Conservation Plan for the Peel Watershed

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For many Canadians, the North is part of the imagined body. It's an extension of the self, not the rational self but the self that feels. When the North is damaged and we hear about it, we hurt. The twenty-first century will tell us--once and for all, I suspect--how much of ourselves we're prepared to destroy. – Margaret Atwood

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Preamble – Why Protected Areas?

CPAWS focuses on protected areas and wildland conservation for four main reasons.

1. We think that protected areas are the single most important and effective conservation tool. This is also the consensus of conservation biologists.[1] *In situ* conservation of viable populations in natural ecosystems is widely recognized as a fundamental requirement for the maintenance of biological diversity.[2]
2. There is unfortunately scant evidence that resource management agencies—of all forms of government and however well intentioned—have effectively managed natural systems sustainably, for long-term integrity, health, resilience. Especially when the managers are under tremendous political, economic and social pressure to liquidate natural capital, to maximize net present value. We do not forsake resource management rather we strive to improve it, remaining mindful of its inherent flaws[3] and of the lessons of history.[4]
3. Wilderness, or traditional homeland as it is viewed by many aboriginal peoples, is an integral part of the North and of our Canadian identity; it has intrinsic value as well as spiritual, cultural, heritage, aesthetic, recreational and economic values, values that can only increase with time.
4. In much of Canada, especially in the North, it is still possible to realize a meaningful conservation vision that includes an interconnected system of protected areas. But the clock is ticking and it's later than many people realize.

CPAWS Goals for the Peel Watershed

1) Protect and conserve the globally important boreal wilderness of the Three Rivers and maintain the ecological integrity of the greater Peel watershed.
2) Create a conservation legacy that will help develop and sustain community health, vitality, and economy.

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[1] Rodrigues, A.S.L. and others. 2004. Global gap analysis: priority regions for expanding the global protected-area network. BioScience 54: 1092-1100.

[2] Convention on Biological Diversity. 1992. Preamble to the Convention on Biological Diversity. http://www.biodiv.org/convention/articles.asp

[3] Holling, C.S. and G.K. Meffe. 1996. Command and control and the pathology of natural resource management. Conservation Biology 10: 328-337.

[4] Ludwig, D., R. Hilborn, and C. Walters. 1993. Uncertainty, resource exploitation, and conservation: lessons from history. Science 260: 17, 36.

Who Shares Similar Goals?

Canadian Boreal Initiative

As we declared to the Peel Watershed Planning Commission, CPAWS is a signatory to the Boreal Forest Conservation Framework (visit www.borealcanada.org). Other signatories of interest to Northerners are the **Dehcho First Nation** and the **Innu Nation** and conservation organizations including **Ducks Unlimited Canada** and **World Wildlife Fund**. Guided by the principles of conservation science, Framework signatories work to "*conserve the natural, cultural, and sustainable economic values of the entire Canadian boreal region"* and aim to:

- protect at least 50% of the region in a comprehensive network of large protected areas, and
- support sustainable communities, world-leading ecosystem-based resource management practices and state-of-the-art stewardship practices in the remaining landscape.

Yellowstone to Yukon Conservation Initiative

The Yellowstone to Yukon Conservation Initiative (Y2Y) is one of the most established and widespread conservation collaborations in the world (visit http://www.y2y.net/). Y2Y is an alliance of organizations and individuals working together to maintain and restore the ecological health of the region between Yellowstone National Park and the northern Yukon. CPAWS helped found Y2Y in 1993 and continues to support it by promoting the shared vision (a day when "all natural and human communities in the Yellowstone to Yukon region co-exist in a healthy mountain ecosystem of clean air and water, abiding beauty, and abundant wildlife and wilderness") and by setting our work in the region in the context of the Initiative.

CPAWS focusses its efforts on delivering conservation outcomes in key areas of the Y2Y region. The Peel watershed is one of those key areas, highlighted as one of 17 Critical Cores & Corridors in the region, and one that presents some of the greatest conservation opportunities.

Existing Commitments

Today, Canada and all provincial and territorial jurisdictions are still committed by formal agreement to complete a network of protected areas, although some including the current Yukon government try to ignore this. The purpose of a network of Yukon protected areas is to:

- Protect wildlife and fish, and the habitat they depend upon; protect wilderness areas and wetlands; protect representative examples of our natural regions; and, conserve the variety of life, known as biodiversity;
- Protect places and landscapes of cultural, spiritual, historical and aesthetic importance;
- Provide direct long term economic and social benefits to communities, First Nations, and the territory as a whole; and, in turn foster a diverse and robust Yukon economy;

- Provide protection and conservation of ecological services such as clean water and country foods, which in turn support our Yukon way of life.

Our responsibility and opportunity to complete a network of protected areas are based on:

- **Umbrella Final Agreement** (1992) and all First Nation Final Agreements;
- **International Convention on Biodiversity** (1992) & and the Canadian Biodiversity Strategy that stipulate completing a protected areas network;
- **Tri-Council Commitment on Protected Areas** (1992), where federal, provincial and territorial Ministers agreed to complete a representative network of protected areas across Canada;
- **Yukon Protected Areas Strategy** (1998) – shelved but not forgotten;
- **North American Waterfowl Management Plan** (1986; plus Yukon Plan, 1991);
- **Whitehorse Mining Initiative** (1994), where governments, NGOs and the mining industry agreed to the legitimacy and importance of a network of representative protected areas free of industrial development.

CPAWS Objectives for the Peel Watershed

1) Conservation-oriented land use plan for entire Peel watershed, including a network of formal protected areas linked to a mosaic of conservation lands.
2) Establishment of a core 30,000-km^2 protected area encompassing the entire Three Rivers watersheds (Wind, Snake, Bonnet Plume) plus special conservation zones elsewhere in the Greater Peel ecosystem, to protect critical wetlands, sensitive river corridors, a portion of the southern Richardson Mountains, and other important biological and cultural features.
3) A Biosphere Reserve, based on cooperative management and using existing mechanisms outlined in Final Agreements, for the entire Peel River watershed.

Why is the Peel Important?

The Peel watershed is the ultimate mountain boreal landscape, a vast, largely intact, wild northern ecosystem. The Peel region is a spacious (14% of the Yukon) land of clean rivers, boreal forests, subarctic plateaus, and shining mountains. The area lies at a key biogeographic crossroad, where the apex of the Yellowstone to Yukon (Y2Y) cordilleran axis intersects the transcontinental swath of the boreal forest. Beringian species that escaped past glaciations and seasonal pulses of birds along transcontinental flyways add to the mix, enhancing the diversity of the magnificent landscapes.

Natural and Cultural Context

Big wild rivers still flow free and clean and support healthy fish populations. Full guilds of prey and predators roam freely, from productive riparian zones to alpine ridges. An intact, large-mammal predator-prey system, enhanced by the topographic and habitat diversity of the mountain boreal landscapes, persists and is globally significant. Mammal species include wolf, grizzly bear, wolverine and caribou—all of which require big wilderness to survive and thrive—as well as black bear, lynx, moose and thinhorn sheep. There are significant populations of raptors, including golden eagle, gyrfalcon, merlin,

and the threatened anatum peregrine falcon, which with their bird and small mammal prey constitute another significant predator-prey system. Myriad migratory songbirds and waterbirds rely on the boreal forests and wetlands annually. Key wetland systems, breeding and staging areas enrich the watershed's tapestry of life.

The Peel lies mainly in the traditional territories of the First Nation of Nacho Nyak Dun and Tetl'it Gwich'in First Nation; for generations they were sustained by the plants, fish and wildlife of the region as they traversed the valleys and mountains on a network of travel and trade routes. Fishing, hunting and trapping are still mainstays of the way of life in the region. Moreover local people and visitors from around the world value the watershed as a premiere destination for canoeing, backcountry travel, photography and natural history, cultural activities and research. Today the Peel watershed also serves as a vital benchmark of wild nature; ecological processes continue to play out freely, predators and prey roam across the landscape, the free-flowing rivers slide down to the Mackenzie.

Wilderness, or traditional homeland as it is viewed by many aboriginal peoples, is an integral part of the North and of the Yukon and Canadian identity. Wild lands and waters have intrinsic and spiritual value now and for the future. Conservation provides lasting community and economic benefits, supporting traditional land uses such as harvesting food, medicines and structural materials, and sustaining cultures and local ways of life.

In many areas of North America, restoration of ecosystems and watersheds is the focus of much conservation effort. In the Peel the systems are largely or wholly intact. The wild rivers are unfettered but they are also unprotected (even the Bonnet Plume's Canadian Heritage River designation does not protect it). The Peel watershed, like much of Canada's North, is vulnerable to the continental hunger for energy and development. There are development schemes for oil and natural gas, pipelines, coal, coalbed methane, and iron ore smelting, as well dreams of building roads and railways to extract iron ore, copper, and other metals from the currently inaccessible mountains. The Yukon is also entrained in climate change—already manifesting itself in the Peel as elsewhere in northern Canada—a 'wild card' that will have dramatic consequences for this subarctic watershed and its organisms and ecosystems.

Stewardship Responsibility

We can achieve in the Yukon what has eluded us elsewhere in Canada—to live on the land and draw from its resources while assuring the entire living community remains whole and healthy. As the tide of industrial development surges north, as climate change takes hold, as wildlands and mountain rivers become increasingly rare in North America and around the world, we have a profound responsibility to bequeath some wonderful natural places to future generations.

Ecological Considerations and Attributes

Stepping back and taking a broad, continental view, the Yukon has some nationally and internationally significant ecological attributes. The Peel watershed makes a major contribution to these overarching conservation assets.

- Intact large watersheds with pristine water quality and aquatic habitat (intact freshwater aquatic habitats are one of the rarest class of ecosystems in the world)
- Intact large-mammal predator-prey system in a mountain boreal wilderness
- Continentally important populations of grizzly bear, Dall's sheep, woodland caribou, grey wolf, and wolverine
- Refuge for large carnivores such as wolves, grizzly bears, lynx, wolverine, species that require large wilderness to survive
- 23 woodland caribou herds, including 3 large herds free of disturbance—the largest of which, the Bonnet Plume herd, ranges mostly within the Three Rivers core area
- Major North American flyways with important wetland staging and breeding areas for waterfowl; one of these flyways crosses west from the Mackenzie valley into the upper Peel and beyond
- Continentally important populations of migratory species, including peregrine falcon, trumpeter swan, and many songbirds
- Endemic races/populations of fish, resulting from complex glacial history
- Beringian landscapes with endemic species and unique ecological conditions
- Vast intact wilderness areas encompassing entire mountain ranges and large watersheds of wild rivers.

