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Yukon Parks  
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# PEEL WATERSHED, YUKON

International Significance from the perspective of  
Parks, Recreation and Conservation



Report prepared for:

**Yukon Parks**

Department of Environment, Government of Yukon, Whitehorse

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## FOREWORD

This study was commissioned by the Yukon Parks Branch of the Department of Environment, Government of Yukon. Its purpose is to assess the significance of the Peel Watershed, a wilderness region within the central Yukon that is currently undergoing a regional planning process to determine the appropriate balance of uses for the future, including conservation, traditional use, economic development and resource extraction.

This report provides an international perspective to the significance of the Peel Watershed within the Arctic, focusing on the extent and quality of this wilderness particularly with respect to its biodiversity and recreational values. In addition to being examined at Arctic and continental (North America) scales, the Peel Watershed is also considered in more detail as a river basin level.

**Readers with little time at their disposal are encouraged to first look at the Conclusions and Recommendations in the final chapter (5) of this report, in conjunction with the 16 Maps that present much of the technical data in spatial form.** More detailed findings in support of the conclusions can be found at the end of the two analytical chapters (3 and 4) that consider the Peel Watershed within an international (Section 3.7) and local river basin context (Section 4.5), respectively.

Findings, conclusions and recommendations are intended to objectively inform national policy-making and local planning processes, based on the best available information. The overriding emphasis is to provide global context to the importance of the Peel Watershed for its wilderness. No attempt is made to examine biodiversity in any great detail at a local scale because such information either already exists or is best generated by local experts.

## **ACKNOWLEDGEMENTS**

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Raynald Harvey Lemelin (Lakehead University), Priidu Juurand, Ian Pineau (Algonquin College in the Ottawa Valley) and Professor John Shultis (University of Northern British Columbia) very kindly volunteered their time, expertise and local knowledge to assess the wilderness qualities of the main river basins within the Peel Watershed, using an evaluation system designed specifically for this study.

**Front cover: Wind River [© James Thorsell]**

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# 1. INTRODUCTION

## 1.1 Background

The upper catchment of the Peel Watershed lies in Yukon, adjacent to the border with Northwest Territories, at the northern extremity of the Rocky Mountains. The Peel River drains an area of 68,872 km<sup>2</sup> within Yukon, its six southern tributaries (Ogilvie, Blackstone, Hart, Wind, Bonnet Plume and Snake) rising in the Olgivie Mountains and Wernecke Mountains to the south and its northern tributaries (Caribou, Trail and Road) rise in the Richardson Mountains to the west.

The Peel Watershed<sup>1</sup> is spectacular, mountainous part of a vast wilderness of boreal forest<sup>2</sup> and tundra<sup>3</sup>, covering some 21 million square kilometres and encompassing the Arctic (Mittermeier *et al.*, 2003). The western corner of the Watershed is fragmented, in wilderness terms, by the Dempster Highway on its route from Dawson City, Yukon to Inuvik, Northwest Territories. The eastern part of the Watershed is one of the Yukon's largest roadless areas and this inaccessibility has helped protect both the wilderness, diversity of plant and animal life, and traditional livelihoods of the Nacho Nyak Dun, Tetlit Gwich'in, Tr'on d'ek Hwëch'in and Vuntut Gwitchin, part of whose territories lie within the Watershed. No communities reside permanently within the Watershed but First Nations people and big game outfitters set

up camps during the summer for purposes of hunting, fishing, trapping and guiding visitors. Recently, there has been an increasing number of temporary seasonal camps established for the purpose of mineral, oil and gas exploration.

The Peel Watershed Planning Region encompasses a slightly smaller area of 67,377 km<sup>2</sup> within the Yukon, which excludes the headwaters of the Blackstone River and a small northern section of the Ogilvie drainage (Figure 1.1). The Blackstone River headwaters part of this excluded area lies within Tombstone Territorial Park (Section 3.6). The majority of the land is Crown owned. The Tetlit Gwich'in are the largest private landowners in the Planning Region, while the Na-cho Nyak Dun and the Tr'ondëk Hwëch'in also have private lands. Communities with direct interests in the Planning Region include Mayo and Dawson City to the south, and Old Crow and Fort McPherson to the north. Currently there are no protected areas in the Planning Region.

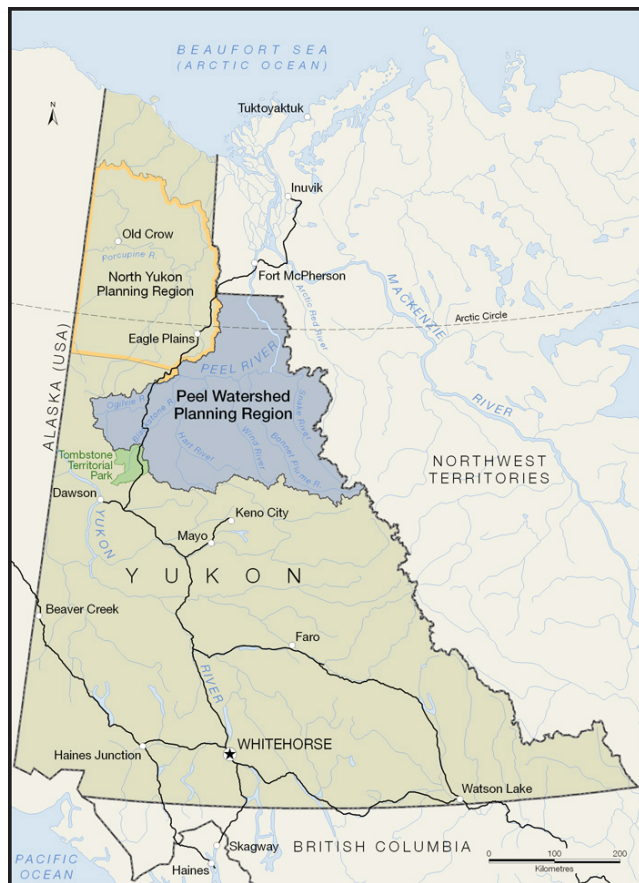


Figure 1.1 Location of the Peel Watershed Planning Region

<sup>1</sup> All references to the Peel Watershed in this document refer only to the Yukon portion.

<sup>2</sup> Boreal or taiga refer to a broad circumpolar belt of predominantly coniferous forest. In Canada, boreal forest is the term commonly used to describe the southern part of this ecosystem, while taiga is used with respect to the more barren northern areas of the Arctic tree line.

<sup>3</sup> Tundra is the treeless area between the ice cap and tree line of Arctic regions, where the subsoil is permanently frozen and supports low stature vegetation, such as lichens, mosses and stunted shrubs.

Major land use interests in the Planning Region include oil, gas and mineral exploration wilderness tourism, traditional uses and conservation through protected areas establishment and management.

## **1.2 Study objectives**

The objectives of this study are twofold:

- To assess the concentration and distribution of natural heritage resource values within the Peel Watershed and their significance locally, within Yukon, regionally within North America and globally within the Arctic and beyond.
- To assess the quality and diversity of the natural heritage afforded by the Peel Watershed with respect to park-related functions of conservation, recreation and education.

The approach to these objectives and the extent to which they have been addressed are outlined in Sections 2.3 and 2.4.

## **1.3 Scope**

The area of study is the entire drainage of the upper catchment of the Peel Watershed in Yukon. The northern, lower catchment that lies in Northwest Territories is beyond the scope of this study. The Peel Watershed, rather than the slightly smaller Planning Region, is the subject of all statistical analyses in Sections 3-4, unless otherwise indicated.

The study focuses on the natural heritage of the Peel Watershed, particularly with respect to the quality of its wilderness at a landscape level and the significance of its biodiversity within an Arctic and North American context. Assessment of recreation values is confined to a comparison between the main river basins within the Watershed.

No attempt is made to examine biodiversity in any great detail at a local scale because such information either already exists or, where required, is best generated by local experts familiar with the area.

The overriding emphasis of this study is to provide global context to the importance of wilderness and biodiversity within the Peel Watershed in order to inform national and local decision-making processes.

## **1.4 Report structure**

This introductory section is followed by Section 2, which describes the approach taken in this study. The concept of wilderness is examined, in terms of what it means and how it can be measured, and the methodology adopted for this study is described. Results concerning the importance of the Peel Watershed for wilderness, including its biodiversity, within an international, Arctic context are presented in Section 3. Wilderness, biodiversity and recreational values within the main river basins of the Peel Watershed are subject to more detailed assessment in Section 4. The main conclusions and recommendations are elaborated in Section 5, including key areas identified for further assessment.

## 2. APPROACH

### 2.1 Wilderness concept

Given the public interest in the value of the Peel Watershed as a wilderness area, it is important to understand the concept of wilderness and how this links to the present study.

#### *Defining wilderness*

The term *wilderness* originates from Teutonic and Norse languages: *will* meaning self-willed, *deor* meaning animal and *ness* meaning place. *Willed* became wild, referring to an uncontrolled state, and hence the three components refer “to a place of wild animals” and, by extension, a place that humans do not control (Nash, 1967).

Wilderness, today, is generally understood to refer to *a large, remote and undisturbed natural area*. Much more debate concerns defining wilderness, in terms of how large, how remote and how undisturbed an area should be to qualify as wilderness (Mittermeier *et al.*, 2003). Part of the difficulty of defining wilderness arises from the many different objectives established for protecting wilderness around the world covering biological, social, economic, political, aesthetic and spiritual values that may also have a cultural context.

The Wild Foundation, which champions wilderness and its conservation, considers its key ingredients to be wildness, intactness and remoteness, based on the following definition:

Broadly speaking, “wilderness” refers to the most intact, undisturbed wild natural areas left on our planet – those last truly wild places that humans do not control and have not developed with roads, pipelines or other industrial infrastructure.

While there is no one methodology for defining what is still wild, because wildness embraces a spectrum that can be measured with a range of variables, **from a biological standpoint wilderness refers to wild places with largely intact habitat and where natural processes predominate** (Wild Foundation, 2007).

#### *Protecting wilderness*

Regulations to protect wilderness first appeared in the 1929 Regulation L-20 of the U.S. Department of Agriculture’s *National Forest Manual*, with provisions for “... a supplemental series of areas ... to be known as primitive areas, and within which will be maintained primitive conditions of environment, transportation, habitation, and subsistence, with a view to conserving the value of such areas for purposes of public education and recreation.”

The United States lead the way *to establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes* with its 1964 Wilderness Act, in which is framed the most famous of all wilderness definitions:

“A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has

at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” [Section 2(c)]

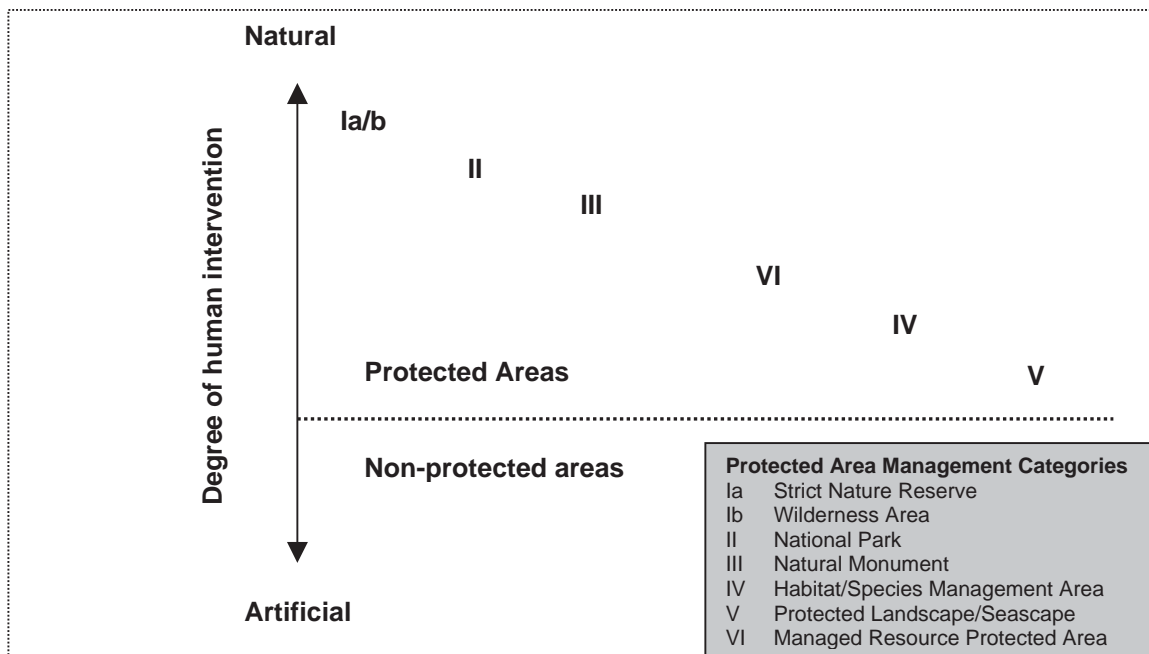
Key, important criteria contained within this definition are the following:

- focus on natural processes, not noticeably affected by man;
- provision of outstanding opportunities for solitude and primitive forms of recreation, the latter being restricted to non-mechanised forms (motorised transport and equipment is prohibited in Section 4(c);
- a minimum size of 5,000 acres (2,023 ha) and, crucially, large enough for its preservation and use to be practicable without impairing its condition (integrity); and
- provision of other values, including research, education and aesthetics, subject to their expression being compatible with preservation of an area as wilderness.

The 1964 Act was followed by the 1975 Eastern Wilderness Act, which compromised on the pristine element in order to protect the wilderness character of forested lands in the eastern United States, under threat from large-scale industrial development and urban sprawl, and “the specific values of solitude, physical and mental challenge, scientific study, inspiration, and primitive recreation for the benefit of all the American people of present and future generations.” Such values are reflected in much of the subsequent wilderness legislation that has emerged in countries around the world.

*International standards for classifying protected areas*

Given the wide range of national, legal provisions and designations for protecting areas, including wilderness, for nature conservation purposes, IUCN has developed a system for classifying *protected areas* based on their management objectives (IUCN, 1994). This system of management categories covers a spectrum of human intervention on naturalness, ranging from effectively none in Category I to relatively high levels in Category V (Figure 2.1).



**Figure 2.1** Relationship between IUCN protected area management category and degree of human intervention (Source: Bridgewater *et al.*, 1996)

According to this system, a protected wilderness area (Category Ib) is defined as:

*Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.*

Management objectives and criteria for classifying a protected area as an IUCN Category Ib *Wilderness Area* are summarised below. While the IUCN guidelines incorporate the key characteristics of wilderness discussed above, they expand the concept in one important respect: **recognition of the rights of indigenous human communities to maintain their lifestyles within wilderness areas in balance with available resources.**

#### IUCN guidelines on the classification of protected areas as wilderness areas (Category Ib)

##### Objectives of Management

- to ensure that future generations have the opportunity to experience understanding and enjoyment of areas that have been largely undisturbed by human action over a long period of time;
- to maintain the essential natural attributes and qualities of the environment over the long term;
- to provide for public access at levels and of a type which will serve best the physical and spiritual wellbeing of visitors and maintain the wilderness qualities of the area for present and future generations; and
- to enable indigenous human communities living at low density and in balance with the available resources to maintain their life style.

##### Guidance for Selection

- The area should possess high natural quality, be governed primarily by the forces of nature, with human disturbance substantially absent and be likely to continue to display those attributes if managed as proposed.
- The area should contain significant ecological, geological, physiogeographic, or other features of scientific, educational, scenic or historic value.
- The area should offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet, non-polluting and non-intrusive means of travel (i.e. non-motorised).
- The area should be of sufficient size to make practical such preservation and use.

Source: IUCN, 1994

#### *Assessing wilderness quality*

In general and for purposes of this study, areas of wilderness are considered to be relatively large places, with few signs of human influence and development, where biodiversity is shaped primarily by natural processes and opportunities for primitive and unconfined recreation are outstanding. These attributes provide the basis for measuring or assessing the quality of an area, in terms of its overall character and suitability, for purposes generally described as 'wilderness'.

Various attempts reported in the literature have been made to portray these characteristics more specifically. For example, Aplet (2000) describes naturalness and freedom as characteristics of wilderness that, when examined in two-dimensional space along continua, move from the built environment (cityscapes) to increasingly wild environments (wilderness). Aplet describes the characteristics of both naturalness and freedom in a landscape, those for freedom being:

1. the degree to which land provides opportunities for solitude,
2. the remoteness of the land from mechanical devices, and
3. the degree to which ecological processes remain uncontrolled by human agency;

and those for naturalness being:

1. the degree to which the land maintains its natural composition,
2. the degree to which the land remains unaltered by artificial human structures, and
3. the degree to which the land is unpolluted.

Each of these attributes need not exist at an absolute maximum in wilderness, but, collectively, they define the qualities of freedom and naturalness and, therefore, describe the important elements of wilderness. Other authors, such as Landres *et al.* (1994) and Cole (1996, 2001), confirm that these attributes are the defining elements of wilderness.

Landres (2004) considers that the U.S. Wilderness Act defines four essential qualities that, taken together, comprise an area of high wilderness character:

1. Untrammelled – wilderness is unhindered and free from modern human control or manipulation.
2. Natural – wilderness ecological systems are substantially free from the effects of modern civilization.
3. Undeveloped – wilderness is substantially without permanent improvements or modern human occupation.
4. Outstanding opportunities for solitude or primitive and unconfined types of recreation.

In the late 1970s, the U.S. Department of Agriculture Forest Service used three types of criteria within its Wilderness Attribute Rating System to assess wilderness quality<sup>4</sup>, outlined below.

1. The **capability** of a potential wilderness, which is the degree to which that area contains the basic characteristics that make it suitable for wilderness designation without regard to its availability for or need as wilderness. Attributes of wilderness considered in this analysis are:
  - a. **Untrammelled** - lack of evidence of human control or manipulation;
  - b. **Undeveloped** - lack of evidence of modern human presence, occupation, modification;
  - c. **Natural** - ecological systems are substantially free from effects of modern civilization; and
  - d. **Opportunities for solitude or primitive and unconfined recreation** - remoteness, solitude, freedom, risk, challenge.
2. The **availability** of a potential wilderness, which is conditioned by the value of and need for the wilderness resource compared to the value of and need for other resources. Availability analysis includes a description of historic land uses and potential conflicts with other uses. Also, it takes into account the effect that wilderness designation and management is likely to have in response to the growing need for wilderness lands because of ever-increasing human population.
3. The **need** for an area to be designated as wilderness, based on the degree to which it contributes to the local and national distribution of wilderness. Important considerations include: the amount of wilderness adjacent to the area under consideration; the evidence of public need for more wilderness here (demonstrated through public involvement); and the geographic distribution of landforms and ecosystems that closely match the area.

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<sup>4</sup> This system was used to assess the potential value of roadless areas as additions to the U.S. National Wilderness Preservation System.

While these approaches are all oriented toward the U.S. situation, the qualities of wilderness they address are certainly ones that many other nations consider when evaluating potential areas as wilderness.

In the present study, wilderness within the Peel Watershed is assessed primarily with regard to its capability for wilderness designation. Notions of the availability of wilderness and need for wilderness are components of the political discourse over whether or not the area should be classified as wilderness. They are best assessed through participative processes, informed by the present assessment of capability/suitability for wilderness designation, that will enable all interested parties and stakeholders to engage in the debate.

## 2.2 Previous research

A significant amount of research about the natural and cultural heritage of the Peel Watershed has been undertaken in recent decades (e.g. Kuch, 1998), much of which has been collated and mapped using geographic information systems (CPAWS-Yukon, 2004). While there are significant gaps in some of this information, knowledge about the distribution and status of the vegetation and biodiversity indicator species, such as raptors and large prey species (e.g. caribou, moose and thin-horn sheep), is sufficiently well developed to inform planning and management processes.

What is currently lacking, however, is the wider context within which to assess the Peel Watershed, particularly with respect to the significance of its wilderness and biodiversity at circumpolar and continental scales. Two studies of particular relevance to the present work are: the identification of the 25 largest unfragmented areas of natural habitat in the Arctic by UNEP-WCMC and UNEP/GRID-Arendal (Lysenko and Zöckler, 2001); and the conservation prioritisation of 37 wilderness areas from around the world by Conservation International (Mittermeier *et al.*, 2003). Conservation of these 37 wilderness areas is considered vital in order to help maintain the ecological health of the planet.

**Table 2.1** Criteria and thresholds used to identify remaining areas of wilderness at a global scale (Mittermeier *et al.*, 2003)

Criterion	Threshold	Comments
<b>Size</b>	≥10,000 km <sup>2</sup>	Wilderness must be a distinct biogeographic unit or series of units (e.g. ecoregions) within a biome that share certain biological features.
<b>Intactness</b>	≥70% original natural vegetation intact	It is also critical that intact faunal assemblages of large mammals and birds are maintained.
<b>Human population density</b>	≤5 inhabitants km <sup>-2</sup>	Threshold applies to the unit as a whole and excludes urban populations.
<b>Biodiversity</b>	≥300,000 <sup>1</sup> vascular plant species endemic to the unit <b>or</b> ≥1,500 endemic vascular plant species	Biodiversity is a secondary criterion, applied after unit in question added to wilderness list based on size, intactness and population density.

<sup>1</sup>Equates to 0.5% global vascular plant diversity.

Criteria used by Conservation International for wilderness are broad and take into account size, intactness of natural systems, human population density and biodiversity at a biome (ecosystem) level (Table 2.1). The 37 wilderness areas matching these criteria cover nearly 81 million km<sup>2</sup>, or 54% of the land surface of the planet. Of this total, 68 million km<sup>2</sup>, 46% of the Earth's land surface, remains largely intact.

Two of these wilderness areas, Boreal Forest (16,179,500 km<sup>2</sup>) and Arctic Tundra (8,850,000 km<sup>2</sup>), are relevant to the present study in so far as they are both represented within the Peel Watershed.

The study undertaken by UNEP-WCMC and UNEP/GRID-Arendal defines wilderness in terms of intact natural habitat, unfragmented by any permanent physical man-made structures, such as settlements, roads, power transmission cables or pipelines, and of at least 25,000 km<sup>2</sup> in extent. Any sources of disturbance are taken into account by delineating a 20 km buffer around them. The Dempster Highway, for example, divides the Peel Watershed into two fragments of wilderness, namely the Central Canadian Taiga and Tundra and the North-Yukon, which are among the 25 unfragmented areas of wilderness identified for the Arctic. These wildernesses provide the wider, international context for the present assessment of the Peel Watershed.

### 2.3 Quantitative assessment of wilderness, biodiversity and recreation

Quantitative analyses were undertaken by UNEP-WCMC using its geographic information system (GIS), with Digital Chart of the World as the spatial base layer. Analyses were carried out at global (Arctic), continental (North America) and local (river basins within the Peel Watershed) levels, details of which are given below.

