that have resulted in the revised Northwest Territories classification presented in this report. The revision process was similar to that applied to the 1996 Taiga Plains Ecozone (Ecosystem Classification Group 2007), and improvements included:

- Refinements to existing ecoregion and ecozone boundaries;
- Subdivision of existing ecoregions into more ecologically homogeneous map units;
- Inclusion of a climatic component by re-integrating the 1989 *Ecoclimatic Regions of Canada* classification; and
- Enhancement of ecoregion names to reference not only the geographic locale, but also the main landform and the regional climate.

From 1996 to early 2006, the Canadian National Eosystem Framework was employed to delineate and describe ecosystem units within the Northwest Territories (Ecological Stratification Working Group 1995; Downing *et al.* 2006). Discussions with other experts in Canada and the United States in May 2006 led to adoption of a North American continental ecosystem classification scheme (refer to Section 1.2 for further discussion).

The North American ecosystem classification system is a multilevel continental system for delineating and describing ecosystems; the Government of the Northwest Territories uses this information for planning and reporting purposes. The top four levels of the continental framework as applied in the Northwest Territories to the Taiga Shield are Level I ecoregions, Level II ecoregions, Level III ecoregions, and Level IV ecoregions.

The detailed work by Bradley *et al.* (1982) presented in their report *An Ecological Land Survey of the Lockhart River Map Area, Northwest Territories* was integral to the revision process; their ecodistrict map units are equivalent to Level IV ecoregions in the Northwest Territories classification, and their summaries of landscape, vegetation and soil relationships are incorporated in many of the Level IV ecoregion descriptions in Section 3. An intensive field program to review and verify existing work was carried out in July 2006 (refer to Section 2 of this report) and over 15,000 geographically referenced digital photographs were collected along with ground survey data throughout the entire Northwest Territories Taiga Shield Level II Ecoregion within the Northwest Territories. General ecoregion descriptions and map unit delineations were finalized in a five-day workshop in November 2006 at which Federal and Territorial representatives participated.

Record of Changes to 1996 Classification

A three-part naming convention has been adopted for Level IV ecoregions to provide better information on where they are located and what their physiographic and climatic characteristics are. This naming convention is described in Section 1.5.

Compared to the 1996 Ecoregions and Ecozones map, in which four ecoregions were identified in the Taiga Shield Ecozone, the revised Northwest Territories ecosystem classification identifies 25 distinct Level IV ecoregions within the Level II Taiga Shield Ecoregion. Changes between the 1996 and 2008 versions of the Taiga Shield and adjacent Level II ecoregions and their Level III and Level IV ecoregion components are summarized in Table 5.

Figures 24 and 25 compare the 1996 and 2008 Taiga Shield versions. The individual ecoregion names are not included in the two figures; grey tones and colours corresponding to major physiographic elements in the Taiga Shield graphically illustrate these broad-scale changes.

Table 5. Summary of changes between 1996 Taiga Shield Ecozone and Ecoregions, and 2008 Level II, Level III and Level IV Taiga Shield Ecoregions, Northwest Territories. The 1996 Ecoregions are shown in Figure 24, and the 2008 Level III and Level IV Ecoregions are shown in Figure 25.

1996 Ecozone	1996 Ecoregion	2008 Level II Ecoregion	2008 Level III* and Level IV Ecoregion	Main changes
Taiga Shield	Coppermine River Upland	Taiga Shield	Radium Hills HS	Separation of narrow hill system adjacent to Great Slave Lake that is distinctly different from the adjacent bedrock plains to the south and east.
			Coppermine Upland HS	Recognition of Coppermine River influences on parent materials that differentiate it from the adjacent Point Upland HS Ecoregion to the east; it has colder climates than the adjacent Calder Upland LS Ecoregion to the south and west.
			Point Upland HS	See comments for Coppermine Upland HS. Revisions to northern boundary with the Level II Southern Arctic Ecoregion based on tree line as presented by Timoney *et al*. (1992) and 2006 field observations.
			Snare Plain HS	Recognizes transitional climate from tundra-dominated near the Point Upland HS to forest-dominated in the Calder Upland LS; higher proportion of wetlands than other High Subarctic ecoregions.
			Mackay Upland HS (in part)	Terrain with a higher proportion of till deposits and fewer wetlands than the adjacent Snare Plain HS Ecoregion.
			Whitefish Plain HS (in part)	Recognized as a distinct ecoregion because of low-relief hummocky till plains and tundra – forest mixture indicating High Subarctic conditions
			Calder Upland LS	See comments for Coppermine Upland HS; higher and more rugged than the adjacent Camsell Plain LS Ecoregion to the west.
			Camsell Plain LS	Recognized as a separate ecoregion because of low-relief topography, relatively common wetlands, and lacustrine deposits.
			Radium Hills LS	Similar to Radium Hills HS, but not as strongly influenced by the cold waters of Great Bear Lake; split recognizes climatic differences.
			Great Slave Upland LS (in part)	Recognized as a separate ecoregion from the adjacent Calder Upland LS, Snare Plain HS, and Mackay Plain HS on the basis of more rugged topography and somewhat warmer climates.
			Great Slave Upland HB (in part)	Recognized as a separate ecoregion from the adjacent Great Slave Upland LS because of less rugged topography, lower elevations and warmer climates.
	Kazan River Upland		Mackay Upland HS (in part)	More bedrock and fewer till deposits than the adjacent Whitefish Plain HS Ecoregion.
			Whitefish Plain HS (in part)	See comments above for Mackay Upland HS Ecoregion; the adjacent Sid Plain HS Ecoregion to the east has higher proportions of eskers and outwash deposits, and the Dubawnt Plain HS Ecoregion is dominated by extremely bouldery ribbed till deposits. Revisions to northern boundary with the Level II Southern Arctic Ecoregion based on tree line as presented by Timoney *et al*. (1992) and 2006 field observations. Tent – Firedrake High Subarctic and Sifton – Whitefish High Subarctic Ecodistricts (in part) of Bradley *et al.* (1982).
			Sid Plain HS	See comments for Whitefish Plain HS Ecoregion. Revisions to northern boundary with the Level II Southern Arctic Ecoregion based on tree line as presented by Timoney *et al*. (1992) and 2006 field observations. Tyrell – Sid High Subarctic Ecodistrict (in part) of Bradley *et al*. (1982).
			Dubawnt Plain HS	See comments for Whitefish Plain HS Ecoregion.
			Thelon Valley HS	Recognized as separate unit because of unique vegetation (outlier forests) and lower-elevation outwash and fluvial deposits. Revisions to boundary with the Level II Southern Arctic Ecoregion based on tree line as presented by Timoney *et al.* (1992) and 2006 field observations. Thelon High Subarctic Ecodistrict (in part) of Bradley *et al.* (1982).

Table 5 (continued).

1996 Ecozone	1996 Ecoregion	2008 Level II Ecoregion	2008 Level III* and Level IV Ecoregion	Main changes
Taiga Shield	Tazin Lake Upland	Taiga Shield	Great Slave Upland LS (in part)	Recognized as a separate ecoregion from the adjacent Calder Upland LS, Snare Plain HS, and Mackay Plain HS Ecoregions on the basis of more rugged topography and somewhat warmer climates.
			Great Slave Upland HB (in part)	Recognized as a separate ecoregion from the adjacent Great Slave Upland LS Ecoregion because of less rugged topography, lower elevations and warmer climates.
			Great Slave Lowland HB	Recognized as a separate ecoregion because of warmer climates, associated distinctive upland and wetland vegetation, and low-relief terrain with lacustrine and fluvial deposits
			East Arm Upland LS	Recognized as a separate ecoregion because of lake influence on subregional climate and island – peninsula bedrock complex. East Arm Mid-Boreal Ecodistrict (in part) of Bradley *et al.* (1982).
			East Arm Upland HB	Recognized as separate from East Arm Upland LS Ecoregion because of warmer climates and lacustrine materials at lower elevations. East Arm Mid-Boreal Ecodistrict (in part) of Bradley *et al.* (1982).
			Nonacho Upland HB	Nonacho – Whirlwind High Boreal Ecodistrict of Bradley *et al.* (1982).
			Rutledge Upland HB	Rutledge – Pilot High Boreal Ecodistrict of Bradley *et al.* (1982).
			Slave Plain MB	Distinctly different from uplands to the east; warmer climates, lacustrine deposits. Includes Tsu – Slave Ecodistrict of Bradley *et al.* (1982). Changes to Taiga Shield – Taiga Plains boundary based on Precambrian bedrock occurrences.
	Selwyn Lake Upland		Abitau Upland LS	Abitau – Dunvegan Low Subarctic Ecodistrict of Bradley *et al.* (1982).
			Porter Lake LS	Porter – Wignes Low Subarctic Ecodistrict of Bradley *et al.* (1982); the Ecodistrict was split into two ecoregions based on till thickness and lake patterns.
			Wignes Lake LS	Porter – Wignes Low Subarctic Ecodistrict of Bradley *et al.* (1982); the Ecodistrict was split into two ecoregions based on till thickness and lake patterns.
			Dubawnt Plain LS	Wholdaia – Selwyn Low Subarctic Ecodistrict (in part) of Bradley *et al.* (1982).
			Selwyn Upland LS	Wholdaia – Selwyn Low Subarctic Ecodistrict (in part) of Bradley *et al.* (1982).

*Level III Ecoregions are indicated by the suffixes HS (High Subarctic), LS (Low Subarctic), HB (High Boreal), and MB (Mid-Boreal).