These "big" continental themes and additional regional environmental features are best addressed in coarse-filter analysis.

Coarse Filter/Fine Filter

Conservation biologists propose that by protecting a representative array of *ecosystems*, the majority of *species* (most of which we know little or nothing about) and their *genetic diversity* will be protected as well.[5,6] This is termed the coarse-filter[7] approach to conserving biodiversity. However, some species will fall through the pores of the coarse filter, because of specialized habitat requirements, or because they are rare, endangered, harvested for food, over-exploited, or otherwise of particular interest to managers. These species will require individual attention and management—the fine-filter approach. Effective conservation requires a combination of the two approaches.

More recently, conservation biologists have recommended that planners should consider three general types of conservation targets: 1) abiotic or physical environment units, 2) communities and ecosystems, and 3) species.[8] We choose to retain the coarse-filter/fine-filter metaphor and distinction, and address the three types of targets in each approach.

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[5] Noss, R.F. 1987. From plant communities to landscapes in conservation inventories: A look at the Nature Conservancy (USA). Biological Conservation 41: 11-37.

[6] Franklin, J.F. 1993. Preserving biodiversity: Species, ecosystems or landscapes? Ecological Applications 3: 202-205.

[7] Hunter, M.L., Jr. 1992. Coping with ignorance: The coarse-filter strategy for maintaining biodiversity. Pages 266-281 *in* K. Kohm, ed. Balancing on the edge of extinction. Island Press, Washington, DC. 315 p.

[8] Groves, C.R. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. Island Press, Washington, DC. 455 p.

Coarse Filter

1) Abiotic units

A coarse-filter strategy (based on biophysical representation) is required and logically should be considered first. The rationale for a coarse filter includes a) our very incomplete knowledge of the biota (the myriad species that live in an area) and thus the need for surrogates of biodiversity, and b) an acknowledgement of the impermanence of the living component of ecosystems—especially in times of rapid environmental change. Moreover in many parts of northern Canada, including the Peel watershed, there are no **detailed** classifications or maps of vegetation or ecosystems, nor will there be anytime soon. But there is digital information on physical variables such as elevation, topography, terrain, substrate. These data can be overlain and combined into land systems (areas with recurring patterns of landform, vegetation cover, soils, hydrology), which can be used as proxies for ecosystems and as conservation targets.

Hence, given the incompleteness of biological knowledge and the reality of climate change, CPAWS, WWF and others have concluded that we must place more emphasis in conservation planning on the better known (or at least more readily accessible), less changeable components of ecosystems: physical landscape, geology, landforms, soils. Particularly germane here are Stan Rowe's thoughts on "biogeo-ecosystems": Real structured *volumetric systems* occupying relatively fixed earth spaces. Layered site-specific systems—a lake, a wetland, a particular landform-based forest—**into and out of which mobile organisms come and go**.[9]

Representation of the physical "enduring features" is especially important in the context of climate change. If we set aside today 5,000 ha of boreal forest, in 20 or 50 years it will not have the same mix of plant and animal species nor will it support the same ecosystems as it does now; indeed it may no longer be forested. But the physical landscape will persist; topography, bedrock geology and landforms will not change (barring mass movements), and soils will change relatively slowly. The physical landscape is the template for ecosystems, it is the stage upon which the drama of climate change will play out. The CPAWS science workshop report[10] and the YTG report[11] on natural values criteria for protected areas planning provide a good background and approach.

2) Communities and ecosystems

Terrestrial community types or ecosystems are usually defined based on vegetation, and can be used as conservation targets only if a hierarchical classification of vegetation or ecosystems exists and if units of the classification can be mapped. This is not the case for

[9] Rowe, J.S & B.V. Barnes. 1994. Geo-ecosystems and bio-ecosystems. Bull. Ecol. Soc. America 75: 40-41.

[10] Canadian Parks & Wilderness Society-Yukon Chapter. 2005. Towards a Yukon conservation strategy. Workshop report: Scientific basis of a conservation strategy for the Yukon. 11-12 Feb., 2005, Whitehorse, Yukon. 43 p.

[11] Yukon Parks Branch. 2003. Natural values criteria for the identification of core protected areas in the Yukon, version 2.0. Yukon Parks Branch, Department of the Environment, Yukon Government, Whitehorse, Yukon. 35 p.

the Peel watershed, at best there are coarse physiognomic vegetation units (e.g., open forest, shrubland, grassland) that can be distinguished using remote sensing. Vegetation is also very sensitive to climate change, thus present-day vegetation is not a reliable indicator of future ecosystems. Nonetheless physiognomic vegetation units can be combined with physical features to come up with landscape units as surrogates for ecosystems and as combinations with some predictive value for future site conditions. For example, riparian tall shrub thickets will probably continue to be productive ecosystems/landscape units in a changing or different climate (unless the stream dries up), but they could become riparian forests or grassy meadows.

We would add another consideration. Conservation targets should also include ecosystems, like peatlands on the Peel Plateau, that sequester lots of carbon. Maintaining such ecosystems could be globally significant in reducing emissions of carbon dioxide and methane from standing biomass and decomposing organic matter, thus reducing the feedback mechanism that enhances the greenhouse effect and accelerates global warming.

3) Species

Species targets in a coarse-filter strategy should include what have been termed in the literature flagship, umbrella, keystone, indicator, and focal species. To simplify, we can call all such targets focal species,[12] which most commonly are those few whose direct conservation is most likely to indirectly confer protection to numerous co-occurring species.[13] Such focal species, which ideally are habitat generalists with large home ranges (like top carnivores), can serve as surrogates or umbrellas[14] for many other species that have smaller space or more specialized habitat requirements. Planners can also select focal species because they are sensitive to environmental change or industrial impacts, or are of particular management interest. Table 1 suggests some focal species for the Peel watershed; others could be added.

Table 1. Some focal species for the Peel watershed.

Woodland Caribou	Ground Squirrel	Peregrine Falcon	Grayling	White Spruce
		Gyrfalcon	Lake Trout	Tamarack
Dall's Sheep	Collared Pika	Golden Eagle	Arctic/Dolly	Ladyslipper
Wolf	Voles?	Loons	Varden Char	Orchids
Grizzly Bear	Muskrat	Ptarmigans	Arctic Cisco	Altai Fescue
Wolverine		Large-cavity nesting	Whitefish?	Northern Kittentails
Lynx		birds	Salmon?	(*Synthyris borealis)*

[12] Miller, B., R. Reading, J. Strittholt, C. Carroll, R. Noss, M.E. Soulé, O. Sanchez, J. Terborgh, D. Brightsmith, T. Cheeseman, and D. Foreman. 1998/99. Using focal species in the design of nature reserve networks. Wild Earth 8: 82-92.

[13] Caro, T. 2000. Focal species. Conservation Biology 14: 1569-1570.

[14] Cluff, D. and P. Paquet. 2003. Large carnivores as umbrellas for reserve design and selection in the North. *In* Designing Protected Areas: Wild Places for Wild Life. Proceedings Summary of the Canadian Council on Ecological Areas (CCEA) and Circumpolar Protected Areas Network (CPAN) Workshop, Sept. 9-10, 2003, Yellowknife, NWT.

One could then compile the relevant biological and management information available for each focal species, in a fashion useful for the development and eventual implementation of a land use plan. The thinking is that meeting the conservation needs of these species will simultaneously take care of many of the other species that live in the Peel watershed. For example, consider Woodland Caribou.

Various studies have shown that the human impact of resource extraction (seismic lines, roads, and noise) has a deleterious effect on caribou populations. Researchers in the boreal forest of northern Alberta and elsewhere have found that resource extraction affects caribou populations, with major implications for industrial management practices.

Results	Management implications
• Caribou avoid seismic lines[15] • Seismic lines and roads can provide increased access to wolves and other predators[16] • Linear corridors provide increased access for hunters into caribou range[17] Caribou disturbed by petroleum exploration expend more energy as a result of increased movement during winter[18] Such disturbances: • can displace caribou into less suitable habitat[15] • "impede the ability of caribou to avoid harsh microclimatic events and deep snows"[15] • can cause caribou to "switch habitat type for cover or escape terrain"[16] • can result in functional habitat loss.[15] Caribou require large intact areas both between seasonal ranges and among herds.[19] Linear features (roads, seismic lines, power lines, pipelines, etc.) • increase predator access & efficiency, poaching • result in habitat avoidance & loss • alter natural predator-prey relationships[19]	Need more research into cutting low impact seismic lines[17] "Small changes in population dynamics as a result of industrial development may have significant consequences to the long-term viability of caribou populations in Alberta."[15] Recommend a "conservative and adaptive" approach to resource extraction[15] Incorporate a cumulative effects threshold into the management of caribou ranges[17] "…consider limits to industrial operations in caribou habitat until acceptable thresholds to levels of development are determined" [15] "Land-use guidelines must be reviewed, improved, and implemented to promote caribou conservation in the region." [17] Identify & protect core ranges and movement corridors.[19] "Best bet for ensuring connectivity is maintenance of functional caribou habitat across large landscapes."[19] "Conservation of boreal caribou will requuire us to modify our expectations in the use of our boreal landscape and its resources."[19]

[15]Dyer, S.J., J.P. O'Neill, S.M. Wasel, and S. Boutin. 2001. Avoidance of industrial development by woodland caribou. Journal of Wildlife Management 65(3): 531-542.
[16]McLoughlin, P.D., E. Dzus, B. Wynes, and S. Boutin. 2003. Declines in populations of woodland caribou. Journal of Wildlife Management 67: 755-761.
[17]Johnson, D.R. 1985. Man–caused deaths of mountain caribou, *Rangifer tarandus*, in southeastern British Columbia. Canadian Field-Naturalist 99:542-544.

4) Water

Most people concerned about the Peel watershed emphasize the primary importance of clean, pure water. We extend the concern and the logic to a big-picture, coarse-filter approach: entire, large, intact watersheds—including major river corridors, lakes and wetland complexes—as fundamental ecological and landscape units, with appropriate attention to hydrologic connectivity (groundwaters and surface waters are interconnected as a single resource) and functioning.[20] Watersheds are key to defining ecological structure, function and productivity in landscapes. Rivers are the arteries of living landscapes and water ultimately integrates all ecosystem components and processes.[21] Watersheds are a sound basis for coarse-filter planning and design. Major undeveloped watersheds are regionally and globally significant conservation opportunities. As well, intact large watersheds are ideal conservation targets in mountain boreal landscapes undergoing climate change. The strongest argument in favour of watersheds as reserves is that they represent functional ecosystems with the greatest likelihood of maintaining ecological integrity over the long term.[22]

5) Reverse Matrix

Related to the above comments is the "reverse matrix" approach,[23] which would embed connected nodes of human habitation and industrial development within an intact supportive matrix, rather than embedding networks of conservation lands in a hostile matrix of human-altered landscapes (as in conventional reserve design). In a reverse matrix model, core protected areas would be surrounded by progressive zones of human activities ranging from intensive development, through lower impact activities (as in "special management areas"), to strict protection of biological and cultural values. This model is essentially that envisioned by the Biosphere Reserve concept (see p. 34).

