STATE OF THE MUSKWA-KECHIKA REPORT

PREPARED FOR:

MUSKWA-KECHIKA ADVISORY BOARD

PREPARED BY:

CRANE
MANAGEMENT
CONSULTANTS

1763 EAST 3RD AVE.

VANCOUVER, BC V5N 1H3

WITH ASSISTANCE FROM:

enfor consultants ltd

212 – 1200 LYNN VALLEY RD.

NORTH VANCOUVER, BC V7J 2A2

MAY 2008

Table of Contents

1. Executive Summary 1

2. Introduction 4

2.1 Report Purpose 4

2.2 Approach and Data Sources 4

3. Muskwa-Kechika Management Area 7

3.1 Overview of Muskwa-Kechika Management Area 7

3.2 Vision 9

3.3 Legislation 10

3.4 Governance 12

4. Ecological Conservation 14

4.1 Environmental Management 14
4.1.1 Linear Development Indicator 14
4.1.2 Wilderness Indicator 19
4.1.3 Protected Areas Indicator 21
4.1.4 Sustainable Wildlife Populations Indicator 24
4.1.5 Old Growth Indicator 26

4.2 Biodiversity 28
4.2.1 Species at Risk Indicator 28
4.2.2 Grizzly Bear Indicator 32
4.2.3 Stone's Sheep Indicator 34
4.2.4 Caribou Indicator 36
4.2.5 Plains Bison Indicator 41
4.2.6 Bull Trout Indicator 42

4.3 Climate Change 46
4.3.1 Mountain Pine Beetle Infestation Indicator 46
4.3.2 Carbon Storage Indicator 50

4.4 Water 53
4.4.1 Stream Crossings Indicator 53

4.5 Air 56
4.5.1 Industrial Operations Indicator 56

5. Economic Progress 58

5.1 Regional Economy 58

5.1.1 Unemployment Indicator 58
5.1.2 Income Indicator 59

5.2 Regional Economic Diversification *60*
5.2.1 Economic Diversity Indicator 60

5.3 Tourism *62*
5.3.1 Provincial Park Visitation Indicator 62
5.3.2 Tourism Infrastructure Indicator 63

5.4 Recreation *65*
5.4.1 Hunting Activity Indicator 65

5.5 Forestry *67*
5.5.1 Forestry Indicators 67

5.6 Mineral Exploration and Development *71*
5.6.1 Mineral Exploration and Development Indicators 71

5.7 Oil and Gas *74*
5.7.1 Oil and Gas Exploration and Development Indicators 74

5.8 Energy *76*
5.8.1 Renewable Energy Indicator 76

5.9 Trapping *77*
5.9.1 Furbearer Harvest Indicator 77

6. Social Development 80

6.1 Population *80*
6.1.1 Population Indicator 80

6.2 Health *82*
6.2.1 Population Mortality Indicators 82

6.3 Forest and Wilderness Recreation *84*
6.3.1 Forest and Wilderness Recreation Opportunity Indicators 84

6.4 Worker Safety *86*
6.4.1 Worker Mortality and Morbidity Indicators 86

6.5 First Nations *88*
6.5.1 First Nations Indicators 88

7. Appendix I – Reporting Model 91

8. Appendix II – Map of Ecoprovinces of BC 94

9. Appendix III – Linear development data reported by watershed 95

1. Executive Summary

Situated in northeast BC and stretching from the BC-Yukon border to Williston Reservoir, the Muskwa-Kechika Management Area (M-KMA) is larger than the two provinces of Nova Scotia and Prince Edward Island combined.

Created in 1998 by the BC Government through the *Muskwa-Kechika Management Area Act*, approximately 25% of the M-KMA is designated as protected area, such as Class A provincial parks, and the other 75% is designated as either a Special Wildland, Special Management or Enhanced Resource Management Zone. A BC Government appointed Advisory Board, which draws from a wide spectrum of stakeholders, provides advice to the BC Government on various land and resource planning and management issues within the Management Area boundaries. The Mukwa-Kechika legislation complements the authority of other bodies, including First Nations, which have interests and responsibilities for stewardship and direction of land and resources in the Management Area's boundaries.

In 2006, the vision for the Muskwa-Kechika Management Area (M-KMA) was refined, through an Advisory Board driven strategic planning process, to become the following:

The M-KMA is a globally significant area of wilderness, wildlife and cultures, to be maintained in perpetuity, where world class integrated resource management decision-making is practiced ensuring that resource development and other human activities take place in harmony with wilderness quality, wildlife and the dynamic ecosystems on which they depend.[1]

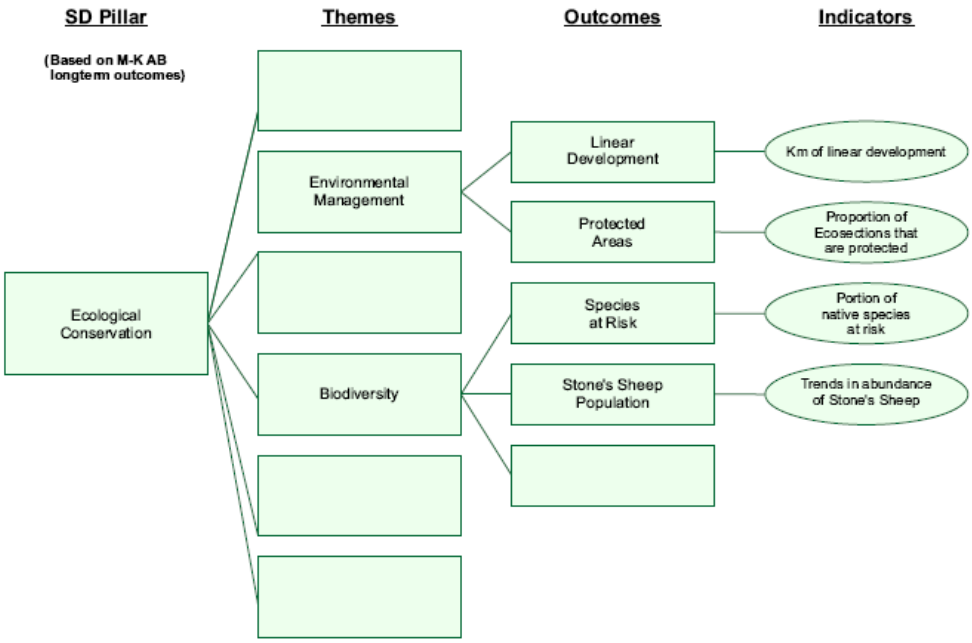
The M-KMA board's vision is for the M-KMA to be a model of sustainability, enabling economic development while protecting a large, intact and predominantly unroaded wilderness.

This document is structured as a "State of the Muskwa-Kechika Report" and reports on the current status of the area's ecological conservation, economic progress and social development, i.e. each of the three sustainability pillars.

It is the initial report of its type for the M-KMA and so acts as a baseline for comparing to changes in the three pillars of sustainability that will be reported in subsequent State of the Muskwa-Kechika Reports.

[1] Vision: M-KMA Strategic Direction and Strategic Plan, 2006

A model was developed for identifying suitable indicators for this report. Shown below is part of the reporting model for the Ecological Conservation pillar. Several themes were identified within this pillar, and then outcomes and associated indicators were identified for each theme. A significant factor in selecting indicators was the availability of current data, because developing new data for indicators was not part of this project's mandate.