#### *Arctic analyses*

A previous spatial dataset of unfragmented areas of wilderness in the Arctic<sup>5</sup>, prepared by Lysenko and Zöckler (2001), provided the basis upon which to assess the significance of the Peel Watershed with respect to this region. This dataset was generated from a Global Wilderness Index developed by R. Lesslie in 1998. The index is essentially a measure of remoteness from human influence, derived from measures of remoteness from settled land/permanent occupation, vehicle access, and apparent naturalness (remoteness from permanent man-made structures). This same spatial layer of Arctic wilderness areas was used in conjunction with the following global spatial datasets for analysis purposes:

- **WWF Global Ecoregions** - This classification system combines biogeographical realms with floristic and zoogeographical provinces. Ecoregions are regional-scale (continental-scale) units of biodiversity, defined as relatively large areas of land or water containing characteristic sets of natural communities that share a large majority of their species, ecological dynamics, and environmental conditions (Dinerstein *et al.*, 1995 and Groves *et al.*, 2000 cited in Magin and Chape, 2004). They function effectively as coarse-scale conservation units because they encompass similar biological communities, and their extent roughly coincides with the area over which key ecological processes interact most strongly (Orians, 1993 cited in Magin and Chape, 2004).
- **IUCN/SSC Habitat Types (Version 2.1)** – The IUCN Species Survival Commission (SSC) habitat classification scheme is hierarchical, with three levels. The first level comprises 15 broad habitat categories, such as [1.] Forest and [5.] Wetland; the second level 78 habitat types, such as [1.1] Boreal Forest and [1.2] Subarctic Forest; and the third level 154 types, such as [1.1.1] Coniferous Forest or [1.1.16] Wooded Tundra as types of Boreal Forest. This scheme has been populated by a modified

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<sup>5</sup> Definition of the Arctic region follows that used by Lysenko and Zöckler (2001). This is based on boundaries used by the various Working Groups of the Arctic Council: specifically that used for the Conservation of Arctic Flora and Fauna (CAFF) programme and that for the Arctic Monitoring and Assessment Programme (AMAP). However, unfragmented areas of wilderness are considered in their entirety, even those that extend beyond the CAFF and AMAP boundaries (see Map 1).

version of the Global Land Cover Characterization (GLCC) developed by the U.S. Geological Survey's Earth Resource Observation Centre (EROS) Data Center and others (see: <http://edcdaac.usgs.gov/glcc/glcc.html>), further details of which are provided by Magin and Chape (2004).

First level habitats are available as a spatial layer, as are a few second/third-level habitats or combinations thereof, but more comprehensive GIS analysis is currently not possible. For purposes of this study, therefore, analysis was limited to first-level categories and certain combinations of second/third-level habitat types (mostly forest).

- **WWF Global 200 Ecoregions** - The WWF Global Ecoregions system classifies the world's terrestrial (including freshwater) and marine areas into a total of 867 ecoregions, of which 238 (195 terrestrial and 43 marine) have been identified as priorities for conservation action. This set of priority ecoregions, commonly referred to as the *Global 200*, has been identified on the basis of harbouring exceptional biodiversity and being representative of their respective ecosystems. Furthermore, their conservation status has been assessed using a three-tier system: critical or endangered, vulnerable and relatively stable or intact (Olson and Dinnerstein, 2002).
- **BirdLife International Important Bird Areas** – Selection of Important Bird Areas (IBAs) is based on the presence of viable populations of birds that are globally threatened and/or geographically concentrated through small global ranges, congregatory behaviour, or restriction to a particular biome. More than 7,500 IBAs have so far been recognised worldwide. Selection takes full account of existing protected area networks but is not limited to them.
- **UNEP-WCMC World Database on Protected Areas** – Analyses are based on a subset of 405 nationally designated areas located within Arctic wildernesses, classified by IUCN Protected Area Management Category (IUCN, 1994).

#### *North America analyses*

Where appropriate, separate analyses of wilderness were undertaken for North America using the above spatial layers. In particular, the significance of the Peel Watershed was assessed with respect to the Central Canadian Taiga and Tundra Wilderness No. 2 (2,476,398 km<sup>2</sup>) and North-Yukon Wilderness No. 9 (273,165 km<sup>2</sup>), within which it lies. These two wildernesses are separated by the Dempster Highway (Section 2.2).

#### *Peel Watershed analyses*

More detailed, comparative analyses of the Peel Watershed was undertaken at river basin level with respect to existing and potential wilderness, biodiversity indicator species and recreation. The Watershed was divided into seven river basins for this purpose as follows:

- Snake, Bonnet Plume, Wind, Hart, Blackstone and Ogilvie river basins to the south of the Peel River (N=6); and
- Northern Peel River Basin, which includes all tributaries rising in the Richardson Mountains that flow south into the Peel River and those rising in the Peel Plateau that flow eastwards into the Peel River. The Caribou, Trail and Road rivers were considered too small to treat separately from the Northern Peel River Basin.

The following spatial datasets supplied by or accessed via Yukon Parks provided the basis of the analyses:

- Ecological Land Classification (ELC.tif vegetation/elevation raster dataset) for use as base map (hydrology).
- Roads and routes ([Base250k\transportation.shp](#) National Topographic Database (NTDB) 1:250,000, Environment Yukon) for road infrastructure, including Dempster

Highway, Old Amerada Road with trail to Crest Iron Property and oil/gas exploration roads and seismic lines.

- Gas, oil and mineral exploration and mining infrastructures ([http://geomaticsyukon.ca/data\\_download.html#mining](http://geomaticsyukon.ca/data_download.html#mining)) for, wells, dispositions and successful bid areas.
- Spatial data from a conceptual study to identify potential natural resource infrastructure access corridors (Access Consulting Group, 2003) were used to assess the potential impact of such developments on existing wilderness within the Peel Watershed.
- Wildlife Key Areas, Environment Yukon ([ftp://ftp.geomaticsyukon.ca/Environment/ENV\\_WildlifeKeyArea.zip](ftp://ftp.geomaticsyukon.ca/Environment/ENV_WildlifeKeyArea.zip)) for raptor and mammal distributions.
- Recreation Features Inventory, Northern Yukon, Department of Renewable Resources (1988), which broadly identifies the potential forms of recreational use afforded by various landscape units.

Spatial layers for existing and potential wilderness were generated using buffers ranging in width from 1 to 10 km, depending on the type of development, to define the boundaries of wilderness. Buffer widths, as shown in Table 2.2, are based on the classification system developed for the Yukon State of the Environment Report 1999<sup>6</sup>.

**Table 2.2** Widths of buffers around developments for defining boundaries of wilderness

Development type	Wilderness category width (km)	Notes
Dempster Highway	>10	Accessible only in winter using over-snow vehicles.
Winter trail <sup>7</sup>	> 5	
Airstrip	> 5	
Seismic line	> 1	No mines currently active; all exploration is for minerals.
Mine	> 5	
Active coal licenses	> 5	
Active quartz claims	> 5	
Oil/gas well	> 5	
Oil/gas active dispositions	> 5	
Natural access corridor - proposed	>10	
Pipeline - proposed	> 5	
Hydroelectric dam - proposed	> 5	

## 2.4 Qualitative assessment of wilderness values

Assessment of the quality of wilderness within the Peel Watershed, in terms of its characteristics as defined earlier (Section 2.1), is based on current rather than past or future conditions. It was undertaken separately for each of the seven river basins, using ten attributes that relate to the four essential qualities of wilderness (untrammelled, natural, undeveloped and outstanding opportunities for solitude or primitive forms of recreation) identified previously (Section 2.1).

A three or four category ranking system was developed to describe the potential range of conditions prevailing for each attribute. A simple scoring system was employed to determine the relative wilderness quality of each river basin, based on four points (or three, depending

<sup>6</sup> See <http://www.environmentyukon.gov.yk.ca/pdf/chap3.pdf> (Figure 3.1 on page 36)

<sup>7</sup> Winter trail is defined as a route accessible only in winter months by over-snow vehicles, where there is sufficient ground cover and/or frozen ground. Over-snow vehicles vary in size from snow-mobiles to long convoys of tracked vehicles (cat trains), towing large sleighs of fuel and/or equipment.

on the number of categories in the criterion) assigned to the most and one point to the least wilderness-like category. “Don’t Know” responses were assigned zero points. Attributes, their respective categories and respective scores are listed in Table 2.3.

**Table 2.3** Criteria, descriptions and scores used to evaluate wilderness quality

Criterion	Evaluative descriptor	Score
<b>Untrammelled</b>		
	Natural processes dominate the entire area	4
	Natural processes occur over much of the area	3
	Natural processes occur in some of the area	2
	Natural processes are not allowed to operate without human intervention	1
	Do not know	0
<b>Size</b>		
	Area is large enough to maintain all necessary natural processes to ensure ecological integrity	4
	Area is large enough to maintain most necessary natural processes to ensure ecological integrity	3
	Area can maintain necessary natural processes to ensure ecological integrity, but some intervention likely to be required	2
	Area is too small for natural processes to operate in a way to preserve ecological integrity	1
	Do not know	0
<b>Evidence of permanent roads</b>		
	Entire area lacks evidence of permanent roads	4
	Most of the area lacks evidence of permanent roads (<5%)	3
	Evidence of permanent roads exists across a substantial proportion of the area (5-25%)	2
	Evidence of permanent roads throughout the area (>25%)	1
	Do not know	0
<b>Evidence of seasonal roads</b>		
	Entire area lacks evidence of seasonal roads	4
	Most of the area lacks evidence of seasonal roads (<5%)	3
	Evidence of seasonal roads exists across a substantial proportion of the area (5-25%)	2
	Evidence of seasonal roads throughout the area (>25%)	1
	Do not know	0
<b>Evidence of human occupancy</b>		
	Evidence of human development or occupancy/use is primarily seasonal	3
	Evidence of human development is about equally split between seasonal and permanent occupation	2
	Evidence of human development is primarily of a permanent nature	1
	Do not know	0
<b>Evidence of human modification</b>		
	No evidence of human modification (e.g. logging, mines, exploration sites) of the landscape	4
	Evidence of human modification of the landscape is limited to a small area (<5%)	3
	Evidence of human modification of the landscape exists in a substantial proportion of the area (5-25%)	2
	Evidence of human modification of the landscape exists across the area (>25%)	1
	Do not know	0
<b>Naturalness</b>		
	Area contains all the biodiversity of its pre-Euro-American occupation	4
	Some of the existing biodiversity is threatened with emerging development	3
	Some species have been extirpated, but can be recovered easily with simple protection of the landscape	2
	Some species have been extirpated, but current conditions within the area would make it difficult for their recovery	1
	Do not know	0
<b>Natural processes</b>		
	Fires and other natural processes are allowed to occur within the area unencumbered by human policy and action	3
	Fires and other natural processes are subject to formal policy, allowing them to occur unencumbered except in extreme cases	2
	Fires and other natural processes (particularly disturbances) are subject to immediate suppression action	1
	Do not know	0
<b>Accessibility for recreation</b>		
	Area is not accessible by vehicle, only by boat or on foot	5
	Area is remote and accessible only by four-wheel drive road in winter	4
	Area is remote and accessible only by four-wheel drive road in winter and summer	3
	Some parts of the area are accessible with two-wheel drive vehicles	2
	Most of the area is accessible with two-wheel drive vehicles	1
	Do not know	0
<b>Recreation facilities</b>		
	There are few or no facilities other than trails, for primitive recreation in the area	3
	The area includes many trails and designated campsites	2
	The area includes lodges and roads accessible to recreationists	1
	Do not know	0

Consortium members used this evaluation system to assess each of the river basins within the Peel Watershed. In addition, four of seven invited individuals, external to this study and familiar with the Watershed, contributed independently to the assessment. Evaluations were combined by totalling individual scores for each criterion. Thus, this assessment combines evaluations from individuals who know the Watershed with those from Consortium members who are knowledgeable about concepts and characteristics concerning wilderness but collectively have very limited knowledge specific to the study area.

This assessment was constrained in two notable respects: sample size and the impacts of air traffic on wilderness quality. Firstly, given the limited time and resources, it was not possible to sample the views and judgements of a wide range of experts, interest groups and local communities. Secondly, access was evaluated principally in terms of the presence of permanent and/or seasonal roads (Table 2.3). While the presence of airstrips was a material consideration when evaluating the human modification criterion (Table 2.3), access by air and its impact on the quality of wilderness recreation was not evaluated due to data limitations. This is considered further in Section 4.2.

### 3. INTERNATIONAL SIGNIFICANCE OF PEEL WATERSHED WITHIN THE ARCTIC

#### 3.1 Wilderness

The Peel Watershed straddles two of the 25 largest remaining areas of wilderness in the Arctic, namely Central Canadian Taiga and Tundra to the east and North-Yukon to the west (Map 1 and Table 3.1). Its coverage of these two wilderness areas is shown in Table 3.2. They are considered to be wilderness by definition of the unfragmented nature of their habitats, from which settlements, roads and other major forms of infrastructural development are absent (Lysenko and Zöckler, 2001).

**Table 3.1** Extent of unfragmented areas of wilderness in the Arctic. Portions of the Peel Watershed lie within the two highlighted wilderness areas.

ARCTIC WILDERNESS		Area	
No.	Name	km <sup>2</sup>	% total
1	Northern Siberia	2,802,404	20.3%
2	Central Canadian Taiga and Tundra	2,476,398	18.0%
3	Greenland	2,114,727	15.3%
4	Canadian Archipelago	1,371,461	10.0%
5	Eastern Canadian Shield	906,166	6.6%
6	Chukotka-Koryak	858,518	6.2%
7	Alaska	690,518	5.0%
8	Southern Hudson Bay	596,190	4.3%
9	North-Yukon	273,165	2.0%
10	Gydan	574,306	4.2%
11	Yamal	94,525	0.7%
12	Bolshezemelskaya Tundra	103,155	0.7%
13	Muskwa/Slave Lake Forests	95,404	0.7%
14	Southern Labrador	171,153	1.2%
15	Novaya Zemlya	78,212	0.6%
16	St. Elias/Kluane	99,459	0.7%
17	Svalbard	59,512	0.4%
18	Sordoginskiy Mountains	55,329	0.4%
19	Kola	47,263	0.3%
20	Yukon Alpine Tundra	47,102	0.3%
21	Markha River Valley	44,399	0.3%
22	James Bay Lowland	55,790	0.4%
23	New Siberian Islands	37,887	0.3%
24	Severnaya Zemlya	35,573	0.3%
25	Malozemelskaya Tundra	89,878	0.7%
	<b>Total</b>	<b>13,778,494</b>	<b>100.0%</b>
2,9	<b>Peel Watershed, Yukon</b>	<b>#62,664</b>	<b>0.5%</b>

# Total is less than actual area of Peel Watershed (68,872 km<sup>2</sup>) due to impact of Dempster Highway on wilderness.

Most of the Peel Watershed (93%) lies within the Central Canadian Taiga and Tundra (2,476,398 km<sup>2</sup>), among the largest of Arctic wildernesses and second<sup>8</sup> only to Northern Siberia (2,802,404 km<sup>2</sup>). Although the unfragmented portion of the Peel Watershed (58,154 km<sup>2</sup>) comprises just 2.3% of the total area of the Central Canadian Taiga and Tundra

<sup>8</sup> Arguably, the Central Canadian Taiga and Tundra is part of the largest wilderness (2.8 million km<sup>2</sup>) when considered in conjunction with the Canadian Archipelago, given that the two are separated naturally by sea (most of which is sea ice) rather than fragmented as a result of human interventions.

Wilderness (Table 3.2), this portion alone is almost the size of Svalbard in Norway and larger than seven of the other 25 Arctic wildernesses (Table 3.1). Thus, the size of the Peel Watershed in wilderness terms (62,664 km<sup>2</sup>) is significant at an Arctic scale and this is clearly evident from Map 1.

**Table 3.2** Extent of Peel Watershed within unfragmented areas of Arctic wilderness

ARCTIC WILDERNESS			PEEL WATERSHED	
No.	Name	Area (km <sup>2</sup> )	Area (km <sup>2</sup> )	% wilderness
2.	Central Canadian Taiga and Tundra	2,476,398	58,154	2.3%
9.	North-Yukon	273,165	4,510	2.7%
	<b>Total</b>	<b>2,749,563</b>	<b>#62,664</b>	<b>2.3%</b>

# Total is less than actual area of Peel Watershed (68,872 km<sup>2</sup>) due to the impact of Dempster Highway on wilderness.

The impact of the Dempster Highway on Arctic wilderness is also evident. Locally, in the Yukon, it isolates the south-western corner of the Peel Watershed, occupied by the Ogilvie and southern portion of the Blackstone river basins, from the rest of the Watershed. At an Arctic scale, it fragments the North-Yukon Wilderness from that of the Central Canadian Taiga and Tundra. Reference to Map 1 indicates that this Highway is one of only a very few forms of transport infrastructure (roads, railways, pipelines or power transmission lines) that fragments Arctic wilderness in this way. Other examples, evident from Map 1, include: the Alaska North Slope Pipeline Highway that runs from Fairbanks to the Arctic Ocean and separates Alaska Wilderness from that of North-Yukon; and the pipelines that isolate Southern Hudson Bay Wilderness from those of the Central Canadian Taiga and Tundra to the west and James Bay Lowland to the east. Further examples and more details can be found in Lysenko and Zöckler (2001).

### 3.2 Ecoregions

The distribution of WWF Global Ecoregions with respect to Arctic wilderness is shown in Map 2; and the extent to which the different ecoregions are represented within each of the 25 wildernesses is tabulated in Annex 1. Analysis of the ecoregion composition of each wilderness enables the extent of their representation of these biogeographic units to be assessed. Thus, for example, the Central Canadian Taiga and Tundra Wilderness is significant with respect to Northwest Territories Taiga [NA0614] because it contains 88% of this ecoregion (Annex 1 and Table 3.3). Furthermore, 5% of this ecoregion lies within the Peel Watershed (Map 2 and Table 3.4).

#### *Arctic and North America*

The Central Canadian Taiga and Tundra and North-Yukon wildernesses, within which the Peel Watershed is located, are particularly significant for four ecoregions, accounting for 90-95% of Northern Canadian Shield Taiga, Northwest Territories Taiga and Ogilvie-Mackenzie Alpine Tundra, as well as 75% of Low Arctic Tundra (Table 3.3). Their distributions are shown in Map 2. Two of these four ecoregions, Northwest Territories Taiga and Ogilvie-Mackenzie Alpine Tundra, are represented within the Peel Watershed.

#### *Peel Watershed*

A total of four ecoregions are represented in the Peel Watershed, as shown in the inset to Map 2. A breakdown of their extent is provided in Table 3.4. Ogilvie-Mackenzie Alpine Tundra is the most extensive ecoregion, comprising 39,692 km<sup>2</sup> or 58% of the Watershed

**Table 3.3** Extent of WWF Ecoregions represented within Central Canadian Taiga and Tundra and North-Yukon wildernesses. Those exceeding 50% are highlighted.

WWF ECOREGION			2. Central Canadian Taiga and Tundra		9. North-Yukon		Wildernesses 2 and 9	
Code	Name	Total area km <sup>2</sup>	Area km <sup>2</sup>	Ecoregion %	Area km <sup>2</sup>	Ecoregion %	Area km <sup>2</sup>	Ecoregion %
NA0607	Interior Alaska-Yukon Lowland Taiga	443,405	2,622	1%	77,553	17%	80,175	18%
NA0608	Mid-Continental Canadian Forests	369,034	97,603	26%	0	0%	97,603	26%
NA0609	Midwestern Canadian Shield Forests	547,257	162,096	30%	0	0%	162,096	30%
NA0610	Muskwa-Slave Lake Forests	262,693	87,961	33%	0	0%	87,961	33%
NA0612	Northern Canadian Shield Taiga	616,290	586,009	95%	0	0%	586,009	95%
NA0613	Northern Cordillera Forests	262,866	34,615	13%	0	0%	34,615	13%
NA0614	Northwest Territories Taiga	346,408	306,390	88%	9,036	3%	315,426	91%
NA0616	Southern Hudson Bay Taiga	373,122	6,131	2%	0	0%	6,131	2%
NA0617	Yukon Interior Dry Forests	62,379	3,642	6%	0	0%	3,642	6%
NA0802	Canadian Aspen Forests and Parklands	397,593	4,809	1%	0	0%	4,809	1%
NA1103	Arctic Coastal Tundra	101,112	27,354	27%	9,484	9%	36,838	36%
NA1104	Arctic Foothills Tundra	129,338	0	0%	17,952	14%	17,952	14%
NA1108	Brooks-British Range Tundra	159,500	2,926	2%	70,474	44%	73,400	46%
NA1111	Interior Yukon-Alaska Alpine Tundra	232,671	33,303	14%	51,484	22%	84,787	36%
NA1114	Low Arctic Tundra	800,074	596,144	75%	0	0%	596,144	75%
NA1115	Middle Arctic Tundra	1,034,891	313,760	30%	0	0%	313,760	30%
NA1116	Ogilvie-Mackenzie Alpine Tundra	208,466	150,406	72%	37,182	18%	187,588	90%
	Lake Lake	393,296	60,627	15%	0	0%	60,627	15%
<b>Wilderness - totals</b>			<b>2,476,398</b>		<b>273,165</b>		<b>2,749,563</b>	

and most of which is located within the Central Canadian Taiga and Tundra (i.e. east of the Dempster Highway). Ninety percent of this ecoregion is confined to this and the North-Yukon Wilderness (Table 3.3), with 19% distributed within the Peel Watershed (Table 3.4). Thus, **the Peel Watershed is most significant in terms of its extensive representation of Ogilvie-Mackenzie Alpine Tundra** in comparison with the other three ecoregions, the next most extensive being Northwest Territories Taiga with 5% present in the Watershed. The other two ecoregions (Interior Alaska-Yukon Lowland Taiga and Interior Yukon-Alaska Alpine Tundra) are neither extensively represented within the Peel Watershed (Table 3.4) nor within the Central Canadian Taiga and Tundra or North-Yukon wildernesses (Table 3.3).

**Table 3.4** Extent of WWF Ecoregions represented within Peel Watershed, broken down into its respective Central Canadian Taiga and Tundra Wilderness No. 2 and North-Yukon Wilderness No. 9 portions

WWF ECOREGION			2. Central Canadian Taiga and Tundra		9. North-Yukon		Wilderness 2 and 9	
Code	Name	Total area km <sup>2</sup>	Area km <sup>2</sup>	Ecoregion %	Area km <sup>2</sup>	Ecoregion %	Area km <sup>2</sup>	Ecoregion %
NA0607	Interior Alaska-Yukon Lowland Taiga	443,405	2,460	1%	9	0%	2,469	1%
NA0614	Northwest Territories Taiga	346,408	17,704	5%	0	0%	17,704	5%
NA1111	Interior Yukon-Alaska Alpine Tundra	232,671	2,799	2%	0	0%	2,799	2%
NA1116	Ogilvie-Mackenzie Alpine Tundra	208,466	35,191	17%	4,501	2%	39,692	19%
<b>Peel Watershed - totals</b>			<b>58,154</b>		<b>4,510</b>		<b>#62,664</b>	

# Total is less than actual area of Peel Watershed (68,872 km<sup>2</sup>) due to the impact of Dempster Highway on wilderness.

### 3.3 Habitats

The distribution of habitats, based on the IUCN Species Survival Commission (SSC) classification system, across Arctic wilderness is shown in Map 3a and their extent within each of the 25 wildernesses is tabulated in Annex 2. This provides the basis for assessing the Arctic-level (or global) significance of a given wilderness with respect to its particular compliment of habitats.

#### *Arctic and North America*

Reference to Annex 2 shows that Arctic wilderness accounts for 55% of Shrubland, Boreal and Sub-polar habitat, 65% of Temperate and Boreal Sparse Forest, 82% of Tundra and, unsurprisingly, 94% of Snow and Ice.

Habitats that are found predominantly within North American Arctic wildernesses are Temperate and Boreal Sparse Forest (54%), Tundra (58%) and Inland Water (41%), with over 40%, 50% and 30%, respectively, distributed within Canada. Central Canadian Taiga and Tundra and North-Yukon wildernesses account for 31% of Temperate and Boreal Sparse Forest, 27% of Tundra and 17% of Inland Water, these being the habitats for which they are most significant (Map 3b and Annex 2).

#### *Peel Watershed*

Of the 14 habitats considered in this study, 10 are present in the Peel Watershed (Table 3.5). Tundra [19] and Temperate and Boreal Sparse Forest [7] are predominant, covering 45% and 34% of the Watershed, respectively. However, neither constitutes more than 2% of the total global extent of these two habitats.

**Examination of habitats at a more detailed level is necessary to assess any significant or possibly unique features of the Peel Watershed but such data are currently not available for analysis with a Geographic Information System.** The IUCN/SSC classification extends to more detailed second and third levels, comprising 78 and 154 habitat types, respectively, but most of their distributions have not been digitised.