6) Recommendations

- ***if adequate information is available, conservation planners should use combinations of abiotic and biotic targets***
- ***representing biotic targets across the full spectrum of physical environments in a planning region is one of the best ways to conserve biodiversity during climate change***

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[18] Bradshaw, C.J.A., S. Boutin, and D.M. Hebert. 1997. Effects of petroleum exploration on woodland caribou in Northeastern Alberta. Journal of Wildlife Management 61: 1127-1133.

[19] Racey, G., I. Hatter, and K. Whaley. 2005. Report from the caribou workshops. Woodland Caribou Science Workshop. April 26-27, 2005, Winnipeg, MB.

[20] Pringle, C.M. 2001. Hydrologic connectivity and the management of biological reserves: a global perspective. Ecological Applications 11: 981-998.

[21] Schindler, D.W. 1998. Sustaining aquatic ecosystems in boreal regions. Conservation Ecology [online] 2: 18. 20 http://www.consecol.org/vol12/iss2/art18/ 20 p.

[22] Lertzman, K., L. Kremsater, A. MacKinnon, and F. Bunnell. 1993. Are intact watersheds the best units for conserving forest ecosystems? Unpubl. ms courtesy of K.L.

[23] Schmiegelow, F.K.A., S.G. Cumming, S. Harrison, S. Leroux, K. Lisgo, and B. Olsen. 2004. Conservation beyond crisis management: the matrix reclaimed. Unpublished ms. Canadian BEACONS Project, University of Alberta, Edmonton, Alberta. 21p.

- ***build a conservation portfolio for the Peel watershed that includes:***
    - ***landscape-level targets spanning the full range of current environments in at least 3 (Mackenzie Mountains, Peel River Plateau, British-Richardson Mountains) of the 6 ecoregions in the watershed:***
        - ***glaciofluvial landforms***
        - ***shrubland on till with cryosolic soil development***
        - ***steep colluvial slopes with brunisolic and regosolic soil development***
        - ***long gradual unglaciated slopes***
        - ***alpine tundra***
        - ***shallow lake/wetland complexes***
        - ***mountain passes***
        - ***incised reaches of rivers***
        - ***etc.***
    - ***ecosystem targets***
        - ***riparian shrublands***
        - ***patches of old forest***
        - ***peat plateaus***
        - ***ribbed fens***
        - ***large and medium-sized lakes***
        - ***etc.***
    - ***ecologically diverse species targets; i.e., focal species such as***
        - ***wolf***
        - ***caribou***
        - ***grizzly***
        - ***voles***
        - ***migratory birds***

  Such a conservation portfolio would "automatically encompass the widest possible range of future environments."[24] In other words, go for big areas that include the full range of abiotic targets (land systems) and current ecosystems, with full elevational sequences and broad longitudinal and latitudinal reach (go deep, wide and long).

- ***The best way to achieve this, and to conserve the freshwater resources and aquatic systems that tend to get second billing in conservation planning, is to conserve entire large watersheds—like those of the Three Rivers.***

Fine Filter

This approach to conservation planning focusses on special elements, physical features, communities /ecosystems, and species that may not be "captured" by the coarse filter, or

[24] Saxon, E.C. 2003. Adapting ecoregional plans to anticipate the impact of climate change. Pages 345-365 *in* Groves, C.R. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. Island Press, Washington, DC.

that are sensitive or significant enough that specific attention is required. Refer to the CPAWS report on the 2005 conservation science workshop, for more information.

1) Abiotic elements

Special physical components of a Peel conservation plan should include:

- bedrock geology features – regionally unusual or rare bedrock, karst systems, canyons and cliffs (physiographic edges), waterfalls, tors
- glacial history features – eskers and other glaciofluvial landforms, some unglaciated (Beringian) landforms
- process features – landslide complexes, slumps in permafrost landscapes, thermokarst, pingos, palsas, rock glaciers, hoodoos

2) Communities and ecosystems

- mineral springs, hotsprings
- essential or key wildlife habitats – maternity areas, winter range, mineral licks
- islands of old forest
- lakes with early open water in spring
- short streams that connect lakes; stream segments with groundwater discharge throughout the winter
- unusual or special wetlands/wetland types (e.g., migratory stopovers)
- boreal grasslands

3) species

Fine filter species typically are threatened, vulnerable, declining (species at risk) or are rare or endemic (occur nowhere else in the world) species. NatureServe Yukon is the repository for information about at-risk or rare, listed species, but we are not aware of a summary of the database specific to the Peel watershed. With respect to endemics, the Beringian biota[25,26] is especially significant. These are species that have persisted through glacial epochs in unglaciated Alaska-Yukon. There are some concentrations of Beringian species in the Peel watershed, most notably in the unglaciated southern Richardson Mountains.

4) Recommendations

- ***information (such as mapped occurrences) is inadequate for most of these special elements; local knowledge can fill in some of the information gaps***
- ***conservation planning should start with the coarse filter approach; the fine filter can then be applied to address the most important special elements***

[25] Danks, H.V., J.A. Downes, D.J. Larson, and G.G.E. Scudder. 1997. Insects of the Yukon: characteristics and history. Pages 963-1013 *in* H.V. Danks and J.A. Downes, editors. Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods), Ottawa, Ontario.

[26] Schweger, C.E. 1997. Late Quaternary palaeoecology of the Yukon: a review. Pages 59-72 *in* H.V. Danks and J.A. Downes, editors. Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods), Ottawa, Ontario.

- ***focus attention on those special elements that are critical resources for coarse filter species (e.g., early open water for migrating waterbirds, riparian cliffs for carnivorous mammals and birds of prey) and that are easy to distinguish and map***
- ***a landscape-level protected area in the southern Richardson Mountains would be the most effective way to conserve a full suite of Beringian special features, from individual landforms to communities to species of plants and animals.***

Rationale for Large Intact Wild (Roadless) Areas

What Do We Think We Know?

Generic policy targets, or conservation goals, for the proportion of a region required to ensure long-term protection of biodiversity have often over the past two decades been arbitrarily set at 10 or 12 percent. Unfortunately "… the 12% goal of the Brundtland Commission is significantly less than what is needed to avoid species extinctions and maintain biodiversity."[27] The well-established relationship (i.e., species-area curve) between habitat loss and species loss predicts that, at the 10% level of habitat protection, 50% of species could eventually be lost. A recent review of the international literature on the issue of conservation targets indicates that evidence-based targets were on average about three times higher than policy-driven approaches; i.e., about 30% core protection rather than 11%.[28] There is no single threshold value for the amount of habitat needed for species to persist. Most scientifically credible estimates of conservation goals fall between 25% and 70% protection. Cautious and generalised interpretations of the evidence and literature suggest that 30-40% of the habitats or ecosystems "within a planning region will need to be conserved in order to also conserve 80-90% of the species" occurring in that region.[22]

As if to underscore these points, a March 2006 report[29] in the Proceedings of the National Academy of Sciences includes northern Canada and Alaska as one of the regions in the world with a high "latent extinction risk" for mammals, areas where species are considered most likely to decline rapidly toward extinction if they are exposed to levels of human impact that have been felt elsewhere—as say in Alberta. The animals (especially those with relatively small ranges, like some Beringian species, and those with large body mass and low reproduction rate, like grizzly bear) of these potential "extinction hotspots" are at risk even if the regions have experienced little human impact to date.

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[27] Groves, C.R. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. The Nature Conservancy & Island Press, Washington, DC. 457 p.
[28] Svancara, LO.K., R. Brannon, J.M. Scott, C.R. Groves, R.F. Noss, and R.L. Pressey. 2005. Policy-driven versus evidence-based conservation: A review of political targets and biological needs. BioScience 55: 1-7.
[29] Cardillo, M., G.M. Mace, J.L. Gittleman and A. Purvis. 2006. Latent extinction risk and the future battlegrounds of mammal conservation. PNAS 103: 4157-4161.

In much of North America, protected areas have become ecological islands, disconnected from other areas of remaining natural habitat. Worrisome studies by Newmark[30] found that most western North American parks (even Yellowstone) were too small and too insular to maintain the wildlife found at time of establishment; only the Kootenay-Banff-Jasper-Yoho complex (20,376 km^2) had maintained the original number of mammal species. And the rate of extinction was highest in the smallest parks.

Moreover the core protected areas should be adequately buffered, with much of the rest of the region in compatible use and linkage zones. "The old model of isolated parks has failed. Unless it contains millions of acres, no reserve can maintain biodiversity for long … Scientists studying boundary problems around reserves emphasize the importance of large areas and well-managed buffer zones."[31] Conservation at this scale, with protected areas, buffers and linkages, is the new model of protected areas—from islands to networks.

Minimum Critical Area and Minimum Dynamic Area

A primary goal of CPAWS is to protect and conserve the globally important boreal wilderness of the Three Rivers and to maintain the ecological integrity or health of the greater Peel watershed. Sustaining ecosystem health requires maintaining viable populations of native species and the ecological processes that they depend on. Most land use decisions involve limiting the area conserved so as to facilitate industrial development. Hence conservation biologists tend to use the language of minimums—not optimums, such as what would be best for a species or an ecosystem.

Regarding native species, the scientific consensus is that populations of a few thousand individuals are required for long-term viability of species. Except for truly rare organisms, this usually isn't a problem for most species in most parts of their range. But wide-ranging boreal species, especially the large predators, require large areas of habitat to persist in a region. The minimum contiguous area of non-degraded habitat required to maintain viable populations is known as the *minimum critical* area (MCA). Table 2 presents the MCA for some boreal animals, with 1,000 individuals chosen as the minimum viable population size for long-term persistence.