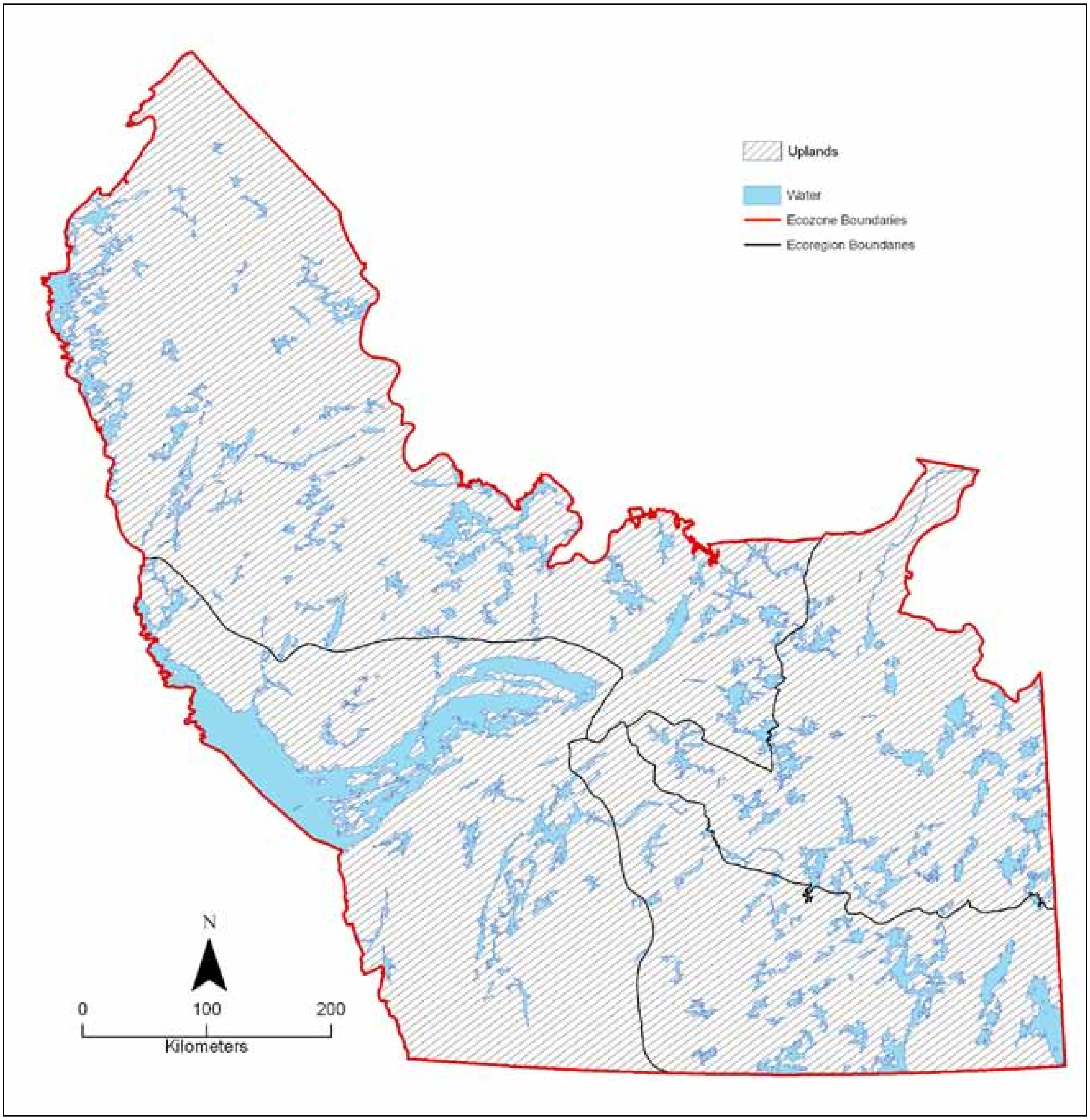

Figure 24. 1996 National Ecological Framework Ecoregions of the Taiga Shield Ecozone, Northwest Territories.

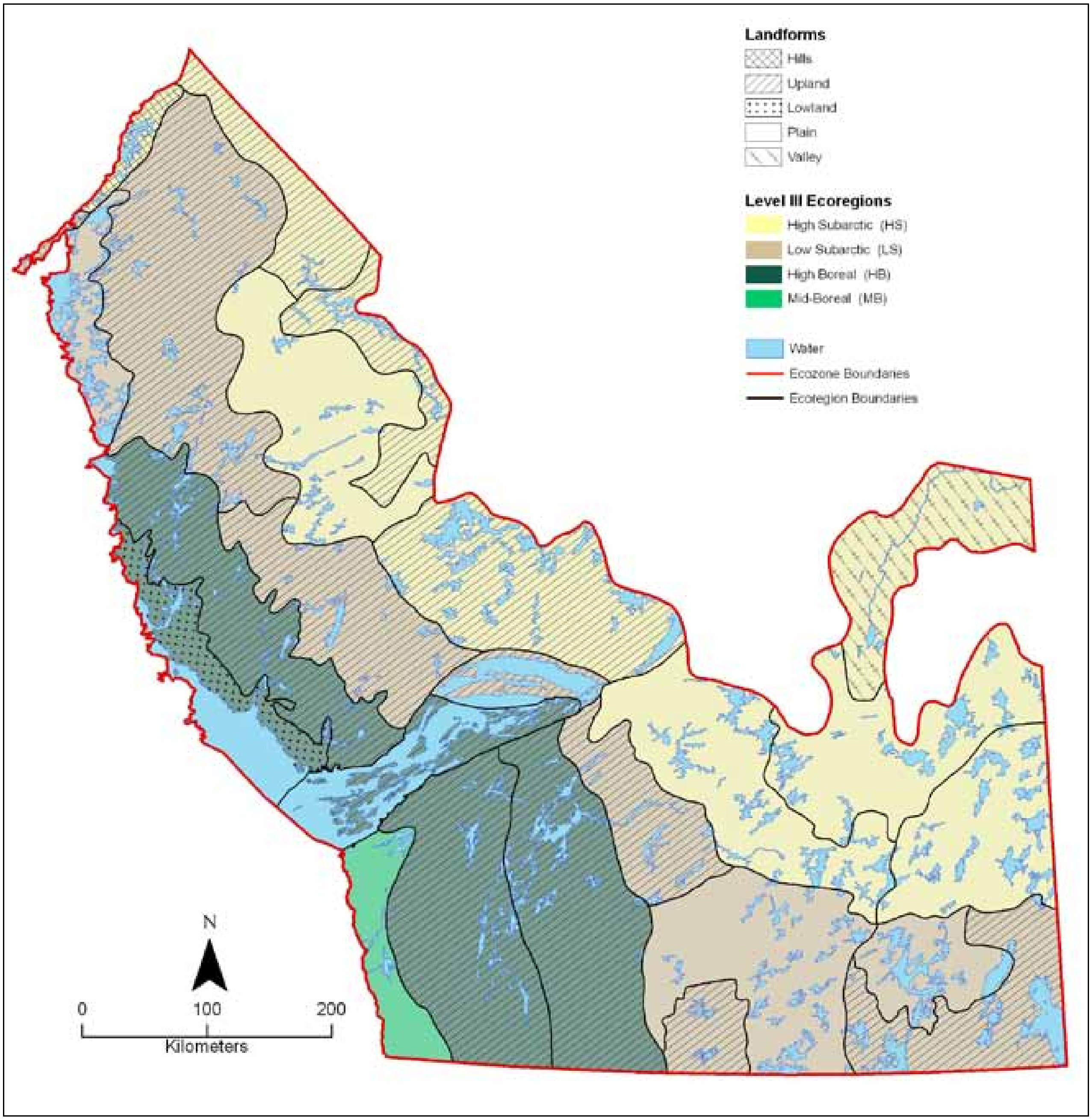

Figure 25. 2008 Level III and Level IV Ecoregions and major physiographic elements of the Taiga Shield, Northwest Territories**.** Refer to Appendix 4 for Ecoregion labels and legend.

Appendix 4. 2008 Level III and Level IV Ecoregions of the Taiga Shield, Northwest Territories

Map Legend (Figure 26)

Taiga Shield High Subarctic (HS) Ecoregion (3.4.1)

3.4.1.1 Radium Hills HS
3.4.1.2 Coppermine Upland HS
3.4.1.3 Point Upland HS
3.4.1.4 Snare Plain HS
3.4.1.5 Mackay Upland HS
3.4.1.6 Thelon Valley HS
3.4.1.7 Whitefish Plain HS
3.4.1.8 Sid Plain HS
3.4.1.9 Dubawnt Plain HS

Taiga Shield Low Subarctic (LS) Ecoregion (3.4.5)

3.4.5.1 Radium Hills LS
3.4.5.2 Calder Upland LS
3.4.5.3 Camsell Plain LS
3.4.5.4 Great Slave Upland LS
3.4.5.5 East Arm Upland LS
3.4.5.6 Porter Upland LS
3.4.5.7 Wignes Plain LS
3.4.5.8 Abitau Upland LS
3.4.5.9 Dubawnt Plain LS
3.4.5.10 Selwyn Upland LS

Taiga Shield High Boreal (HB) Ecoregion (3.4.6)

3.4.6.1 Great Slave Upland HB
3.4.6.2 Great Slave Lowland HB
3.4.6.3 East Arm Upland HB
3.4.6.4 Rutledge Upland HB
3.4.6.5 Nonacho Upland HB

Taiga Shield Mid-Boreal (MB) Ecoregion (3.4.7)