**Table 3.5** Extent of IUCN/SSC Habitats represented within Peel Watershed, broken down into its respective Central Canadian Taiga and Tundra Wilderness No. 2 and North-Yukon Wilderness No. 9 portions

IUCN/SSC HABITAT			2. Central Canadian Taiga and Tundra		9. North-Yukon		Wildernesses 2 and 9	
Code	Name	Total area km <sup>2</sup>	Area km <sup>2</sup>	Habitat %	Area km <sup>2</sup>	Habitat %	Area km <sup>2</sup>	Habitat %
4	Temperate and Boreal Broadleaf Forest	2,735,533	96	0.0%	0	0.0%	96	0.0%
5	Temperate and Boreal Mixed Forest	3,047,905	307	0.0%	0	0.0%	307	0.0%
6	Temperate and Boreal Needle-leaf Forest	9,951,401	2,320	0.0%	0	0.0%	2,320	0.0%
7	Temperate and Boreal Sparse forest	1,542,158	20,531	1.3%	684	0.0%	21,215	1.4%
12	Temperate Grassland	2,015,929	817	0.0%	772	0.0%	1,589	0.1%
18	Shrubland, Boreal and Sub-polar	2,646,154	6,933	0.3%	61	0.0%	6,994	0.3%
19	Tundra	4,669,618	25,216	0.5%	2,991	0.1%	28,207	0.6%
21	Snow and Ice	2,661,806	48	0.0%	0	0.0%	48	0.0%
24	Cropland and Natural Vegetation Mosaic	1,253,760	9	0.0%	0	0.0%	9	0.0%
27	Inland Water	1,836,730	1,877	0.1%	2	0.0%	1,879	0.1%
Peel Watershed - totals			58,154		4,510		#62,664	

\* Total is less than actual area of Peel Watershed (68,872 km<sup>2</sup>) due to the impact of Dempster Highway on wilderness.

### 3.4 Biodiversity priorities

#### Arctic and North America

Global 200 Ecoregions are those prioritised by WWF for conservation action (Section 2.2). The distributions of the ten WWF Global 200 Ecoregions that lie at least partly within the Arctic are shown in Map 4a. They extend across 15 of the 25 Arctic wildernesses, including both Central Canadian Taiga and Tundra and North-Yukon, and represent 17 WWF Global Ecoregions, full details of which can be found in Annex 1. All but two of the Global 200 Ecoregions are considered to be relatively stable, the exceptions being the critical/endangered Pacific Temperate Rainforests, found in St Elias/Kluane Wilderness, and the vulnerable Fenno-Scandia Alpine Tundra and Taiga, found in Kola Wilderness (Olson and Dinerstein, 2002).

Some 66% of the Central Canadian Taiga and Tundra Wilderness comprises ecoregions that are included within four of the Global 200 for priority conservation action. Much less (13%) of North-Yukon Wilderness is represented by Global 200 ecoregions (Map 4b and Table 3.6). At least 20% of each of these four Global 200 ecoregions lies within the Central Canadian Taiga and Tundra and North-Yukon wildernesses, over 50% in the case of Canadian Boreal Taiga and 75% in the case of Canadian Low Arctic Tundra (Table 3.6).

**Table 3.6** Extent of WWF Global 200 Ecoregions for priority conservation represented within Central Canadian Taiga and Tundra and North-Yukon wildernesses

ARCTIC WILDERNESS				WWF GLOBAL 200 ECOREGION							
				Alaskan North Slope Coastal Tundra		Canadian Boreal Taiga		Canadian Low Arctic Tundra		Muskwa/Slave Lake Boreal Forests	
				230,450 km <sup>2</sup>		1,718,349 km <sup>2</sup>		800,074 km <sup>2</sup>		525,559 km <sup>2</sup>	
Code	WWF Ecoregion	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Global 200 %	Area km <sup>2</sup>	Global 200 %	Area km <sup>2</sup>	Global 200 %	Area km <sup>2</sup>	Global 200 %
2.	CENTRAL CANADIAN TAIGA/TUNDRA	2,476,398									
NA1103	Arctic Coastal Tundra	27,354	1.1%	27,354	11.9%	-	-	-	-	-	-
NA0612	Northern Canadian Shield Taiga	586,009	23.7%	-	-	586,009	34.1%	-	-	-	-
NA0614	Northwest Territories Taiga	306,390	12.4%	-	-	306,390	17.8%	-	-	-	-
NA1114	Low Arctic Tundra	596,144	24.1%	-	-	-	-	596,144	74.5%	-	-
NA0610	Muskwa-Slave Lake Forests	87,961	3.6%	-	-	-	-	-	-	87,961	16.7%
NA0613	Northern Cordillera Forests	34,615	1.4%	-	-	-	-	-	-	34,615	6.6%
	<i>Subtotal</i>	<i>1,638,473</i>	<i>66.2%</i>	<i>27,354</i>	<i>11.9%</i>	<i>892,399</i>	<i>51.9%</i>	<i>596,144</i>	<i>74.5%</i>	<i>122,576</i>	<i>23.3%</i>
9.	NORTH-YUKON	273165									
NA1103	Arctic Coastal Tundra	9,484	3.5%	9,484	4.1%	-	-	-	-	-	-
NA1104	Arctic Foothills Tundra	17,952	6.6%	17,952	7.8%	-	-	-	-	-	-
NA0614	Northwest Territories Taiga	9,036	3.3%	-	-	9,036	0.5%	-	-	-	-
	<i>Subtotal</i>	<i>36,472</i>	<i>13.4%</i>	<i>27,436</i>	<i>11.9%</i>	<i>9,036</i>	<i>0.5%</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
	<b>Total</b>	<b>1,674,945</b>	<b>60.9%</b>	<b>54,790</b>	<b>23.8%</b>	<b>901,435</b>	<b>52.5%</b>	<b>596,144</b>	<b>74.5%</b>	<b>122,576</b>	<b>23.3%</b>

#### Peel Watershed

**Approximately 26% of the Peel Watershed lies within Canadian Boreal Taiga, the only Global 200 ecoregion represented within the Watershed.** Canadian Boreal Taiga is confined to the Central Canadian Taiga and Tundra portion of the Watershed (Map 4b) and amounts to 17,713 km<sup>2</sup>, which is 1% of this Global 200 ecoregion.

### 3.5 Biodiversity hotspots

The distribution of biodiversity around the globe is uneven. Some areas, usually those in more tropical regions, have a higher diversity of plants and animals than others. Identification of such hotspots of biodiversity can help to focus conservation efforts, on the basis that more species can be conserved for a given investment.

The most comprehensive global assessment of biodiversity hotspots is that undertaken by Conservation International (CI), which has defined 34 regions where 75% of the planet's most threatened mammals, birds and amphibians survive within habitat covering just 2.3% of the Earth's surface (Mittermeier *et al.*, 2005). To qualify as a hotspot, a region must meet two criteria: it must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics; and it must have lost at least 70% of its original habitat due to the impact of human activities. By definition, none of these 34 biodiversity hotspots is located within the Arctic because the criteria are based on high levels of endemism within areas that have lost much of their original habitat. Thus, the CI biodiversity hotspot system does not inform the prioritisation of conservation needs and efforts in the Arctic.

There are several other internationally recognised, global analyses of biodiversity, all of which focus on specific taxonomic groups:

- Centres of Plant Diversity, of which 234 have been identified by IUCN and WWF (Davis *et al.*, 1995);
- Endemic Bird Areas, of which 221 have been defined by Birdlife International (Stattersfield *et al.*, 1998); and
- Important Bird Areas (IBAs), of which some 7,500 have been identified to date by Birdlife International.

None of the Centres of Plant Diversity or Endemic Bird Areas falls within the Arctic, again reflecting to some extent the criteria used to define these hotspots as the Arctic does not support as high levels of endemic species as many other regions of the world.

The distribution of IBAs is shown for the Arctic in Map 5. None falls within the Peel Watershed but some 20 IBAs lie in the Central Canadian Taiga and Tundra Wilderness and five in North-Yukon Wilderness. However, the process of identifying IBAs in Canada has not yet been completed. To date, IBAs have been nominated mostly on the basis of waterfowl, sea birds and shorebirds, based on the primary criterion of at least 1% of a bird population being present at any time of the year. There is another criterion that can be applied to sites that are important because they contain a representative assemblage of birds typical of a biological region. This criterion, known as biome representative species assemblage, has not yet been applied in Canada due largely to issues of data deficiency (Denis Leplage and Andrew Couturier, Bird Studies Canada, pers. comm.). Thus, assessment of the importance of the Peel Watershed for birds representative of particular biomes remains outstanding.

### 3.6 Conservation

#### *Nationally designated protected areas*

To date, some 16% of the total area of Arctic wilderness has been nationally designated for the conservation of natural and associated cultural heritage within a network of over 470 protected areas. The adequacy of this network of protected areas<sup>9</sup>, as shown in Map 6a and

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<sup>9</sup> A protected area is defined by IUCN (1994) as: *An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.*

summarised in Annex 3, varies considerably with respect to its distribution and extensiveness across Arctic wildernesses. Greenland, Alaska, North-Yukon, St. Elias/Kluane, Svalbard and Sordoginskiy Mountains have at least 39% of their wilderness lying within protected areas, while the rest are poorly represented (13% or, in most cases, very much less). In the case of the Central Canadian Taiga and Tundra and North-Yukon, respectively, 10% and 50% of these wildernesses lie within protected areas (Annex 3).

Reference to Table 3.7 shows that almost 50% of Arctic wilderness lies in North America, where Canada accounts for 86% (5,848,996 km<sup>2</sup>) and the United States 14% (933,810 km<sup>2</sup>). Canada accounts for more Arctic wilderness (43%) than any other country but the extent of its protection is low, 10% as compared with 47% in the United States (Alaska), 41% in Denmark (Greenland) and 57% in Norway. The network of nationally designated protected areas within North American Arctic wilderness is shown in more detail in Map 6b.

Overall, most protected Arctic wilderness (10%) is managed in accordance with IUCN Category II (national park) objectives (Table 3.7); relatively little (1%) is managed specifically to safeguard its wilderness quality in line with IUCN Category Ib criteria, as listed in the box in Section 2.1. Canada and the United States account for similar extents of wilderness, approximately 70,000 km<sup>2</sup>, managed for wilderness values (IUCN Category Ib) but proportionately it is much higher in the United States (7%) than in Canada (1%) (Table 3.7).

**Table 3.7** Extent of nationally designated protected areas within Arctic wilderness

ARCTIC WILDERNESS			IUCN Category Ia		IUCN Category Ib		IUCN Category II		IUCN Categories III-VI		IUCN Categories I-VI <sup>#</sup>	
			Strict Nature Reserve	Wilderness Area	Wilderness Area	National Park	Natural Monument [III] Habitat/Species Management Area [IV] Protected Landscape [V] Managed Resource Protected Area [VI]					
Country	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %
Canada	5,848,996	42.5%	1,861	0.0%	72,131	1.2%	297,184	5.1%	199,500	3.4%	558,369	9.5%
Denmark	2,114,727	15.3%	0	0.0%	2,729	0.1%	863,661	40.8%	0	0.0%	866,390	41.0%
Norway	59,512	0.4%	24,593	41.3%	0	0.0%	9,318	15.7%	20	0.0%	33,925	57.0%
Russia	4,821,449	35.0%	108,001	2.2%	0	0.0%	0	0.0%	246,941	5.1%	354,942	7.4%
United States	933,810	6.8%	1,498	0.2%	68,598	7.3%	164,180	17.6%	273,720	29.3%	435,175	46.6%
N. America	6,782,806	49.2%	3,359	0.0%	140,729	2.1%	461,364	6.8%	473,220	7.0%	993,544	14.6%
Arctic	13,778,494		135,953	1.0%	143,458	1.0%	1,334,343	9.7%	720,181	5.2%	2,248,801	16.3%

<sup>#</sup> Total for Categories I-VI in last column may be less than the sum of totals for Categories Ia, Ib, II and III-VI because the latter sum does not account for overlapping protected areas (e.g. a Category Ia nature reserve may lie within a Category II national park).

A small part (1,176 km<sup>2</sup>) of the Peel Watershed beyond the Planning Commission boundary, comprising the southern extremity of the Blackstone River Basin, lies within the 2,113 km<sup>2</sup> Tombstone Territorial Park (Map 6b). **None of the Watershed lying within the jurisdiction of the Peel Planning Commission is designated as a protected area.**

#### *Internationally designated protected areas*

Approximately 9% of Arctic wilderness is designated for biodiversity conservation under a number of international agreements, namely the World Heritage Convention, Ramsar Convention on Wetlands and Unesco's Man and Biosphere Programme, as shown in Map 6c and summarised in Annex 3.

The Biosphere Reserve network, which aims to be representative of major ecosystems around the world, extends over 7% of Arctic wilderness. Most of this network of six Biosphere Reserves comprises the vast North-East Greenland Biosphere Reserve (972,000 km<sup>2</sup>), there being little representation of many of the Arctic ecoregions.

Twenty nine wetlands have been designated in the Arctic wilderness as being of international importance, especially for waterfowl, under the Ramsar Convention, with its emphasis on “the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”<sup>10</sup>. These Ramsar wetlands extend over just 1.2% of Arctic wilderness. Many of these sites are small (<1,000 km<sup>2</sup>) but the three largest are in Canada: Queen Maud Gulf (62,782 km<sup>2</sup>), Polar Bear Provincial Park (24,087 km<sup>2</sup>) and Whooping Crane Summer Range (16,895 km<sup>2</sup>).

Six sites, covering almost 1% of Arctic wilderness, have been identified as being of *outstanding universal value*<sup>11</sup> under the World Heritage Convention, four of which are in Canada: Wood Buffalo National Park (44,800 km<sup>2</sup>), Kluane/Wrangell-St Elias/Glacier Bay/Tatshenshini-Atkasut National Park (98,391 km<sup>2</sup>, of which 31,595 km<sup>2</sup> lies in Canada and 66,796 km<sup>2</sup> in the United States) and Nahanni National Park (4,765.6 km<sup>2</sup>). How much more Arctic wilderness merits inscription under this Convention awaits comprehensive and systematic assessment.

### 3.7 Main findings

#### *Wilderness*

- The Peel Watershed (68,872 km<sup>2</sup>) straddles two of the 25 largest remaining areas of wilderness in the Arctic, defined by virtue of the unfragmented nature of their habitats, from which settlements, roads and other major forms of infrastructural development are absent. Most of the Peel Watershed (93%) lies within the Central Canadian Taiga and Tundra, second largest Arctic wilderness or, arguably, the largest (2.8 million km<sup>2</sup>) when considered in conjunction with the adjacent Canadian Archipelago Wilderness that is separated naturally by sea (most of which is sea ice).
- The unfragmented portion of the Peel Watershed (58,154 km<sup>2</sup>), east of the Dempster Highway, is significant in wilderness terms at an Arctic scale being larger than seven of the 25 largest Arctic wildernesses.
- Potentially significant is the impact of the Dempster Highway on Arctic wilderness. Locally, it isolates the south-western corner, occupied by the Ogilvie and southern portion of the Blackstone river basins, from the rest of the Peel Watershed. At an Arctic scale, it is one of only a very few forms of transport infrastructure (roads, railways, pipelines or power transmission lines) and possibly the only road that fragments Arctic wilderness along a north-south axis, separating North-Yukon Wilderness from that of the Central Canadian Taiga and Tundra.

#### *Ecoregions*

- Four ecoregions, based on the WWF global classification system, are represented within the Peel Watershed. These comprise different types of taiga and tundra. Ogilvie-Mackenzie Alpine Tundra is the most extensively represented ecoregion, amounting to

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<sup>10</sup> Ramsar Convention mission statement in the Strategic Plan 2003-2008 (COP8 Resolution VIII.25).

<sup>11</sup> Outstanding universal value means: Cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole (Operational Guidelines for the Implementation of the World Heritage Convention, January 2008).

39,692 km<sup>2</sup>. This represents 19% of its total global distribution and comprises 58% of the Peel Watershed

#### *Habitats*

- Ten main habitat types, based on the IUCN/SSC global classification system, are represented in the Peel Watershed, of which Tundra and Temperate and Boreal Sparse Forest are predominant, respectively covering 45% and 34% of the watershed. Neither constitutes more than 2% of the total global extent of these two habitats.

#### *Biodiversity priorities and hotspots*

- Canadian Boreal Taiga, one among 238 Global 200 ecoregions prioritised for conservation action, extends across 17,713 km<sup>2</sup> (26%) of the Peel Watershed. This represents 1% of its global distribution, 53% of which is confined to the Central Canadian Taiga and Tundra Wilderness.
- Other global conservation prioritisation schemes, based on the identification of biodiversity hotspots, are less relevant to the Arctic because they tend to focus on centres of endemism and, in some cases, massive loss of original habitat. Unsurprisingly, therefore, none of CI's 34 Biodiversity Hotspots, WWF/IUCN's Centres of Plant Diversity or BirdLife International's Endemic Bird Areas fall within any of the Arctic wildernesses. Many Important Bird Areas, however, do lie within Arctic wildernesses, including a number within the Central Canadian Taiga and Tundra Wilderness and North-Yukon Wilderness, but to date none has been located within the Peel Watershed. The process of identifying IBAs in Canada is still underway, notably with respect to assemblages of birds representative of particular biomes, and it is possible that the Peel Watershed may prove to be important in this respect.

#### *Conservation*

- Some 16% of Arctic wilderness has been nationally designated to conserve natural and associated cultural heritage within a network of over 400 protected areas. The adequacy of this network is extremely variable and, in the case of the Central Canadian Taiga Wilderness, only 10% lies within protected areas.
- Nearly 50% of Arctic wilderness lies in North America, where Canada accounts for 86% (5,848,996 km<sup>2</sup>) and the United States 14% (933,810 km<sup>2</sup>). Canada accounts for more Arctic wilderness (43%) than any other country but, in comparison with all other Arctic nations except Russia, relatively little (9%) is protected. Only 1% of protected Arctic wilderness is managed specifically to maintain the values and quality of wilderness, based on the IUCN criteria for wilderness area (Category Ib).
- A small part (1.7%) of the Peel Watershed beyond the Planning Commission boundary, comprising the southern extremity of the Blackstone River Basin, lies within the 2,113 km<sup>2</sup> Tombstone Territorial Park. None of the Peel Planning Commission area is currently designated for the conservation of wilderness and its biodiversity.
- There are major gaps in the representation of wilderness and associated biodiversity within existing protected area networks, both nationally and internationally. Moreover, there is an urgent need to identify potential areas of outstanding universal value with respect to Arctic wilderness ahead of development and other interventions that may reduce its value through habitat fragmentation.

#### 4. WILDERNESS VALUES OF PEEL WATERSHED

This section focuses on the Peel Watershed, particularly with respect to its wilderness values, and provides comparisons between its 7 river basins using spatially related data. The sizes of these river basins are given in Table 4.1, with respect to both the Planning Commission and Watershed, and their boundaries are shown in Map 7. The boundary of Tombstone Territorial Park, which lies adjacent to that of the Peel Planning Commission and extends into the headwaters of the Blackstone River, is also shown in Map 7.

**Table 4.1** River basin sizes in Peel Planning Commission area and Peel Watershed

RIVER BASIN	Peel Planning Commission		Peel Watershed	
	km <sup>2</sup>	%	km <sup>2</sup>	%
<b>Northern</b>	15,952	23.7%	15,952	23.2%
<b>Snake</b>	9,158	13.6%	9,158	13.3%
<b>Bonnet Plume</b>	10,582	15.7%	10,582	15.4%
<b>Wind</b>	9,676	14.4%	9,676	14.0%
<b>Hart</b>	12,131	18.0%	12,131	17.6%
<b>Blackstone</b>	2,874	4.3%	4,050	5.9%
<b>Ogilvie</b>	7,004	10.4%	7,322	10.6%
<b>Total</b>	<b>67,377</b>		<b>68,872</b>	

Existing information about the biodiversity, cultural heritage and tourism/recreation are presented in a series of maps to inform national and local assessment of the significance of the Peel Watershed. Given the wealth of knowledge that is available more locally, as provided for example in the Peel Watershed Atlas (CPAWS-Yukon, 2004), no attempt is made to examine the physical, biological and cultural features of the Watershed in detail as this is best done by experts with local knowledge and experience of the area.

##### 4.1 Wilderness fragmentation

###### *Existing wilderness*

As previously highlighted in Section 3.1, the Peel Watershed straddles two Arctic wildernesses that are fragmented by the Dempster Highway. While this is the only significant impact on wilderness evident at an Arctic scale, Map 8a provides more detailed assessment using available spatial data for access and infrastructures relating primarily to exploration of gas, oil and minerals. As defined in Table 2.2, impacts on wilderness are estimated on the basis of buffers around sources of disturbance, such as access routes and exploration structures. Buffers range in width from 1 km (seismic lines) to 10 km (Dempster Highway).

Key points emerging from this analysis of existing wilderness are as follows:

- The Wernecke Winter Road (2008) or Wind River Trail is a recognizable winter trail that bisects the Peel Watershed into two similarly sized portions. From Mayo, it follows the length of the Wind River to join the Dempster Highway on Eagle Plains in the north-west. This route has had limited historical use but is recognized by current exploration initiatives in the area as a means of supplying exploration camps during winter only, using over-snow vehicles

The Wind River Trail comprises three sections, which are subject to varying levels of activity and, thus, impacts on the landscape as follows:

- The section from the Community of Keno to the southern edge of the Peel Watershed boundary was last permitted in 2006 for access to mineral claims at Braine Pass<sup>12</sup>.
  - The section along the Upper Wind River to latitude 65N was last permitted and used in 1994. Approval to use this section of winter trail was granted by the Yukon Government in January 2008 but the proponent will not use this section of trail this year<sup>12</sup>.
  - The section from Latitude 65N along the Wind River and thence via a link northwest to Eagle Plains was last used over a decade ago. It is still evident from the air. Any permits issued for the Wind River Trail have been for winter use only<sup>12</sup>.
- 
- The concentration of active coal licenses and quartz claims, centred largely along the divide between the Wind and adjacent Bonnet Plume valleys, fragments wilderness in the heart of the Peel Watershed.
  - The concentration of seismic lines, wells, oil and gas dispositions and active quartz claims in the Northern Peel River Basin reduces the area of unfragmented wilderness by well over 50%.
  - Wilderness in the Hart, largest of the six river basins that comprise the southern part of the Peel Watershed, is least fragmented by access routes and exploration activities.

#### *Potential wilderness*

Further fragmentation of existing wilderness within the Peel Watershed will occur if proposed developments proceed, including a new pipeline along much (but not entirely) of the route of the Dempster Highway and new roads to access natural resources such as gas, oil and minerals (Access Consulting Group, 2003). The potential fragmentation of wilderness caused by such developments within the Peel Watershed is shown in Map 8b.

The overriding impact of these access corridors will be extensive fragmentation of existing wilderness to the extent that:

- All river basins, at a minimum, will be bisected by roads, reducing the size of existing wilderness fragments by 50% or more in many cases.
- The heart of wilderness, centred on the Hart River Basin and straddling the area between the Blackstone and Wind rivers, will be lost from the Peel Watershed.
- The currently unfragmented portion of the Peel Watershed (58,154 km<sup>2</sup>), east of the Dempster Highway, will no longer be significant in wilderness terms at an Arctic scale.

Some of this potential fragmentation is due to be realised following the Yukon Government's approval on 22 January 2008 of a permit to clear 178 km of winter roads along the Wind River to access multiple mineral claims in the Wind and Bonnet Plume drainages. The impact of these developments on the wilderness quality of the area would be significant.

## **4.2 Wilderness quality**

The results of the evaluations of wilderness quality, with respect to its characteristics being suitable for designation as wilderness based on current conditions, are summarised in Table 4.2 for each river basin. Full details of the distribution of scores for individual evaluations are provided in Annex 4. It should be noted that only five of the seven evaluations covered every

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<sup>12</sup> Source of information: Manager, Land Use, Energy, Mines & Resources, Yukon Government, February 2008.

river basin. Thus, to avoid biases in sample size, the summary results presented in Table 4.2 are based only on the five comprehensive evaluations.