Table 2. Estimated minimum critical area for 1,000 individuals of some wide-ranging boreal species. [32]

Species	**Area for 1,000 individuals (km^2)**
Marten	1,150
Black Bear	3,750
Moose	4,000
Great Horned-owl	12,500

[30] Newmark, W.D. 1995. Extinction of mammal populations in western North American national parks. Conservtion Biology 9: 512-526,
[31] Noss, R.F. and A.Y. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. Island Press, Washington, DC.
[32] Alberta Centre for Boreal Studies. 2002. Alternative futures for Alberta's Boreal forest lands.

Fisher	13,900
Goshawk	16,250
Lynx	18,300
Wolverine	52,500
Wolf	124,000
Caribou	Several thousand-10,000+

We know that many boreal animal species, including several of the recommended focal species and especially the large carnivores that play such an important role in northern ecosystems, [33,34] have large range requirements. Conservation scientists recommend that such "highly interactive" species be maintained at ecologically effective and evolutionarily viable population densities, across geographic ranges as large as possible.[35,36] The minimum critical area for these boreal species, and for the predator-prey systems in which they function, is several 10s to 100s of thousands of square kilometres. The Three Rivers together total about 30,000 km^2.

Fully functional landscapes must also be large enough to accommodate landscape-level ecological processes, including natural disturbances such as wildfire, insect and disease epidemics, floods and mass movements, within their natural range of variability over the long term. Protected areas should be large enough to incorporate and maintain such disturbance regimes, so that only a portion of the area is disturbed at any given time. The minimum size required for maintaining natural disturbance regimes is termed the *minimum dynamic area* (MDA). Researchers recommend that protected areas be substantially larger than the most extensive type of disturbance; e.g., three or four times the largest disturbance (typically wildfire in boreal regions), or at least 50 times the average size of disturbance. As part of YPAS, Yukon government staff did an "ecological viability analysis for fire size" on the Peel Plateau, which indicated that 3,800 km^2 are required to maintain medium viability. Estimates from northern Alberta and from Labrador[37] suggest that protected areas on the order of 5,000 to 25,000 km^2 are required to maintain the natural boreal fire regime, to represent all forest age classes, conditions and patch sizes.

[33] Miller, B., B. Dugelby, D. Foreman, C. Martinez del Rio, R. Noss, M. Phillips, R. Reading, M.E. Soulé, J. Terborgh, and L. Wilcox. 2001. The importance of large carnivores to healthy ecosystems. Endangered Species UPDATE 18: 202-210.
[34] Soulé, M.E. and J. Terborgh, editors. 1999. Continental conservation: scientific foundations of regional reserve networks. The Wildlands Project & Island Press, Washington, DC.
[35] Soulé, M.E., J. Estes, J. Berger, and C. Martinez del Rio. 2003. Ecological effectiveness: Conservation goals for interactive species. Conservation Biology 17: 1238-1250.
[36] Soulé, M.E., J. Estes, B. Miller, and D.L. Honnold. 2005. Strongly interacting species: Conservation policy, management, and ethics. BioScience 55: 168-176.
[37] Mondor, C. 2005. An assessment of the proposed Mealy Mountains/Akamiuapishkua study area in Newfoundland and Labrador for national park purposes. Parks Canada, Ottawa.

Climate Change

We need to conserve areas large enough to accommodate climate change,[38] which will result in biome shifts;[39,40] species losses, gains and reassembly in communities; changes to stream temperatures, flows and fish habitat; melting of permafrost; increased frequency of slumps and other mass movements.[41]

For example, Pacific salmon are known to occur to a limited degree in Canadian Arctic waters, with reports of Pink, Chum, Sockeye, and Coho in decreasing order of frequency. Stray salmon continue to turn up in the catches from domestic and subsistence fisheries in the Arctic; the Gwich'in Renewable Resource Board (Inuvik) confirms that salmon have been caught at Aklavik and elsewhere in the Mackenzie River delta, also upriver near Arctic Red River, Norman Wells, and in the Peel River. Perhaps salmon will increasingly use the Peel watershed as climate changes?

The precautionary approach would be to set aside climate-change sanctuaries, theatres large enough for the ecological drama to play out, where species could react and interact as best they can without additional human-caused disturbances and industrial insults. To repeat:

- ***Representing biotic targets across the full spectrum of physical environments in a planning region is one of the best ways to conserve biodiversity during climate change***
- ***In other words, go for big areas that include the full range of abiotic targets (land systems) and current ecosystems, with full elevational sequences and broad areal extent (go deep, wide and long)***
- ***Intact large watersheds are ideal conservation targets in mountain boreal landscapes undergoing climate change because watersheds are functional ecosystems with the greatest likelihood of maintaining ecological integrity over the long term.***
- ***The best way to achieve this, and to conserve the freshwater resources and aquatic systems that tend to get second billing in conservation planning, is to conserve entire large watersheds—like those of the Three Rivers.***

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[38] Climate Impact Assessment. 2004. Impacts of a warming Arctic: highlights. Cambridge University Press. 17 p.

[39] Scott, D., J.R. Malcolm, and C. Lemieux. 2002. Climate change and modelled biome representation in Canada's national park system: implications for system planning and park mandates. Global Ecology and Biogeography 11: 474-484.

[40] Sturm, M., J. Schimel, G. Michelson, J.M. Welker, S.F. Oberbauer, G.E. Liston, J. Fahnestock, and V.E. Romanovsky. 2005. Winter biological processes could help convert arctic tundra to shrubland. BioScience 55: 17-26

[41] von Finster, A. 2001. Possible effects of climate change on the physical characteristics of fish habitats in the Yukon River Basin in Canada. Discussion paper. Department of Fisheries and Oceans, Whitehorse, Yukon. http://www.taiga.net/reports/dfo1.html 17 p.

Trans-Regional Linkages and Landscape Connectivity

Successful conservation requires not only core protected areas but also linkages among wild landscapes, vital habitats, and formal protected areas.[42] Maintaining landscape-level connectivity is a key theme of contemporary conservation science[43] and science-based strategies such as Y2Y and the Canadian Boreal Initiative. In this modern approach, the goal is not an archipelago of small insular parks but rather a network of protected areas and linkages that provide non-degraded matrix habitat (sometimes in the form of corridors) for movement and transport of materials, nutrients, energy, and organisms.

Connectivity issues and considerations in the Peel watershed include:

- Mountain linkages among the Ogilvie Mountains, Tombstone Park, southern Richardson Mountains, Wernecke Mountains, Mackenzie Mountains (including NWT portion), and Nahanni National Park Reserve.
- North-south connectivity between the Peel Plateau and Wernecke Mountains, and along the major river corridors.
- Maintaining the Beringian connection to the northwest.
- Linkages to the northwest for the Porcupine caribou herd, which has part of its winter range in the Peel watershed.
- Maintaining east-west connectivity for caribou of the Bonnet Plume and Hart River herds.
- The east-west flyway for birds that come up the Mackenzie Valley then head west up the Peel, its tributaries, and beyond.
- Hydrologic connectivity among rivers, streams, lakes and wetlands.
- Elevational connectivity, from valley floor to ridgetop.
- Big connected spaces for really wide-ranging species that require large secure areas to sustain populations. Visit http://www.wcs.org/nahannibears to learn why Nahanni National Park Reserve is too small (4,765 km^2) and narrow (merely 8 km wide in places) to provide for the needs of trans-boundary species like grizzly bears and woodland caribou, who move all through the greater Nahanni ecosystem (35,000 km^2) and beyond, west and south into the Yukon and east and north deeper into the Northwest Territory.

[42] Groves, C.R. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. The Nature Conservancy & Island Press, Washington, DC. 457 p.

[43] Dobson, A., K. Ralls, M. Foster, M.E. Soulé, D. Simberloff, D. Doak, J.A. Estes, L.S. Mills, D. Mattson, R. Dirzo, H. Arita, S. Ryan, E.A. Norse, R.F. Noss, and D. Johns. 1999. Corridors: reconnecting fragmented landscapes. Pages 120-170 *in* M.E. Soulé and J. Terborgh, eds. Continental conservation: scientific foundations of regional reserve networks. The Wildlands Project & Island Press, Washington, DC.

Wilderness Tourism, Guide-Outfitting, and Other Extensive Activities and Uses Depend on Big Wild Landscapes

The value of wilderness to aboriginal people and Yukon society is recognized in the Umbrella Final Agreement with Yukon First Nations. The Yukon Environment Act also recognizes wilderness as a resource with intrinsic, ecological, and economic value. Wilderness is acknowledged as one of our most precious assets by the tourism industry, and as a priceless heritage by people who rely on the land for a way of life. The recent "branding" exercise by Yukon Tourism & Culture clearly demonstrates that big, natural, wild spaces are not only prime tourism assets but also are deeply valued by Yukon **residents**.

Commercial operators who rely on the Three Rivers wilderness include 4 aircraft charter companies in the Yukon and NWT, 6-8 wilderness adventure operators, 4 guide-outfitters, and a few more specialized outfits offering horse-back trips, or writing and art retreats. In addition, there are 25 trapping concessions in the Peel watershed.

Wilderness rivers are an integral part of the Yukon landscape and cultural heritage. Rivers are used as travel routes and as a source of livelihood. We fish their waters, hunt their shores, are challenged by their rapids and wilderness, find peace of mind and solitude along their valleys. They are special features of our land and deserve special protection.

Yet we have failed to protect many of them. Even as we have made halting progress in protecting representative parts of natural regions, we have not succeeded often in protecting entire watersheds for their wilderness or ecological values. The Canadian Heritage Rivers system offers some progress towards river conservation, but few Heritage Rivers are fully protected in their entirety. For example, the Bonnet Plume Canadian Heritage River has a management plan that provides no room for wilderness protection or even, in legal terms, a higher standard of care.

Social and Economic Considerations

Traditional, Cultural, Historic Landscapes and Uses

The identification of heritage values in the Peel watershed is very preliminary, especially in the Mackenzie Mountains Ecoregion. Four First Nations have cultural and heritage interests in the planning region but the Peel drainage lies mostly within the traditional territory of the Nacho Nyak Dun and Tetl'it Gwich'in First Nations. For generations they were sustained by the plants, fish and wildlife of this region as they traversed its valleys and mountains on a network of travel and trade routes. A testament to the strong cultural tie of the Tetl'it Gwich'in to the Peel is their application to Parks Canada to designate a portion of the the Peel River as a National Historic Site.

The Dawson-Ft. McPherson Trail is significant in the Yukon's recent history as a route to the Klondike Gold Rush and for its part in the early annals of the RCMP in the territory.

Wilderness remains an integral part of Canadian life, although we most often refer to it as "the bush." The word wilderness is not found in aboriginal languages, yet for many people in the north it has come to mean a still natural condition found in "our homeland." Wilderness in the Yukon includes people and their traditional activities - it is not perceived as an exclusive recreational playground for visitors.