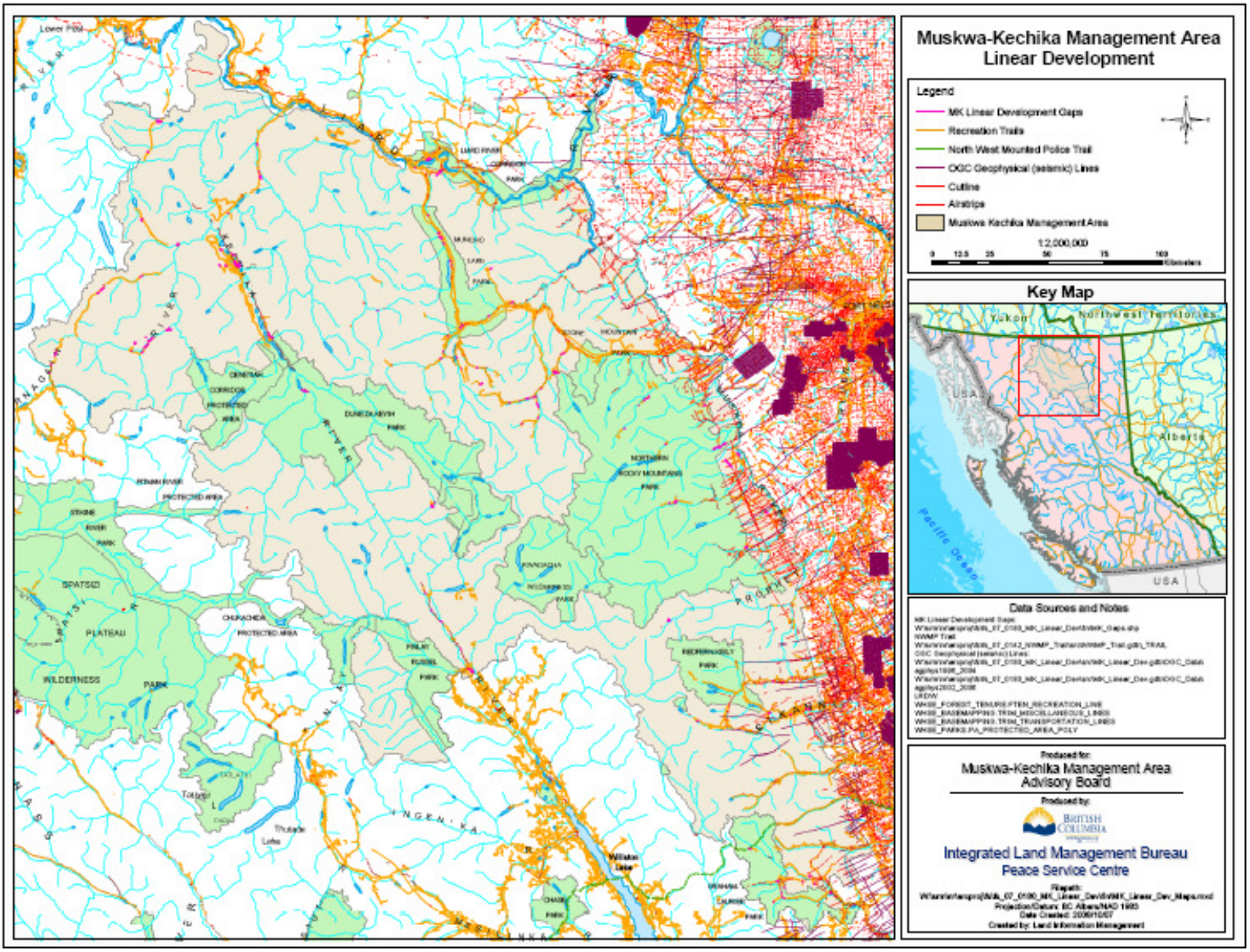


ILMB extensively assisted with this project by supplying GIS-based data upon requests of the project consultant.

Nineteen themes are covered in the report and results for 31 indicator groups are presented within a sustainability framework of ecological conservation, economic progress and social development.

The overall conclusion from a review of indicator results is that the M-KMA remains a largely wilderness area with relatively tiny amounts of economic activity at this time. There has been no acceleration of economic development within its boundaries in the past few years and M-K tourism business activity appears to have fallen off slightly, especially evident in lower Alaska Highway tourist traffic numbers.

The results for the linear development indicator well illustrate the distinct wilderness characteristic of the Muskwa-Kechika Management Area. The M-KMA's total linear development density is very low, 0.112 km per sq km. The linear development map shown below clearly shows a relatively low level of linear development in the M-KMA, especially in comparison to the lands lying to its east where petroleum resource exploration and development are well established.



2. Introduction

2.1 Report Purpose

This document is structured as a "State of the Muskwa-Kechika Report" and reports on the current status of the area's ecological conservation, economic progress and social development, each of the three sustainability pillars.

It is the initial report of its type for the Muskwa-Kechika Management Area (M-KMA) and so acts as a baseline for comparing changes in each of the three pillars of sustainability that will be reported in subsequent State of the Muskwa-Kechika Reports.

It is similar to State of the Environment reports issued by various governments as it features pressure and state indicators, but differs from them in its broader approach of including economic and social development indicators as well as environmental indicators.

The intent of this report is to assist the M-K Advisory Board in communicating with various stakeholders and audiences using a comprehensive and standardized reporting of the state of the M-KMA.