**Table 4.2** Point summaries of evaluation of wilderness quality by Consortium members and external reviewers (N=5)

CRITERION	Peel Watershed - River Basins						
	Northern Peel	Snake	Bonnet Plume	Wind	Hart	Blackstone	Ogilvie
<b>Untrammelled</b>	10	15	19	16	19	14	13
<b>Size</b>	16	12	18	15	18	10	14
<b>Evidence of permanent roads</b>	11	17	16	17	19	8	6
<b>Evidence of seasonal roads</b>	13	13	15	12	17	14	10
<b>Evidence of human occupancy</b>	9	7	12	10	12	8	6
<b>Evidence of human modification</b>	7	12	15	12	16	10	10
<b>Naturalness</b>	5	7	7	7	7	8	8
<b>Natural processes</b>	2	3	3	3	3	2	2
<b>Accessibility for recreation</b>	15	15	17	16	17	10	10
<b>Recreation facilities</b>	8	12	12	12	12	10	10
<b>Total</b>	96	113	134	120	140	94	89

The Hart ranks highest, followed closely by the Bonnet Plume; the Northern Peel, Blackstone and Ogilvie rank lowest; and the Wind and Snake river basins are intermediate in their ranks.

These results largely reinforce those from the GIS analysis of wilderness fragmentation, particularly with respect to the high quality of wilderness in the Hart River Basin and comparatively much lower quality in the Northern Peel, Blackstone and Ogilvie drainages. Results from the GIS analysis and quality assessment are less consistent with respect to the Snake, Bonnet Plume and Wind drainages. For example, the Bonnet Plume scores highly with respect to being untrammelled and showing little evidence of human occupancy and modification, despite there being extensive, active quartz claims in this and the adjacent Wind drainage (Map 8a). River basins of intermediate rank are more likely to be subject to various interpretations by evaluators than those at either extreme (i.e. drainages highest or lowest in wilderness character are more easily assessed, resulting in greater consensus among evaluators). These differences between the two analyses indicate that policy makers need to be particularly sensitive to development activities that may threaten wilderness quality and should commission more detailed and extensive surveys to inform future policies and decisions.

The concept of fragmented wilderness, which is based on the impact of transport structures such as roads and pipelines, requires further consideration. Although access to the Peel Watershed by road is only possible in winter, using over-snow vehicles to haul supplies and equipment to exploration camps, most of the activity (exploration) supported by these winter trails takes place during the summer. For example, a cat train may haul fuel to a storage site in winter but that fuel is used to fly helicopters and run drill rigs throughout the summer. Thus, summer air traffic (helicopters and small fixed-wing aircraft) is reported to be an increasingly significant issue (Bruce Downie, Yukon Parks, February 2008), particularly in response to escalating resource exploration activities. For example, a recent permit application for resource exploration included 80 helicopter landing sites in the permit area that straddles the Peel River. Recreation also contributes to air traffic but its contribution is very much lower relative to exploration activities (Source: Yukon Parks). Although comparative data were not available to this study, it is known that there were 47 recreation-

related flights in 2007. These conveyed a total of 220 visitors to the Wind, Snake, Hart and Bonnet Plume river basins (Source: Draft report to Peel Planning Commission, Department of Tourism and Culture, 2008) . Clearly, access by air can lead to significant impacts on the character of wilderness in each of the river basins but its assessment requires further information on flight paths, frequency of flights, types of aircraft and purpose (exploration or recreation). Thus, the impacts of winter trails, in terms of summer exploration activities that they support, and summer air traffic on wilderness values, including opportunities for primitive recreational experiences, may have been underestimated.

### 4.3 Biodiversity indicators

The distributions of some key biodiversity indicator species of birds and large mammals are shown in Map 9a and more detailed seasonal distributions of the woodland caribou are provided in Map 9b. Key points arising from studying these maps and reviewing relevant literature are as follows:

- Most raptor species occur throughout the Peel Watershed. Exceptions are the osprey, which is found predominantly along the course of the Peel River between its junctions with the Snake, Bonnet Plume and Wind rivers; and the merlin with its seemingly very localised distribution in parts of the Northern, Snake and Wind river basins.
- Few raptor species and locations of them have been recorded for the Hart River Basin. Whether this is indicative of lower raptor diversity or reflects paucity of information is not known.
- The Peel-Caribou River and Chappie Lake complexes, in the Northern Peel and Bonnet Plume/Snake river basins, respectively, are the principle wetland areas of importance for migratory waterfowl (Mossop, 2001 and Mossop *et al.*, 2002 cited in CPAWS, 2004).
- The beaver is found only in north-eastern corner of the Northern Peel River Basin.
- The thin-horn sheep is localised in its distribution but widespread throughout the Peel Watershed east of the Dempster Road. There are no records of thin-horn sheep being present in Ogilvie River Basin.
- Three of Yukon's 22 Woodland Caribou herds reside within the Peel Watershed, moving seasonally between different parts of their ranges (Department of Renewable Resources, 2002 cited in CPAWS, 2004). The core of the distribution lies within the southern river basins, other than Ogilvie, as shown in Map 9b.

In summary, most raptor species are widespread throughout the Peel Watershed. The wetlands are important for migratory waterfowl and the southern river basins of the Watershed provide core habitat for thin-horn sheep and woodland caribou. Such conclusions are preliminary; they need to be substantiated by information based on more detailed and extensive survey data.

### 4.4 Recreation

The Peel Watershed is well known across Canada and in other parts of the world as a premiere destination for primitive, nature-based recreation opportunities. Its key values for tourism include its spectacular mountain and river scenery, remoteness, wildlife, cultural history and on-going traditions of its two First Nations, the Nacho Nyak Dun and Tetl'it Gwich'in. The main recreational activities revolve around canoeing and rafting, with which are associated activities such as fishing, wildlife viewing, bird watching, photography and hiking in alpine areas. Hunting is another activity of long-standing importance in the region.

The distribution of the main recreational features is shown in Map 10, including areas of very high value for hiking and very high potential for recreation. An exhaustive analysis of

recreational resources is available in a separate *Tourism & Recreation* report to the Peel Planning Commission. Key points that emerge from Map 10 are as follows:

- Seven main types of recreational activity have been recorded for the Peel Watershed, for which the Snake, Bonnet Plume, Wind feature the greatest diversity of activities and number of suitable locations. Very few activities take place in the Northern Peel, Ogilvie or Blackstone river basins.
- Very high value hiking areas<sup>13</sup> are most numerous (6-8) in the Snake, Bonnet Plume, Wind and Hart river basins; only one is identified for the Northern Peel River Basin. The most extensive areas lie in the Hart River Basin but hiking opportunities within the Upper Wind and Snake river basins (especially Mount MacDonald) are of superior quality.
- Locations considered suitable for hiking are most numerous (29) of all recreational activities, followed by canoeing (14), big game outfitting (12) and horseback riding (8).
- In terms of very high recreational potential, most has been identified along the headwaters of the Snake and Bonnet Plume rivers, midway along the divide between the Snake and Bonnet Plume valleys and along a 70 km section of the Peel River itself<sup>14</sup>.

The Wind, Snake and Bonnet Plume drainages have been more extensively used for recreation than those of the Ogilvie, Blackstone and Hart to the west. This is partly attributed to the latter three drainages being upstream of Aberdeen Canyon, which is not navigable and involves a strenuous 10 km stretch of portage. The upper sections of Blackstone River are used regularly, while use of the Hart has also increased in recent years. Importantly, the entire length of the Bonnet Plume River (>350 km) is included within the Canadian Heritage Rivers System on account of its high natural, cultural and recreational values.

Comprehensive data concerning levels of recreational use within the Peel Watershed were not available to this study but the level of air traffic for recreational purposes is low. Of the 220 visitors who travelled by air in summer 2007, 53% visited the Wind, 20% visited each of the Snake and Hart, and 7% visited the Bonnet Plume (Source: Peel Watershed Tourism & Recreation Report, 2008. Draft. Yukon Department of Tourism & Culture).

## 4.5 Main findings

### *Wilderness*

The **Hart River Basin**, together with the unfragmented portions of the adjacent divides that separate Blackstone Valley to the west and Wind Valley to the east, occupies the heart of wilderness within the Peel Watershed. This core wilderness area features the following:

- The Hart, itself, is the largest (12,131 km<sup>2</sup>) of the six southern river basins and the only river basin with wilderness that remains unfragmented. It comprises 18% of the Peel Watershed.
- Characteristics of the Hart and adjoining unfragmented habitat that have a high wilderness value include its naturalness, untrammelled nature, almost complete absence of infrastructure (including recreational facilities) and inaccessibility due to the absence of any winter trails.
- Biodiversity indicators, notably raptors and large ungulates, are well represented in the Hart drainage. The apparent dearth of raptors in the headwaters may reflect a lack of

<sup>13</sup> Peel Watershed Tourism & Recreation Report, 2008. Draft. Yukon Department of Tourism & Culture. Note: very high value for hiking was derived from anecdotal reports from on the ground recreationists.

<sup>14</sup> All of these features mentioned have been identified and mapped as having 'very high' significance (Source: *Recreation Features Inventory Northern Yukon*, 1998. Yukon Renewable Resources.

information, possibly attributable to the more difficult access and lower numbers of visitors. The upper valleys of the Hart comprise the core autumn rutting area of the woodland caribou, as well as one of its two key winter ranges in the Peel Watershed.

- The Hart contains the greatest extent of high value areas for hiking but such areas within the Upper Wind and Snake river basins (especially Mount MacDonald) are of superior quality.

Many wilderness characteristics of the **Wind, Bonnet Plume** and, to a lesser extent, **Snake** river basins also have high values but their unfragmented extent and quality of wilderness have been reduced by past exploration for gas, oil and minerals, while existing licences and planned access corridors threaten their future integrity. Such threats are already being realised in the Wind and Bonnet Plume drainages, where mineral claims and the associated site development and activity are increasing dramatically as commodity prices remain high<sup>15</sup>.

Of all the river basins, wilderness with the **Northern Peel** is the most fragmented, to the extent that the landscape is scarred by a network of seismic lines, and scores comparatively low for many characteristics of wilderness. However, it is the predominant part of the Peel Watershed that features Canadian Boreal Taiga, a WWF Global 200 ecoregion that is prioritised for conservation action. One percent of the entire distribution of this ecoregion is located within the Peel Watershed, most of it in the Northern drainage (Map 4b). The Northern Peel is also rich in biodiversity indicator species and is particularly important for migratory waterfowl in the Peel-Caribou River complex.

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<sup>15</sup> There was an approximate nine fold increase in the number of active claims for the Mayo Mining District between 2003 (263 claims) and 2007 (2,384 claims). Although it would be very difficult to disaggregate claims for the Peel Watershed, since the Mayo Mining District is approximately twice as large as the Peel Watershed, it is assumed that a correlation exists between areas inside and outside the Watershed. [Source: Yukon Parks]

## 5. CONCLUSIONS AND RECOMMENDATIONS

### **Conclusions**

- i. The Peel Watershed is internationally significant in an Arctic context for its wilderness and biodiversity on account of the following:
  - The 58,154 km<sup>2</sup> unfragmented portion of the Peel Watershed, which lies within the second largest of Arctic wildernesses (Central Canadian Taiga and Tundra, covering 2,476,398 km<sup>2</sup>), exceeds the size of seven of 25 wildernesses in the Arctic.
  - Four global ecoregions are represented within the Peel Watershed, of which Ogilvie-Mackenzie Alpine Tundra is the most extensive, covering 58% of the Watershed, and also the most significant, with 19% of its global distribution confined to the Watershed.
  - Canadian Boreal Taiga, one of 238 Global 200 ecoregions prioritised by the international biodiversity conservation community for conservation action, comprises 26% of the Peel Watershed. This equates to 1% of this ecoregion's global distribution, much of which (52%) lies within the Central Canadian Taiga and Tundra Wilderness of which the Peel Watershed east of the Dempster Highway is an integral part.
- ii. The Hart drainage and some adjacent unfragmented areas to its east and west represent the core wilderness within the Peel Watershed, in terms of both extent and quality, on account of the following:
  - The Hart is the largest of the six southern river basins, comprising 12,131 km<sup>2</sup> or 18% of the Peel Watershed, and the only river basin with wilderness that remains unfragmented.
  - High value wilderness characteristics of the Hart and adjoining unfragmented habitat include its naturalness, untrammelled nature, almost complete absence of infrastructure (including recreational facilities) and inaccessibility due to the absence of any winter trails.
- iii. While the Hart drainage and adjacent unfragmented areas represent the core wilderness, they are an integral part of the Peel Watershed whose other drainages afford wilderness values (including biodiversity) that complement or even exceed those present in the Hart. For example:
  - Canadian Boreal Taiga, a Global 200 ecoregion prioritised for conservation action, is represented predominantly in the Northern Peel River Basin. None of this ecoregion lies in the Hart drainage.
  - High value areas for hiking within the Upper Wind and Snake river basins are of superior quality to those in the Hart.
  - The Bonnet Plume River (>350 km) is included within the Canadian Heritage Rivers System on account of its high natural, cultural and recreational values.

### **Recommendations**

- iv. The Peel Watershed Planning Commission should give serious consideration to effectively protecting the wilderness and biodiversity values of this Watershed in perpetuity through formal designations and other mechanisms, given that:
  - The wilderness and biodiversity values of the Peel Watershed are of global significance within an Arctic context, as concluded above.
  - The extent and quality of this wilderness in the Peel Watershed is under increasing threat from gas, oil and mineral exploration, the most recent example being the approval of an access corridor along the Wind Rive that could dramatically

- accelerate exploration activities is managed specifically to safeguard its wilderness quality in line with IUCN Category Ib criteria in the Wind and Bonnet Plume drainages.
- Canada accounts for more Arctic wilderness (43%) than any other country but less than 10% of Arctic wilderness in Canada lies within protected areas, as defined by IUCN, and only 1% is managed specifically to safeguard its wilderness quality in line with IUCN Category Ib criteria. This status is very unfavourable in comparison with all other Arctic countries except Russia.
  - None of the Peel Watershed Planning Commission area is currently designated for the conservation of wilderness and its biodiversity. Only a small part (1.7%) of the Peel Watershed beyond the Planning Commission boundary, comprising the southern extremity of the Blackstone River Basin, lies within the 2,113 km<sup>2</sup> Tombstone Territorial Park.
- v. While this study contributes to informing planning policy and decision-making processes, principally from a global perspective that focuses on the values and qualities of the Peel Watershed as a wilderness area, there remain a number of critical issues that need to be examined to help ensure that opportunities are not reduced or lost through inappropriate forms of development. These include the following:
- More extensive evaluation of the quality of wilderness within individual river basins of the Peel Watershed among a wide range of stakeholders familiar with the entire area, based on the method designed and piloted in this study.
  - More detailed assessment of the Canadian Boreal Taiga Global 200 ecoregion, given its global conservation priority, in relation to the distribution and status of its plant and animal communities both within and beyond the Peel Watershed.
  - Assessment of the potential impact of climate change on the Peel Watershed to inform management and any potential development.
  - Assessment of the services provided by the Peel Watershed as an ecosystem, particularly in relation to maintenance of biological and cultural diversity (including indigenous life-styles), protection of watersheds and provision of sinks for carbon.<sup>16</sup>
  - Assessment of Canada's wilderness to inform national policy and strategy concerning its wise use and management, thereby providing the national context within which the role of wilderness areas such as the Peel Watershed can be determined. Importantly, such a study should examine the adequacy of Canada's network of existing designated wilderness areas (IUCN Category Ib) and also identify areas of potential outstanding universal value as wilderness for inscription on the World Heritage List.

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<sup>16</sup> Boreal forests, for example, store 49% of the 1,146 gigatons of carbon that is locked up in the world's forests (Mittermeier *et al.*, 2000).

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## Extent of WWF Ecoregions and Global 200 Ecoregions represented within Arctic wildernesses

ARCTIC WILDERNESS WWF Ecoregion	Area km <sup>2</sup>	WWF Ecoregion		Global 200 Ecoregion [conservation priority]	Global 200 Ecoregion	
		Area km <sup>2</sup>	Wilderness %		Area km <sup>2</sup>	Wilderness %
<b>1. NORTHERN SIBERIA</b>	<b>2,802,404</b>					
PA0601 East Siberian taiga	1,255,585	3,903,273	32.2%	Central and Eastern Siberian taiga	3,903,273	32.2%
PA0605 Northeast Siberian taiga	254,578	1,124,770	22.6%			
PA1101 Arctic desert	1	158,762	0.0%			
PA1103 Cherskii-Kolyma mountain tundra	240,419	556,833	43.2%			
PA1107 Northeast Siberian coastal tundra	186,526	225,298	82.8%	Taimyr and Russian coastal tundra	1,185,537	15.7%
PA1111 Taimyr-Central Siberian tundra	865,109	960,239	90.1%	Taimyr and Russian coastal tundra	1,185,537	73.0%
PA1114 Yamal-Gydan tundra	186	411,169	0.0%			
<b>2. CENTRAL CANADIAN TAIGA AND TUNDRA</b>	<b>2,476,398</b>					
NA0607 Interior Alaska-Yukon lowland taiga	2,622	443,405	0.6%			
NA0608 Mid-Continental Canadian forests	97,603	369,034	26.4%			
NA0609 Midwestern Canadian Shield forests	162,096	547,257	29.6%			
NA0610 Muskwa-Slave Lake forests	87,961	262,693	33.5%	Muskwa/Slave Lake Boreal Forests	525,559	16.7%
NA0612 Northern Canadian Shield taiga	586,009	616,290	95.1%	Canadian boreal taiga	1,718,349	34.1%
NA0613 Northern Cordillera forests	34,615	262,866	13.2%	Muskwa/Slave Lake Boreal Forests	525,559	6.6%
NA0614 Northwest Territories taiga	306,390	346,408	88.4%	Canadian boreal taiga	1,718,349	17.8%
NA0616 Southern Hudson Bay taiga	6,131	373,122	1.6%			
NA0617 Yukon Interior dry forests	3,642	62,379	5.8%			
NA0802 Canadian Aspen forests and parklands	4,809	397,593	1.2%			
NA1103 Arctic coastal tundra	27,354	101,112	27.1%	Alaskan North Slope coastal tundra	230,450	11.9%
NA1108 Brooks-British Range tundra	2,926	159,500	1.8%			
NA1111 Interior Yukon-Alaska alpine tundra	33,303	232,671	14.3%			
NA1114 Low Arctic tundra	596,144	800,074	74.5%	Canadian Low Arctic tundra	800,074	74.5%
NA1115 Middle Arctic tundra	313,760	1,034,891	30.3%			
NA1116 Ogilvie-MacKenzie alpine tundra	150,406	208,466	72.1%			
Lake Lake	60,627	393,296	15.4%			
<b>3. GREENLAND</b>	<b>2114727</b>					
NA1112 Kalaallit Nunaat high arctic tundra	313,137	315,968	99.1%			
NA1113 Kalaallit Nunaat low arctic tundra	147,052	178,021	82.6%			
Rock/Ice Rock and Ice	1,654,538	1,809,863	91.4%			

ARCTIC WILDERNESS WWF Ecoregion	Area km <sup>2</sup>	WWF Ecoregion		Global 200 Ecoregion [conservation priority]		Global 200 Ecoregion	
		Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %
<b>4. CANADIAN ARCHIPELAGO</b>	1371461						
NA1103 Arctic coastal tundra	11,034	101,112	10.9%	Alaskan North Slope coastal tundra	230,450	4.8%	
NA1105 Baffin coastal tundra	9,071	9,211	98.5%				
NA1109 Davis Highlands tundra	85,073	88,037	96.6%				
NA1110 High Arctic tundra	472,474	478,733	98.7%				
NA1112 Kalaallit Nunaat high arctic tundra	104	315,968	0.0%				
NA1114 Low Arctic tundra	36,620	800,074	4.6%	Canadian Low Arctic tundra	800,074	4.6%	
NA1115 Middle Arctic tundra	658,124	1,034,891	63.6%				
Rock/Ice Rock and Ice	98,961	1,809,863	5.5%				
<b>5. EASTERN CANADIAN SHIELD</b>	906166						
NA0602 Central Canadian Shield forests	39,453	461,908	8.5%				
NA0605 Eastern Canadian forests	82,703	487,303	17.0%				
NA0606 Eastern Canadian Shield taiga	563,734	755,651	74.6%	Canadian boreal taiga	1,718,349	32.8%	
NA0616 Southern Hudson Bay taiga	6	373,122	0.0%				
NA1114 Low Arctic tundra	152,673	800,074	19.1%	Canadian Low Arctic tundra	800,074	19.1%	
NA1115 Middle Arctic tundra	36,189	1,034,891	3.5%				
NA1118 Torngat Mountain tundra	31,408	32,342	97.1%				
<b>6. CHUKOTKA-KORYAK</b>	858518						
NA1107 Beringia upland tundra	31	97,979	0.0%				
PA0603 Kamchatka-Kurile meadows and sparse forests	25,105	145,865	17.2%	Kamchatka taiga and grasslands	280,303	9.0%	
PA0604 Kamchatka-Kurile taiga	2,183	15,217	14.3%	Kamchatka taiga and grasslands	280,303	0.8%	
PA0605 Northeast Siberian taiga	93,746	1,124,770	8.3%				
PA1102 Bering tundra	397,911	478,047	83.2%				
PA1103 Cherskii-Kolyma mountain tundra	82,472	556,833	14.8%				
PA1104 Chukchi Peninsula tundra	197,368	300,839	65.6%	Chukhote coastal tundra	308,575	64.0%	
PA1105 Kamchatka Mountain tundra and forest tundra	59,702	119,221	50.1%	Kamchatka taiga and grasslands	280,303	21.3%	
<b>7. ALASKA</b>	690518						
NA0601 Alaska Peninsula montane taiga	26,187	48,182	54.4%				
NA0603 Cook Inlet taiga	6,749	28,000	24.1%				
NA0607 Interior Alaska-Yukon lowland taiga	221,020	443,405	49.8%				
NA1101 Alaska-St. Elias Range tundra	41,856	154,478	27.1%				
NA1103 Arctic coastal tundra	43,444	101,112	43.0%	Alaskan North Slope coastal tundra	230,450	18.9%	

ARCTIC WILDERNESS WWF Ecoregion		Area km <sup>2</sup>	WWF Ecoregion		Global 200 Ecoregion [conservation priority]		Global 200 Ecoregion	
			Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %	Area km <sup>2</sup>	Wilderness %
NA1104	Arctic foothills tundra	99,835	129,338	77.2%	Alaskan North Slope coastal tundra	230,450	43.3%	
NA1106	Beringia lowland tundra	91,309	155,622	58.7%				
NA1107	Beringia upland tundra	58,090	97,979	59.3%				
NA1108	Brooks-British Range tundra	70,658	159,500	44.3%				
NA1111	Interior Yukon-Alaska alpine tundra	24,628	232,671	10.6%				
	Rock/Ice	6,742	1,809,863	0.4%				
<b>8. SOUTHERN HUDSON BAY</b>		596190						
NA0416	Western Great Lakes forests	496	274,573	0.2%				
NA0602	Central Canadian Shield forests	106,743	461,908	23.1%				
NA0608	Mid-Continental Canadian forests	1,972	369,034	0.5%				
NA0609	Midwestern Canadian Shield forests	175,039	547,257	32.0%				
NA0616	Southern Hudson Bay taiga	296,765	373,122	79.5%				
NA0802	Canadian Aspen forests and parklands	503	397,593	0.1%				
	Lake	14,672	393,296	3.7%				
<b>9. NORTH YUKON</b>		273165						
NA0607	Interior Alaska-Yukon lowland taiga	77,553	443,405	17.5%				
NA0614	Northwest Territories taiga	9,036	346,408	2.6%	Canadian boreal taiga	1,718,349	0.5%	
NA1103	Arctic coastal tundra	9,484	101,112	9.4%	Alaskan North Slope coastal tundra	230,450	4.1%	
NA1104	Arctic foothills tundra	17,952	129,338	13.9%	Alaskan North Slope coastal tundra	230,450	7.8%	
NA1108	Brooks-British Range tundra	70,474	159,500	44.2%				
NA1111	Interior Yukon-Alaska alpine tundra	51,484	232,671	22.1%				
NA1116	Ogilvie-MacKenzie alpine tundra	37,182	208,466	17.8%				
<b>10. GYDAN</b>		574306						
PA0611	West Siberian taiga	383,064	1,670,293	22.9%				
PA1111	Taimyr-Central Siberian tundra	89	960,239	0.0%	Taimyr and Russian coastal tundra	1,185,537	0.0%	
PA1114	Yamal-Gydan tundra	191,153	411,169	46.5%				
<b>11. YAMAL</b>		94525						
PA0611	West Siberian taiga	2	1,670,293	0.0%				
PA1114	Yamal-Gydan tundra	94,523	411,169	23.0%				
<b>12. BOLSHEZEMELSKAYA TUNDRA</b>		103155						
PA0608	Scandinavian and Russian taiga	15,877	2,160,208	0.7%				
PA1108	Northwest Russian-Novaya Zemlya tundra	87,278	274,520	31.8%				