3.4.7.1 Slave Plain MB

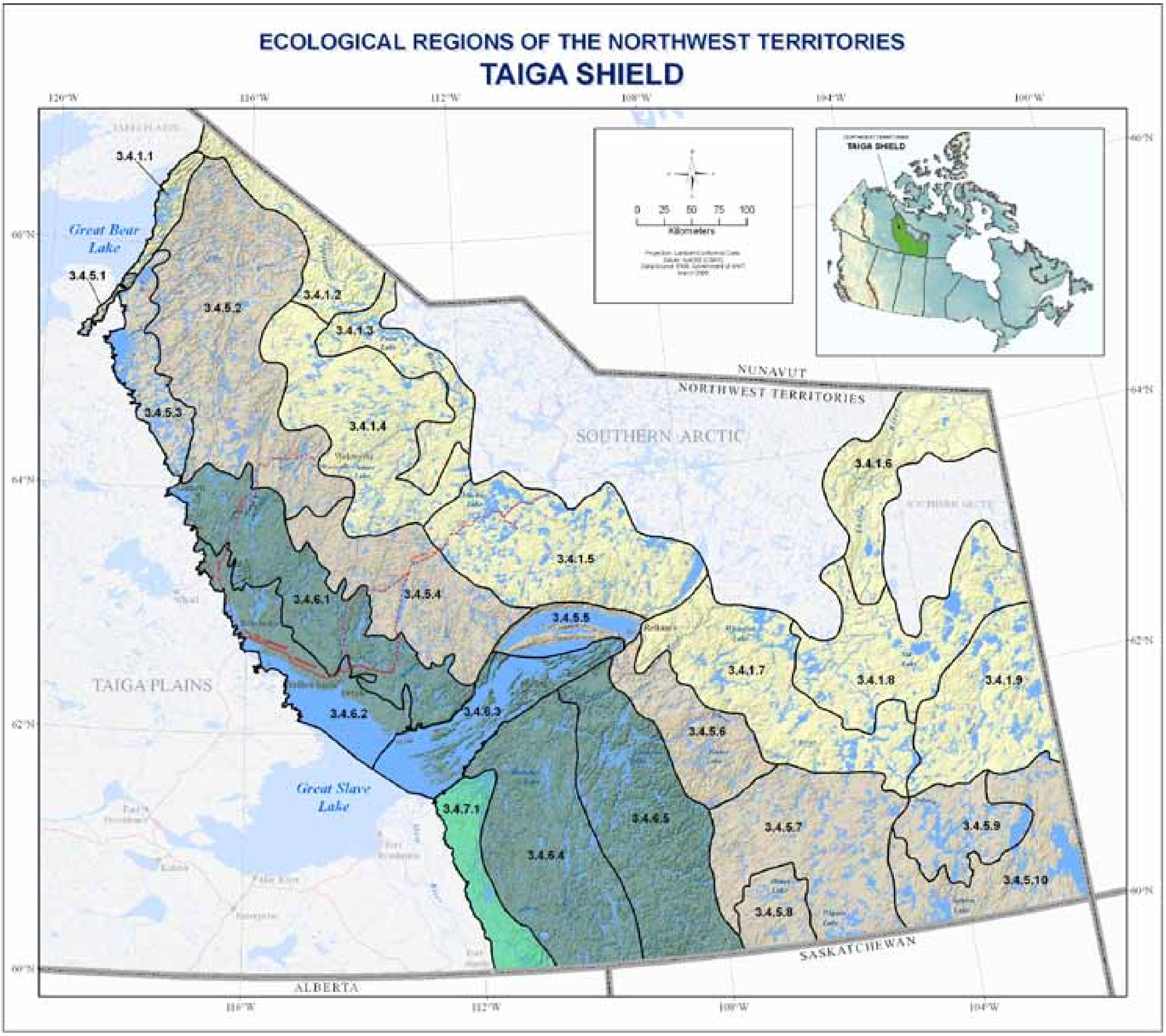

Figure 26. 2008 Level III and Level IV Ecoregions of the Taiga Shield, Northwest Territories. Legend is on Page 120.

Appendix 5. Glossary of Terms

The following definitions are taken mainly from *Terminology of Ecological Land Classification in Canada* (Cauboue *et al.* 1999) and *Soil and Environmental Science Dictionary* (Gregorich *et al.* 2001), supplemented by *Glossary of terms in Soil Science* (Canadian Society of Soil Science 1976), *Multi-language glossary of permafrost and related ground-ice terms* (van Everdingen, 2005), *Glossary of Permafrost and Related Ground-ice Terms* (National Research Council 1988), and *Wetlands of Canada* (National Wetlands Working Group 1988). W.W. Pettapiece compiled most of this glossary from the listed sources; many of the permafrost terms are referenced in van Everdingen (2005) and National Research Council (1988).

A horizon – A mineral horizon formed at or near the surface in the zone of removal of materials in solution and suspension, or maximum accumulation of organic carbon, or both.

Ae – A horizon that has been eluviated of clay, iron, aluminum, or organic matter, or all of these.

Ah – A horizon in which organic matter has accumulated as a result of biological activity.

Ap – A horizon markedly disturbed by cultivation or pasture.

abiotic – Describing the nonliving components of an ecosystem.

abundance – dominance – This term expresses the number of individuals of a plant species and their coverage in a phytosociological survey. The scale generally used is that of J. Braun-Blanquet from which stemmed many variations. It is based on the coverage of individuals for classes with a coverage higher than 5% and on the abundance for classes with a lower percentage; frequently, this is also referred to as "cover-abundance". See **Braun-Blanquet** method.

acid igneous rock – Describing igneous rock composed of >66% silica.

acidic (soil) – Having a pH value of less than 7.0.

active delta marsh – A marsh occupying lowlands on deltas, usually with drainage connections to active river channels. The marsh is subject to inundation at least once during a season, followed by a slow drawdown of the water levels. A high rate of sedimentation may occur in many parts of the marsh.

active layer – The seasonal thaw zone at the surface of permafrost terrain.

advance regeneration – Young trees under existing stands. Regeneration established before logging that has survived the logging operation.

aeolian (eolian) – Referring to mineral particles moved and sorted by wind, usually fine sands and coarse silt. See dune and loess.

aerobic – Occurring in the presence of oxygen as applied to chemical and biochemical processes; opposite of anaerobic.

aggregate – A group of soil particles cohering in such a way that they behave mechanically as a unit.

albedo – A measurement of reflected energy. Albedo is the coefficient of reflectance, usually applying only to short-wave radiation.

alkaline – Having a pH value of >7.0.

alliance – A vegetation classification level in the Braun-Blanquet system, a collection of associations with similar physiognomy and the same dominant and constant species. See **Braun-Blanquet method.**

alluvium – Mineral material deposited by flowing water, usually sands, silts and gravels.

alpine – The ecological zone that occurs above an elevational tree line, characterized by a distinct climate and vegetation.

alvar – Swedish term for an unusual landform which occurs when soils are scraped away from bare limestone bedrock by ice, wind, and water. Alvars and associated biota are globally rare features.

anaerobic – Occurring in the absence of oxygen as applied to chemical and biochemical processes.

anthropogenic – Human-made or human-modified materials such that their initial physical properties have been drastically altered.

aquatic – Living or growing in water.

arable land – Land that is cultivated or suitable for cultivation (as opposed to grazing or non-cultivated land).

arctic – The ecological zone north of the latitudinal tree line, characterized by a distinct climate and vegetation.

arid – Describing a soil, climate or region where vegetation may not grow due to a severe lack of water.

aspect – The orientation of a slope face, expressed using a compass direction.

association – 1. A classification level in the Braun-Blanquet system, which is a subdivision of a formation based on floristic composition, an abstract plant community.

2. Sometimes used as a general term for a collection of vegetation stands with similar composition and structure.

avalanche – A form of mass wasting involving snow and ice.

Azonal – Vegetation (or soil) that develops on atypical conditions such as flooded or rapidly drained sites.

B horizon – A subsoil horizon characterized by one of:

a) an enrichment in clay, iron, aluminum, or humus (Bt or Bf).
b) a prismatic or columnar structure that exhibits pronounced coatings or stainings associated with significant amounts of exchangeable sodium (Bn or Bnt).
c) an alteration by hydrolysis, reduction, or oxidation to give a change in colour or structure from the horizons above or below, or both (Bm).

basal area – The area occupied by a plant near the ground surface; measured across the stem of a tree 1.3 to 1.5 m above the ground surface, or across a clump in the case of graminoids, usually 2 to 3 cm above the ground surface.

bedrock – The solid rock underlying soils and the regolith or exposed at the surface.

bioclimate – All the climatic conditions (climate factors) of a region that have a fundamental influence on the survival, growth, and reproduction of living organisms.

biocoenosis – A group of interacting organisms including both plants and animals.

biodiversity – Totality of the richness of biological variation, ranging from within-species genetic variation, through subspecies and species, to communities, and the pattern and dynamics of these on the landscape.

Biogeoclimatic Ecosystem Classification (BEC) in British Columbia – A hierarchical ecosystem classification system applied in British Columbia that describes the variation in climate, vegetation, and site conditions throughout the province.

biogeoclimatic zone – A level in the British Columbia Biogeoclimatic ecosystem classification system that represents areas with the same regional climate. See **ecoclimatic region**, **ecoregion**, and **ecological region**.

biogeocoenosis – A group of interacting organisms living together in a particular environment, an ecosystem.

biogeography – A branch of biology or of geography that deals with the geographical distribution of plants and animals.

biomass – The mass of living organisms within a defined space, usually expressed in kg/ha or g/m2 of dry matter.

biome – Major biotic community composed of all the plants and animals and smaller biotic communities. The smaller communities in a biome possess similarities in gross external appearances (deciduous trees, grasslands, etc.) and gross climatic conditions (desert, tropical, etc.). A particular biome is defined in terms of the characteristic vegetation forms (or life forms).

Biophysical Land Classification – An approach to land classification that combines the physical and biological components of the environment. This hierarchical classification system originally included four levels, within which the physical components of classification are sometimes more heavily weighted than the biological components. The term biophysical was subsequently replaced by "ecological".

biota – The living component of an ecosystem.

biotic – Pertaining to life.

Black – A soil classification Great Group or Subgroup designation indicating a surface (Ah or Ap horizon) colour value darker than 3.5 moist and dry, with a chroma less than 2, dry (grassland or parkland soils with generally greater than 4 % organic matter).

bog – Ombrotrophic (nutrient poor) peatland that is acidic (generally unaffected by nutrient-rich groundwater) and usually dominated by heath shrubs and *Sphagnum* mosses and that may include open-growing, stunted woodlands of black spruce or other tree species.

boreal – (1) Pertaining to the north.

(2) A climatic and ecological zone that occurs south of the subarctic, but north of the temperate hardwood forests of eastern North America, the parkland of the Great Plains region, and the montane forests of the Canadian cordillera.

boulder – Rock fragment over 60 cm in diameter. In engineering, practice boulders are over 20 cm in diameter.

brackish – Water with a salt content between that of fresh and sea water. Brackish water usually has 5-10 parts of salt per thousand.