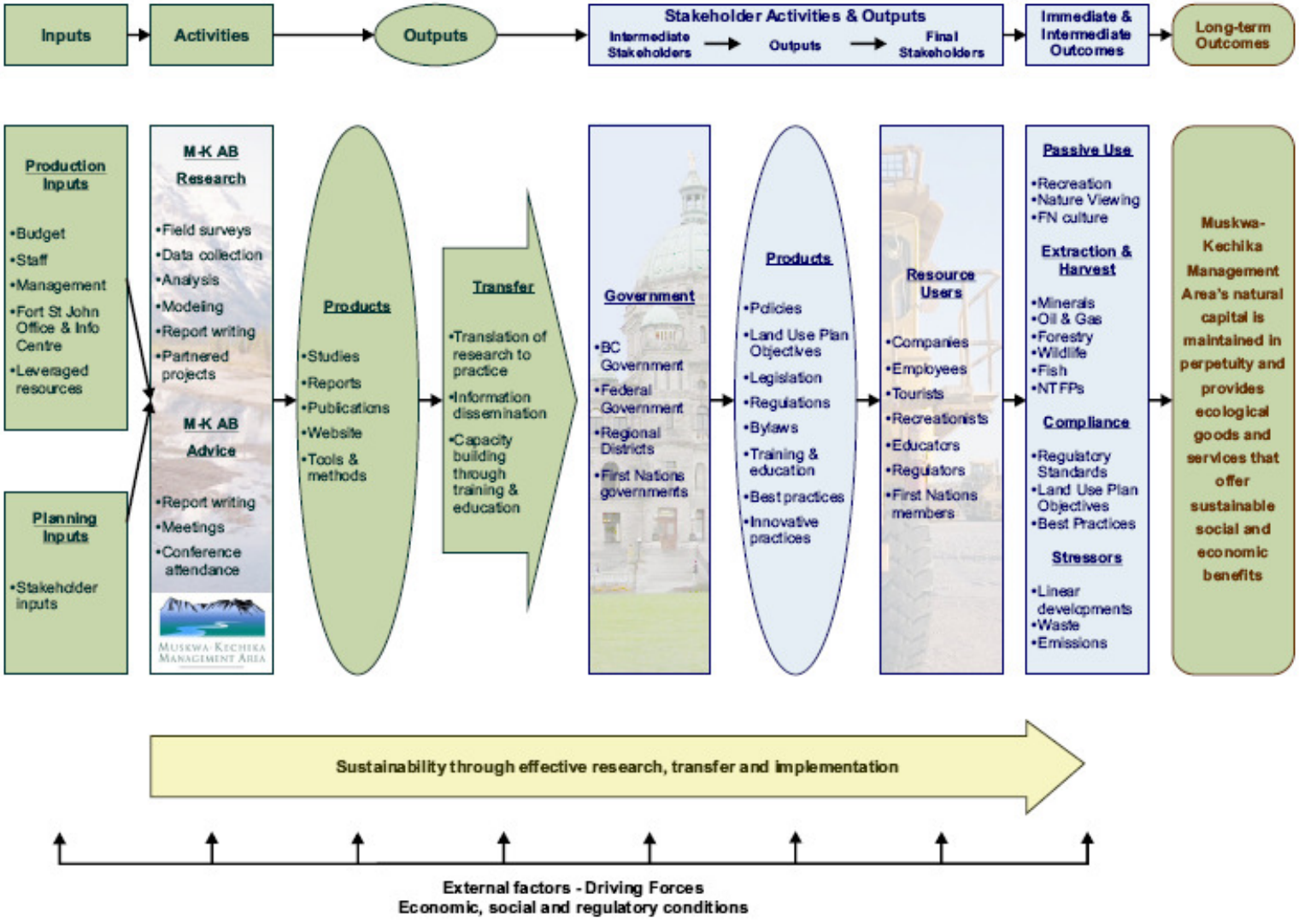
2.2 Approach and Data Sources

The sustainability report structure provides a way to measure progress on realizing the vision for the M-KMA. It examines developments over time in each of ecological conservation, economic progress and social development and this approach assists organizations, businesses and individuals to make informed decisions by:

- analyzing trends in measurable environmental, economic and social conditions;
- tracking progress towards sustainability; and
- providing quantitative information about the M-KMA in a readily accessible form.

A logic model was developed for this project to assist in developing indicators for the three sustainability pillars, and is displayed on the next page.

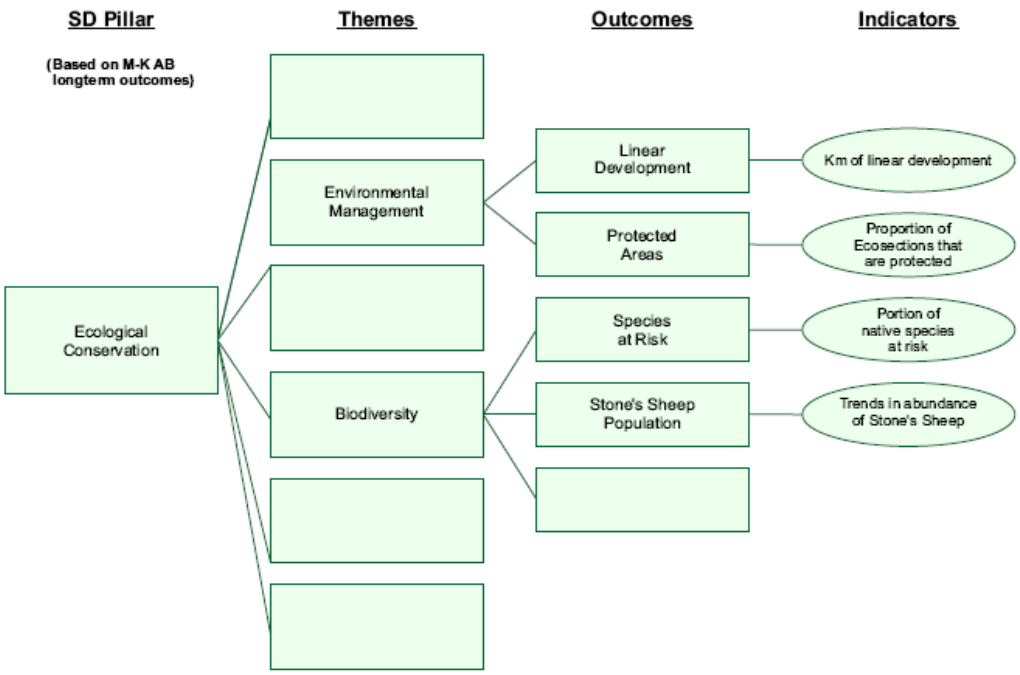
Muskwa-Kechika Logic Model



Using the M-KMA logic model shown on the previous page and the sustainability reporting framework, a reporting model was developed for identifying suitable indicators for this report. Shown below is part of the reporting model for the Ecological Conservation pillar. Several themes were identified within this pillar, and then outcomes and associated indicators were identified for each theme. A significant factor in selecting indicators was the availability of current data, because developing new data for indicators was not part of this project's mandate.

ILMB extensively assisted with this project by supplying GIS-based data upon requests of the project consultant.

A complete listing of the themes, outcomes and indicators was discussed and approved at a November 26, 2007 project meeting of the consultants, M-KMA staff, the Integrated Land management Bureau (ILMB) coordinator for the M-KMA and some M-K Advisory Board members. A listing of the report's themes, outcomes and indicators is in Appendix I.



3. Muskwa-Kechika Management Area

3.1 Overview of Muskwa-Kechika Management Area

Situated in northeast BC and stretching from the BC-Yukon border to Williston Reservoir, the Muskwa-Kechika Management Area is larger than the two provinces of Nova Scotia and Prince Edward Island combined.

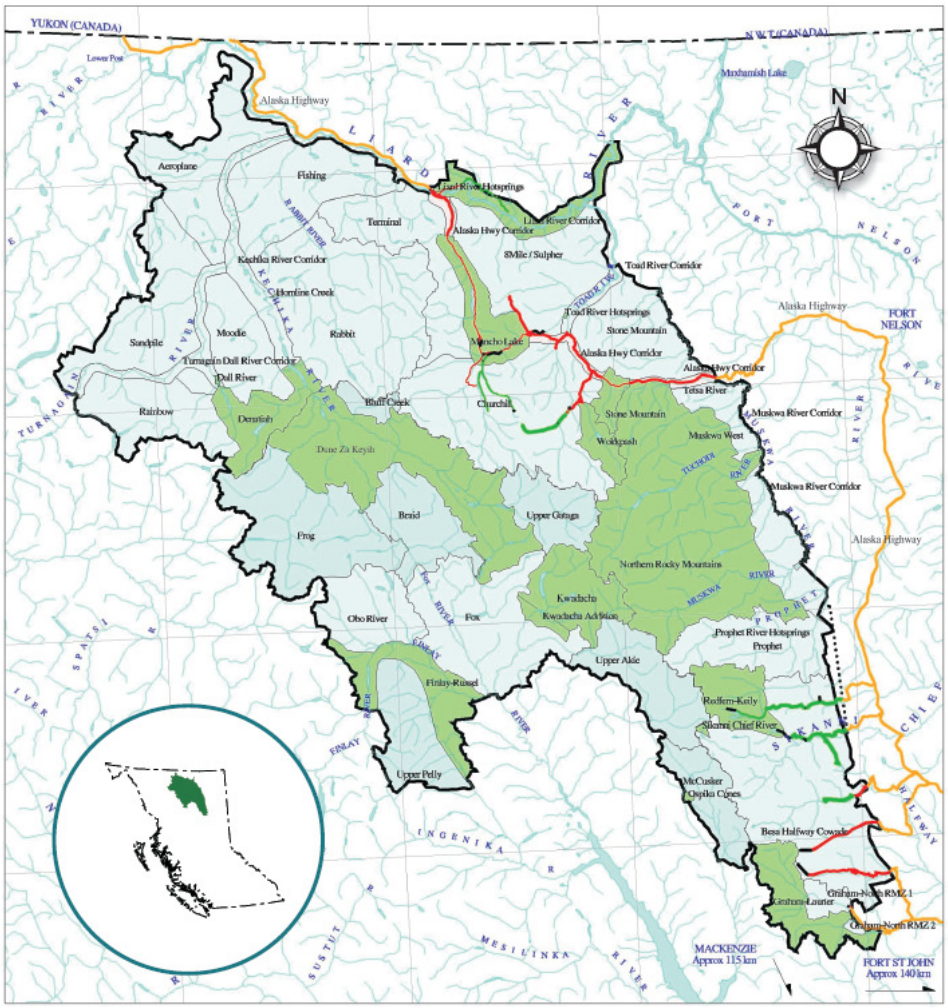
Created in 1998 by the BC Government through the *Muskwa-Kechika Management Area Act*, within its boundaries are more than 17,000 sq. km of protected areas, including Class A provincial parks, and special management zones. A BC Government appointed Advisory Board, which draws from a wide spectrum of stakeholders, provides advice to the BC Government on various land and resource planning and management issues within M-KMA boundaries. The Mukwa-Kechika legislation complements the authority of other bodies, including First Nations, which have interests and responsibilities for stewardship and direction of land and resources in the Management Area's boundaries.