ARCTIC WILDERNESS WWF Ecoregion		Area km <sup>2</sup>	WWF Ecoregion		Global 200 Ecoregion [conservation priority]	Global 200 Ecoregion	
			Area km <sup>2</sup>	Wilderness %		Area km <sup>2</sup>	Wilderness %
<b>13. MUSKWA/SLAVE LAKE FORESTS</b>		95404					
NA0502	Alberta-British Columbia foothills forests	18,300	120,503	15.2%			
NA0610	Muskwa-Slave Lake forests	77,104	262,693	29.4%	Muskwa/Slave Lake Boreal Forests	525,559	14.7%
<b>14. SOUTHERN LABRADOR</b>		171153					
NA0605	Eastern Canadian forests	98,423	487,303	20.2%			
NA0606	Eastern Canadian Shield taiga	72,730	755,651	9.6%	Canadian boreal taiga	1,718,349	4.2%
<b>15. NOVAYA ZEMLYA</b>		78212					
PA1101	Arctic desert	44,054	158,762	27.7%			
PA1108	Northwest Russian-Novaya Zemlya tundra	34,158	274,520	12.4%			
<b>16. ST. ELIAS/KLUANE</b>		99459					
NA0520	Northern Pacific coastal forests	4,450	60,917	7.3%	Pacific temperate rainforests	292,007	1.5%
NA0604	Copper Plateau taiga	1,346	17,189	7.8%			
NA0607	Interior Alaska-Yukon lowland taiga	449	443,405	0.1%			
NA0613	Northern Cordillera forests	2,802	262,866	1.1%	Muskwa/Slave Lake Boreal Forests	525,559	0.5%
NA1101	Alaska-St. Elias Range tundra	41,516	154,478	26.9%			
NA1111	Interior Yukon-Alaska alpine tundra	1,475	232,671	0.6%			
NA1117	Pacific Coastal Mountain icefields and tundra	36,533	109,483	33.4%			
	Rock/Ice Rock and Ice	10,888	1,809,863	0.6%			
<b>17. SVALBARD</b>		59512					
PA1101	Arctic desert	59,512	158,762	37.5%			
<b>18. SORDOGINSKIY MOUNTAINS</b>		55329					
PA0601	East Siberian taiga	12,601	3,903,273	0.3%	Central and Eastern Siberian taiga	3,903,273	0.3%
PA0605	Northeast Siberian taiga	20,706	1,124,770	1.8%			
PA1103	Cherskii-Kolyma mountain tundra	22,022	556,833	4.0%			
<b>19. KOLA</b>		47263					
PA0608	Scandinavian and Russian taiga	22,270	2,160,208	1.0%			
PA1106	Kola Peninsula tundra	24,993	56,607	44.2%	Fenno-Scandia alpine tundra and taiga	301,175	8.3%
<b>20. YUKON ALPINE TUNDRA</b>		47102					
NA0617	Yukon Interior dry forests	8,564	62,379	13.7%			
NA1111	Interior Yukon-Alaska alpine tundra	38,538	232,671	16.6%			
<b>21. MARKHA RIVER VALLEY</b>		44399					
PA0601	East Siberian taiga	44,399	3,903,273	1.1%	Central and Eastern Siberian taiga	3,903,273	1.1%

ARCTIC WILDERNESS WWF Ecoregion	Area km <sup>2</sup>	WWF Ecoregion		Global 200 Ecoregion [conservation priority]	Global 200 Ecoregion	
		Area km <sup>2</sup>	Wilderness %		Area km <sup>2</sup>	Wilderness %
<b>22. JAMES BAY LOWLAND</b>	55790					
NA0602 Central Canadian Shield forests	13,879	461,908	3.0%			
NA0606 Eastern Canadian Shield taiga	7,511	755,651	1.0%	Canadian boreal taiga	1,718,349	0.4%
NA0616 Southern Hudson Bay taiga	34,400	373,122	9.2%			
<b>23. NEW SIBERIAN ISLANDS</b>	37887					
PA1109 Novosibirsk Islands arctic desert	37,887	38,141	99.3%			
<b>24. SEVERNAYA ZEMLYA</b>	35573					
PA1101 Arctic desert	35,573	158,762	22.4%			
<b>25. MALOZEMELSKAYA TUNDRA</b>	89878					
PA0608 Scandinavian and Russian taiga	67,190	2,160,208	3.1%			
PA1108 Northwest Russian-Novaya Zemlya tundra	22,688	274,520	8.3%			

## Extent of IUCN/SSC Habitats represented within Arctic wildernesses

No.	ARCTIC WILDERNESS		4. Temperate and Boreal Broadleaf Forest	5. Temperate and Boreal Mixed Forest	6. Temperate and Boreal Needle-leaf Forest	7. Temperate and Boreal Sparse forest	12. Temperate Grassland	18. Shrubland, Boreal and Sub-polar	19. Tundra	20. Polar and High-Altitude Desert	21. Snow and Ice	22. Wetlands	24. Cropland and Natural Vegetation Mosaic	25. Cropland	26. Urban and built-up	27. Inland Water
	Name	Total area km <sup>2</sup>														
1	Northern Siberia	2,802,404	7,483	45,092	1,041,733	98,143	110,807	435,194	606,090	321,691	1,076	53,296	346	195	0	1,836,730
2	Central Canadian Taiga/Tundra	2,476,398	1,951	101,435	323,900	397,784	3,224	172,995	1,166,487	0	1,530	81	1,071	86	0	305,854
3	Greenland	2,114,727	41	0	0	0	0	16,734	90,035	33,557	1,970,234	17	0	5	0	4,104
4	Canadian Archipelago	1,371,461	37	0	6,190	4,935	0	0	806,808	168,207	329,980	42	0	106	0	55,059
5	Eastern Canadian Shield	906,166	43	8,063	309,095	105,002	71	28,902	351,245	0	399	7	6	0	0	103,333
6	Chukotka-Koryak	858,518	22,576	0.8%	82,041	37,279	15,798	286,605	190,878	87,546	1,091	17,941	1	0	1	15,283
7	Alaska	690,518	2,835	0.1%	31,815	103,865	35,057	177,721	254,132	0	24,107	3,827	9,240	0	0	39,496
8	Southern Hudson Bay	596,190	54	0.0%	4,344	82,363	22	35,616	14,016	0	20	4,758	15	0	0	72,150
9	North-Yukon	273,165	306	0.0%	32,176	75,631	14,283	46,985	90,926	0	623	14	360	0	0	9,435
10	Gydan	574,306	16,654	0.6%	172,606	14,908	3,187	87,071	98,196	4,164	0	103,168	428	27	7	12,025
11	Yamal	94,525	23	0.0%	183	112	0	30,002	51,107	5,988	31	2,128	0	0	0	4,950
12	Bolshezemelskaya Tundra	103,155	129	0.0%	13,695	3,457	0	48,520	22,048	183	0	12,421	9	0	0	1,267
13	Muskwa/Slave Lake Forests	95,404	289	0.0%	46,989	20,552	2	11,006	304	0	0	20	336	0	0	4,177
14	Southern Labrador	171,153	221	0.0%	125,819	11,174	641	7,522	6,527	0	0	31	5	0	0	18,053
15	Novaya Zemlya	78,212	30	0.0%	12	3	0	2,716	17,881	18,284	37,662	98	0	0	0	1,526
16	St. Elias/Kluane	99,459	89	0.0%	3,259	4,712	584	3,789	24,138	0	56,685	3,068	197	0	0	2,584
17	Svalbard	59,512	0	0.0%	1	0	0	0	2,848	9,675	46,713	2	0	0	0	273
18	Sordoginskiy Mountains	55,329	604	0.0%	28,280	3,391	2,076	12,473	569	4,951	0	911	0	0	0	628
19	Kola	47,263	31	0.0%	10,403	5,367	118	18,453	2,726	27	0	7,857	30	18	0	1,351
20	Yukon Alpine Tundra	47,102	51	0.0%	11,772	15,941	988	7,011	6,246	0	0	26	0	0	0	4,045
21	Markha River Valley	44,399	133	0.0%	30,810	4,301	790	4,685	125	899	0	1,528	7	0	0	54
22	James Bay Lowland	55,790	80	0.0%	31,965	11,330	0	5,288	2,037	0	0	366	0	0	0	3,219
23	New Siberian Islands	37,887	3	0.0%	0	0	0	314	14,515	12,535	8,719	168	0	0	0	1,633
24	Severnaya Zemlya	35,573	0	0.0%	1	0	0	0	410	1,169	33,826	0	0	0	0	167
25	Malazemelskaya Tundra	89,878	556	0.0%	45,768	1,932	153	12,918	3,723	428	0	14,884	28	2	0	1,224
	Subtotal - North America	6,782,806	5,956	0.2%	140,461	833,289	54,872	496,835	2,722,866	168,207	413,344	12,240	11,327	192	0	617,405
	Total - Arctic	13,778,494	54,219	2.0%	261,979	1,002,182	87,801	1,452,520	3,824,017	669,304	5,512,696	226,659	12,176	439	8	743,148

Note: North American wildernesses are highlighted.

**Extent of nationally designated protected areas within Arctic wildernesses, based on IUCN management categories ANNEX 3a**

ARCTIC WILDERNESS		IUCN Category Ia		IUCN Category Ib		IUCN Category II		IUCN Categories III-VI		IUCN Categories I-VI	
		Area km <sup>2</sup>	Total area %	Area km <sup>2</sup>	Total area %	Area km <sup>2</sup>	Total area %	Area km <sup>2</sup>	Total area %	Area km <sup>2</sup>	Total area %
No.	Name	Total area km <sup>2</sup>									
1	Northern Siberia	2,802,404	3.0%	0	0.0%	0	0.0%	0	0.0%	140,949	5.0%
2	Central Canadian Taiga and Tundra	2,476,398	0.0%	58,432	2.4%	111,635	4.5%	77,350	3.1%	247,480	10.0%
3	Greenland	2,114,727	0	2,729	0.1%	863,661	40.8%	0	0.0%	866,390	41.0%
4	Canadian Archipelago	1,371,461	0	0	0.0%	87,208	6.4%	28,735	2.1%	115,943	8.5%
5	Eastern Canadian Shield	906,166	235	0	0.0%	10,667	1.2%	52,516	5.8%	63,418	7.0%
6	Chukotka-Koryak	858,518	3,449	0	0.0%	0	0.0%	30,533	3.6%	33,982	4.0%
7	Alaska	690,518	1,498	67,605	9.8%	113,546	16.4%	87,231	12.6%	269,880	39.1%
8	Southern Hudson Bay	596,190	1,452	465	0.1%	51,843	8.7%	9,292	1.6%	63,052	10.6%
9	North-Yukon	273,165	0	5,172	1.9%	14,300	5.2%	118,281	43.3%	137,753	50.4%
10	Gydan	574,306	19,373	0	0.0%	0	0.0%	0	0.0%	20,868	3.6%
11	Yamal	94,525	0	0	0.0%	0	0.0%	0	0.0%	12,676	13.4%
12	Boishezemelskaya Tundra	103,155	136	0	0.0%	0	0.0%	0	0.0%	4,769	4.6%
13	Muskwa/Slave Lake Forests	95,404	0	0	0.0%	0	0.0%	1,087	1.1%	0	0.0%
14	Southern Labrador	171,153	111	0	0.0%	12	0.0%	5,425	3.2%	5,548	3.2%
15	Novaya Zemlya	78,212	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
16	St. Elias/Kluane	99,459	0	9,055	9.1%	70,328	70.7%	7,876	7.9%	87,259	87.7%
17	Svalbard	59,512	24,593	0	0.0%	9,318	15.7%	14	0.0%	33,925	57.0%
18	Sordoginskiy Mountains	55,329	0	0	0.0%	0	0.0%	21,513	38.9%	21,513	38.9%
19	Kola	47,263	0	0	0.0%	0	0.0%	5,420	11.5%	5,420	11.5%
20	Yukon Alpine Tundra	47,102	0	0	0.0%	0	0.0%	103	0.2%	103	0.2%
21	Markha River Valley	44,399	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
22	James Bay Lowland	55,790	0	0	0.0%	738	1.3%	0	0.0%	2,021	3.6%
23	New Siberian Islands	37,887	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
24	Severmaya Zemlya	35,573	13	0	0.0%	0	0.0%	2,988	8.4%	3,001	8.4%
25	Malazemelskaya Tundra	89,878	1,148	0	0.0%	0	0.0%	7,225	8.0%	8,373	9.3%
	<b>Subtotal - North America</b>	<b>6,782,806</b>	<b>3,359</b>	<b>140,729</b>	<b>2.1%</b>	<b>461,364</b>	<b>6.8%</b>	<b>388,092</b>	<b>5.7%</b>	<b>993,544</b>	<b>14.6%</b>
	<b>Total - Arctic</b>	<b>13,778,494</b>	<b>135,953</b>	<b>143,458</b>	<b>1.0%</b>	<b>1,334,343</b>	<b>9.7%</b>	<b>635,047</b>	<b>4.6%</b>	<b>2,248,801</b>	<b>16.3%</b>
2,9	<b>Peel Watershed, Yukon</b>	<b>62,664</b>	<b>0</b>	<b>0</b>	<b>0.0%</b>	<b>1,176</b>	<b>0.0%</b>	<b>0</b>	<b>0.0%</b>	<b>1,176</b>	<b>1.9%</b>

**Notes:** [1] North American wildernesses are highlighted. [2] Wilderness in the Peel Watershed (68,872 km<sup>2</sup>) amounts to 62,664 km<sup>2</sup>, taking into account the impact of Dempster Highway.

## Extent of areas internationally designated for biodiversity conservation within Arctic wildernesses

ANNEX 3b

ARCTIC WILDERNESS		World Heritage Convention		Ramsar Convention		Unesco Man and Biosphere Programme	
		Area km <sup>2</sup>	% Total area	Area km <sup>2</sup>	% Total area	Area km <sup>2</sup>	% Total area
No.	Name	Total area km <sup>2</sup>					
1	Northern Siberia	2,802,404	0	26,813	1.0%	61,281	2.2%
2	Central Canadian Taiga and Tundra	2,476,398	34,432	68,230	2.8%	0	0.0%
3	Greenland	2,114,727	3,586	11,103	0.5%	863,661	40.8%
4	Canadian Archipelago	1,371,461	0	6,843	0.5%	0	0.0%
5	Eastern Canadian Shield	906,166	0	0	0.0%	0	0.0%
6	Chukotka-Koryak	858,518	6,713	18,736	2.2%	0	0.0%
7	Alaska	690,518	0	608	0.1%	29,833	4.3%
8	Southern Hudson Bay	596,190	0	21,329	3.6%	0	0.0%
9	North-Yukon	273,165	0	186	0.1%	0	0.0%
10	Gydan	574,306	0	3,476	0.6%	5,088	0.9%
11	Yamal	94,525	0	969	1.0%	0	0.0%
12	Bolshzemelskaya Tundra	103,155	0	0	0.0%	0	0.0%
13	Muskwa/Slave Lake Forests	95,404	0	233	0.2%	0	0.0%
14	Southern Labrador	171,153	0	0	0.0%	0	0.0%
15	Novaya Zemlya	78,212	0	0	0.0%	0	0.0%
16	St. Elias/Kluane	99,459	81,657	0	0.0%	71	0.1%
17	Svalbard	59,512	0	0	0.0%	0	0.0%
18	Sordoginskiy Mountains	55,329	0	0	0.0%	0	0.0%
19	Kola	47,263	0	0	0.0%	0	0.0%
20	Yukon Alpine Tundra	47,102	0	0	0.0%	0	0.0%
21	Markha River Valley	44,399	0	0	0.0%	0	0.0%
22	James Bay Lowland	55,790	0	200	0.4%	0	0.0%
23	New Siberian Islands	37,887	0	0	0.0%	0	0.0%
24	Severnaya Zemlya	35,573	0	0	0.0%	0	0.0%
25	Malazemelskaya Tundra	89,878	0	0	0.0%	0	0.0%
	<b>Subtotal - North America</b>	<b>6,782,806</b>	<b>116,089</b>	<b>97,629</b>	<b>1.4%</b>	<b>29,904</b>	<b>0.4%</b>
	<b>Total - Arctic</b>	<b>13,778,494</b>	<b>126,388</b>	<b>158,726</b>	<b>1.2%</b>	<b>959,934</b>	<b>7.0%</b>

**Note:** North American wildernesses are highlighted.

## Distribution of summated scores of wilderness quality evaluations for river basins in Peel Watershed

ANNEX 4

ASSESSMENT DIMENSIONS Criteria	Northern Peel	Snake	Bonnet Plume	Wind	Hart	Black- stone	Ogilvie
<b>UNTRAMMELLED</b>	5	5	5	7	5	5	5
Number of respondents							
1a Natural processes dominate the entire area		2	4	4	4		
1b Natural processes occur over much of the area	1	1	1	2	1	4	3
1c Natural processes occur in some of the area	3	2		1		1	2
1d Natural processes are not allowed to operate without human intervention	1						
1e Do not know	1	1	1		1	1	1
<b>SIZE</b>							
2a Area is large enough to maintain all necessary natural processes to ensure ecological integrity	3	1	3	3	3	3	2
2b Area is large enough to maintain most necessary natural processes to ensure ecological integrity		2	2	2	2	2	2
2c Area can maintain necessary natural processes to ensure ecological integrity, but some intervention likely to be required	2	1		2		1	3
2d Area is too small for natural processes to operate in a way to preserve ecological integrity						2	2
2e Do not know	1	2	1		1	1	1
<b>UNDEVELOPED</b>							
3a Entire area lacks evidence of permanent roads	2	3	4	4	4		
3b Most of the area lacks evidence of permanent roads (<5%)		1		2	1		
3c Evidence of permanent roads exists across a substantial proportion of the area (5-25%)	1	1		1		3	1
3d Evidence of permanent roads throughout the area (>25%)	1					2	4
3e Do not know	2	1	2		1	1	1
<b>UNDEVELOPED cont.</b>							
4a Entire area lacks evidence of seasonal roads	1	1	1	2	2	2	
4b Most of the area lacks evidence of seasonal roads (<5%)	2	2	3	1	3		1
4c Evidence of seasonal roads exists across a substantial proportion of the area (5-25%)	1	1	1	4		3	3
4d Evidence of seasonal roads throughout the area (>25%)	1	1					1
4e Do not know	1	1	1		1	1	1
<b>UNDEVELOPED cont.</b>							
5a Evidence of human development or occupancy/use is primarily seasonal		1	4	4	4	1	
5b Evidence of human development is about equally split between seasonal and permanent occupation	4	1		2		2	2
5c Evidence of human development is primarily of a permanent nature	1	2				1	2
5d Do not know	1	2	2	1	2	2	2
<b>UNDEVELOPED cont.</b>							
6a There is no evidence of human modification (e.g. logging, mines, exploration sites) of the landscape			1	1	1	1	1

## Distribution of summated scores of wilderness quality evaluations for river basins in Peel Watershed

ANNEX 4

ASSESSMENT DIMENSIONS Criteria	Northern Peel	Snake	Bonnet Plume	Wind	Hart	Black-stone	Ogilvie
	5	5	5	7	5	5	5
6b Evidence of human modification of the landscape is limited to a small area (<5%)	Number of respondents	3	3	3	4		
6c Evidence of human modification of the landscape exists in a substantial proportion of the area (5-25%)	2	1	1	3		5	5
6d Evidence of human modification of the landscape exists across the area (>25%)	3	1					
6e Do not know	1	1	1	1	1	1	1
<b>NATURALNESS</b>							
7a Area contains all the biodiversity of its pre-Euro-American occupation		1	1	2	1		
7b Some of the existing biodiversity is threatened with emerging development	1	1	1	2	1	2	2
7c Some species have been extirpated, but can be recovered easily with simple protection of the landscape	1					1	1
7d Some species have been extirpated, but current conditions within the area would make it difficult for their recovery							
7e Do not know	4	4	4	3	4	3	3
<b>NATURALNESS cont.</b>							
8a Fires and other natural processes are allowed to occur within the area unencumbered by human policy and action		1	1	2	1		
8b Fires and other natural processes are subject to formal policy, allowing them to occur unencumbered except in extreme cases	1			1		1	1
8c Fires and other natural processes (particularly disturbances) are the subject of immediate suppression action							
8d Do not know	5	5	5	4	5	5	5
<b>OPPORTUNITIES FOR PRIMITIVE RECREATION</b>							
9a Area is not accessible by vehicle, only by boat or on foot		2	2	2	2		
9b Area is remote and accessible only by four-wheel drive road in winter	3	1	1	3	1		
9c Area is remote and accessible only by four-wheel drive road in winter and summer			1	1	1		
9d Some parts of the area are accessible with two-wheel drive vehicles	1					5	5
9e Most of the area is accessible with two-wheel drive vehicles	1	1					
9f Do not know	1	2	2	1	2	1	1
<b>OPPORTUNITIES FOR PRIMITIVE RECREATION cont.</b>							
10a There are few or no facilities other than trails, for primitive recreation in the area	1	4	4	6	4	3	3
10b Area includes many trails and designated campsites	2						
10c Area includes lodges and roads accessible to recreationists	1						1
10d Do not know	2	2	2	1	2	2	2

# Map 1 Distribution of 25 largest unfragmented areas of wilderness in the Arctic

Wilderness Areas:

1. Northern Siberia
  2. Central Canadian Taiga and Tundra
  3. Greenland
  4. Canadian Archipelago
  5. Eastern Canadian Shield
  6. Chukotka-Koryak
  7. Alaska
  8. Southern Hudson Bay
  9. North-Yukon
  10. Gydan
  11. Yamal
  12. Bolshezemelskaya Tundra
  13. Muskwa/Slave Lake Forests
  14. Southern Labrador
  15. Novaya Zemlya
  16. St. Elias/Kluane
  17. Svalbard
  18. Sorologinskiy Mountains
  19. Kola
  20. Yukon Alpine Tundra
  21. Markha River Valley
  22. James Bay Lowland
  23. New Siberian Islands
  24. Severnaya Zemlya
  25. Malozemelskaya Tundra
- CAFF boundary  
AMAP boundary  
Peel Watershed