Recreation and Tourism

Although fishing, hunting and trapping are still important to the way of life in the region, local people and visitors from around the world also value the watershed as a premiere destination for canoeing, backcountry travel, photography, education, cultural activities and scientific research.

The Peel River watershed, with its spectacular mountain river tributaries, is widely known as a premiere destination for a broad range of wilderness recreation and backcountry tourism activities. The watershed remains one of the largest regions in the Yukon that has really big expanses of intact wilderness, with no roads or other development. This asset is increasingly rare in North America and elsewhere in the world. The mountain and river scenery in the Peel watershed is second to none in Canada, and has some of the Yukon's most stunning vistas and special features.

Aside from the Dempster Highway corridor, the main recreation and tourism activity and potential in the region centre on the 5 tributaries (the Three Rivers plus the Hart and Blackstone) as well as the main stem of the Peel River, and on remote mountain wilderness, wildlife, scenery and special features, and the cultural history and on-going traditions of two First Nations.

In terms of numbers of travelers, the main recreational activities taking place in the Peel watershed today revolve around canoeing and rafting. Activities such as fishing, wildlife viewing, bird watching, photography and hiking in alpine areas are often done in association with these canoe and raft trips. Hunting is another recreation and tourism activity of long-standing importance in the region. In recent years, activities such as "writers retreats" and artist's expeditions have also taken place. Regardless of the activity, it is the wilderness setting that attracts all these people.

The Wind, Snake and Bonnet Plume drainages have been more extensively used for recreation than the three drainages to the west, the Ogilvie, Blackstone and Hart Rivers. In part this may be because most recreational activities involve river travel and the three westernmost tributaries all join the Peel River main stem upstream of Aberdeen Canyon. Aberdeen Canyon is not navigable and has a strenuous 10 km portage so is generally avoided by most recreationists. The upper sections of the Blackstone River are used regularly, while use of the Hart has also increased in recent years.

Resources

Agriculture

There is no existing agricultural use in the Peel nor is there any potential, given the soils and climate of the region.

Forestry

Most of the region has no commercial forest value. The forest is mostly "non-productive"; i.e., the trees are too scattered and scrubby to form commercially viable stands. In some of the major valley bottoms there are patches of mature, potentially commercial forest, but the patches are small and the trees are a long long way from any market. Some mature spruce stands may be suitable for local community uses such as log building.

Tourism and Outfitting

The tourism sector in the Peel currently consists of Dempster Highway travellers, adventure tourists (e.g., private and commercial paddlers), commercial outfitting clientele, and recreational hunters and fishers. Most tourism activity presently occurs along the Dempster Highway and along the corridors of the Wind, Bonnet Plume, Snake and Hart rivers. The Mackenzie Mountains portion of the Peel watershed has high potential recreation and tourism values, the other ecoregions in the watershed have relatively low potential.

In 2003 and 2004, there was an average of 9 wilderness tour operators with on the waters of the Peel watershed. Six outfitting concessions are located wholly or partially in the Peel drainage. Both backcountry wilderness tourism and guide-outfitting require large tracts of wild landscapes to deliver a true wilderness experience.

Oil and Gas

Hydrocarbon Potential

Three hydrocarbon basins have been mapped within the Peel watershed: the Bonnet Plume, the Eagle Plains, and the Peel Plateau Basins. The Yukon Government contracted the Geological Survey of Canada to compete assessments of these three basins. Although the assessments provide an insight into the potential hydrocarbon resources of the basins, they remain estimates, they cannot provide guidance on how much of the potential resource is technically or economically recoverable.

Bonnet Plume Basin – The Geological Survey's 2000 report for the Yukon Government entitled "Petroleum Resource Assessment Of Bonnet Plume Basin, Yukon Territory, Canada"[44] states that "There are no discovered reserves in the Bonnet Plume region, but 2 gas fields greater than 3000 million m^3 (100 BCF) are expected." The author states that "Thermal maturity studies indicate that insignificant oil potential is expected in the area."

[44]Hannigan, P.K. 2000. Petroleum Resource Assessment Of Bonnet Plume Basin, Yukon Territory, Canada. Unpubl. Rep. on file, Whitehorse, Yukon.

Therefore, natural gas resources are the most likely form of petroleum in the area. The report cautions that "Hydrocarbon volumes reported for these conceptual plays are total statistical estimates of the resource present 'in the ground', not the volumes that are economically producible."

The Bonnet Plume Basin appears to have limited potential for hydrocarbons.

Eagle Plains Basin – A 2005 Geological Survey report[45] summarizes the Basin's potential as follows:

> The Eagle Plain Basin and its environs is a potentially prospective petroleum province in the Yukon where extensive initial exploration, focused on discovering crude oil, identified 83.7 Bcf, and 11.05 MMbbls, with 33 wells…. A probabilistic petroleum assessment of fifteen petroleum plays suggests that an expected 5.971 Tcf of natural gas and 425.95 MMbbls of crude oil remain to be discovered… This study differs significantly from previous estimates of undiscovered potential, which were less optimistic.

The assessment, which attempts to estimate the **total gas in place**, anticipates that up to 6 trillion cubic feet (6 TCF) of natural gas exists in the Eagle Plain Basin. Keep in mind that only a portion of the total gas in place would be **technically recoverable** and, in turn, only a fraction of the **technically recoverable gas** would be **economically recoverable**. Thus, the economically recoverable gas, should it exist in the area, would be some fraction of the total gas in place.

Peel Plateau and Plain – The Geological Survey's recent report[46] summarizes this Basin's potential as follows:

> Assessment of this region suggests that there is a significant potential for natural gas throughout the region with a summed mean play potential of approximately *(sic)* 83.428 X 109 m^3 initial raw gas in place1 (~3 TCF) in approximately 88 pools. The largest expected pool of 3.36 X 109 m^3 gas is expected to occur in Mesozoic clastics of the Peel Plain. In general the small size of gas pools will be an impediment to their development because of their location. …No crude oil potential can be estimated due to an inferred lack of oil prone sources in strata of suitable maturity. …Despite the negative characteristics and features of the geological setting and history the inferred natural gas potential is significant, with gas of ~3 TCF in approximately 88 pools.

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[45] Osadetz, K. G., Chen, Z. and Bird, T. D. 2005 (in review). Petroleum Resource Assessment, Eagle Plain Basin and Environs, Yukon Territory, Canada. Geological Survey of Canada, Open File Report.

[46] Osadetz, K. G., MacLean, B.C., Morrow, D.W. and Hannigan, P.K. 2005 (in review). Petroleum Resource Assessment, Peel Plateau and Plain, Yukon Territory, Canada. Geological Survey of Canada, Open File Report.

Likewise, the economically recoverable gas would likely be some portion of the 3 TCF that may exist in the area.

Potential Extraction of Natural Gas Resources in Peel Watershed – The consulting firm Gilbert Lausten Jung Associates Ltd. was retained by Imperial Oil Resources Ventures Limited, on behalf of the Mackenzie Valley Pipeline Group:

> ...to prepare a study of future gas supply for the Mackenzie Gas Project. The primary objective of the study was to provide an assessment of the economically recoverable gas resources and deliverability in the region to support construction of the Mackenzie Valley pipeline and Mackenzie gathering system. The time frame considered for development of resources for this supply study was 25 years from the projected on-stream date of November 1, 2009. Production forecasts were prepared for a period of 50 years from the effective date of the study, May 1, 2004.

The report entitled "Mackenzie Gas Project: Gas Resource and Supply Study"[47]: (GLJ Study) assessed the northern portion of the Yukon Territory including the Eagle Plain Basin. The GLJ report noted that in reference to the *discovered* gas reserves::

> Three gas fields have been discovered and assigned resources by the NEB in the Eagle Plains region of the Yukon Territory. The discovered recoverable sales gas resources for these fields are summarized in Table 16... These fields are uneconomic to tie-in on a stand-alone basis, but may become economic in the future as additional pools are discovered nearby, thereby decreasing the tie-in cost per unit of production.[48]

In reference to the *undiscovered* recoverable gas resources the report noted:

> The Eagle Plain area is uneconomic to develop given the expected small average pool size and the cost of the connecting pipeline required to transport gas 300 kilometres to the Mackenzie Valley pipeline.[49]

The GLJ study provides some interesting data, including a calculation (their Table 16) of a *discovered* recoverable sales gas resource that was 56% of the discovered original gas-in-place. A little more than half of the potential gas already discovered is theoretically marketable—an important figure to keep in mind when evaluating resource potential.

The GLJ analysis concluded that its " final undiscovered low, best, and high estimates of OGIP [original gas-in-place] are 293 BCF, 607 BCF and 1.18 TCF." The GLJ study's numbers differ from those of the Yukon Government, which projected almost 6 TCF of natural gas. Presumably since it was the only one available at the time, GLJ relied on a

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[47] Mackenzie Gas project, Gas Resource and Supply Study, A Study Prepared for Imperial Oil Resources Ventures Limited by Gilbert Lausten Jung Associations Ltd. Effective May 01, 2004

[48] *Ibid*., p. 56.

[49] *Ibid*., p. 60.

National Energy Board (NEB) assessment for its analysis. The GLJ authors noted the drawbacks of the NEB's approach and explained that they notified the Yukon Government that there was a problem with the NEB calculation of total gas volumes. But, for reasons discussed below, debate over these gas resources could be moot.

A critical element of the GLJ study was its projection of pipeline capacity. Assuming the pipeline was ready to move gas on November 1, 2009, the study assessed pipeline capacity in several scenarios, including one using the current capacity projection of 1.2 BCF/day and another in which capacity would be increased by 50% to 1.8 BCF/day. In the first case, when "contingent and prospective onshore and offshore resources" of potential sales gas are calculated, capacity for significant new gas resources would not be available until 2035.[50] If pipeline capacity was 1.8 BCF/day, capacity for major new resources would not exist until 2031.[51] These are uncertain estimates but the main point is that it could be 20 years or more before any gas from the Eagle Plains area would move to market, if the GLJ assumptions are correct.

It behooves Yukoners to remember that the purpose of the Mackenzie Gas Project is not to move Yukon gas to market. If it is built, the pipeline will move to market the gas reserves of the partners in the Mackenzie Gas Project – Imperial, Shell Canada, ConocoPhillips Canada and ExxonMobil Canada. Specifically, the Mackenzie Gas Project is designed to exploit the three anchor fields – the Niglintgak, Parsons Lake and Taglu fields – as a first priority. Once that gas is on stream, other gas resources could be tapped to keep the pipeline filled to capacity.