"BC's Working Wilderness", the slogan for the Management Area given by its Advisory Board, captures the guiding objective to preserve its wilderness qualities in parallel with allowing sustainable economic use of its resources.

The richness of its northern environment is captured in the informal slogan of "Serengeti of the North" that is often attached to the Muskwa-Kechika.

The map on the following page shows boundaries, protected areas, special management zones, access management, roads and trails of the Muskwa-Kechika Management Area, along with its location in northeastern BC.

The M-KMA is situated in the foothills and mountains of the northern Rocky Mountains.



A vast mosaic of protected areas and special management zones.

Total area: 6.4 million hectares
Protected Areas: 1.64 million hectares
Special Management Zones: 3.63 million hectares
Special Wildland Zones: 0.92 million hectares

A quotation from a Ministry of Sustainable Resource Management (MSRM) report summarizes the natural world features of this vast part of the province.

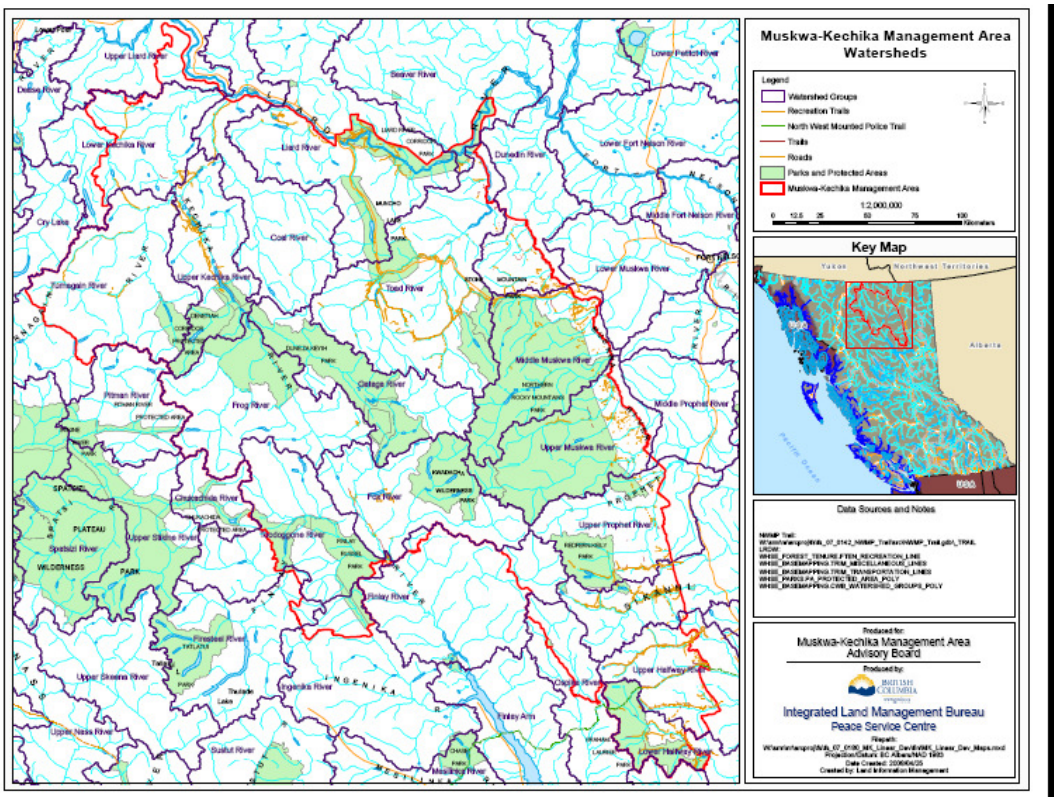
"Representative and unique landforms are present in the M-KMA. Vegetation includes boreal white and black spruce and sub-boreal spruce wetlands and forests at lower elevations, spruce-willow-birch and Engelmann spruce-subalpine fir forests and high-elevation wetlands below the treeline, and alpine tundra, rock and glaciers above the treeline. Fire is the dominant natural disturbance, but landslides and floods are locally important.

These ecosystems support a diversity of wildlife habitats and populations. The area has the greatest combined abundance and diversity of wild animals in North America and it comprises a significant, intact predator-prey system. Key wildlife species

include Northern (woodland) caribou, elk, grizzly bear, moose, mountain goat, Stone's sheep, wolf and many species of furbearers and birds. The largest wild plains bison herd in North America travels into the area.

The M-KMA lies entirely within the Arctic drainage and encompasses 50 undeveloped watersheds. Major streams include the Finlay, Fox, Frog, Halfway, Kechika, Liard, Muskwa, Prophet, Rabbit, Toad, Tuchodi, Turnagain and Sikanni Chief rivers. The Kechika River drains most of the western half of the M-K and at 2.2 million ha is North America's largest remaining unroaded watershed south of the Yukon and NWT." [2]

The following map shows the boundaries of the watersheds that either lie within or overlap into the M-KMA.



3.2 VISION

Supported by the pillars of wildlife and wilderness, the M-KMA land and resource management model is considered unique in North America. In 2006, the vision of

[2] Statement attributed to Ministry of Sustainable Resource Management (MSRM) and cited in R. McManus Consulting Ltd. and Salmo Consulting Inc. (July 2004) *Muskwa-Kechika Case Study.* Prepared for The National Round Table on the Environment and The Economy, pg. 26.

the M-KMA was refined through an Advisory Board driven strategic planning process, to become the following:

The M-KMA is a globally significant area of wilderness, wildlife and cultures, to be maintained in perpetuity, where world class integrated resource management decision-making is practiced ensuring that resource development and other human activities take place in harmony with wilderness quality, wildlife and the dynamic ecosystems on which they depend.[3]

The M-KMA board's vision is for the M-KMA to be a model of sustainability, enabling economic development while protecting a large, intact and predominantly unroaded wilderness.

3.3 LEGISLATION

A 5.3 million ha Muskwa-Kechika Access Management Area was established in 1993 under Section 111(b) of the *Wildlife Act*. Motor vehicle use was restricted in this area, and oil and gas tenure requests were deferred, pending deliberations of the Fort Nelson and Fort St. John LRMP roundtables. Each recommended creation of a special management area over the Muskwa-Kechika.