Braun-Blanquet method – An approach to classifying vegetation that utilizes floristic composition (i.e. characteristic species and associations), developed in central and southern Europe. Includes the ZurichMontpellier School of Phytosociology.

break of slope – An abrupt change in slope steepness.

broadleaved forest See **deciduous forest.**

Brown – A soil classification Great Group or Subgroup designation indicating a surface (Ah or Ap horizon) colour value darker than 3.5 moist and 5.5 dry with a chroma less than 3.5 moist (grassland soils with less than about 2% organic matter).

Brunisol – A soil of the Brunisolic Order.

Brunisolic (1) – An Order of soils whose horizons are developed sufficiently to exclude them from the Regosolic Order but lack the degrees or kinds of horizon development specified for soils in other orders. They always have Bm or Btj horizons. The order consists of Melanic, Eutric, Sombric and Dystric Great Groups.

(2) – A soil classification Subgroup designation indicating the formation of a Bm or Btj horizon within the Ae of a Luvisolic soil (a strongly degraded Luvisol).

bulk density, soil – The mass of dry soil per unit bulk volume.

C horizon – A mineral horizon comparatively unaffected by the pedogenic processes operative in the A and B horizons except for the process of gleying (Cg) or the accumulation of calcium carbonate (Cca) or other salts (Csa). A naturally calcareous C horizon is designated Ck.

calcareous soil – Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1 N hydrochloric acid.

C:N ratio – The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Canadian System of Soil Classification – Hierarchical soil classification system in which the conceptual classes are based upon the generalization of properties of real bodies of soil. Taxa are defined on the basis of observable and measurable soil properties that reflect processes of soil genesis and environmental factors.

canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees.

canopy closure – The degree of canopy cover relative to openings.

capability – A natural ability to support a selected activity such as agriculture or recreation.

catchment area See **drainage basin.**

channel marsh – A marsh occurring in well-defined, abandoned channels where stream flow is discontinuous or blocked.

characteristic species – (1) A diagnostic species used to separate plant community types within the Braun-Blanquet vegetation classification system.
(2) Characteristic species may occur in more than *one* community, but are significant (e.g., much more abundant) in only one community.
(3) A species with high cover (abundance) and presence.

Chernozem – A soil of the Chernozemic Order.

Chernozemic – An Order of soils that have developed under xerophytic or mesophytic grasses and forbs, or under grassland – forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-coloured surface (Ah, Ahe or Ap) horizon and a B or C horizon, or both, of high base saturation. The order consists of Brown, Dark Brown, Black and Dark Gray Great Groups.

Chinook – a warm, dry wind characteristic of southern Alberta and northern Montana created by moisture condensation and precipitation on the western side of the mountains and compression as the dry air descends onto the plains. In the Northwest Territories, similar conditions produce Chinook-like winds in the Fort Liard area.

chroma – A measure of colour strength in the Munsell Soil Colour Chart.

chronosequence – A chronosequence is a sequence through time. Often, it refers to a secondary successional sequence within a set of plant communities.

classification – The systematic grouping and organization of objects, usually in a hierarchical manner.

clay – 1. Mineral particles <0.002 mm in diameter.
2. Soil and texture class with approximately a 40 to 60% composition of clay size particles.

climate – The accumulated long-term effects of weather that involve a variety of heat and moisture exchange processes between the earth and the atmosphere.

climatic climax See climax.

climatic index – Number indicating a combination of climatic factors, most often temperature and precipitation, in order to describe the vegetation distribution.

climax – Stable, self-perpetuating vegetation that represents the final stage of succession.

climatic climax – Stable, self-perpetuating vegetation developed through succession in response to long-term climatic conditions, as opposed to edaphic climax. **Edaphic climax** – Stable, self-perpetuating vegetation developed through succession on azonal sites.

cluster analysis – A multidimensional statistical analysis technique used to group samples according to their degree of similarity.

classification, soil – The systematic arrangement of soils into categories and classes on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

clay – As a particle-size term: a size fraction mm equivalent diameter.

clod – A compact, coherent mass of soil produced by digging or plowing.

coarse fragments – Rock or mineral particles 2.0 mm in diameter.

coarse texture – The texture exhibited by sands, loamy sands, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

codominant – Trees with crowns forming the general level of the main canopy in an even-aged stand of trees. Two plant species of similar stature and cover that occur on the same site.

collapse scar – That portion of a peatland where the whole or part of a palsa or peat plateau has thawed and collapsed to the level of the surrounding peatland.

collapse scar bog – A circular or oval-shaped wet depression in a perennially frozen peatland. The collapse scar bog was once part of the perennially frozen peatland, but the permafrost thawed, causing the surface to subside. The depression is poor in nutrients, as it is not connected to the minerotrophic fens in which the palsa or peat plateau occurs.

collapse scar fen – A fen with circular or oval depressions, up to 100 m in diameter, occurring in larger fens, marking the subsidence of thawed permafrost peatlands. Dead trees, remnants of the subsided vegetation of permafrost peatlands, are often evident.

colluvium – Unconsolidated materials moved by gravity, often occurring at the base of a slope.

community – An assemblage of organisms that interact and exist on the same site.

community type – A group of vegetation stands that share common characteristics, an abstract plant community.

companion species – In phytosociology, a species occurring in several associations with relatively the same frequency, or a species characteristic of another association, but having a lower frequency.

competition – The interaction between organisms resulting from common use of a limited resource. Intraspecific competition occurs within the same species, while interspecific competition arises between different species.

conifer – A cone-bearing plant (except for the taxaceous family) belonging to the taxonomic group Gymnospermae.

coniferous forest – A plant community with a cover made up of 75% or more conifers.

consistence – The degree of soil cohesion and adhesion based on its resistance to deformation.

consociation – A classification level within the Scandinavian approach to vegetation classification, a collection of sociations with the same dominant species.

constant species – A species occurring more than 80% of the time within a particular plant community type.

constraint – A factor that limits the optimal condition, such as steep slopes or cold temperatures, usually associated with land use capability assessments.

continuous permafrost – Permafrost occurring everywhere beneath the exposed land surfacethroughout a geographic region with the exception of widely scattered sites, such as newly deposited unconsolidated sediments, where the climate has just begun to impose its influence on the thermal regime of the ground**,** causing the development of continuous permafrost

continuous permafrost zone – The major subdivision of a permafrost region in which permafrost occurs everywhere beneath the exposed land surface with the exception of widely scattered sites.

control section – The minimum depth used to classify a soil, usually 1.0 m for mineral soils and 1.6 m for organic deposits.

cordillera – An elongated range of mountains.

corridor – In a landscape, a narrow strip of land that differs from the matrix on either side. Corridors may be isolated strips, but are usually attached to a patch of somewhat similar vegetation.

coulee – A western Canadian term for a steep-sided prairie valley. It may refer to valleys that have a relatively broad bottom, often as a result of a glacial meltwater channel or to v-shaped gullies caused by more recent erosion.

cover – The area of ground covered with plants of one or more species, usually expressed as a percentage.

cover type – A very general unit of vegetation classification and mapping based on existing plant cover, e.g., closed-canopied deciduous forest, pasture, or native prairie.

Cryosol – A soil of the Cryosolic Order.

Cryosolic – An Order of soils formed in either mineral or organic materials that have perennially frozen material within 1 m of the surface in some part of the soil body (or within 2 m if the pedon has been strongly cryoturbated). The mean annual temperature is less than 0^0C. The order consists of Turbic, Static or Organic Great Groups based on degree of cryoturbation and the nature of the soil material.

cryoturbation – Irregular structures formed in earth materials by deep frost penetration and frost action processes, and characterized by folded, broken and dislocated beds and lenses of unconsolidated deposits, included organic horizons and even bedrock. Terms such as “frost churning” and “frost stirrings” are not recommended.

Cumulic – A soil classification Subgroup designation indicating successive mineral layers that result from deposition of materials (e.g., flood plain deposits).

Dark Brown – A soil classification Great Group or Subgroup designation indicating a surface (Ah or Ap horizon) colour value darker than 3.5 moist and 4.5 dry with a chroma greater than 1.5, dry (grassland soils with organic matter content in the 2% to 4% range).

Dark Gray – A soil classification Great Group or Subgroup designation indicating a surface (Ah or Ap horizon) colour value darker than 3.5 moist and 3.5 to 4.5 dry with a chroma of 1.5 or less (transition forest soils with less than about 2% organic matter).

dbh – The diameter of a tree at breast height. Diameter is measured at 1.3 to 1.5 m above ground surface.

deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season.

deciduous forest – A plant community with a cover made up of 75% or more of deciduous trees. *Syn.* broadleaved forest.

degree-day – A measure of temperature above or below a reference temperature that is generally added up for a certain period. Thus it is a cumulative measurement of the quantity of energy available for growth that makes it possible to compare growth conditions between regions.

delta – Alluvial deposits at the mouth of a river, usually triangular in outline with low relief.

deposit See surficial materials.

depression – An area that is lower than the general surrounding landscape, usually less well-drained than the surrounding terrain.

diagnostic species – Plant species used to distinguish plant communities based on their presence or absence and on their abundance.

differential species – A diagnostic species that occurs primarily within one or a few plant community types, but that is less abundant and with lower constancy than characteristic species. It may be present in other communities, but with lower abundance and constancy.

discontinuous permafrost – Permafrost occurring in some areas beneath the exposed land surface throughout a geographic region where other areas are free of permafrost.

diversity – The richness of species within a given area. Diversity includes two distinct concepts:

(1). richness of species.

(2). evenness in the abundance of the species.

domain – Territory including all the regions having the same vegetation or climatic groups on modal sites.

dominant – A plant with the greatest cover and/or biomass within a plant community. The tallest trees within a forest stand, which extend above the general canopy.

drainage – The removal of excess water from soil as a result of gravitational flow. Soil drainage refers to the frequency and duration of periods when the soil is not saturated. Terms used are – excessively, well, moderately, imperfectly and poorly-drained.

drainage basin – Area tributary to or draining to a lake, stream, reservoir or other body of water. *Syn.* catchment area. See watershed.

drift – A glacial deposit.

droughty soil – A soil with low water supplying capacity (sandy or very rapidly drained soil).

drumlin – A smooth, elongated hill created by flowing glacial ice. The long axis and tapered end are oriented in the direction of glacial ice flow.

dryland farming – The practice of crop production in low-rainfall areas without irrigation.

duff – A general term for the litter and humus layers of the forest floor.

dune – A low hill or ridge of sand that has been sorted and deposited by wind.