It is anticipated that once the three anchor fields start to decline, new production from other known onshore fields in the Mackenzie Delta and Colville Hills, and then from offshore, would come on stream. Subsequent production to fill the pipeline would radiate out from areas closest to the pipeline to areas farther afield. According to the GLJ report, not until 2035 is any gas from Eagle Plains or elsewhere in the North Yukon likely to move to market. While a massive new gas discovery at Eagle Plains could move the schedule around, access to the pipeline will probably be very competitive. Pipeline capacity may not be available for Eagle Plains gas until far into the future.

Summary

The Peel watershed contains significant mostly natural gas potential, largely in the Peel Plateau and Eagle Plains ecoregions. Most of the Three Rivers area is not part of a sedimentary basin, but the lower (northern) reaches of the drainages—including the Bonnet Plume Basin—are part of the Peel Plateau and thus potentially have gas reserves. Impediments to development of the as-yet-undiscovered petroleum resources include

- Small size of gas pools
- Unfavourable results of previous exploratory drilling
- Present lack of transportation infrastructure
- Uncertainty about size of technically and economically recoverable reserves.

[50] *Ibid.*, Table 41.
[51] *Ibid.*, Table 37.

Mining

The Peel watershed hosts a variety of specific mineral resources but mineral occurrence varies greatly over the region. The Peel Plateau Ecoregion has relatively low mineral potential. The Mackenzie Mountains Ecoregion has relatively high mineral potential, but the minerals are not economical to extract nor have they been for at least 40 years. For example, in the Three Rivers area the Bonnet Plume Range contains showings of uranium, iron, copper, lead, zinc, silver, barium, cobalt, nickel and gold. Potentially significant deposits include a large hematite iron deposit (the Crest iron ore deposit) near the Snake River, lead-rich and zinc-rich veins in the south end of the Range, and abundant coal seams in the Bonnet Plume Basin. There has been much exploration over the years but remoteness and difficult access have made any development prohibitively expensive.

Mining Potential

As a general comment, mining projects in the Yukon must compete for financing and markets with mining projects everywhere else. Over the past decade or two, mining has increasingly become an international industry with exploration and development capital raised from across the globe. Consequently, projects must demonstrate favourable economics not only in and of themselves, but in relation to other similar projects around the world. A mining project in the Peel watershed, for example, would need to compete for exploration and development resources with similar projects in Australia, South Africa and Chile.

While in the Yukon much has been made of Chinese and Indian demand for resources, every resource exporting country in the world is competing to supply those very markets. Not only is the Yukon geographically distant from them, but it also does not have the infrastructure to supply those markets from the far reaches of the territory. Even if the Yukon did have expanded infrastructure it is not necessarily the case that Yukon projects could compete globally in the markets of undifferentiated base metals and energy commodities. Bulk commodities like iron ore, lead, zinc, copper and coal are expensive to ship to market, thus reducing the competitiveness of producers North of 60. Even a railway would not automatically solve the problem, because a tonne of ore or coal produced in the Yukon must compete with a tonne of ore or coal produced in other parts of Canada or the world, where shipping costs may be much lower.

Two major deposits in the Peel watershed have been the focus of considerable attention; it is worthwhile to scrutinize these projects through an economic lens.

Iron Ore – There are a variety of factors to consider when assessing the potential viability of iron ore mining in the Peel watershed. The Crest iron ore deposit is very large. Chevron, the property owner, believed in 1974 that eventually the project would go into production because of its size.[52] Chevron stated that extraction of the resource would require “a very large scale operation”. However, the company acknowledged that

[52] Dahlstrom, C.D.A.. 1974. “Status of the Snake River Iron Deposit” (September 23, 1974) and “Evaluation of the Snake River Iron Deposit” (October 16, 1974). Chevron Corporation, San Francisco, CA.

distance from market, metallurgical issues concerning phosphorous content, world prices and Canadian government support were determining factors in the project's success: "In economics the two most critical items are the price of iron ore in Japan and the amount of support the Canadian government will provide;" and "In the engineering field the two specifically critical items are phosphorous removal and the cost of fuel supply." The company acknowledged that the economic assessment done in the 1960s – which the Yukon Government still seems to reference – was very much out of date by 1974 and would require a compete reworking. As well, the company believed that it would have to process the ore in the Yukon (or Alaska) because "Energy costs and pollution problems at home have obliged the Japanese to import practically processed raw materials." (Facing increased environmental regulations and public concern in Japan, since the 1970s Japanese industries have "exported" their pollution by ensuring the dirty processing occurs where regulations are weaker.[53])

The global iron ore industry has been undergoing considerable changes over the past years. Industry consolidation, expansion of existing iron ore mines, construction of new mines and the use of ever larger bulk ore carriers have been major trends as producers try to strengthen their economies of scale to compete in the global marketplace. Presently three companies control 70% of world iron ore production. Iron ore prices have risen tremendously in response to increased demand, much of which emanated from China, but production is also on the rise. While many producers are convinced that the "once in a lifetime boom period" will continue, there is a risk that increased production will generate an oversupply that will place downward pressure on the market.[54]

Whether the Crest Iron Ore deposit can compete in the global iron ore market remains to be seen. Iron ore prices are high but so too are development costs and the price of fuel, each of which is a major factor in the production equation.

Coal – The Bonnet Plume Basin hosts a large deposit of thermal coal estimated to be in the range of 660 million tonnes of high volatile bituminous C coal.[55] A variety of projects have been proposed over the years to exploit the coal resources since they were delineated by Pan Ocean Oil Ltd. in the late 1970s and early 1980s. Pan Ocean proposed construction of a thermal generating plant in the Wind River to provide power to the Yukon electrical grid. The government of the day did not approve the project and concurrently Pan Ocean Oil Ltd. was sold and the project was dropped. Subsequently other schemes have been advanced to exploit the resource, including a recent proposal to mine coal and develop coalbed methane to power a steel-making facility in the Peel River watershed, and another scheme to develop a coal-to-liquids project that would pipe hydrocarbons to Fort Norman. While 660 million tonnes seems like a lot of coal, only a portion of that resource would likely be technically or economically recoverable. It is pretty small potatoes in the Canadian and international market. And the coal market is an international market, not a local or regional market.

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[53] Mani, M. and D. Wheeler. 1997. "In Search Of Pollution Havens?: Dirty Industry In The World Economy, 1960-1995". Report produced for World Bank research project on "Social and Environmental Consequences of Growth-Oriented Policies", World Bank's Development Research Group, April 1997.

[54] The Iron Ore Market 2004-2006 is produced under the UNCTAD Trust Fund Project on Iron Ore Information, http://r0.unctad.org/infocomm/Iron/covmar05.htm

[55] http://www.emr.gov.yk.ca/energy/coal.html

According to the United States government's Energy Information Administration[56] Canada hosts 7,251 million short tonnes of recoverable coal resources or 0.7% of the world total. However, Canada only hosts 2.6% of the North American total. The United States holds 270,718 million short tonnes of recoverable coal resources (almost 40 times as much), which is almost 97% of the North American total and 27% of the global coal supply. The USA has the world's largest coal resources with Russia a distant 2nd with 173,074 million short tonnes. For their part India and China each host considerable recoverable coal resources: India has 101,903 million tonnes (10% of world total) and China 126,215 million tonnes (13% of world total). The top ten countries by recoverable coal resources are in order: 1, United States, 270,718 million tonnes; 2, Russia, 173,074; 3, China, 126,215: 4, India, 101,903: 5, Australia, 86,531: 6, South Africa, 53,738: 7, Ukraine, 37,647: 8, Kazakhstan, 34,479: 9, Serbia and Montenegro (Yugoslavia), 18,288: 10, Poland, 15,432: Canada is 15th on the list, after Colombia.

Much of Canada's coal exports are from British Columbia. BC's coal export industry has been driven by its valuable anthracite coking coals, which are highly favoured by steel producers. These coals are not known to occur in the Bonnet Plume Basin.

Given that the Bonnet Plume coals are thermal grade, high volatile bituminous C coal, there are serious questions about the economic viability of coal exports from the Bonnet Plume Basin. Even in British Columbia with its very well-developed coal mining and coal transportation infrastructure, thermal coal export operations have not been commercially viable except for the small-scale Quinsam coal mine on Vancouver Island. Thermal coal operators have looked to Pulverized Coal for Injection (PCI) to expand their markets. Because coking coals demand a premium price in the coal market, steel producers have relied on PCI technologies, which allow steel plants to use quantities of lower cost thermal coal in the steel-making process. Is thermal coal mining for export economically viable from the Bonnet Plume Basin? Can thermal coal exports from the Bonnet Plume Basin compete with coal mining operations in southern Canada? Can they compete in the North America and world market? The thermal coal market is very competitive because there many thermal coal mines already in production around the globe. It is unclear that coal produced in the North Yukon would be able to compete with existing and planned coal mines.

Summary

The Yukon has no demonstrable competitive advantage in producing iron ore or coal. Brazil, Australia and others do. There is no lack of these minerals elsewhere in the world. Their development in the Yukon is neither imminent nor inevitable, given the difficulty of access, even if governments subsidize access (roads, railway), housing, power plants, and communications infrastructure—as the proponents argue would be required.

[56] International Energy Annual 2003 (Table Posted: June 13, 2005)
http://www.eia.doe.gov/pub/international/iea2003/table82.xls

Meanwhile we could take a different economic path, immediately, by capitalizing on the resources where the Yukon clearly has significant and sustainable economic potential, and in which the Yukon has a global competitive advantage—the combination of magnificent wilderness, abundant wildlife, pure water, and our way of life.

Conservation Economics[57]

Wilderness is a keystone of the Yukon economy, but also has enormous inherent value to the Yukon way of life. Tourism is one important sector that benefits directly from protected areas. Other economic benefits include direct employment in protected areas and related resource management occupations, related service industries, cultural industries, research, education, a variety of local entrepreneurial activities, and benefits related to the ecosystem services provided by protected areas.

Community and Economic Benefits of Conservation

Conservation and protected areas are a proven way to develop local and regional economies through public investment; training, education and research; tourism and related services; transportation, facilities and infrastructure; conservation management; increased visitor spending and investment from outside the region.

The value of abundant clean water and air, plentiful fish and wildlife, can be measured as ecosystem services of direct benefit to the community. The social and spiritual values of wilderness are well known, but harder to estimate in economic terms.