The Muskwa-Kechika Management Area (M-KMA) was legislated in 1998 with the passing of the *Muskwa-Kechika Management Area Act* (Bill 37), and its subsequent amendments (Bill 14-2001 and Bill 22-2002).

Expansion of the M-KMA occurred in 2000 upon completion of the Mackenzie Land and Resource Management Plan (LRMP). The Mackenzie addition increased the size of the M-KMA to 6.4 million ha. This addition has not yet been officially included in the *M-KMA Regulation*. Amendments to the *M-KMA Regulation* are currently underway to legally include the Mackenzie addition.

Created by the *Muskwa-Kechika Management Area Act*, the legislation states the following.

"*The M-MKA is an area of unique wilderness in northeastern British Columbia that is endowed with a globally significant abundance and diversity of wildlife."*

This legislation established the M-KMA resource planning and management framework. The Muskwa-Kechika Management Plan[4] and five local strategic plans are development prerequisites defined by the M-KMA Act. The Act specifies that decisions affecting the M-KMA must be consistent with these plans.

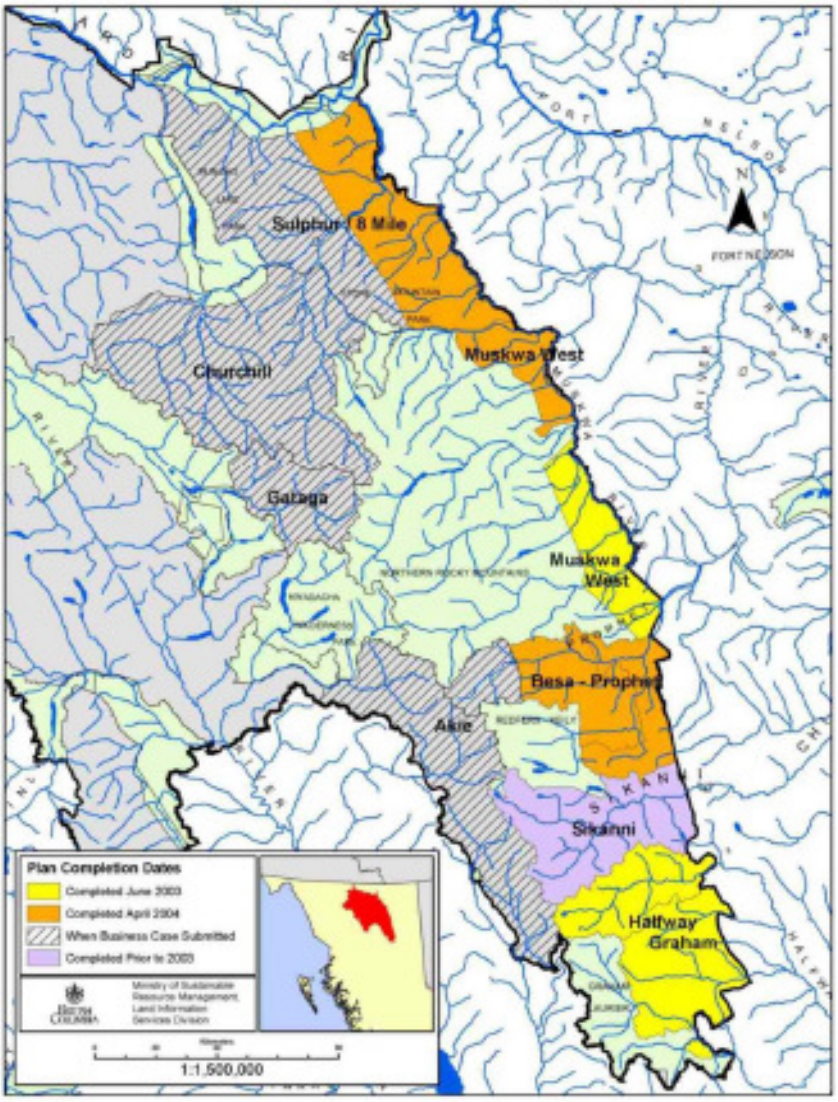
The M-K Management Plan was adopted by regulation in 2003.[5] It features the "wilderness concept," the M-KMA management model, the formal inclusion of First Nations, the emphasis on scientific research, and pre-tenure planning requirements. Sections 2 through 6 of the regulation describe the management framework and sections 7 through 10 specify management objectives.

---

[3] Vision: M-KMA Strategic Direction and Strategic Plan, 2006

[4] Available at: http://srmwww.gov.bc.ca/rmd/lrmp/frtnelsn/app7/app7toc.htm

[5] Available at: http://www.qp.gov.bc.ca/statreg/reg/M/53_2002.htm



Note: the Phase I Besa-Prophet Pre-Tenure Plan, completed prior to 2003, is not shown separately on this map. See Section 5.1 for more information

The M-KMA Management Plan is implemented by BC government agencies through BC ministry and agency management activities, land and resource management plans plans, resource use and development permits, and Crown land and natural resource dispositions. Development plans and permits must be consistent with the objectives and strategies of resource management zones and any local strategic plans as specified in the Management Plan.[6]

Timber tenures, operational plans and permits approved prior to the creation of the Muskwa-Kechika Management Area are exempt from the requirements and objectives of the Muskwa-Kechika Management Plan. Tenure and plan renewals and replacements, as well as new tenures, plans and permits, must demonstrate consistency with the current Muskwa-Kechika Management Plan and local strategic plans.

Pre-tenure planning must be undertaken for an area in the M-KMA before petroleum resource tenures can be issued in that area. Pre-tenure planning is not a pre-requisite for oil and gas focused geophysical activities, however.

The BC Government is required to complete oil and gas pre-tenure plans in a manner that is consistent with the M-K Act and Management Plan. There is a pre-tenure plan written in a three-ring binder format and adopted in May 2004, which contains chapters for each of four pre-tenure plan areas, Halfway-Graham, Besa-Prophet, Muskwa West and Sulpher / 8 Mile. A pre-tenure plan for the Upper Sikanni area was adopted in 1995. The map above shows the pre-tenure plan areas.

[6] Ibid.

3.4 GOVERNANCE

The *Muskwa-Kechika Management Area Act* provides for a Muskwa-Kechika Advisory Board (M-KAB) to advise the BC Government on natural resource planning, research, monitoring and management in the M-KMA. The Premier appoints board members who represent a variety of perspectives.

The Advisory Board's legislated role includes the following responsibilities.

- advising government on natural resource management in the M-KMA to maintain the area's values;
- making recommendations on planning and strategic management;
- ensuring that activities are consistent with the objectives of the *Muskwa-Kechika Management Area Act*, the Muskwa-Kechika Management Plan and approved local strategic plans; and
- making recommendations on expenditures.

The M-KMA regulation also provided for an Inter-Agency Management Committee of regional managers of BC government ministries, which was given the following responsibilities.

- assists in resolving conflicts between agencies and resource users;
- maintains a registry of plan documents and plan amendments, including the Muskwa-Kechika Management Plan and local strategic plans, which are available to any interested parties;
- reviews proposed amendments and provides recommendations to senior BC Government management;
- provides for and coordinates public review and consultation as necessary in partnership with the Advisory Board;
- prepares an annual inter-agency work plan to facilitate the implementation of the Management Plan in consultation with the Advisory Board; and
- works in partnership with the Advisory Board to prepare an annual monitoring report on plan implementation, amendments and expenditures.

The *Muskwa-Kechika Management Act* specifically acknowledges the role of First Nations in the area's stewardship as there is a statement that the "long-term maintenance of wilderness characteristics, wildlife and its habitat is critical to the social and cultural well-being of First Nations and other people in the area."