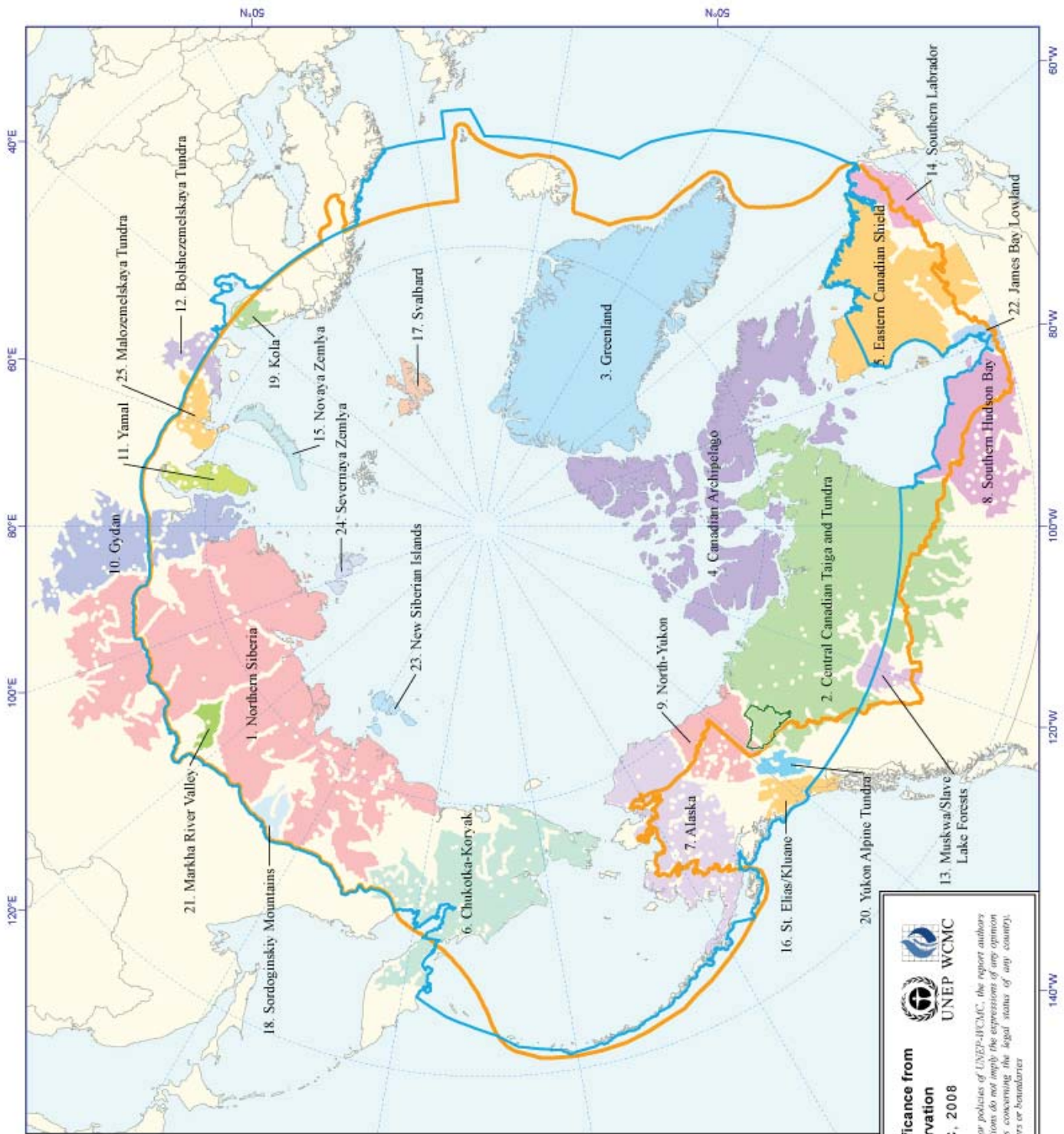
Base data: Digital Chart of the World (© ESRI)  
Wilderness: UNEP-WCMC and UNEP/GRID-Arendal, 2001. The 25 largest unfragmented areas in the Arctic. Report to WWF, Arctic Programme.  
Projection: Lambert Azimuthal Equal Area



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## Map 2 Distribution of WWF Ecoregions within Arctic wildernesses

### Legend

-  Peel Watershed
-  Wilderness Area
-  WWF Terrestrial Ecoregion
- PA0603 Ecoregion number



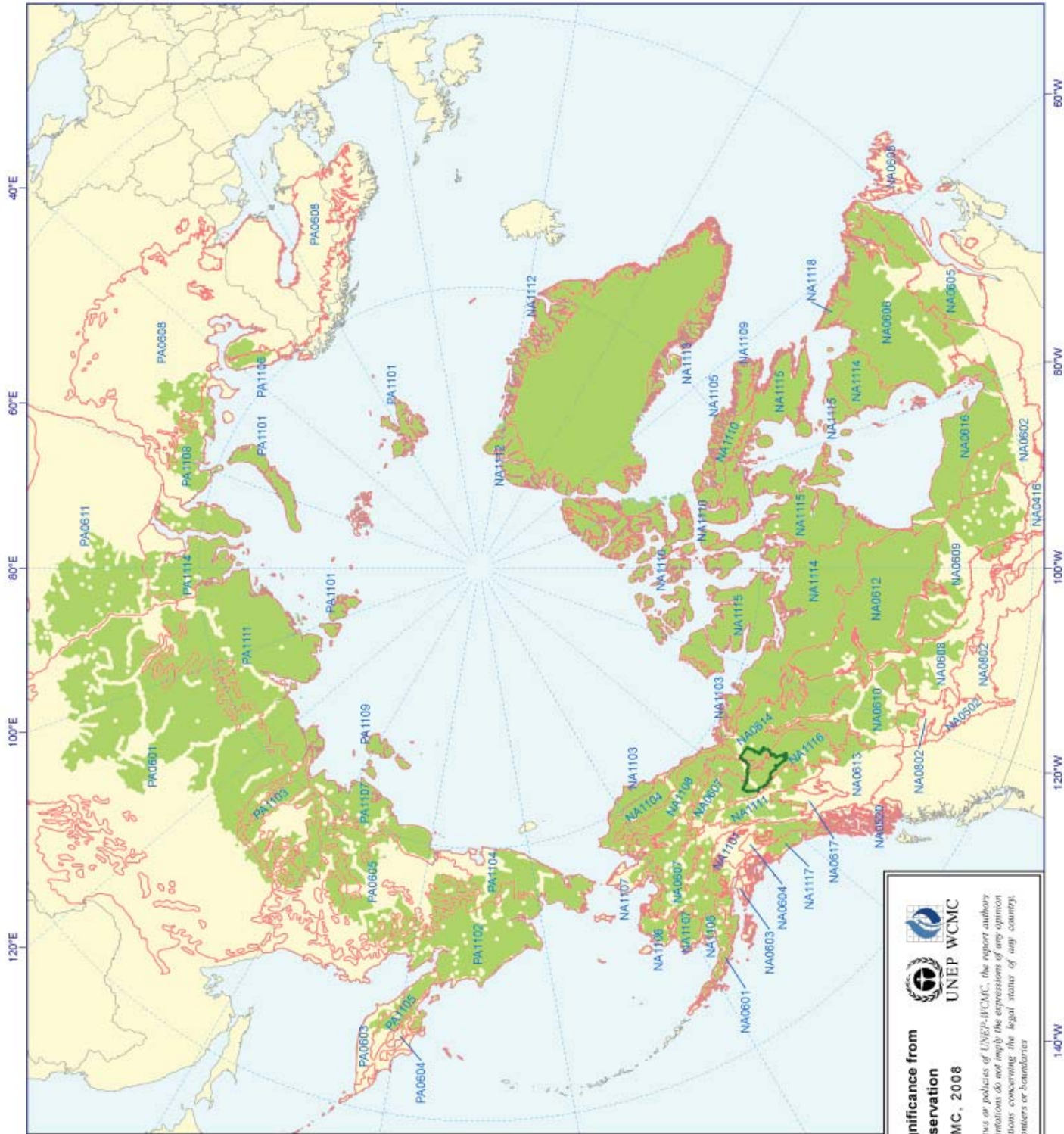
Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP-GRID-Arendal,  
 2001. The 25 largest unfragmented areas in the Arctic.  
 Report to WWF Arctic Programme.  
 Ecoregions: Olson et al. (2001). *Terrestrial Ecoregions  
 of the World: A New Map of Life on Earth*.  
 Projection: Lambert Azimuthal Equal Area



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140°W

120°W

100°W

80°W

60°W

120°E

100°E

80°E

60°E

40°E

**Map 3a**  
**Distribution of IUCN/SSC**  
**Habitats within**  
**Arctic wildernesses**

**Legend**

- 1. Forest (Temperate and boreal needleleaf)
- 2. Forest (Temperate broadleaf and mixed)
- 3. Shrubland
- 4. Grassland
- 5. Wetlands (inland)
- 6. Desert
- 7. Artificial - Terrestrial
- 8. Water (inland)
- 9. Sea
- Peel Watershed

*Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP-GRID-Arendal,  
 2001. The 25 largest unfragmented areas in the Arctic.  
 Report to WWF Arctic Programme.  
 Habitats: USGS Global Land Cover Characteristics  
 Data Base / UNEP-WCMC Habitat GIS, 2004.*

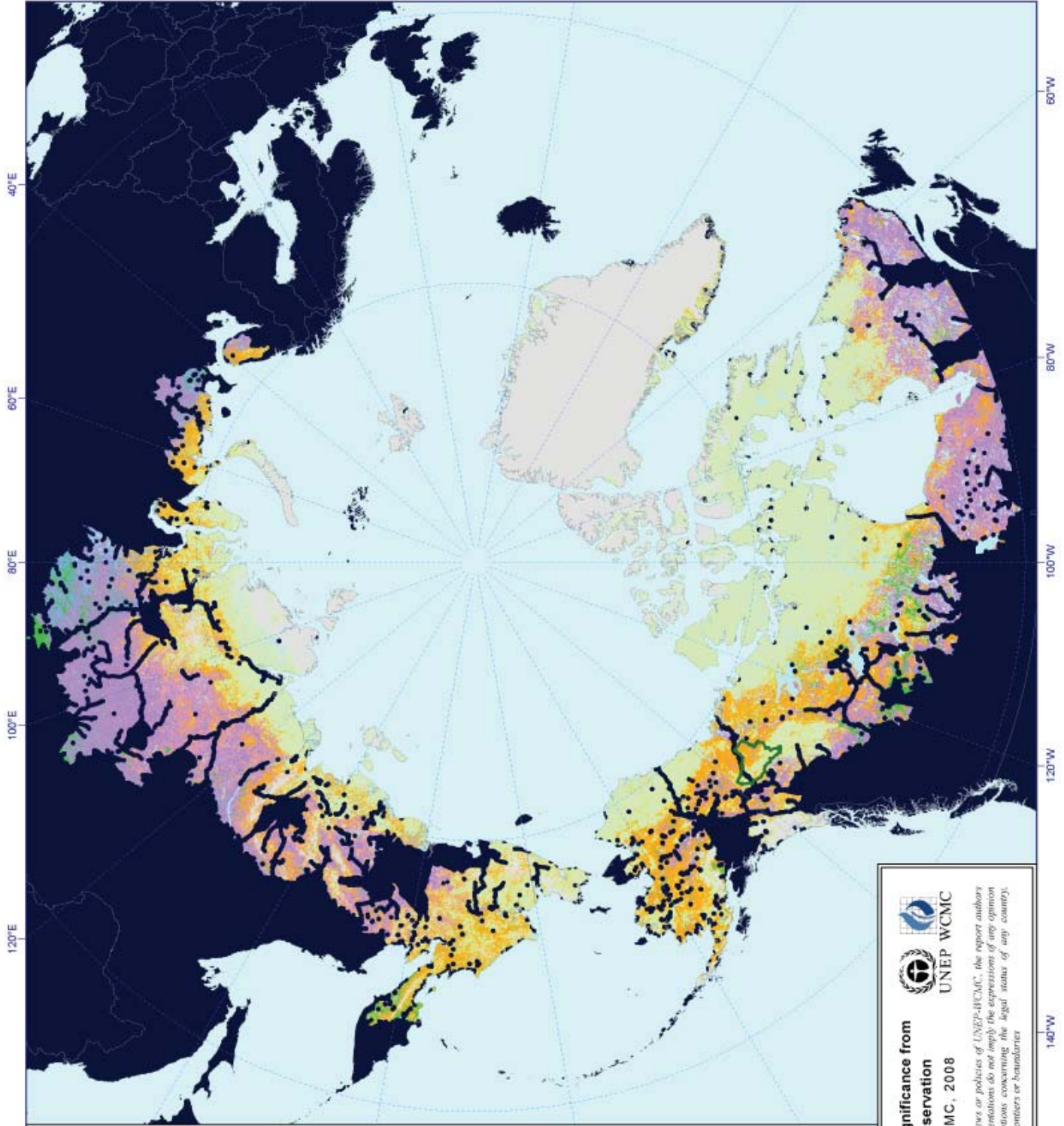
*Projection: Lambert Azimuthal Equal Area*

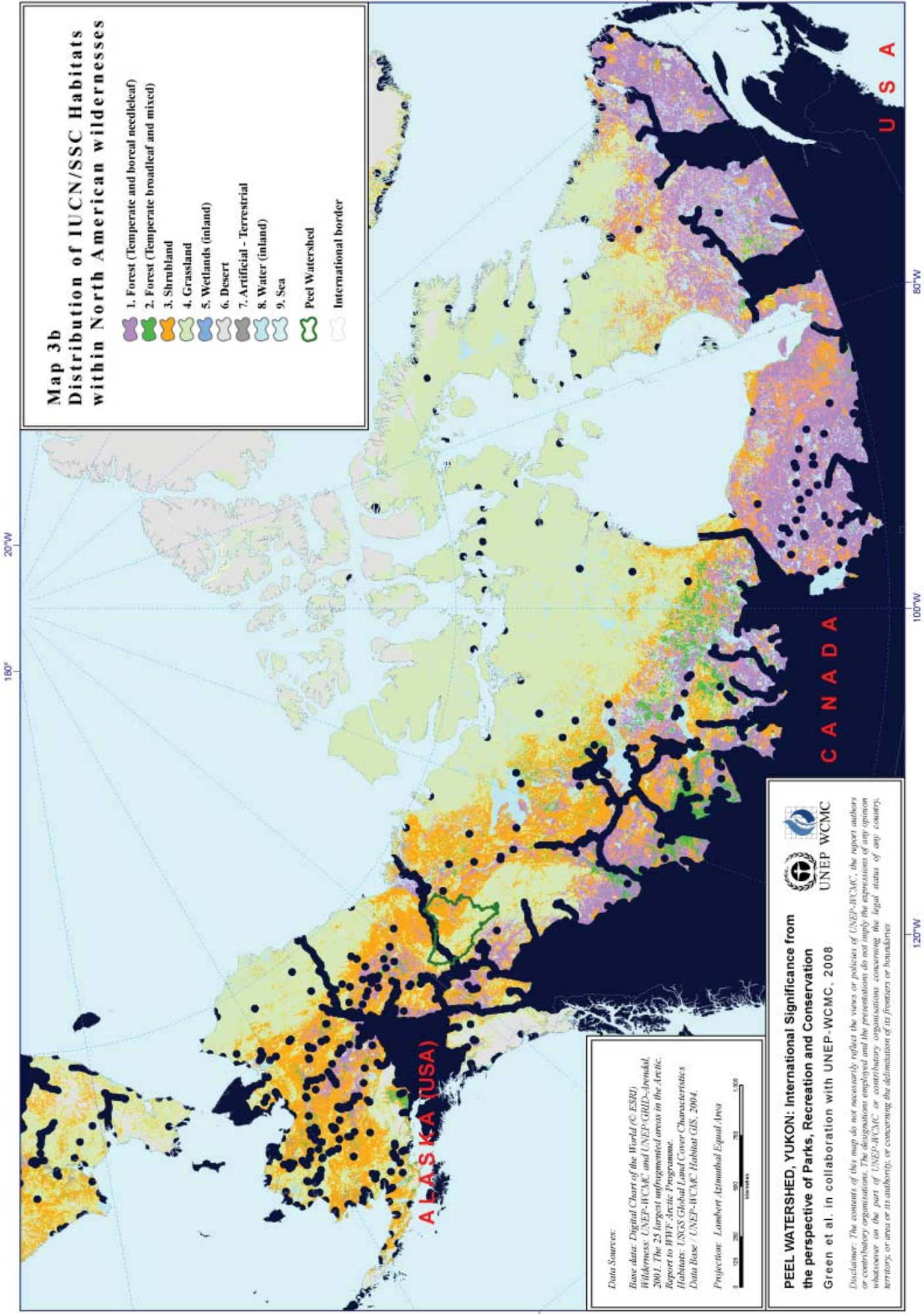


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**Map 3b**  
**Distribution of IUCN/SSC Habitats**  
**within North American wildernesses**

- 1. Forest (Temperate and boreal needleleaf)
- 2. Forest (Temperate broadleaf and mixed)
- 3. Shrubland
- 4. Grassland
- 5. Wetlands (inland)
- 6. Desert
- 7. Artificial - Terrestrial
- 8. Water (inland)
- 9. Sea
- Peel Watershed
- International border

180°W  
 160°W  
 140°W  
 120°W  
 100°W  
 80°W

**ALASKA (USA)**

**CANADA**

**USA**

*Data Sources:*  
 Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP-GRID-Arendal, 2001. The 25 largest unfragmented areas in the Arctic.  
 Report to IITF Arctic Programme.  
 Habitats: USGS Global Land Cover Characteristics Data Base / UNEP-WCMC Habitat GIS, 2004.  
 Projection: Lambert Azimuthal Equal Area



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# Map 4a Distribution of WWF Global 200 Ecoregions within Arctic wildernesses

## Legend

WWF Global 200 Ecoregion:

- Alaskan North Slope coastal tundra
- Canadian Low Arctic tundra
- Canadian boreal taiga
- Central and Eastern Siberian taiga
- Chukhote coastal tundra
- Fenno-Scandia alpine tundra and taiga
- Kamchatka taiga and grasslands
- Muskwa/Slave Lake Boreal Forests
- Pacific temperate rainforests
- Taimyr and Russian coastal tundra

Peel Watershed

Wilderness Area

### Data Sources:

Base data: Digital Chart of the World (© ESRI)  
Wilderness: UNEP-WCMC and UNEP-GRID-Arendal, 2001. The 25 largest unfragmented areas in the Arctic Report to WWF Arctic Programme.  
Ecoregions: Olson et al. (2001). Terrestrial Ecoregions of the World. A New Map of Life on Earth.

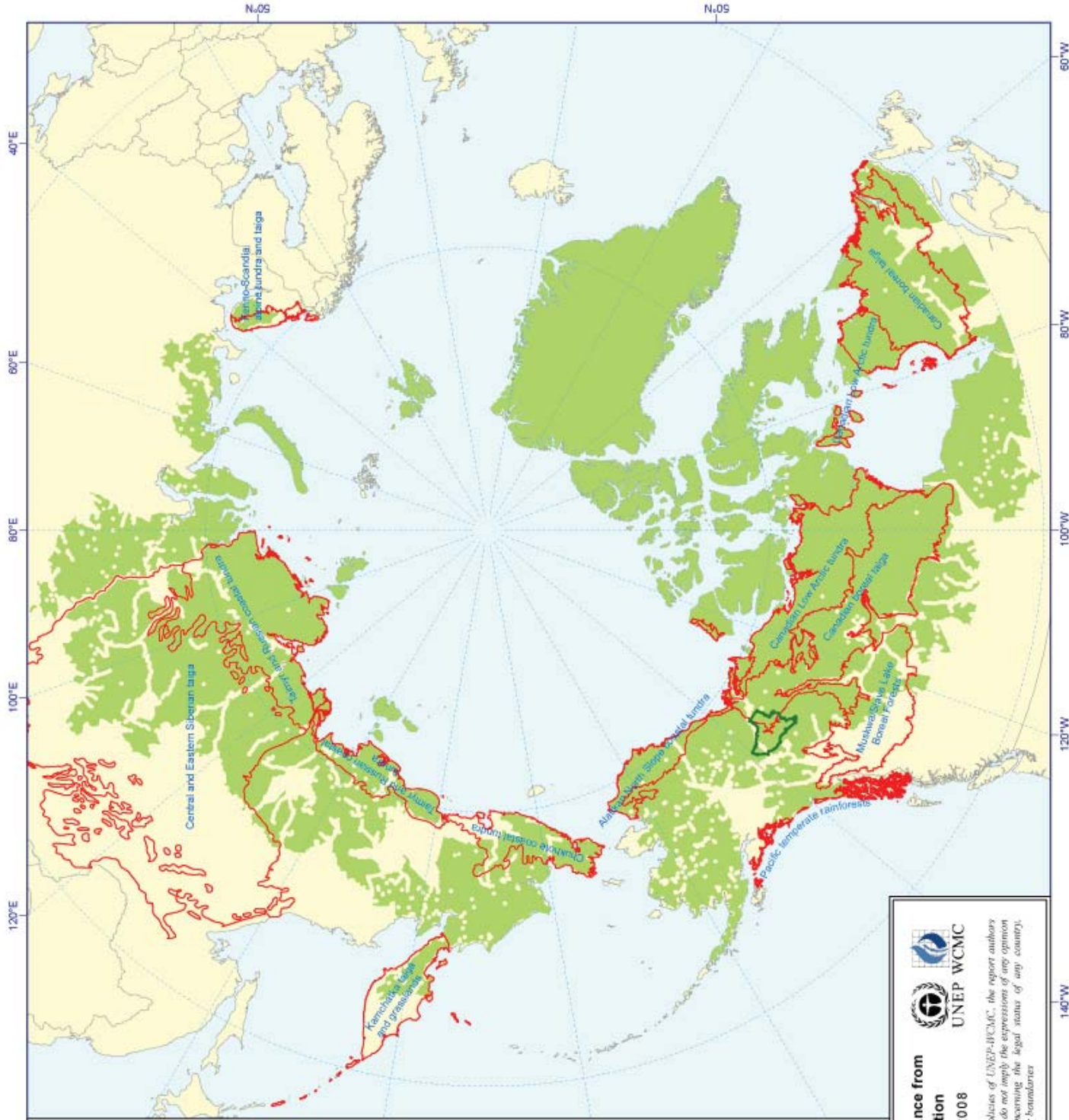
Projection: Lambert Azimuthal Equal Area



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**Map 4b**  
**Distribution of WWF Global 200**  
**Ecoregions within**  
**North American wildernesses**

- Legend**
-  WWF Global 200 Ecoregion:
  -  Alaskan North Slope coastal tundra
  -  Canadian Low Arctic tundra
  -  Canadian boreal taiga
  -  Muskwa/Slave Lake Boreal Forests
  -  Pacific temperate rainforests
  -  Peel Watershed
  -  Wilderness Area

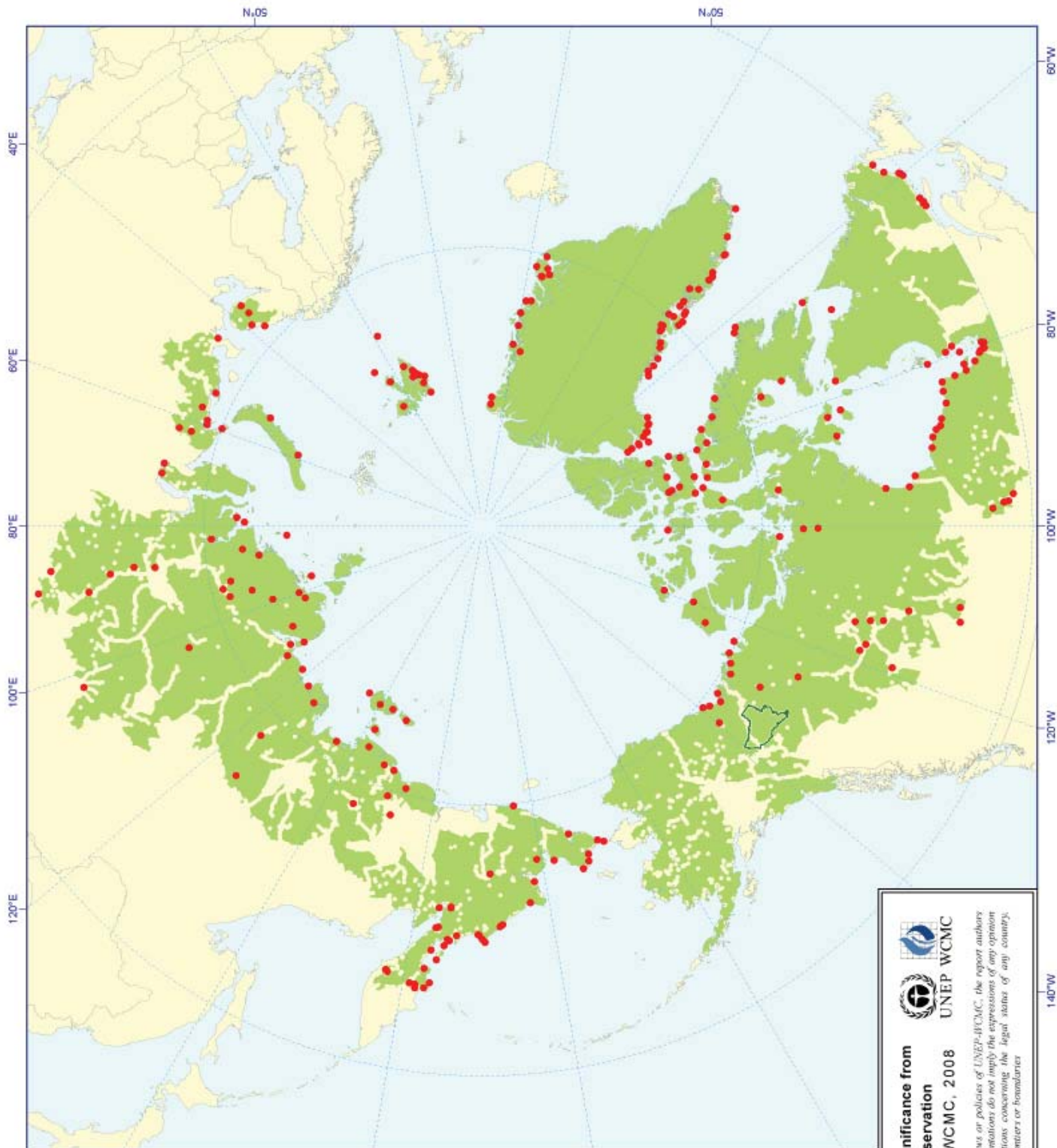


**Data Sources:**  
 Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP-GRID-Iceland, 2001. The 25 largest unfragmented areas in the Arctic. Report to WWF Arctic Programme.  
 Habitats: USGS Global Land Cover Characteristics Data Base / UNEP-WCMC. Habitat GIS, 2004.  
 Projection: Lambert Azimuthal Equal Area

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### Map 6a Distribution of nationally designated protected areas with Arctic wildernesses

**Legend**

- IUCN Category Ia
- IUCN Category Ib
- IUCN Category II
- IUCN Category III-VI
- Peel Watershed
- Wilderness Area

Note: Protected areas are shown only for IUCN Management Categories I-VI. Smaller sites may not be evident at this scale of mapping.