Community Economic Development (CED)

Guide-outfitting, wilderness tourism and outdoor recreation, trapping, and transportation services account for a large part of the economic activity in the Peel watershed. Yet, only a portion of the economic benefits of these activities flow directly to the two nearest communities, Mayo and Ft.McPherson. Many resource exploration or extraction activities in the Peel watershed are (or would be) initiated by corporations from outside the region or the territory, and are based on available outside capital, base metal or energy prices. Communities have little control over the ups and downs of these activities. Much of the advertised spending associated with these types of activities is outside local communities and much of it flows out of the territory.

Although the greater Peel watershed and the Three Rivers wilderness are some distance from the communities of Ft. McPherson and Mayo, conservation and protected areas could play a large role in local community economic development.

Community Economic Development (CED) encourages communities to initiate and generate their own solutions to their common economic problems and build long term community capacity that will foster the integration of economic, social and environmental goals.

[57] We are preparing a more detailed backgrounder on economics and environment in the Peel watershed.

The CED approach increases economic opportunities at the local level. It is a participatory, bottom-up approach to development. With local participation and control, economic development projects based on conservation, protected areas and tourism are well-suited to CED principles.

Mayo & Ft. McPherson As Gateway Communities

Mayo and Ft. McPherson are gateway communities to the greater Peel watershed and the Three Rivers wilderness. These two communities stand to benefit the most from economic development initiatives based on conservation and protected areas in the eastern half of the Peel watershed. Dawson City is the gateway to the Dempster Highway, the northern Yukon arctic landscapes, and the western side of the Peel watershed. Dawson City is the nearest service centre to Tombstone Territorial Park, already a well-known destination.

Gateway communities are located near protected areas, wilderness or other natural attractions. They act as an entry point and service centre for tourists who visit the protected area or natural feature. Gateway communities benefit from visitor spending, but they also attract business investment, professionals, and government spending for infrastructure and facilities. Recent research in western Canada and the US shows that gateway communities near protected wilderness areas have stronger and more diverse economies than communities that rely just on resource extraction industries.[58]

Although Mayo and Ft. McPherson already benefit to some extent from visitors to the Peel watershed by acting as service centres for activities such as chartered air transportation, adventure and ecotourism operators, river boat travel, accommodation and guide-outfitting, they would have a much greater potential role as gateway communities if areas such the Three Rivers wilderness became a protected destination for wilderness tourism, ecotourism, and other types of outdoor recreation, educational or cultural activities.

The 1994 Yukon Visitor Exit survey indicates that about 20,500 people visited the Silver Trail region, and 6,100 visited the North Yukon region, up from 1994 when close to 12,000 visited both regions. Protected areas in the Peel watershed would increase the number of destination visitors to both the North Yukon and Silver Trail tourism regions, and benefit the economic development of Mayo and Ft. McPherson as gateway communities. The growth in use of Tombstone Territorial Park along the Dempster Highway shows how protected areas can attract visitors and lead to positive economic impacts in gateway communities.

Businesses that provide commercial wilderness trips in the Three Rivers area include 4 aircraft charter companies in the Yukon and NWT, 6-8 wilderness adventure operators, 4

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[58]Howe, J., E. Mc Mahon, and L. Propst. 1997. Balancing Nature and Commerce in Gateway Communities.: Island Press. Washington, D.C. 165 p.

guide-outfitters, and a few more specialized outfits offering horse-back trips, or writing and art retreats.

Based on estimated numbers of existing commercial and private canoe or raft trips in the Hart, Wind, Bonnet Plume and Snake tributaries, users spend between $685,000-$850,000 per year. This spending includes aircraft and boat charters, commercial guides, food and accommodation, equipment rentals, arts and crafts, and travel to the Yukon on the locally owned airline, Air North.

Estimated annual visitor spending related to the 5 existing guide-outfitting operations is about $500,000-$750,000 based on individual fees of $10,000 per hunter. Three of the 5 concessions are centred on the Three Rivers wilderness. In addition, there are 25 trapping concessions in the watershed, with unknown annual revenue from fur harvesting. In a conservative estimate, between $1.2 million and $1.6 million is spent each year by visitors to the eastern portion of Peel watershed. These visitors expect, and are paying for, pristine wildland conditions. This estimate does not include visitor spending along the Dempster highway region.

With new protected areas, marketing and careful visitor management to maintain ecological integrity, the Peel watershed tributaries likely have the capacity for more use. Nahanni National Park has about 1,000 visits per year – just for trips on the Nahanni River. If 1,000 river travel visits per year were spread over 3-4 tributaries of the Peel watershed, the annual spending could double to between $1.4 million and $1.7 million – *just for river trips*.

Examples of Potential Conservation-based Economic Activities in the Peel Region

Protected areas and conservation can generate substantial employment and business development across a broad range of skill levels:

- Jobs operating and maintaining protected areas and facilities;
- Wilderness guiding and outfitting for canoeing, rafting, hiking, horse-back travel, photography, research, education, cultural experiences;
- Guided hunting, fishing, lodge-based recreation and nature or culture appreciation;
- Wilderness tourism services such as air charters, ground transportation, supplies, operating recreation and cultural interpretation facilities, food and accommodation;
- Ecological and cultural or historic research programs, ecological monitoring, education programs, youth outdoor education programs, rediscovery camps and trips with local people;
- Guided or unguided bird watching for specific uncommon or rare species;
- Professional services such as web-based businesses, consulting in natural and cultural sciences or communications;
- Visual art, photography, local crafts, cultural activities, local harvest of natural health products, development of local supporting retail businesses or cooperatives;
- Natural resource and wildlife management, protected area planning and management, visitor management, with public investment;
- Enforcement, conservation stewardship, back-country rangers and river guardian programs;
- Development of tourism and recreation infrastructure, with public investment;
- Increased visitor spending on products and services available in the region.

Examples of Existing, New or Expanded Business Development Opportunities

- aircraft charter company for excursions to Three Rivers and other destinations
- flight-seeing based in Mayo and Ft. McPherson
- river trip shuttle services on Dempster highway, combined with birding
- river boat transportation of canoeists on the Peel River
- guided tours before and after extended river excursions
- horse-back wilderness excursions
- hut-to-hut hiking excursions or wilderness hiking trips
- nature appreciation lodges, with focus on wildlife and bird watching
- expanded use of out-fitting lodges and camps for ecotourism and outdoor recreation
- winter dog sled or snow machine trips to re-create lost patrol or Wind City Klondike experience
- motorized float trips to Peel Canyon and Aberdeen Canyon
- birding camps and excursions
- ski or sled trips to trapping cabins
- winter excursions to hot springs
- geology tours
- biology field research camps and excursions
- art and photography excursions and camps
- “bed and breakfast” at Peel River fish camps
- culture and bush lore stays at Peel fish camps
- culture camps
- river guardian posts or camps; habitat steward camps
- interpretive services on the river trips or other excursions
- in-town retail services for wilderness travellers – catering to “last-minute” items
- local arts and crafts cooperative
- visual arts
- writing, publication and sales of books on region’s people, natural or cultural history
- local travel guide-book publishing
- photography
- production of posters, cards, calendars other mementos

Natural Capital and Ecosystem Services

We must also draw your attention to the concepts and value of natural capital and ecosystem services. ***Natural capital*** refers to the natural resources and living systems, including the ecological systems that support life, provided by Earth's biosphere (i.e., by Nature). Goods and services are produced by ecosystems. The commodity goods include timber from forests, oil and gas, minerals, hydroelectricity, fish & wildlife. The benefits that humans obtain for free from ecosystems are called ***ecosystem services***. Ecosystem services include:

- water supply, filtration/purification, and stabilization (flood control)
- erosion control and sediment retention
- climate stabilization
- production of oxygen
- carbon sequestration by forests and peatlands
- soil formation
- nutrient cycling
- waste treatment
- pollination
- wildlife habitat
- biological control of pests and diseases
- genetic resources
- opportunities for nature-related recreational and cultural use
- subsistence values

The market benefits of harvesting timber or extracting oil and gas are measured in terms of contribution to GDP, but the value of most ecosystem services is not considered in GDP accounting. Fortunately, Canadian Boreal Initiative and the Pembina Institute have recently produced an assessment of boreal natural capital.[59] This preliminary economic valuation estimated that the total non-market value of boreal ecosystem services is **2.5 times greater** than the net market value of boreal natural capital extraction. This suggests that the ecological and socio-economic benefits of boreal ecosystem services, in their current state, may be significantly greater than the market values derived from industrial development. The establishment of a network of protected areas can serve as an investment in the natural capital of a region, for the benefit of current and future generations of people.

Payment for Ecosystem Services

Countries such as Costa Rica have developed and implemented innovative approaches to sustainable financing for conservation known as Payment for Environmental Services, or PES. PES schemes reward those whose lands provide these services, with subsidies or market payments from those who benefit, for example society as a whole, or users of a protected area.

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[59] "Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems" http://www.magma.ca/~duckhs/Boreal_Wealth_Report_Nov_2005.pdf

If such a system were tried in the Yukon, it would mean, for example, that landowners or communities that conserve or protect nature could be paid by society as a whole (e.g., Governments or international NGOs), or by those who benefit from the conservation values (e.g., tourists).

Carbon Credits - The Kyoto Protocol and Carbon Sinks

The Kyoto Protocol recognizes the ability of forests and peatlands to help reduce greenhouse gas emissions because they can absorb and retain carbon dioxide. These are called ***carbon sinks***. The CO^2 bound up as organic carbon in trees or peat, however, can be released back into the atmosphere through natural respiration, fire or insect infestation, logging, or surface disturbance of peatlands.

Whether formally signed on to the Kyoto Protocol or not, Canada has a global responsibility to reduce its emissions of carbon dioxide and other greenhouse gases. Carbon sinks have value because they can be used to offset fossil fuel emissions. The Yukon's forests and peatlands as a whole are a large carbon sink though some management areas are sources of CO^2 release. There are opportunities to use these sinks to help offset fossil fuel emissions, at least in the near term. The extensive peatlands of the Peel Plateau are the most significant carbon sinks in the Peel watershed.

Role of NGOs in Supporting A Conservation Economy

Non-government Organizations (NGOs) can support and contribute to the development of the conservation economy. NGOs can help empower communities, encourage sustainable resource stewardship, provide working capital, and help bring the conservation economy to life.

For example, Ecotrust provides information services, mapping, planning to help assess local resources; and, lending and development programs that support building new economic opportunities.