Prior to the establishment of the M-KMA, a letter of understanding, dated September 24, 1997, established a formal agreement between the Kaska Dena Council and the Province of British Columbia regarding the M-K area. The letter of understanding recognizes the Kaska Dena's rights, culture and heritage, including the right to harvest fish and wildlife using traditional or contemporary methods in

accordance with their Aboriginal rights to harvest for sustenance, social and ceremonial purposes.

The current members of the Advisory Board and their main affiliations are as follows.

- Tom Briggs, Board Chair (former Mayor of Mackenzie)
- Bill Lux, Board Vice-Chair (Kaska Dena)
- Jason Lee, Board Vice Chair (Treaty 8 Tribal Association)
- Darrell Regimbald (Industry - forestry)
- Kristy Emery (Industry – mineral exploration and mining)
- Dixie Hammett (Industry – guide outfitting)
- Barry Holland (Non-commercial recreation)
- Gerry Hunter (Treaty 8 - Halfway River First Nation)
- Andy Johnson (Industry – oil and gas)
- Stephanie Killam (Local government – Mackenzie)
- Shelley Middleton (Local government/ tourism – Fort Nelson)
- Johnny Mikes (Conservation – National/Provincial)
- Laurie Montour (Treaty 8 – Fort Nelson First Nation)
- Corrine Porter (Kaska Dena – Daylu Dena Council)
- Wayne Sawchuk (Conservation – local)
- Peter Stone (Kaska Dena – Toad/Muncho)
- Tim Trapp (Kaska Dena – Kwadacha)
- Karrilyn Vince (M-K Program Manager, Ex-Officio board member)

The Muskwa-Kechika Advisory Board directs funding to its operations and various projects within the M-KMA. The following is a summary of final expenditures from 2003-2004 to 2006-2007.

Table 3-1: Muskwa-Kechika Advisory Board Expenditures

Date	Total Expensed
2003-2004	$1,688,659.95
2004-2005	$1,341,081.52
2005-2006	$1,305,978.21
2006-2007	$1,237,388.86
2007-2008	Expenditures to be confirmed
2008-2009	Funding to be confirmed

4. Ecological Conservation

4.1 Environmental Management

4.1.1 Linear Development Indicator

- Distance of linear development (km)
- Density of linear development (km per sq. km)

Relevance

"Linear development" refers to developments that are constructed in a linear fashion across the landscape, i.e. power lines, highways, roads, trails, railways, pipelines, telecommunications infrastructure, cut lines and seismic lines.

Linear development is often consequential to other forms of commercial and industrial development. Although it arises as a result of different impetuses and takes different forms, many of their environmental impacts to watersheds and to fish are similar, regardless of whether it is a road, a hydroelectricity transmission line or a pipeline. For example, each of the following impacts is often common to all types of linear development relative to a natural or wilderness state:

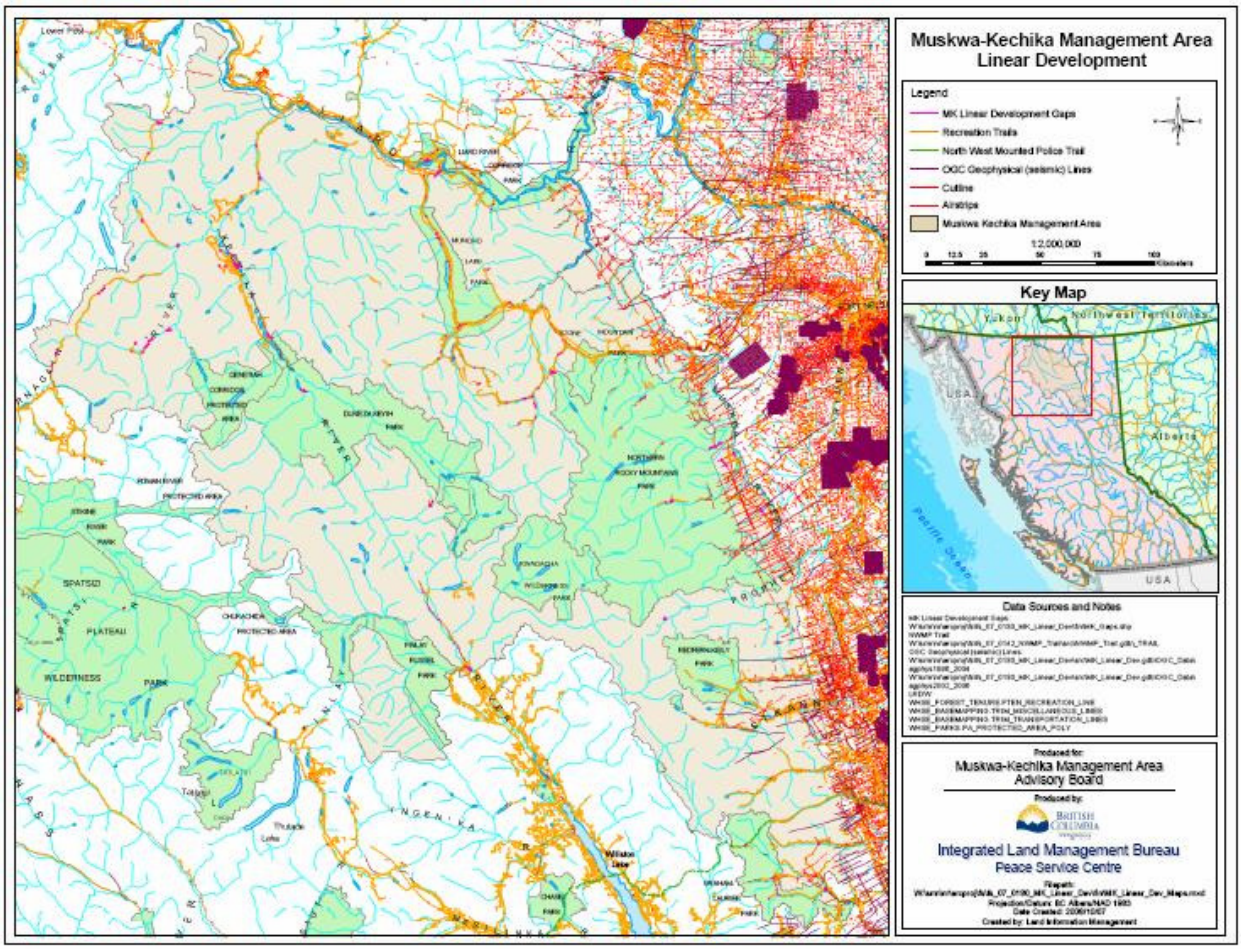
- Fragmentation of land or forests, disturbing or destroying wildlife habitat, migration corridors and other environmentally sensitive areas;
- Higher potential for damage to streams where the linear development crosses waterways;
- Disruption to natural drainage systems;
- Potential for soil erosion, stream sedimentation and slope stability issues
- Increases in noise levels and disturbance
- Introduction of weeds and non-native species
- Intrusion into wild previously untouched tracts of land, including increased public access for hunters and other recreationists; and
- Site clean-up and reclamation issues.

Linear Development in the Muskwa-Kechika

Table 4-1 presents total linear development, linear development by type, such as paved roads, and the density of each within the Muskwa-Kechika Management Area. In Table 1 of Appendix III, linear development is presented by watersheds within the M-KMA.