Dystric – A soil classification Great Group designation indicating Brunisolic soils with an acidic solum – a pH (0.01M Ca Cl_2) of less than 5.5 for at least 25 cm starting at the top of the B horizon.

dystrophic – Referring to a physical environment very unbalanced from a nutritive standpoint due to an excess or a significant lack of a mineral or organic element.

earth hummock – A hummock having a core of silty and clayey mineral soil which may show evidence of cryoturbation**.** Earth hummocks are a type of nonsorted circle (see also *patterned ground*) commonly found in the zone of continuous permafrost. They develop in materials of a high silt and clay content and/or of high ice content.

ecoclimatic province – A broad complex of ecoclimatic regions that have similar climatic conditions as reflected by vegetation. Examples of such units generally approximate continental climatic zones. See **vegetation** zone.

ecoclimatic region – An area characterized by a distinctive regional climate as expressed by vegetation. Equivalent to a domain.

ecodistrict – A subdivision of an ecoregion based on distinct assemblages of relief, geology, landform, soils, vegetation, water, and fauna. Canadian ecological land classification (ELC) system unit. Scale 1 :500,000 to 1 :125,000. The subdivision is based on distinct physiographic and/or geological patterns. Originally referred to as a land district. See **ecological district.**

ecological district – Portion of land characterized by a distinctive pattern of relief, geology, geomorphology, and regional vegetation. See **ecodistrict.**

ecological factor. Element of the site that can possibly influence living organisms (e.g., water available for plants). This term is also frequently used to refer to ecological descriptors.

Ecological Land Classification (ELC) – The Canadian classification of lands from an ecological perspective, an approach that attempts to identify ecologically similar areas. The original system proposed by the Subcommittee on Biophysical Land Classification in 1969 included four hierarchical levels that are currently called ecoregion, ecodistrict, ecosection, and ecosite. Ecozone, ecoprovince and ecoelement were later added to the upper and lower levels of the hierarchy.

ecological range – Interval included between the lower and upper limits of an ecological factor allowing the normal development of a specific organism (or a group of organisms). *Syn.* range of tolerance or ecological amplitude.

ecological region – A region characterized by a distinctive regional climate as expressed by vegetation.

ecological unit – Very general term used to refer to a mapping or classification unit of any rank and based on ecological criteria.

ecology – Science that studies the living conditions of living beings and all types of interactions that take place between living beings on the one hand, and living beings and their environment on the other hand.

ecoprovince – A subdivision of an ecozone that is characterized by major assemblages of landforms, faunal realms, and vegetation, hydrological, soil and climatic zones. Canadian ecological land classification (ELC) system unit.

ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation. Canadian ecological land classification (ELC) system unit. Scale 1:3,000,000 to 1:1,000,000. Originally referred to as a land region. See **ecological region** and **biogeoclimatic zone**.

ecosite – 1. A subdivision of an ecosection that consists of an area of land with a particular parent material, having a homogeneous combination of soils and vegetation. A Canadian ecological land classification (ELC) system mapping unit, usually mapped at a scale of 1 :50,000 to 1 :10000. Originally referred to as a "land type".

2. In Alberta, ecosite is defined as an area with a unique recurring combination of vegetation, soil, landform, and other environmental components.

ecosystem – 1. A complex interacting system that includes all plants, animals, and their environment within a particular area.

2. The sum total of vegetation, animals, and physical environment in whatever size segment of the world is chosen for study.

3. A volume of earth – space that is set apart from other volumes of earth – space in order to study the processes and products of production, particularly those transactions between a community of organisms and its nonliving environment.

ecotone – The transition zone between two adjacent types of vegetation that are different.

ecotype – A group of individuals of the same species that are genetically adapted to local ecological conditions.

ecozone – An area of the earth's surface representing large and very generalized ecological units characterized by interacting abiotic and biotic factors. The most general level of the Canadian ecological land classification (ELC) system.

edaphic – Related to the soil.

edaphic climax …. See climax.

edaphic grid – A two-dimensional graphic illustrating the relationship between soil moisture and soil fertility.

edatopic grid See **edaphic grid**.

elevational zone – Altitudinal zonation of vegetation.

elfinwood See **krummholz.**

eluviation – The general process of removing, or leaching of, materials from a soil horizon in solution or suspension.

emergent vegetation – Plant species that have a part extending below the normal water level. Such plants are adapted to periodic flooding and include genera such as *Carex*, *Scirpus*, and *Typha*.

endangered species – Any indigenous species of fauna or flora whose existence in Canada is threatened with immediate extinction throughout all or a significant portion of its range, owing to the actions of humans.

endemic – An organism confined to a certain geographical area.

environment – The summation of all living and nonliving factors that surround and potentially influence an organism.

eolian See **aeolian.**

erosion – The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

esker – a long, usually narrow ridge of coarse-textured materials deposited on or under glaciers by flowing meltwaters. Eskers can be tens of metres high and hundreds of kilometres long.

Eutric – A soil classification Great Group designation indicating Brunisolic soils with a relatively high degree of base saturation – a pH (0.01M Ca Cl_2) of 5.5 or higher for 25 cm starting at the top of the B horizon.

eutrophic – Refers to nutrient rich status and little or no acid.

evapotranspiration – The combined loss of water by evaporation from the soil surface and by transpiration from plants.

exposure – Location of a site with respect to an environmental factor such as the sun, rain or wind.

fan (alluvial fan) – Unconsolidated materials at the base of a steep slope that were carried and deposited by flowing water; these deposits generally have a conical shape.

fauna – (1) A general term for animals.

(2) A list of the animal species present in an area.

fen – A peat-covered or peat-filled wetland with a water table which is usually at or above the surface. The waters are mainly nutrient-rich, minerotrophic waters from mineral soils. The vegetation consists mainly of sedges, grasses, reeds and brown mosses with some shrub cover and at times, a scanty tree layer.

fertility, soil – The status of a soil with respect to the amount and availability of elements necessary for plant growth.

field guide – A field document with keys to identify a plant community, a forest type or a site from biological and physical criteria. These keys may include complete descriptions of plant communities, forest types or forest sites of the region concerned.

fibric – An organic layer containing large amounts of weakly decomposed material whose origins are readily identifiable.

fine texture – Consisting of or containing large quantities of the fine fractions, particularly of silt and clay.

fire climax – Plant community that is maintained by repeated fires.

flark – A Swedish term to designate an elongated, wet, and muddy depression in a patterned peatland.

flat bog – A bog having a flat, featureless surface and occurring in broad, poorly defined depressions.

flood plain – An area adjacent to a stream or river, consisting of alluvial sediments, that is periodically inundated during periods of high stream flow.

flora – (1) A general term for plants.

(2) A list of the plant species present in an area.

fluvial – Related to stream flow and its associated erosional/depositional processes.

fluvioeolian – Referring to sediments that have been deposited or reworked by both fluvial and aeolian processes; the deposits cannot be separated as either fluvial or aeolian.

fluvio-glacial See **glaciofluvial.**

fluviolacustrine – Describing lacustrine deposits that have been partially reworked by fluvial processes.

floodplain – The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluvial – Material that has been transported and deposited by streams and rivers (also alluvial).

foothills – Low subsidiary hills at the foot of a mountain.

forb – "Forb" is only used for herbaceous plants, and is generally used for broad-leaved herbs, regardless of whether they are monocots or dicots (e.g., *Maianthemum* is a forb).

forest – A relatively large assemblage of tree-dominated stands.

forest floor – Organic layer on soil surface consisting of one or more of L, F, and H horizons.

forest region – A major geographical zone characterized by a broadly uniform topography and the same dominant tree species.

forest site – 1. Portion of land whose physical and biological characteristics are sufficiently homogeneous to justify a specific silviculture, for a given species, with an expected productivity falling within known limits.

2. Forest planning unit whose bioclimatic, physical and plant characteristicsimply some given silvicultural potential and constraints.

forest site type – Summary and synthesis of the characteristics of similar forest sites grouped according to topographic and geomorphological location, nature of soil, floristic composition and vegetation dynamics, etc. It is a classification unit but is often used to name a portion of an area as well as a typological unit.

forest type – 1. An assemblage of forest sample plots with similar floristic composition, forest productivity, and site properties.See **vegetation type** and **association**.

forest typology – Study and classification of forest site (or forest types) according to growing sites, composition and stand evolution.

formation – (1) A regional vegetation zone composed of plants with similar physiognomy and environmental conditions.
(2) A primary unit of bedrock in stratigraphy.

friable – A consistency term pertaining to the ease of crumbling of soils.

frost-free period – Season of the year between the last frost of spring and first frost of fall.

frost boil See **earth hummock**

genotype – The genetic constitution of an individual that may be transmitted.

geomorphology – The study of landforms and their origin.

glaciation – The formation, movement, and recession of glaciers or ice sheets.

glacier – A mass of ice that develops as a result of snow and ice accumulation over a long period of time and that moves laterally from the centre of accumulation.

glaciofluvial – Pertaining to the meltwater streams. flowing from wasting glacier ice and especially to the deposits and landforms produced by streams; relating to the combined action of glaciers and streams.

glaciolacustrine – Pertaining to or characterized by glacial and lacustrine conditions. Said of deposits made in lakes affected by glacier ice or by meltwaters flowing directly from glaciers.

Gleysol – A soil of the Gleysolic Order .