**Data Sources:**

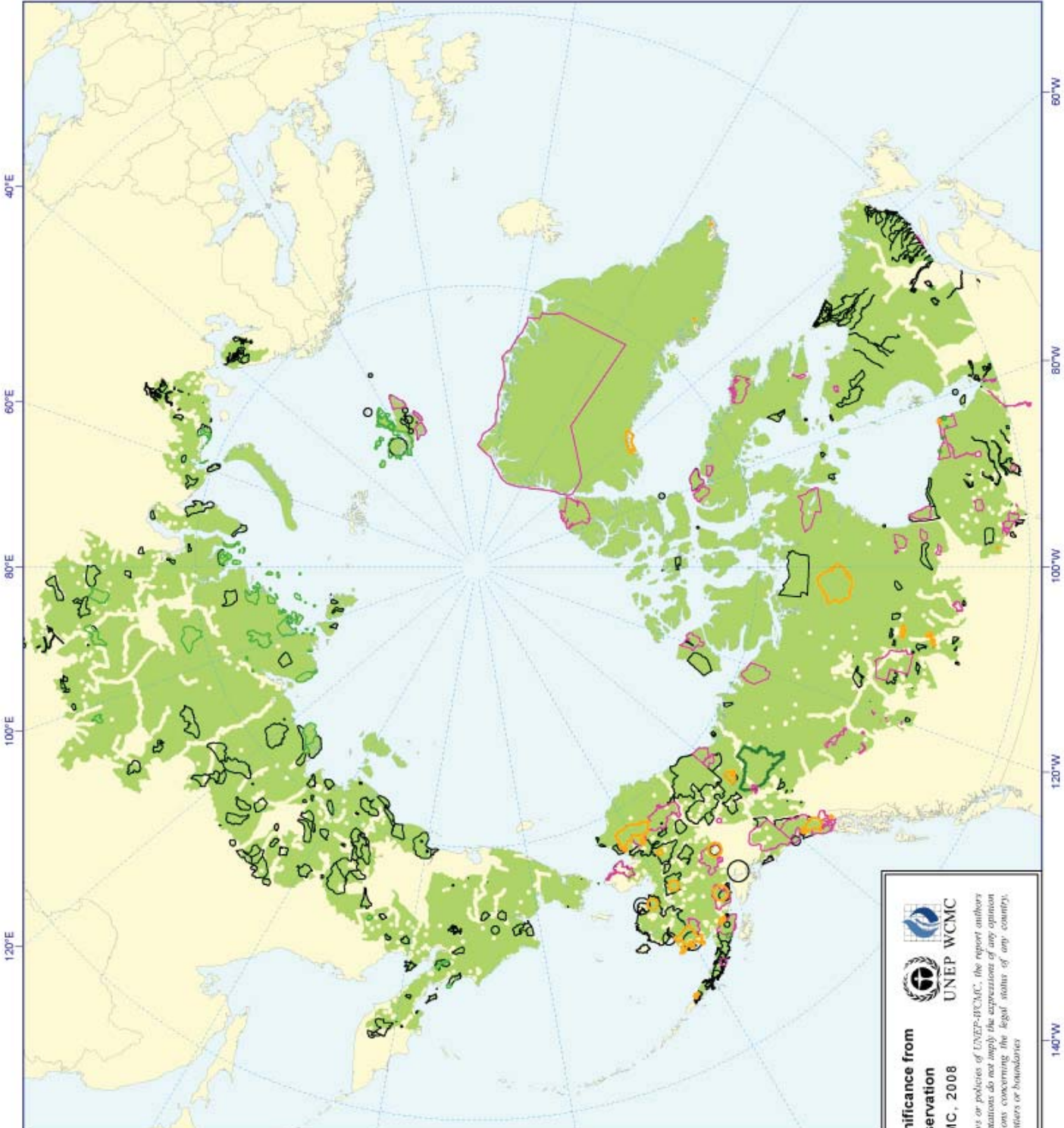
Base data: *Digital Chart of the World* (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP/GRID-Umsdal, 2001, *The 25 largest unfragmented areas in the Arctic. Report to WWF Arctic Programme.*  
 Protected areas: *World Database on Protected Areas* (UNEP-WCMC, 2007)

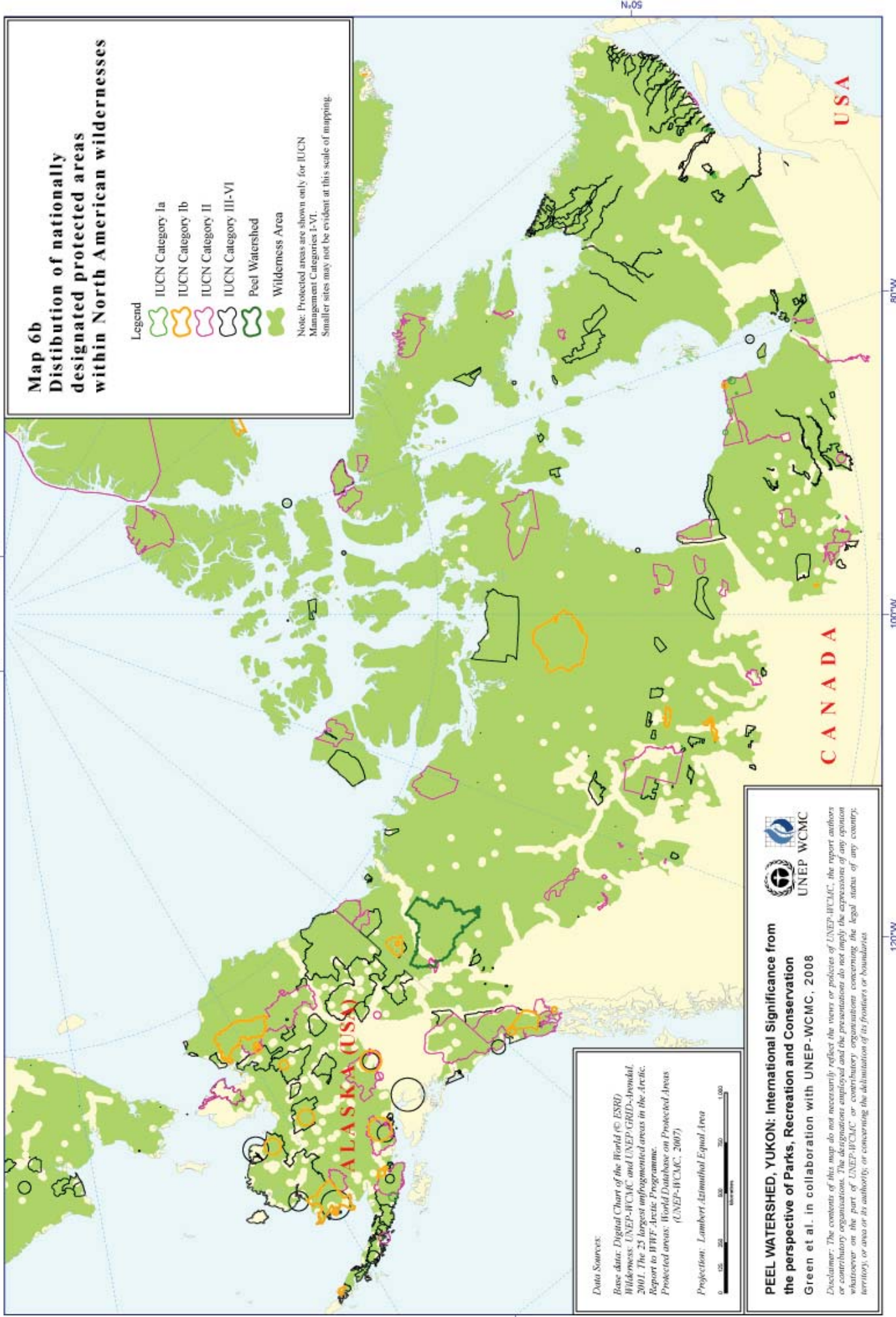
Projection: Lambert Azimuthal Equal Area



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**Map 6b**  
**Distribution of nationally**  
**designated protected areas**  
**within North American wildernesses**

- Legend**
- IUCN Category Ia
  - IUCN Category Ib
  - IUCN Category II
  - IUCN Category III-VI
  - Watershed
  - Wilderness Area

Note: Protected areas are shown only for IUCN Management Categories I-VI. Smaller sites may not be evident at this scale of mapping.

**Data Sources:**  
 Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP GRID-Arendal, 2001. The 25 largest unforgotten areas in the Arctic. Report to WWF Arctic Programme.  
 Protected areas: World Database on Protected Areas (UNEP-WCMC, 2007)

**Projection:** Lambert Azimuthal Equal Area

0 100 200 300 400 500 600 700 800 900 1,000  
 Kilometers

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**UNEP-WCMC**

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180°W 20°W

80°W

100°W

120°W

N.05

N.05

USA

CANADA

ALASKA (USA)


# Map 6c Distribution of internationally designated protected areas within Arctic wildernesses

- Legend**
-  World Heritage site
  -  MAB Biosphere Reserve
  -  Ramsar site
  -  Peel Watershed
  -  Wilderness Area

Note: Small sites may not be evident at this scale of mapping.

*Data Sources:*  
 Base data: Digital Chart of the World (© ESRI)  
 Wilderness: UNEP-WCMC and UNEP-GRID-Arendal, 2001, *The 25 largest unfragmented areas in the Arctic. Report to WWF Arctic Programme.*  
 Protected areas: World Database on Protected Areas (UNEP-WCMC, 2007)

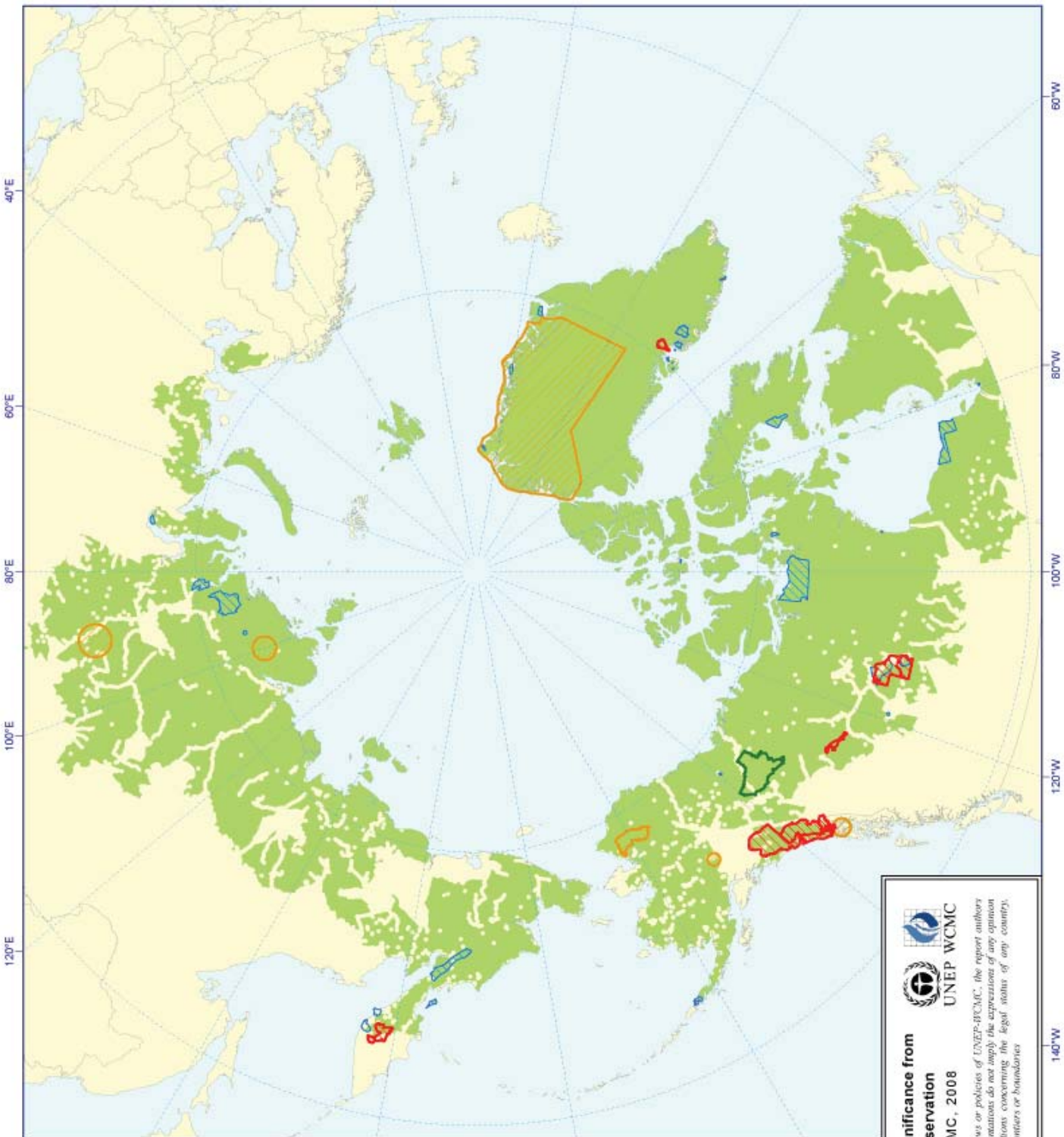
*Projection: Lambert Azimuthal Equal Area*



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**Map 7  
 Peel Watershed:  
 main river basins**

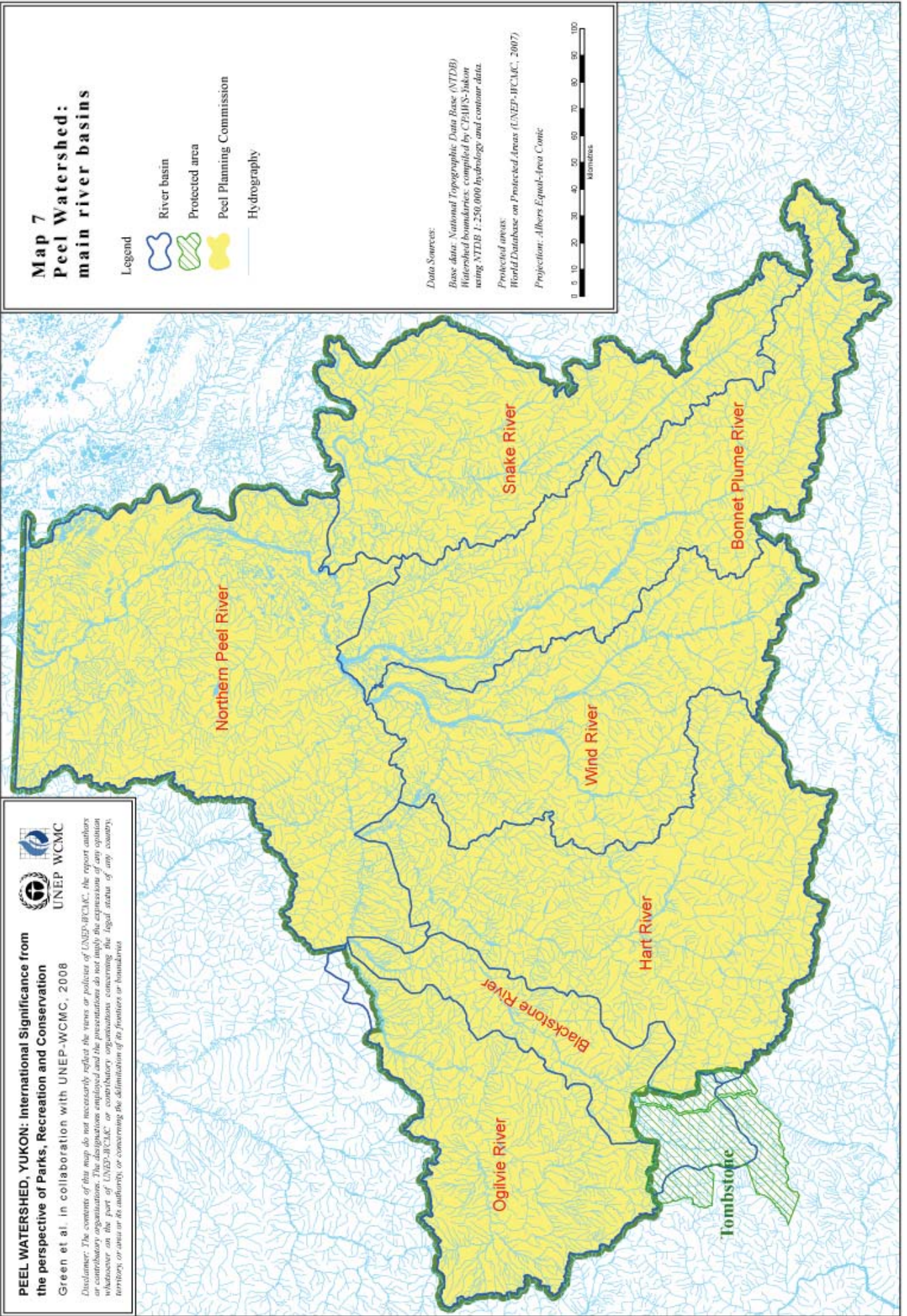
- Legend**
- River basin
  - Protected area
  - Peel Planning Commission
  - Hydrography

**Data Sources:**

Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CHWS-Yukon using NTDB 1:250,000 hydrology and contour data.

Protected areas: World Database on Protected Areas (UNEP-WCMC, 2007)

Projection: Albers Equal-Area Conic



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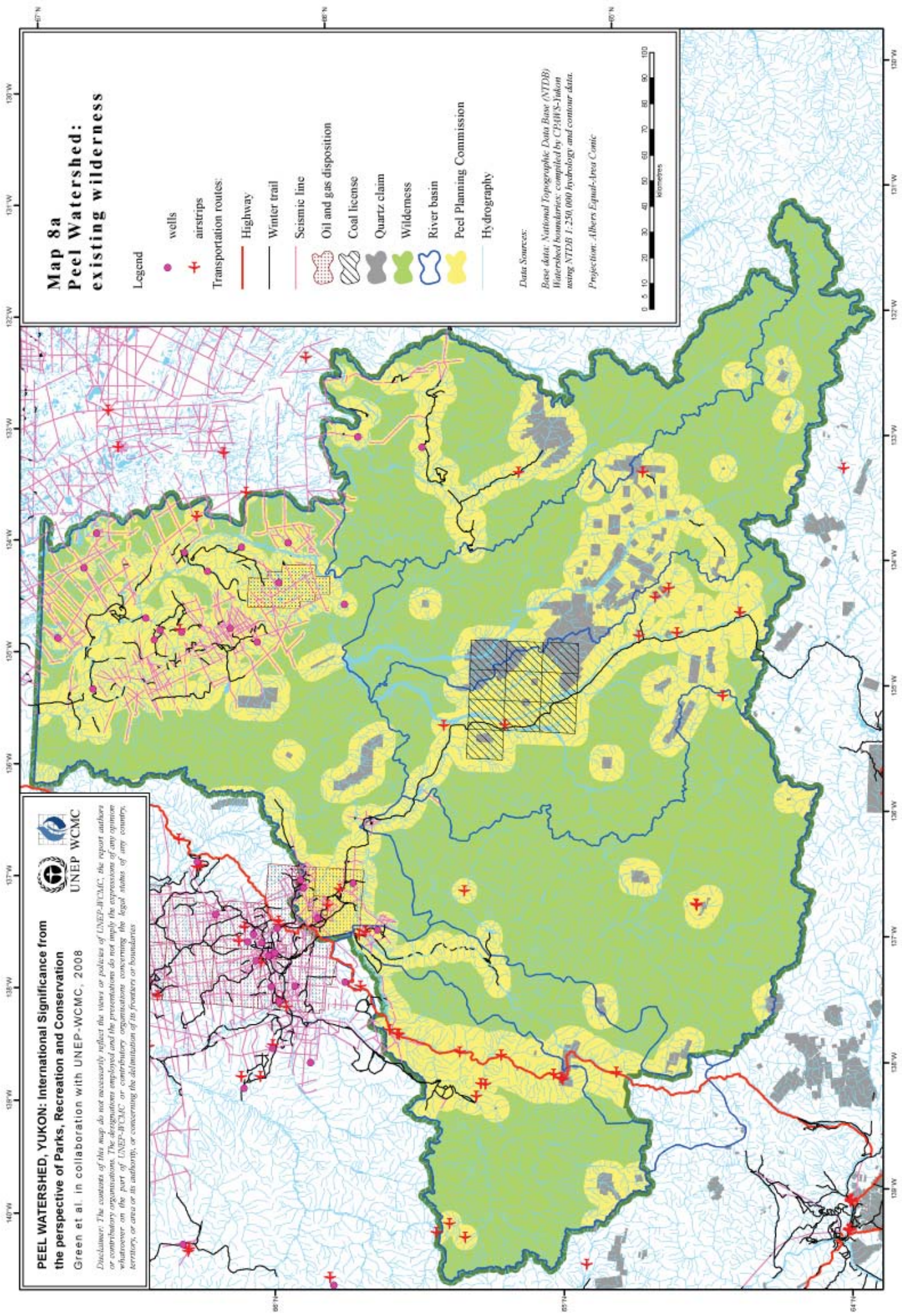