Table 4-1: Distance and density of linear development in the M-KMA (km and km per sq. km)		
Type of linear development	**Distance (km)**	**Density (km per sq. km)**
Total linear development	7,147	0.112
Roads - paved	234	0.004
Roads - graded	309	0.005
Roads - unpaved	2,551	0.040
Roads - overgrown	24	0.000
Recreation	198	0.003
Trails	344	0.005
NWMP Trail	68	0.001
Seismic (OGC 1996-2004)	365	0.006
Seismic (OGC 2002-2006)	67	0.001
Cutlines	2,952	0.046
Aistrips	34	0.000

Following is a map of linear development by type for the M-KMA and surrounding area.



What does the data show?

The linear development map clearly shows a relatively low level of linear development in the M-KMA, especially in comparison to the lands lying to the east where petroleum resource exploration and development is well established.

A distinguishing feature of the linear development on the M-KMA's landbase is its concentration in the eastern border areas. There are four sub-areas where linear development tends to be concentrated.

- The most southern area, which includes the Upper Halfway River, Upper Sikanni Chief River, Upper Prophet River, Upper Muskwa River and Middle Muskwa River watersheds
- The area north of Prophet River where there has been petroleum resource exploration, mainly the Upper Muskwa River and Upper Prophet River watersheds
- The area where the Alaska Highway slices into the M-KMA, mainly the Middle Muskwa River and Dunedin River watersheds
- The recreation trials that give access to the Kechika River in the northern reaches of the M-KMA

The concentration of the linear development in a few areas means that the vast majority of the M-KMA is intact wilderness. The M-KMA's total linear development density is very low, 0.112 km per sq km.

A few watersheds had no linear developments (Finlay River, Firesteel River, Gataga River, and Ingenika River). Others that had quite low levels of linear development include the following: Coal River, Fox River, Frog River, Upper Liard River, Lower Kechika River, Ospika River, Toodoggone River, and Turnagain River.

The watersheds with the highest concentration of linear development included the following: Dunedin River (0.351 km per km^2), Upper Halfway River (0.442 km per km^2), and Upper Sikanni Chief River (0.407 km per km^2).

The total distance of linear development is approximately 7,000 km, and unimproved roads (2,551 km) and cutlines (2,952 km) account for 77% of the total.

The 2007 State of Environment Report issued by BC Ministry of Environment included road density density by ecoprovince for BC.[7] Although the data for the Muskwa-Kechika report and the BC State of Environment report were compiled by different parties, the road density figures from each can be compared in broad terms. The road density for the M-K is approximately 0.049 km per sq. km. The road density in the M-K is lower than for any BC ecoprovince. The Muskwa-Kechika area is largely part of the Northern Boreal Mountains ecoprovince, which was reported as having the lowest road density in BC for 2005. The road densities (km per sq. km) for each BC ecoprovince are as follows.

- Northern Boreal Mountains (NBM) 0.090
- Taiga Plains (TAP) 0.521
- Coast and Mountains (COM) 0.454
- Sub-boreal Interior (SBI) 0.727
- Central Interior (CEI) 1.169
- Southern Interior Mountains (SIM) 0.911
- Boreal Plains (BOP) 1.657
- Georgia Depression (GED) 2.676
- Southern Interior (SOI) 1.719

A thorough search of linear development was undertaken for this project and it is noticeable that there are neither forestry roads nor petroleum resource transmission lines in the M-KMA at this juncture. There are gathering lines to active well sites in the M-KMA but no data on their length that lies within M-KMA boundaries.

Data Sources

Table 4-2 presents the sources of data that were accessed to compile the tables and map on linear development in the M-KMA.

[7] Available at http://www.env.gov.bc.ca/soe/et07/06_ecosystems/technical_paper/ecosystems.pdf

Table 4-2: Data sources for linear development in the M-KMA				
Linear Development Type	**Original Name**	**Original Location**	**Name**	**Location**
M-KMA Gaps			MK_Gaps.shp	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\fin
Roads - paved	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Roads_Paved	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\
Roads - gravel	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Roads_Gravel	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\
Roads - unimproved	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Roads_Unim-proved	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\
Roads - overgrown	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Roads_Overgrown	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\
Recreation Trails	WHSE_FOREST_TENURE.FTEN_RECREATION_LINE	LRDW	Rec_Trails	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\MK_Data\
Trails	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Trails	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\Trails\
Geophysical (seismic) Features	agphys1996_2004	OGC website	agphys1996_2004	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\OGC_Data\
Geophysical (seismic) Features	agphys2002_2006	OGC website	agphys2002_2006	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\OGC_Data\
Cutlines	WHSE_BASEMAPPING.TRIM_MISCELLANEOUS_LINES	LRDW	Landform_Cutline	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\MK_Data\
Airstrips - area	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Airstrips	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\TRIM_Transportation\
Pipelines - OGC	aprow_bc	OGC website		W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\OGC_Data\
Roads - OGC	tpdr_bc, apdr_bc, aapr_bc, syd_road	OGC website		W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\OGC_Data\
Roads - Forestry	WHSE_FOREST_TENURE.ABR_ROAD_SECTION_LINE	LRDW	Roads_Forestry	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\Source_Linear_Dev
Roads - FTEN	WHSE_FOREST_TENURE.FTEN_ROAD_LINES	LRDW	Roads_FTEN	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\Source_Linear_Dev
Roads - DRA	WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP	LRDW	Roads_DRA	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\Source_Linear_Dev
Railway	WHSE_BASEMAPPING.DBM_7H_MIL_RAILWAYS_LINE	LRDW		
Pipelines & Transmission Lines	WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	LRDW	Trans_and_Pipe_MK	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\MK_Linear_Dev.gdb\MK_Data\
Transmission Lines	http://www.bctc.com/the_transmission_system/system_overview_maps/BCTC_circuits.zip	BC Transmission Corporation website	BCTC circuits	W:\srm\nr\arcproj\fs\fs_07_0180_MK_Linear_Dev\src\Source_Linear_Dev\BC_Hydro\

4.1.2 Wilderness Indicator

- Area classified as ROS-1 (primitive) and ROS-2 (semi-primitive non-motorized) and area of ROS-1 (primitive) and ROS-2 (semi-primitive non-motorized) as percentage of M-KMA area

Relevance

The Recreational Opportunity Spectrum (ROS) indicator has a range of classifications that serve to define the landbase according to landscape remoteness, wilderness characteristics, and expected type of social experience. How a landscape is classified depends on distance from roads, evidence of human use, area size and naturalness.

The six ROS classes are as follows:

- Primitive (P)
- Semi-primitive, Non-motorized (SPNM)
- Semi-primitive, Motorized (SPM)
- Roaded Natural (NR)
- Roaded Modified (MR)
- Rural (R)

The ROS-1 (primitive) and ROS-2 (semi-primitive non-motorized) classes indicate remote wilderness features. The wilderness values in these areas are likely to be preserved in the medium to long term due to their relative inaccessibility for recreation, tourism and resource development. Areas with less remote designations such as 'Roaded Modified' and 'Rural' are more accessible, however, and see more visitors and recreationists.

Wilderness in the Muskwa-Kechika

Table 4-3 presents area data for the 'Primitive' and 'Semi-Primitive, Non-Motorized' ROS classes in the M-KMA, along with data for the other, less remote ROS classes. The area of these two wilderness classifications as a percentage of the total Muskwa-Kechika Management Area is also shown.