Gleysolic – An Order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons. The Order includes Gleysol, Humic Gleysol and Luvic Gleysol Great Groups.

gradient (ecological gradient) – Continuous and regular variation of one or more ecological faetors.

graminoid – A plant that is grass-like; the term refers to grasses and plants that look like grasses, i.e. only narrow-leaved herbs; in the strictest sense, it includes plants belonging only to the family *Poaceae.*

grassland – Vegetation consisting primarily of grass species occurring on sites that are arid or at least well-drained.

gravel – Rounded rock particles with sizes ranging from 2 mm to 75 mm in diameter. **gravelly** – Containing appreciable or significant amounts of gravel.

Gray – A soil classification Great Group designation indicating a surface (Ae or Ap horizon) colour value 5 or higher, dry (forest soils with organic matter content less than 2%).

Great Group – A subdivision of a soil order having some properties that reflect differences in the strength of soil-forming processes.

ground cover – The overall canopy cover of a plant community without reference to different strata.

groundwater – The subsurface water that is below the water table. That portion of the hydrosphere which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

growing degree-days – Accumulated heat units above a threshold temperature of 5^0C. See **degree-day.**

growing season – Number of days where the mean temperature is equal to or above 5°C.

habitat – The place in which an animal or plant lives. The sum of environmental circumstances in the place inhabited by an organism, population or community.

hardwood – A tree with broad leaves such as *Acer, Fraxinus, Populus,* and *Quercus*.

heath – Uncultivated land generally dominated by shrubs, such as ericaceous ones.

herb (herbaceous) – A nonwoody vascular plant.

hill – A prominence smaller than a mountain, usually <300 m.

hilly – Large landform elements with local relief in the 200 to 500 m range. This includes foothills, dissected plateaus and major uplands.

horizon – The basic unit of soil classification that is a horizontal layer of mineral or organic material having differentiated characteristics as a result of soil-forming processes.

horizontal fen – A fen with a very gently sloping, featureless surface. This type of fen occupies broad, often ill-defined depressions, and may be interconnected with other fens. Peat accumulation is generally uniform.

hue – One of the three variables of colour. A colour or shade of colour in the Munsell Soil Colour Chart such as red, green, or blue.

humic – An organic layer of highly decomposed material containing little fibre.

humification – The processes by which organic matter decomposes to form humus.

humus – A general term for partially or completely decomposed plant litter; well decomposed organic matter.

humus form – Group of soil horizons located at or near the surface of a pedon, which have formed from organic residues, either separate from, or intermixed with, mineral materials.

hummocky – A landform characterized by a complex surface of low- to moderate-relief (local relief generally less than 10 m) knolls and mounds of glacial sediments separated by irregular depressions, all of which lack linear or lobate forms (also called knob and kettle). Slopes are generally less than 0.8 km with gradients of greater 5% to 30%.

hydromorphic soil – A general term for soils that develop under conditions of poor drainage in marshes, swamps, seepage areas, or flats.

hydrophyte – A plant growing in water. In some cases, only the inflorescence lives out of the water.

ice-contact deposit – Deposits that occur when in contact with ice, such as kames and eskers.

igneous rock – A type of rock that forms from the solidification of magma.

immature soil – A soil with indistinct or only slightly developed horizons.

impeded drainage – A condition which hinders the movement of water through soils under the influence of gravity.

impervious – Resistant to penetration by fluids or by roots.

inactive delta marsh – A marsh occupying higher portions of a delta, usually some distance from active river channels. The marsh is inundated only during very high flood stages or by wind –driven waves. Shallow water may be impounded for long periods of time.

indicator species – Species, usually plants, used to indicate an ecological condition such as soil moisture or nutrient regime that may not be directly measured.

insolation – Radiant energy received from the sun.

inventory – The systematic survey, sampling, classification, and mapping of natural resources.

irrigation – The artificial application of water to the soil for the benefit of growing crops.

isohyet – Lines of equal precipitation.

isostatic rebound – a general rise in the land surface following the removal of thick glacial ice.

isotherm – Lines of equal temperature.

kame – A conical hill or irregular ridge of sand and gravel that was deposited in contact with glacier ice.

karst – Surface and subsurface features created by the dissolving of soluble rock such as limestone or gypsum, which results in such features as caverns and sinkholes.

kettle – A depression created by the melting of glacial ice that was buried in moraine.

key – A taxonomic tool used to identify unknown objects (e.g., plants or plant communities) through the use of paired questions.

krummholz – Scrubby, stunted growth form of trees, often forming a characteristic zone at the limit of tree growth in mountains.

lacustrine – Material deposited in lake water and later exposed; sediments generally consisting of stratified fine sand, silt, and clay.

landform – 1.A topographic feature.

2. The various shapes of the land surface resulting from a variety of actions such as deposition or sedimentation, erosion, and earth crust movements.

landscape – (1) All the natural features such as fields, hills, forests, water, etc., which distinguish one part of the earth's surface from another part. Usually that portion of land or territory which the eye can comprehend in a single view, including all its natural characteristics.

(2). A heterogeneous land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. Landscapes can vary in size, down to a few kilometres in diameter.

landscape ecology – 1. A study of the structure, function, and change in a heterogeneous land area composed of interacting ecosystems.

2. The scientific basis for the study of landscape units from the smallest mappable landscape cell to the global ecosphere landscape in their totality as ordered ecological, geographical and cultural wholes.

Remark.: This concept fluctuates greatly from one author to the other. Nevertheless, the concept generally recognizes the importance of interactions between landscape elements, the necessity of a global approach and the importance of human activities. Impact of human activities on the landscape is recognized with the concept but it also recognizes the constraints imparted by the biophysical properties of the landscape.

landscape element – The basic, relatively homogeneous, ecological unit, whether of natural or human origin, on land at the scale of a landscape.

Layer See stratum.

leaching – The removal of soluble materials from a soil horizon by percolating water.

levee – flood-deposited fluvial materials; when floodwaters overflow streambanks, the resulting fluvial deposits accumulate and raise the streambanks above the adjacent floodplain**.**

level – Refers to land without slope.

limiting factor – Ecological factor that limits the development of an organism by its presence, absence or quantity irrespective of the state of other factors.

lithic – A feature of a soil subgroup which indicates a bedrock contact within the limits of the control section.

litter – The uppermost portion of plant debris on the soil surface, usually not decomposed.

loess – Material transported and deposited by wind and consisting of predominantly silt-sized particles.

lowland – Extended plains or land that occur below a significantly elevated area.

loam See soil texture. A mixture of sand, silt and clay.

loose – A soil consistency term.

Luvisol – A soil of the Luvisolic Order.

Luvisolic – An Order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest of forest-grassland transition in a moderate to cool climate. The Order includes Gray Brown Luvisol and Gray Luvisol Great Groups (The latter is the most common in western Canada).

macroclimate – Regional climate related to geographical location and relief.

mapping unit – Unit that allows the definition of a geographical reference context.

marsh – A wetland with a mineral or peat substrate inundated by nutrient rich water and characterized by emergent graminoid vegetation.

meadow – A moist area usually dominated by grasses or forbs.

meander – Looped pattern of a stream course.

medium texture – Intermediate between fine-textured and coarse-textured (soils). (It includes the following textural classes: very fine sandy loam, loam, silt loam, and silt).

meltwater channel – A valley-like feature created by flowing water that originated from the melting of glacial ice.

mesic – (1) Describing the sites that are neither humid (hydric) nor very dry (xeric). Average moisture conditions for a given climate.
(2) An organic layer of intermediately decomposed material (between that of fibric and humic).

mesoclimate – Macroclimate that undergoes local modifications to many of its elements. The climate of a forest or a slope is a mesoclimate.

mesotrophic – Medium nutrient status and moderately acidic.

metamorphic rock – Rock formed from preexistant rock after undergoing natural geological processes such as heat or pressure. It differs from the original rock in terms of its physical, chemical or mineral properties.

microclimate – Localized climatic conditions ranging down to conditions at the stand or even individual plant environment level.

mineral soil – A soil that is largely composed of unconsolidated mineral matter.

minerotrophic – Nourished by mineral water. It refers to wetlands that receive nutrients from mineral groundwater in addition to precipitation by flowing or percolating water.

mixed-wood – Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover; for example, trembling aspen and white spruce mixed-wood forests.

modal site –A well to moderately well-drained site without topographic or edaphic extremes that could reflect the influences of regional climate rather than local site conditions. Also used to describe typical site conditions for an ecosystem unit. See **normal, zonal** and **reference site.**

moder – Partially decomposed litter as a result of soil faunal activity, usually not matted.

moderately-coarse texture – Consisting predominantly of coarse particles. (In soil textural classification, it includes all the sandy loams except the very fine sandy loam).

moderately-fine texture – Consisting predominantly of intermediate and fine sized particles. (In soil textural classification, it includes clay loam, sandy clay loam, and silty clay loam).

moisture deficit – A condition that occurs when evaporation and/or transpiration exceeds the available water supply.

moisture regime – Refers to the available moisture supply for plant growth estimated in relative or absolute terms.

mor – Raw plant litter, usually matted, with a distinctive boundary that occurs at the mineral soil surface, in which fungal activity is the primary method of decomposition.

moraine – A mound, ridge, or other distinct accumulation of generally unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies (19).

morphology, soil – The physical constitution, particularly the structural properties, of a soil profile as exhibited by the kinds, thickness and arrangement of the horizons and by the structure, consistence and porosity of each horizon.

mountain – Land with large differences in relief, usually refers to areas with more than 600 m of relief.