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**Map 8a  
 Peel Watershed:  
 existing wilderness**

- Legend**
- wells
  - + airstrips
  - Transportation routes:
    - Highway
    - Winter trail
    - Seismic line
  - Oil and gas disposition
  - Coal license
  - Quartz claim
  - Wilderness
  - River basin
  - Peel Planning Commission
  - Hydrography

**Data Sources:**  
 Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CHRS-Jakob  
 using NTDB 1:250,000 hydrology and contour data.  
 Projection: Albers Equal-Area Conic



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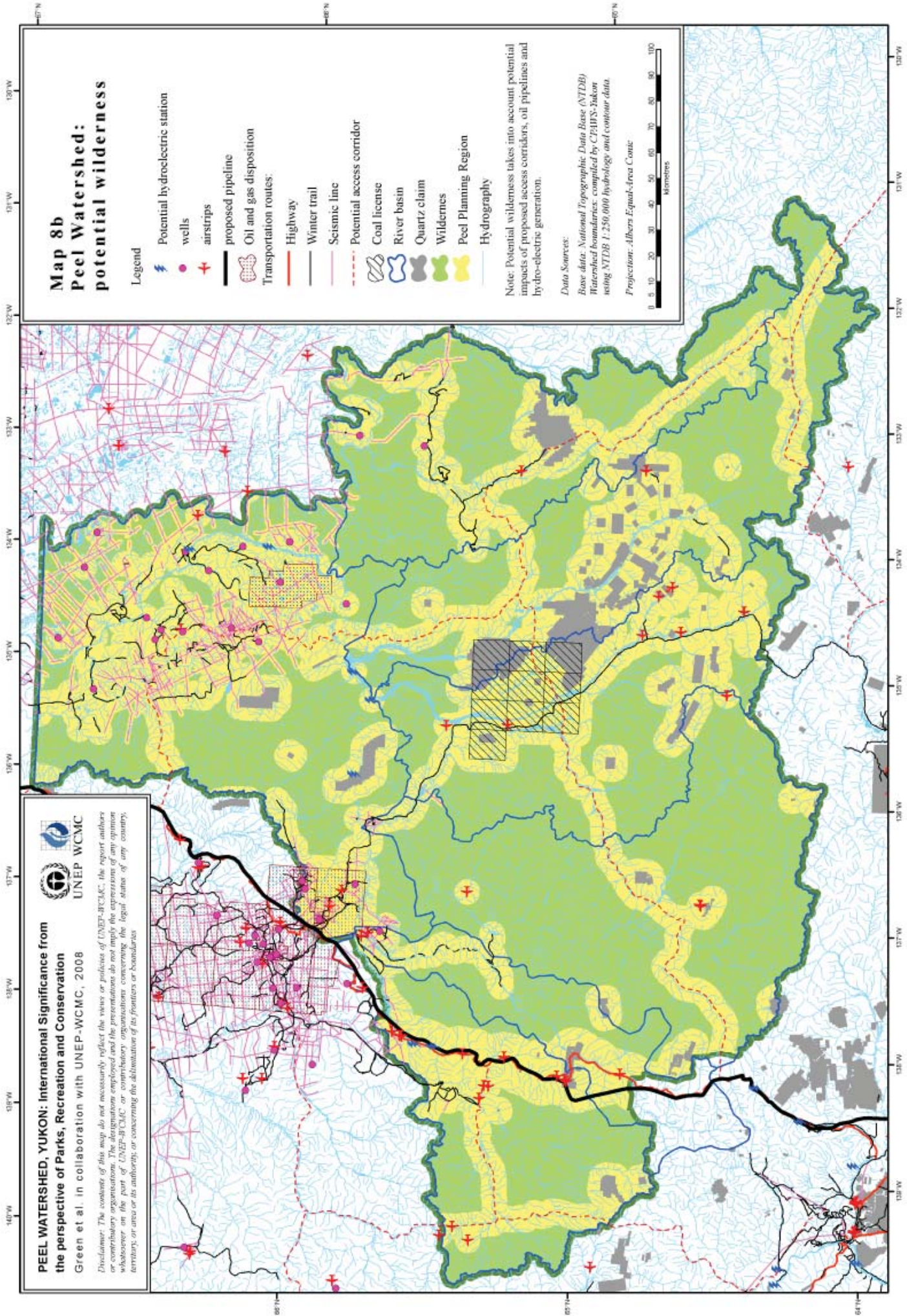
**Map 8b  
 Peel Watershed:  
 potential wilderness**

**Legend**

- Potential hydroelectric station
- wells
- airstrips
- proposed pipeline
- Oil and gas disposition
- Transportation routes:
- Highway
- Winter trail
- Seismic line
- Potential access corridor
- Coal license
- River basin
- Quartz claim
- Wilderness
- Peel Planning Region
- Hydrography

Note: Potential wilderness takes into account potential impacts of proposed access corridors, oil pipelines and hydro-electric generation.

Data Sources:  
 Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CHHS-Yukon using NTDB 1:250,000 hydrology and contour data  
 Projection: Albers Equal-Area Conic



140°W 138°W 136°W 134°W 132°W 130°W 128°W 126°W 124°W 122°W 120°W

65°N 64°N 63°N 62°N

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**Map 9a  
 Peel Watershed:  
 biodiversity features**

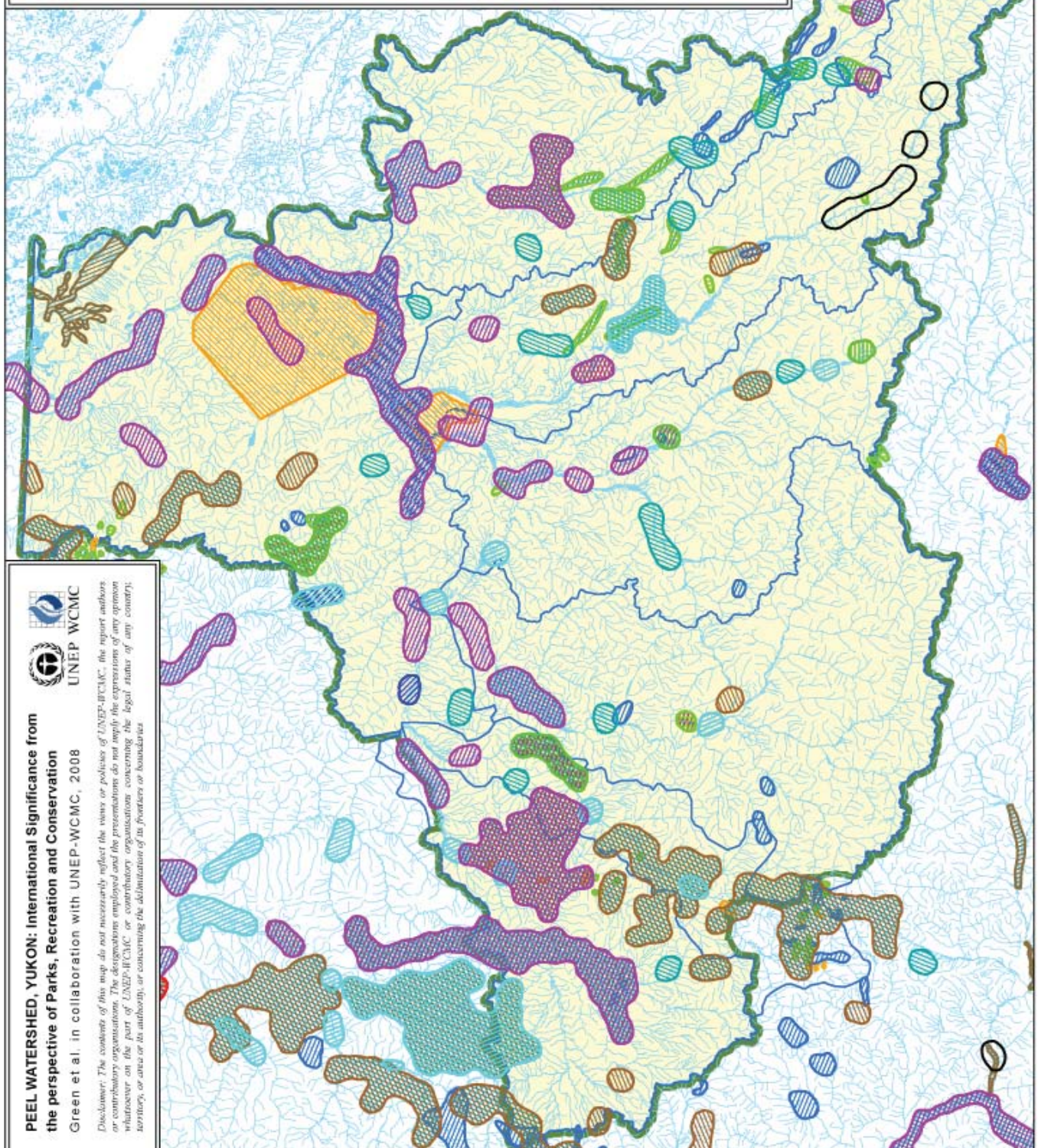
- Rough-legged Hawk (summer nesting)
- Merlin (summer nesting)
- Peregrine Falcon (summer nesting)
- Bald Eagle (summer nesting)
- Osprey (summer nesting)
- Gyrfalcon (summer nesting)
- Golden Eagle (summer nesting)
- Unspecified Raptor (summer nesting)
- Waterfowl (various seasons && functions)
- Sharp-tailed Grouse (all seasons && functions)
- Thinhorn Sheep (spring lambing)
- Thinhorn Sheep (early winter rut)
- Thinhorn Sheep (winter range)
- Thinhorn Sheep (migration corridor)
- Muskrat (all seasons && functions)
- Beaver (all seasons && functions)
- Gull (various seasons && functions)
- Shorebird (various seasons && functions)
- Black Guillemot (summer nesting)

- River Basin
- Peel Planning Region
- Hydrography

Data Sources:

Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CAPRS-Yukon  
 using NTDB 1:250,000 hydrology and contour data

Wildlife: Yukon Department of Environment, 2005  
 Projection: Albers Equal-Area Conic



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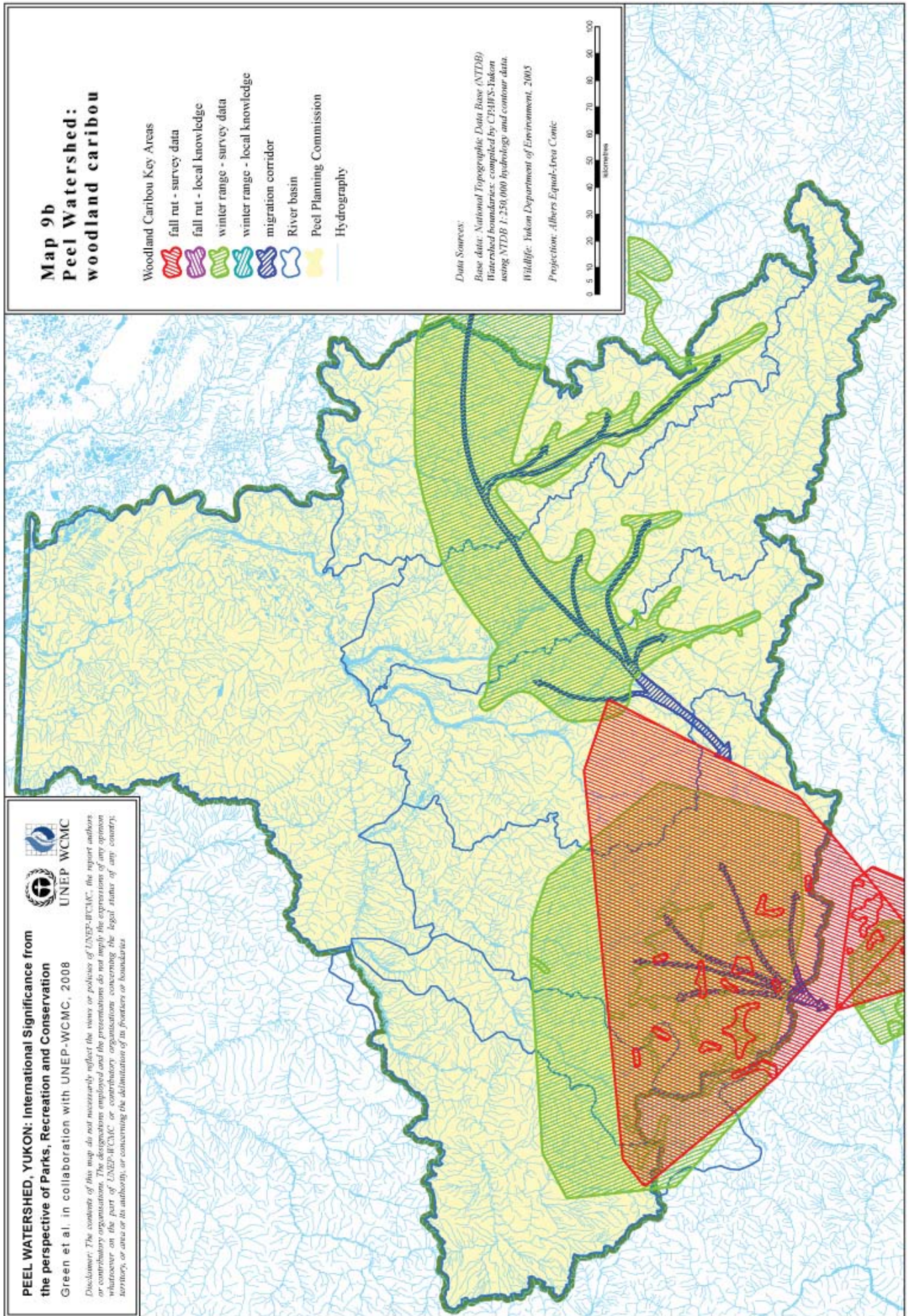


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**Map 9b  
 Peel Watershed:  
 woodland caribou**

- Woodland Caribou Key Areas
- fall rut - survey data
  - fall rut - local knowledge
  - winter range - survey data
  - winter range - local knowledge
  - migration corridor
  - River basin
  - Peel Planning Commission
  - Hydrography

*Data Sources:*  
 Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CHAPS-Yukon using NTDB 1:250,000 hydrology and contour data.  
 Wildlife: Yukon Department of Environment, 2005  
 Projection: Albers Equal-Area Conic



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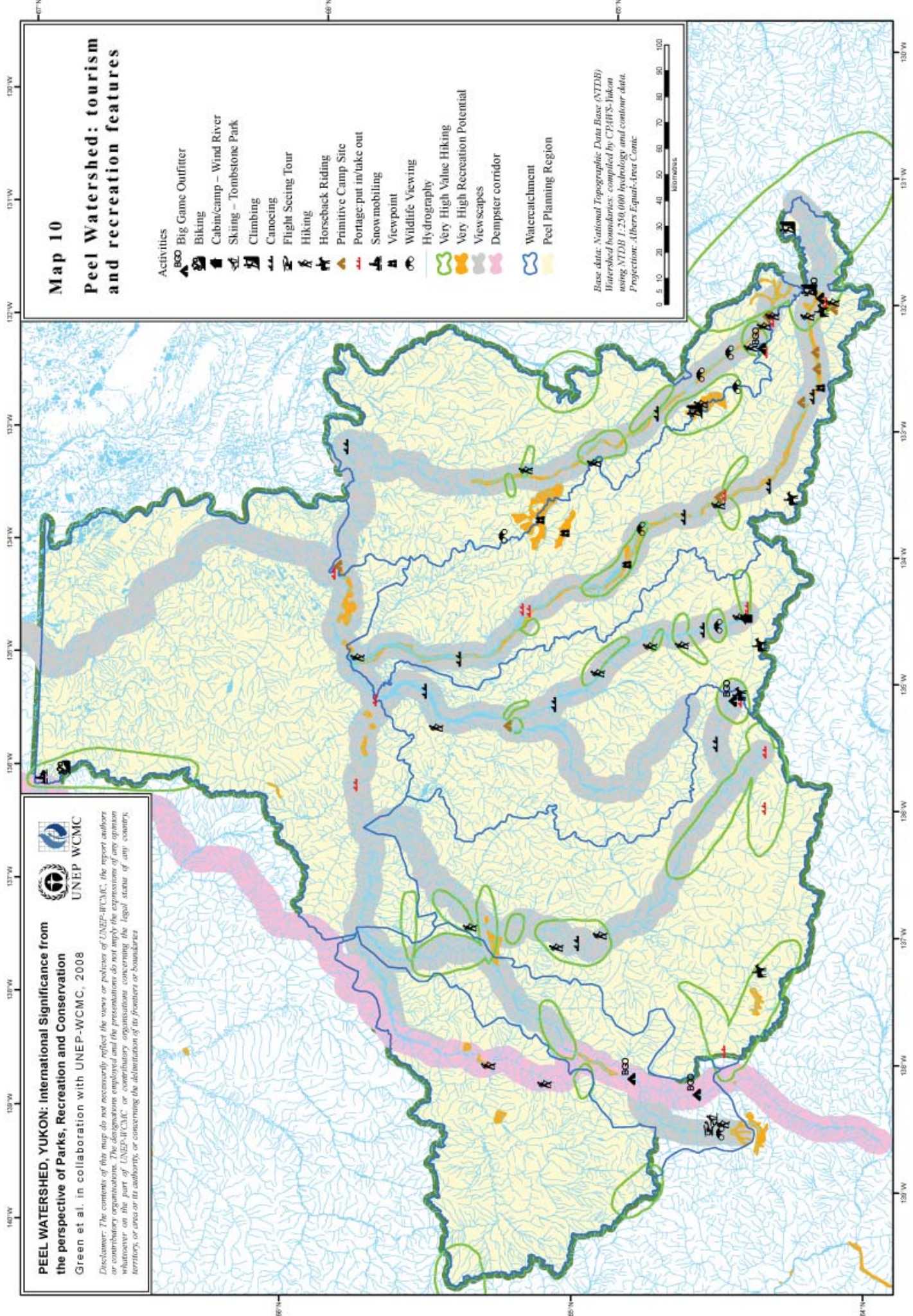
**Map 10**

**Peel Watershed: tourism and recreation features**

**Activities**

- BCO Big Game Outfitter
- Biking
- Cabin/camp - Wind River
- Skiing - Tombstone Park
- Climbing
- Canoeing
- Flight Seeing Tour
- Hiking
- Horseback Riding
- Primitive Camp Site
- Portage-put in/take out
- Snowmobiling
- Viewpoint
- Wildlife Viewing
- Hydrography
- Very High Value Hiking
- Very High Recreation Potential
- Viewscapes
- Dempster corridor
- Waterattachment
- Peel Planning Region

Base data: National Topographic Data Base (NTDB)  
 Watershed boundaries: compiled by CPARS-Yukon  
 using NTDB 1:250,000 hydrology and contour data.  
 Projection: Albers Equal-Area Conic

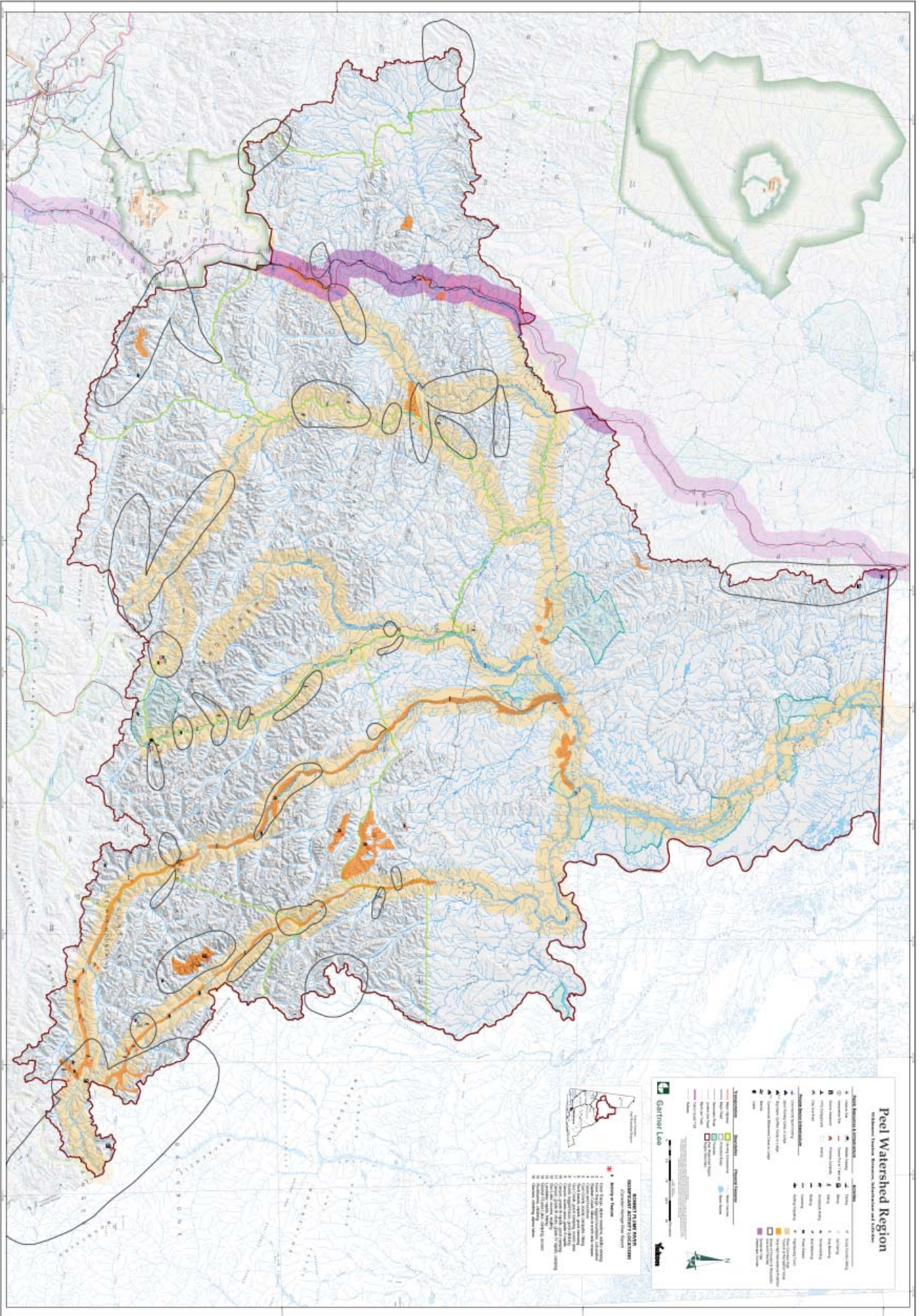


**Explanatory Note**  
**Map 10**

Yukon Parks has worked with Yukon Department of Tourism & Culture in producing the “Peel Watershed Tourism and Recreation Report”

The Wilderness Tourism Resources, Infrastructure and Activities map associated with that report was unavailable to the Peel Significance Report consultant and is now appended here

Yukon Parks  
March 31, 2008



### Peel Watershed Region

Map prepared by the Peel Watershed Board of Directors

- LAND USE AND MANAGEMENT**
- 1. Forest
  - 2. Pasture
  - 3. Agriculture
  - 4. Residential
  - 5. Commercial
  - 6. Industrial
  - 7. Open Space
  - 8. Wetlands
  - 9. Riparian
  - 10. Wetland
  - 11. Wetland
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  - 49. Wetland
  - 50. Wetland

**SCHEMATIC OF PEEL WATERSHED**

1. Peel Watershed Boundary

2. Peel River

3. Peel River Tributaries

4. Peel River Confluence

5. Peel River Mouth

6. Peel River Delta

7. Peel River Estuary

8. Peel River Bay

9. Peel River Inlet

10. Peel River Outlet

11. Peel River Channel

12. Peel River Bank

13. Peel River Floodplain

14. Peel River Wetland

15. Peel River Riparian

16. Peel River Wetland

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Gartner Lab