Biosphere Reserve

The greater Peel watershed is a good candidate for nomination as a Biosphere Reserve, a form of agreement that could be used as a tool for conservation and economic development. Biosphere Reserves conserve landscapes, ecosystems, species and genetic diversity, while fostering economic and human development that is culturally and ecologically sustainable. Biosphere Reserves fit well with the principles of Community Economic Development (CED) and are fully compatible with the First Nations Final Agreements. Biosphere Reserves are cooperation agreements that use existing laws, regulations and management arrangements.

The Man and Biosphere Program of the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognize biosphere reserves. Biosphere Reserves promote solutions for the conservation of biodiversity and sustainable use. Each biosphere reserve provides for:

- landscape and biodiversity conservation areas;
- appropriate development activities that are culturally and ecologically sustainable;
- support for research, monitoring, education and information exchange.

Biosphere Reserves are modeled on land use plans that identify core protected areas, buffer zones where compatible development can take place, and a transition zone that may allow for a variety of economic activities.

The concept of a "biosphere reserve" has evolved from its original emphasis on conservation areas associated with research, monitoring and education. There is now more emphasis placed on the importance of linking the conservation of biodiversity to issues of the sustainable human use of resources, and to fostering the cooperation needed to achieve a better balance between ecological and economic sustainability, especially at the community level.

The three major functions of a biosphere reserve are: conservation of biodiversity, sustainable development, and support for activities of education, research, training and monitoring that partners in a biosphere reserve provide in support of conservation and development.

Local capacity to undertake the various tasks associated with biosphere reserves is essential. Education, research, and training help build local capacity to make sound decisions and implement them. The planning that goes into these activities helps residents in a biosphere reserve identify and meet their own needs, in their own way. It also provides opportunities to draw together broad-based support from all sectors of the communities associated with the biosphere reserve.

In countries such as Canada, biosphere reserve activities depend on cooperation. For this reason, the term *Cooperation Plan* is appropriate. In such a plan, partnership and participation are emphasised. The plan is developed for the residents, businesses and other organisations and agencies of the biosphere reserve. In it, the goals for the three functions of the biosphere reserve are joined with the challenges and actions that best reflect local needs and desires. This cooperative approach encourages innovation, fosters pride in local achievements, and creates a desire to share these experiences within Canada and with other countries around the world.

For more information on biosphere reserves, visit:
Canadian Biosphere Reserves Association:
http://www.biosphere-canada.ca/biosphere_reserves.htm
United Nations (UNESCO): http://www.unesco.org/mab

Why The Three Rivers As A Core Wilderness Area?

Let us examine the proposed Three Rivers core area in terms of the conservation attributes, values and criteria discussed above.

Coarse Filter

1) Nationally and internationally significant ecological attributes

The Three Rivers possess most of these high-level conservation assets:

- ✓ Intact large watersheds with pristine water quality and aquatic habitat
- ✓ Intact large-mammal predator-prey system in a mountain boreal wilderness
- ✓ Continentally important populations of grizzly bear, Dall's sheep, woodland caribou, grey wolf, and wolverine
- ✓ Refuge for large carnivores such as wolves, grizzly bears, lynx, wolverine, species that require large wilderness to survive
- ✓ Bonnet Plume woodland caribou herd, largest in the Yukon and ranging mostly within the Three Rivers core area
- ✓ Endemic races/populations of fish, resulting from complex glacial history
- ✓ Vast intact wilderness encompassing entire mountain ranges and large watersheds of wild rivers.

The Three Rivers have valuable but partial representation of the east-west flyway, with some important wetland staging and breeding areas for waterfowl; and of populations of migratory bird species (e.g., doesn't include the bulk of the best habitat for peregrine falcon). The Three Rivers lack Beringian landscapes although they do harbour a handful of Beringian species.

2) Representation

The Three Rivers area provides excellent representation of the Mackenzie Mountains Ecoregion:

- ✓ the full complement of abiotic units and enduring features
- ✓ a complete array of physical substrates, landscapes, communities and ecosystems
- ✓ all the focal species that one might want to select for this ecoregion.

The Three Rivers also include good but partial representation of the Peel River Plateau Ecoregion, including some of the characteristic peatland-rich plateau landscapes with incised streams. The Three Rivers area lacks representation from the British-Richardson Mountains Ecoregion and thus lacks Beringian landscapes and ecosystems.

Fine Filter

Information on fine filter, special elements is very incomplete. We can safely assume that the physical and biological special elements that occur in the Mackenzie Mountains Ecoregion are well represented in the Three Rivers core area, because of its large size.

Some Peel Plateau special elements probably occur in the Three Rivers, but few Beringian special features do.

Water

Perhaps the most significant environmental feature of the Three Rivers core area is its entire large unregulated watersheds, with the full range of aquatic ecosystems and processes, and with pure water and intact hydrologic connectivity. These large watersheds are the fully functioning ecosystems with the greatest likelihood of accommodating climate change and maintaining ecological integrity over the long term.

Size Matters

Is the core Three Rivers area big enough to ensure long-term maintenance of biodiversity and ecological integrity within its boundaries? At about 30,000 km^2, it is indeed big enough to satisfy the Minimum Critical Area and Minimum Dynamic Area requirements discussed on pages 13 and 14. It should also be big enough to accommodate climate change and to maintain hydrologic connectivity, because it encompasses large intact watersheds, with full elevational sequences and headwater to mouth coverage of the drainages.

Is the core Three Rivers area big enough to ensure long-term maintenance of biodiversity and ecological integrity in the entire Peel watershed? On its own probably not, even though Three Rivers represents close to 40% of the Peel watershed and is within the recommended estimate from conservation science. The goal of ***protecting and conserving the wilderness of the Three Rivers and maintaining the ecological integrity of the greater Peel watershed*** would be adequately addressed by a core Three Rivers wilderness, supplemented with:

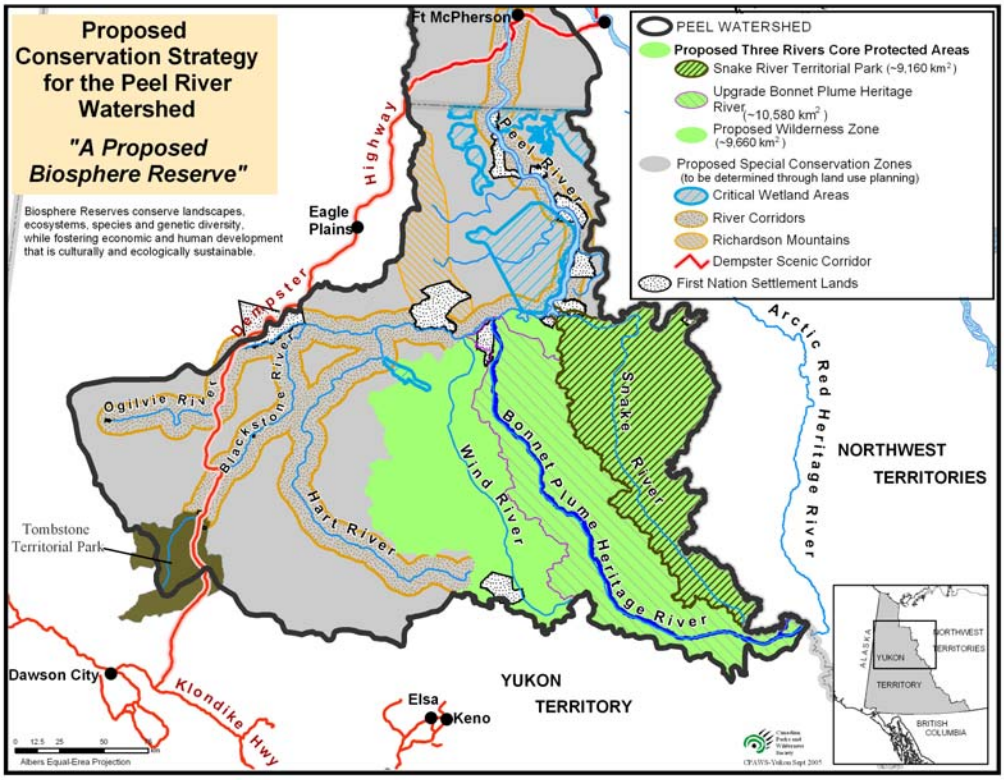
- conservation corridors along the Peel mainstem and its major tributaries
- special conservation zones to protect critical wetlands on the Peel Plateau
- a landscape-level Beringian protected area in the southern Richardson Mountains
- adequate attention to other important biological features and special elements
- with linkages among these components and to landscapes beyond the watershed, and
- appropriate economic development activities that are culturally and ecologically sustainable.

Our Responsibility

To fulfill the Yukon's conservation responsibilities, to protect the globally significant biological and wilderness values in the Peel watershed, and to help create a diverse and stable regional economy, we propose a Peel Watershed Land Use Plan goal:

To protect and conserve the wilderness of the Three Rivers and to maintain the ecological integrity of the greater Peel watershed.

To achieve this goal, CPAWS proposes a core protected wilderness area in the Three Rivers watersheds, including territorial park protection for the Snake River drainage. We call for special conservation zones in the remainder of the Greater Peel watershed to protect critical wetlands (including the Turner Lake wetland complex), sensitive river corridors, a portion of the southern Richardson Mountains (specifically Canyon Creek at least), and other important biological and cultural features.
The core wilderness area is approximately 30,000 km^2, a sufficient size to support species and ecological processes that depend on large intact ecosystems.



The conservation strategy would:

- conserve a globally important mountain boreal ecosystem both for its inherent value and as a benchmark for more developed ecosystems elsewhere;
- allow for appropriate new economic and community development compatible with maintaining a healthy ecosystem;
- ensure continued robust populations of woodland caribou, grizzly bear, wolverine, wolf, peregrine falcon and a host of other species;
- protect the pristine headwaters of the Peel, large intact tributary watersheds, aquatic ecosystems and critical wetlands of territorial importance;
- protect one of Canada's finest arrays of wild mountain river watersheds, supporting existing tourism and service businesses, and attracting new investment;
- protect a northern Canadian cultural landscape, and support continued traditional activities and harvesting throughout the Peel watershed;

- help meet Yukon's commitment to complete a territorial network of protected areas, and meet its obligations under the international convention to conserve biodiversity.

Taken as a whole, the Peel watershed is an exceptional candidate for a "biosphere reserve," where conservation supported by local communities, can contribute to a lasting economy that respects the region's way of life, sustained by an intact ecosystem.

We call on the Land Use Planning Commission to fulfill its commitment to today's Yukon citizens and future generations, to prepare a land use plan based on sound principles of conservation, and on economic development choices that do not erode the watershed's natural capital.