Munsell colour system – A colour designation system that specifies the relative degree of the three simple variables of colour: hue, value, and chroma. For example: 10YR 6/4 is a colour with a hue 10-YR, value -6, and chroma -4. These notations can be translated into several different systems of colour names as desired. See chroma, hue, and value.

mull – Decomposed organic matter that has been incorporated with mineral soil; could represent an Ah horizon,

Munsell Soil Colour Chart – A booklet of standardized colour chips used to describe soil horizon colours.

mycorrhiza – The symbiotic association of fungi with the roots of seed plants.

natural province – Vast land mass (of the order of 100,000 km^2) with characteristic features determined by major geological events. There are 3 Natural Provinces recognized in Alberta).

natural region – In Alberta, an extensive land mass (of the order of 20,000 km^2) characterized by permanent geographic boundaries (geological, physiographic, etc.) and a certain uniformity and individuality of climatic, topographical, geomorphological and biological conditions.

natural subregion – In Alberta, an extensive land mass (of the order of 10,000 km^2) characterized by permanent geographic boundaries (geological, physiographic, etc.) and a certain uniformity and individuality of climatic, topographical, geomorphological and biological conditions.

neutral soil – A soil having a pH value of approximately 7.0 in the surface horizons.

niche – A unique habitat or set of conditions that allows a species to exist with minimalcompetition from other species.

nonsoil – rock, water, snow or ice, mineral or organic material <10 cm thick over rock or soil materials displaced by unnatural processes such as earth fill.

non-sorted circle – A nonsorted circle is a *patterned ground* form that is equidimensional in several directions, with a dominantly circular outline which lacks a border of stones.

normal site – A site with deep loamy soils, with neither a lack nor an excess of soil nutrients, located in welldrained positions in the landscape and neither protected from, nor exposed to, local climatic extremes. See **zonal, modal** and **reference** site.

northern ribbed fen – A fen with parallel, low peat ridges ("strings") alternating with wet hollows or shallow pools, oriented across the major slope at right angles to water movement. The depth of peat exceeds 1 m.

nutrient – Usually refers to one of a specific set of primary elements found in soil that are required by plants for healthy growth, such as nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur.

nutrient regime – The relative level of nutrient availability for plant growth.

old growth – A stand of mature or overmature trees relatively uninfluenced by human activity.

oligotrophic – A condition of low nutrient status and acidic reaction).

ombrotrophic – An ecological system that derives its nutrients solely (or primarily) from precipitation.

Order – The highest taxonomic level in the Canadian System of Soil Classification, reflecting the nature of soil environment and the effects of dominant soil-forming processes.

Organic (1) – An Order of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained. The Great Groups include Fibrisol, Mesisol, Humisol and Folisol.

(2) – A soil classification Great Group designation indicating a Cryosolic soil formed in organic materials (e.g., a bog with permafrost).

organic matter – The decomposition residues of biological materials derived from: (a) plant and animal materials deposited on the surface of the soils; and (b) roots and micro-organisms that decay beneath the surface of the soil.

Orthic – A soil classification Subgroup designation indicating the usual or typical (central concept) for the Great Group.

outcrop – Exposure of bedrock at the ground surface.

outwash – Materials washed from a glacier by flowing water and laid down as stratified sorted beds. Generally, it is made up of stratified sand and/or gravel.

overstory – The uppermost continuous layer of a vegetation cover, e.g., the tree canopy in a forest ecosystem or the uppermost layer of a shrub stand.

paralithic – Poorly consolidated bedrock which can be dug with a spade when moist. It is severely constraining but not impenetrable to roots.

palsa – A peaty permafrost mound possessing a core of alternating layers of segregated ice and peat or mineral soil material. Palsas are typically between 1 and 7 m in height and a few metres to 100 m in diameter**.**

parent material – The unconsolidated and more or less chemically unweathered material from which soil develops by pedogenic processes.

parkland – Relatively open forest at both low and high elevations – very open in nature.

particle size – The size of a mineral particle as measured by sedimentation, sieving, or micrometric methods. Also referred to as grain size.

patterned ground – A general term for circles, polygons, strips, nets, and steps created by frost action.

peat – An accumulation of partially decomposed plant matter under saturated conditions.

peat moss – In scientific literature, peat material is classified on the basis of its botanical composition. The most common moss peat materials are feather moss peat, brown moss peat, *Drepanocladus* moss peat, and *Sphagnum* peat.

peat plateau bog – A bog composed of perennially frozen peat, rising abruptly about 1 m from the surrounding unfrozen fen. The surface is relatively flat and even, and often covers very large areas. The peat was originally deposited in a non-permafrost environment and is often associated with collapse scars or fens.

peaty – A soil classification phase designation indicating an accumulation of 15 cm to 40 cm of surface peat (15 – 60 cm if fibric).

peatland – Peatlands (organic wetlands) are characterized by more than 40 cm peat accumulation on which organic soils (excluding Folisols) develop.

ped – A unit of soil structure such as a prism or granule, which is formed by natural aggregates.

pedogenesis –The mode of origin of the soil, especially the processes or soil-forming factors responsible for the development of the solum.

pedology – The aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping, and taxonomy of soils.

pedon – A real unit of soil, the smallest homogenous, three-dimensional unit that can be considered a soil.

percolation, soil water – The downward movement of water through soil; especially, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less.

periglacial – Said of the processes, conditions, areas, climates, and topographic features at the immediate margins of former and existing glaciers and ice sheets, and influenced by the cold temperature of the ice. Permafrost is a periglacial process.

permafrost – Ground (soil or rock and included ice and organic materials) that remain at or below 0o C for at least two consecutive years.

pH – A measure of acidity or alkalinity of a solution, based on hydrogen ion concentration.

phase – judged to meaningfully subdivide the unit, especially for management purposes. The phase is not a formal category in the taxonomy.

phenotype – The observable structural and functional properties of an organism that derive from the interaction between its genotype and its environment.

physiognomy – The general appearance of vegetation by broadly defined life forms, such as forest or grassland.

physiographic region – Topographically similar landscapes with similar relief, structural geology and elevation at a mapping scale of 1:1,000,000 to 1:3,000,000.

physiographic subregion – A subdivision of a physiographic region based on distinct patterns of relief, geology and geomorphology, and drainage pattern and density at a mapping scale of 1 :250,000 to 1:1,000,000.

physiography – The study of the genesis and evolution of land forms.

pingo –a mound of earth-covered ice found in the Arctic, Subarctic, and Antarctica that can reach up to 70 metres in height and up to 2 kilometres in diameter. The term originated as the Inuit word for a small hill.

pioneer species – Plant species that initially invade a newly exposed surface.

plain – A relatively large, level, featureless topographic surface.

plant community – A concrete or real unit of vegetation or a stand of vegetation.

plateau – An elevated area with steep-sided slopes and a relatively level surface

platy – Consisting of soil aggregates that are developed predominately along the horizontal axes, laminated; flaky.

plot – A vegetation sampling unit used to delineate a fixed amount of area for the purpose of estimating plant cover, biomass, or density. Plots can vary in their dimensions depending on the purpose of the study and the individual researcher.

polygonal peat plateau bog – A perennially frozen bog, rising about 1 m above the surrounding fen. The surface is relatively flat, scored by a polygonal pattern of trenches that developed over ice wedges. The permafrost and ice wedges developed in peat originally deposited in a non-permafrost environment**.** Polygonal peat plateaus are commonly found near the boundary between the zones of discontinuous and continuous permafrost.

population – A group that includes all possible members of a species in a territory at a given time.

postglacial – Occurring after glaciation.

potential – General evaluation of the possible biological productivity or carbon production potential of a site resource (or an area) usually expressed in terms of values to an appropriate management regime. It may be generally established or estimated from site components that represent a permanent character (e.g., soil quality).

potential climax – The species or plant community that will form the climax vegetation on a site. The existing species or plant association may be different from the potential climax due to site disturbance and successional stage.

prairie – An extensive area of native upland grass with a semi-arid to arid climate.

precipitation – A collective term for snowfall and rainfall.

primary succession See **succession.**

pristine – An undisturbed natural condition.

productivity – A measure of the physical yield of a particular crop. It should be related to a specified management. Merchantable wood volume productivity is generally expressed in m3/ha/yr. It may be further subdivided into types (gross, net, primary).or allocations (leaves, wood, above ground, below ground).

profile, soil – A vertical section of the soil through all its horizons and extending into the parent material.

proglacial – Pertaining to all observable phenomena on the face of a glacier or just beyond its ablation area.

quadrat – A vegetation sampling unit with specific dimensions and shape.

reaction, soils – The degree of acidity or alkalinity of soil, usually expressed as a pH value.

rare species – Any indigenous species of fauna or flora that, because of its biological characteristics, or because it occurs at the fringe of its range, or for some other reasons, exists in low numbers or in very restricted areas of Canada but is not a threatened species.

reconnaissance – A level of field analysis that involves relatively quick sampling for the purpose of obtaining general information about an area. In some cases, sampling quality may be high, but the intensity of sampling is very low relative to the size of the total area being studied.

reference site – A site that serves as a normal or modal condition, an "average" or benchmark in terms of vegetation, soil and general site conditions. See **modal, normal** and **zonal site.**

regeneration – 1. The renewal of a forest crop by natural or artificial means. Also the new crop so obtained. The new crop is generally less than 1.3 m in height.

Rego – A soil classification Subgroup designation indicating a sol profile with little or no B horizon – an AC profile (often caused by erosion truncation)

regolith – The unconsolidated mantle of weathered rock and soil material overlying solid rock.

Regosol – A soil of the Regosolic Order .

Regosolic – An Order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other orders. Included are Regosol and Humic Regosol Great Groups.

relief – The difference between extreme elevations within a given area (local relief).

remote sensing – The gathering and interpretation of land-based information by indirect methods such as aerial photography or satellite imagery.

residual material – Unconsolidated and partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

residual soil – Soil formed from, or resting on, consolidated rock of the same kind as that from which it was formed and in the same location.

riparian – Refers to terrain, vegetation or simply a position adjacent to or associated with a stream, flood plain, or standing waterbody.

rock – A consolidated mass of mineral matter; a general term for stones.

rolling – A landform characterized by a regular sequence of moderate slopes producing a wavelike pattern of moderate relief (20 m to 100 m). Slope lengths are often 1.6 km or greater with gradients usually greater than 5%.

runnel – a pattern of alternating flow channels and interchannel uplands perpendicular to contour. In permafrost-affected areas, light and dark-striped patterns on hill slopes are runnels; the light stripes are usually sparsely treed, lichen covered interchannel areas with permafrost close to the surface, and the dark stripes are shallow drainage channels vegetated by dwarf birch, willow and other shrubs with a thicker active layer.

runoff (run-off) – The portion of the total precipitation in an area that flows on the surface of the land, without entering the soil, reaches streams, and flows away through stream channels.

saline soil – A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 dS/m (formerly mmhos/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

salinization – The process of accumulation of salts in soils.

sand – A soil particle between 0.05 and 2.0 mm in diameter.

saturation percentage – The amount of water required to saturate a unit of soil (often correlated with sodicity).

silt – A soil separate consisting of particles between 0.05 to 0.002 mm in equivalent diameter.

soil – The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

sand – Mineral particles with diameters ranging from 0.05 to 2.0 mm.

saprolite See **residual soil**.

Scree See **talus**.

secondary succession See **succession.**

sedimentary rock – A rock formed from materials deposited from suspension or precipitated from solution and usually more or less consolidated.

seepage – The slow movement of water near the soil surface, often occurring above an impermeable subsoil layer or at the boundary between bedrock and unconsolidated material that is exposed at ground surface, usually occurs downslope of the recharge area.

seral – Recognizably different succession stages along a successional path or sere.

seral stage…See **successional stage.**

shade tolerant – Plants capable of growing and successfully reproducing beneath the shading canopy of other species.

shield rock – Crystalline Precambrian rock that forms the core of continents.

shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base.

shrubland – An area dominated by shrubs, usually individual plants not in contact and with a herbaceous ground cover.

silt – Mineral particles with a diameter of 0.05 to 0.002 mm.

site – 1. The place or the category of places, considered from an environmental perspective, that determines the type and quality of plants that can grow there.

2. All the physical elements of a forest site (climate, deposit, drainage, etc.). It is a relatively homogeneous area in its physical permanent conditions.

site index (SI) – An expression of forest site quality based on the height of dominant and codominant trees at a specific age.

slope – 1. An inclined surface.
2. The steepness of an inclined surface, measured in degrees or percentages from the horizontal.

slope fen – A fen occurring mainly on slowly draining, nutrient enriched seepage slopes. Pools are usually absent, but wet seepage tracks may occur. Peat thickness seldom exceeds 2m.

slough – A Western Canadian term for a shallow prairie pond that largely disappears in late summer, often with a muddy bottom.

softwood – 1. A coniferous tree such as *Pinus* (pine) or *Picea* (spruce).
2. A forest type with a cover made up of 76 to 100% of conifers.

soil – Unconsolidated mineral material or organic material >10 cm thick that occurs at the earth's surface and is capable of supporting plant growth. It is also the zone where the biological, physical, and atmospheric components of the environments interact.

soil map – A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical and cultural features of the earth's surface.

soil moisture – Water contained in the soil.

soil profile – A vertical section of the soil through all its horizons and extending into parent material.

soil structure – The combination or arrangement of primary soil particles into secondary compound units or peds. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively. Common terms for kind of structure are – single grain, amorphous, blocky, subangular blocky, granular, platy, prismatic and columnar.

soil survey – The systematic classification, analysis, and mapping of soils within an area.

soil zone – A large area dominated by a zonal soil that reflects the influence of climate and vegetation.

solar radiation See **insolation**.

Solonetz – A soil of the Solonetzic Order .

Solonetzic – An Order of soils developed mainly under grass or grass – forest vegetative cover in semiarid to subhumid climates. The soils have a stained brownish or blackish solonetzic B (Bn, Bnt) horizon that can be very hard when dry and a saline C horizon. The order includes the Solonetz, Solodized Solonetz and Solod Great Groups.

solum – The upper horizons of a soil in which the parent material has been modified and in which most plant roots are contained. It usually consists of A and B horizons.

species – A group of organisms having a common ancestry that are able *to* reproduce only among themselves.

Spring fen – A fen nourished by a continuous discharge of groundwater. The surface is marked by pools, drainage tracks and occasionally somewhat elevated "islands". The nutrient level of water is highly variable between locations.

stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests.

stand density – A quantitative measure of tree cover on an area in terms of biomass, crown closure, number of trees, basal area, volume, or weight

stand structure – The distribution of trees in a stand or group by age, size, or crown classes.

stratum – Horizontal levels in vegetation (e.g., canopy, shrub stratum, herb stratum) or soil (soil layers or strata).

string bog – a pattern of narrow (2-3 m wide), low (less than 1 m deep) ridges oriented at right angles to the direction of drainage. Wet depressions or pools occur between the ridges. The water and peat are very low in nutrients, as the water has been derived from ombrotrophic wetlands. Peat thickness exceeds 1 m.

stone – Rock fragment with a diameter ranging from 25 to 60 cm.

story – A horizontal stratum or layer in a plant community; in forest appearing as one or more canopies.

subalpine – A zone in the mountains that occurs below the alpine.

subarctic – A zone immediately south of the Arctic characterized by stunted, open-growing spruce vegetation.

subclimax – Successional stage of a plant community preceding the climax.

subgroup – A subdivision of a soil great group, differentiated on the basis of the kind and arrangement of horizons that indicate conformity to the central concept of the great group, intergrading towards soils of another order, or other special features.

subsoil – A general term referring to the underlying part of the soil itself and that is often considered as being located under the A horizon.

substrate – The medium on which a plant grows.

succession – The progression within a community whereby one plant species is replaced by another until a stable assemblage for a particular environment is attained. **Primary succession** occurs on newly created surfaces, while **secondary succession** involves the development or replacement of one stable successional species by another on a site having a developed soil. Secondary succession occurs on a site after a disturbance (fire, cutting, etc.) in existing communities.

successional stage – Stage in a vegetation chronosequence in a given site. *Syn.* seral stage.

surficial materials – Unconsolidated materials that occur on the earth's surface.

swamp – A mineral-rich wetland characterized by a dense cover of deciduous or coniferous trees, or shrubs.

taiga – Refers to a coniferous boreal forest. Often, this term is used to refer to the vegetation zone of transition between boreal forest and tundra. This vegetal formation corresponds to a forest – tundra.

talus – A collection of fallen disintegrated material that has formed a pile at the foot of a steep slope.

terrace – Relatively level benches that are created and occur adjacent to streams or rivers, sometimes sharp or low breaks occur between individual terrace surfaces. These features are formed during a period of fluvial stability followed by a period of down cutting by a stream.

Terrain See **topography.**

terrestrial – Pertaining to land as opposed to water.

Terric – A soil classification Subgroup designation indicating a mineral substrate within 40 cm to 140 cm of the surface (shallow peat).

texture – The relative proportions of sand, silt and clay (the soil separates) and coarser materials in a mineral sample. It is described in terms such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam and clay that are often grouped into classes according to specific needs (fine texture, medium texture, moderately coarse texture, etc.).

thermokarst – The process by which characteristic landforms result from the thawing of ice-rich permafrost or the melting of massive ice.

thermokarst lake – A lake occupying a closed depression formed by settlement of the ground following thawing of ice-rich permafrost or the melting of massive ice.

threatened species – Any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.

till (glacial till) – Unstratified drift, deposited directly by a glacier without being reworked by meltwater. See also **moraine**

topography – The physical features of an area such as land shape and relief.

toposequence – A sequence of related soils that differ one from the other primarily because of topography and its influence on soil-forming processes. The relationship between soil and vegetation types, primarily a response to different relief.

tree – A woody plant usually with a single main stem.

tree line – The uppermost elevation or northern limit of tree growth, usually on upland sites.

tundra – A level to undulating, treeless plain characteristic of arctic or alpine regions. For most of the year, the mean monthly temperature is below the freezing point.

Typic – A soil classification Subgroup designation indicating a depth of more than 140 cm of organic material.

undergrowth – All the shrubs, herbaceous plants and mosses growing under a canopy.

understory – Vegetation growing beneath taller plants such as trees or tall shrubs.

undulating – A landform with a regular sequence of gentle slopes producing a wavelike pattern of low local relief. Slopes are generally less than 0.8 km long with gradients of less than 5%.

uneven-aged – Of a forest, stand, or forest type in which intermingling trees differ markedly in age.

upland – (1) A general term for an area that is elevationally higher than the surrounding area, but not a plateau.
(2) An area that is not a wetland and that is also not imperfectly or poorly-drained.

valley – Any hollow or low-lying area bounded by hill or mountain ranges, and usually traversed by a stream.

value, colour – One of the three variables of colour. A Munsell Soil Colour Chart notation that indicates the lightness of a colour.

vegetation – The general cover of plants growing on the landscape.

vegetation structure – The vertical stratification associated with a plant community.

vegetation type – 1.An abstract vegetation classification unit, not associated with any formal system of classification.
2. In phytosociology, the lowest possible level to be described. See **forest type** and **association**.

vegetation zone – A naturally occurring band of vegetation that occupies a particular environment such as an elevational zone (e.g., subalpine zone).

veneer – A thin layer of unconsolidated material between 10- and 100-cm thick that does not mask the topographic character of the underlying terrain.

veneer bog – A bog occurring on gently sloping terrain underlain by generally discontinuous permafrost. Although drainage is predominantly below the surface, overland flow occurs in poorly defined drainage ways during peak runoff. Peat thickness is generally less than 1.5 m.

von Post humification scale – A manual method for estimating degree of decomposition of peat materials. It is a 10 point scale with assessment based on colour of drained water and structure of hand squeezed material.

watershed – All lands enclosed by a continuous hydrologic – surface drainage divide and lying upslope from a specified point on a stream. See **drainage basin**.

water table – The upper surface of groundwater or that level below which the soil is saturated with water.

weathering – The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

wetland – Land that is saturated with water long enough to promote hydric soils or aquatic processes as indicated by poorly-drained soils , hydrophytic vegetation, and various kinds of biological activity that are adapted to wet environments.

wildlife – Natural fauna, usually limited to macro-organisms such as mammals, birds, reptiles, and amphibians.

windfall – A tree uprooted or broken off by wind, and areas containing such trees.

woodland – woody plants 2-8 m tall growing somewhat closely spaced.

xeric – Describes a dry site.

zonal – Describing a soil that reflects the influence of climate and climactic vegetation (e.g., Luvisol).

zonal site – Site with conditions that could potentially support climatic climax plant communities and their associated soils and thus reflect the regional climate. See **normal, modal** and **reference** site.

zonation – The natural stratification of the landscape in response to significant area differences.