Table 4-3: Area of M-KMA by ROS classification

ROS Classification	Area of ROS class (sq. km)	ROS class as percent of MK-MA area (%)
ROS-1 primitive (P)	44,598	69.8
ROS-2 Semi-primitive, Non-motorized (SPNM)	14,353	22.5
ROS-3 Semi-primitive, Motorized (SPM)	2,601	4.1
ROS-4 Roaded Natural (NR)	1,361	2.1
ROS-5 Roaded Modified (MR)	775	1.2
ROS-6 Rural (R)	71.0	0.1
Unclassified	100.1	0.2
Total	63,861	100.0

What does the data show?

The Recreation Opportunity Spectrum data confirms that a large portion of the Muskwa-Kechika MA remains in a wilderness state. Over 90% (92.3) of its total area is classified as either 'Primitive' or 'Semi-Primitive, Non-Motorized'. The largest portion of the M-KMA, 69.8%, is classified as 'Primitive'.

The watersheds in the M-KMA with relatively more areas classed as either 'Semi-Primitive, Motorized', 'Roaded Natural', 'Roaded Modified' and 'Rural' are the following.

- Liard River
- Middle Muskwa River
- Upper Sikanni Chief River
- Upper Halfway River
- Beaver River
- Toad River

The results from the linear development and ROS indicators indicate that the M-KMA remains largely in a wilderness state except in a few specific areas along its eastern boundaries.

Data Source

Table 4-4 presents the source of data that were accessed to compile the tables on areas of ROS classes in the M-KMA.

Table 4-4: ROS data source

Area Analysis Data	Layer Name	Original Location
Recreation Opportunity Spectrum	WHSE_FOREST _VEGETATION.REC_OPPORT UNITY_SPECTRUM_INV	LRDW

4.1.3 Protected Areas Indicator

- Protected Area (sq. km) as percentage of total M-KMA and biogeoclimatic zone (BEC variant) representation in Protected Areas (sq. km and %)

Relevance

Ecosystem, biophysical and nature-based tourism and recreation attributes are protected from degradation through protected area designations. The degree of protection differs according to the type of protected designation, with the Class A Provincial Park designation offering the greatest degree of protection.

"Coarse-filter" management is one of the primary approaches recommended for maintaining biodiversity.[8] Several approaches have been identified to meet coarse-filter objectives; these may be broadly categorized as "ecosystem-based" approaches and "species-based" approaches. One ecosystem-based approach for managing coarse-filter biodiversity objectives is ecological representation of ecosystem-based units (i.e. ecosystems defined by certain criteria such as vegetation and/or wildlife communities, geomorphology, climate, or a combination of these). Ecological representation is increasingly considered one of the most important criteria to ensure the persistence of biological diversity and ecosystem function.[9]

Ecosystem representation at the site series (BEC ecosystem) level is used in this indicator to determine the amount of representation in protected areas of the M-KMA.

Protected Areas in the Muskwa-Kechika

Table 4-5 presents data on area of each Protected Area in the M-KMA and area and percent of area of BEC variant in each Protected Area of the M-KMA.

---

[8] Franklin, J. F. (1993) *Preserving biodiversity: species, ecosystems, or landscapes?* Ecological Applications 3:202-205.

Noss, R.F. (1999) *Assessing and monitoring forest biodiversity: a suggested framework and indicators.* Forest Ecology and Management 115:135-146.

O'Neil, T. A., R.J. Steidl, W.D. Edge, and B. Csuti. (1995) *Using wildlife communities to improve vegetation classification for conserving biodiversity.* Conservation Biology 9:1482-1491.

[9] Ibid

Table 4-5: Area of Protected Area and area of Protected Area by biogeoclimatic zone (sq. km)				
Protected Area	**BEC LABEL**	**Biogeo-climatic zone area (sq. km)**	**Protected Area (sq. km)**	**Biogeo-climatic zone as percent of Protected Area (%)**
Dall River Old Growth Park	BWBSdk 1	6.4	6.4	100.0%
Denetiah Corridor Protected Area	BWBSdk 1	74.5	74.5	100.0%
Denetiah Park	BAFAun	268.4	904.3	29.7%
	BWBSdk 1	169.3		18.7%
	SWB mk	361.0		39.9%
	SWB mks	105.5		11.7%
Dune Za Keyih Park [also known as Frog-Gataga Park]	BAFAun	699.0	3317.3	21.1%
	BWBSdk 1	1092.4		32.9%
	SWB mk	1062.1		32.0%
	SWB mks	463.8		14.0%
Dune Za Keyih Protected Area [a.k.a Frog-Gataga PA]	BAFAun	3.6	160.6	2.2%
	BWBSdk 1	78.7		49.0%
	SWB mk	74.8		46.6%
	SWB mks	3.4		2.1%
Finlay Russel Park	BAFAun	255.3	1092.3	23.4%
	BAFAunp	0.3		0.0%
	BWBSdk 1	272.4		24.9%
	ESSFmv 4	71.5		6.5%
	ESSFmvp	16.7		1.5%
	SWB mk	292.5		26.8%
	SWB mks	183.5		16.8%
Finlay Russel Protected Area	BAFAun	3.6	135.6	2.6%
	BWBSdk 1	73.5		54.2%
	SWB mk	55.4		40.8%
	SWB mks	3.2		2.3%
Graham-Laurier Park	BAFAun	151.2	999.7	15.1%
	BWBSmw 1	23.7		2.4%
	BWBSwk 2	36.6		3.7%
	ESSFmv 4	670.1		67.0%
	ESSFmvp	118.0		11.8%
	SWB mk	0.0		0.0%
	SWB mks	0.2		0.0%
Hornline Creek Park	BWBSdk 1	3.0	3.0	100.0%
Kwadacha Wilderness Park	BAFAun	571.1	1303.4	43.8%
	BWBSdk 1	119.6		9.2%
	ESSFmv 4	0.1		0.0%
	ESSFmvp	0.1		0.0%
	SWB mk	494.1		37.9%
	SWB mks	118.4		9.1%

Protected Area	BEC LABEL	Biogeo-climatic zone area (km^2)	Protected Area (km^2)	Biogeo-climatic zone as percent of Protected Area (%)
Liard River Corridor Park	BWBSdk 2	462.4	812.0	56.9%
	BWBSmw 2	344.6		42.4%
	BWBSwk 3	0.9		0.1%
	SWB mk	4.2		0.5%
Liard River Corridor Protected Area	BWBSdk 2	25.8	47.9	53.9%
	BWBSmw 2	22.1		46.1%
Liard River Hot Springs Park	BWBSdk 2	10.8	10.8	100.0%
Liard River West Corridor Park	BWBSdk 2	29.9	29.9	100.0%
Muncho Lake Park	BAFAun	211.5	860.8	24.6%
	BWBSdk 2	1.0		0.1%
	BWBSmw 2	10.1		1.2%
	SWB mk	566.6		65.8%
	SWB mks	71.7		8.3%
Northern Rocky Mountains Park	BAFAun	2,547.5	6,663.8	38.2%
	BWBSmw 2	427.9		6.4%
	SWB mk	2,933.3		44.0%
	SWB mks	755.1		11.3%
Northern Rocky Mountains Protected Area	BWBSmw 2	1.4	7.6	18.8%
	SWB mk	6.2		81.2%
Ospika Cones Ecological Reserve	BAFAun	3.8	12.8	29.4%
	ESSFmv 4	7.2		56.5%
	ESSFmvp	1.2		9.0%
	SWB mk	0.7		5.2%
Prophet River Hotsprings Park	SWB mk	1.8	1.8	100.0%
*Red*fern-Keily Park	BAFAun	340.6	808.0	42.2%
	SWB mk	312.8		38.7%
	SWB mks	154.6		19.1%
Sikanni Chief River Ecological Reserve	BAFAun	14.1	21.8	64.6%
	SWB mk	2.6		11.7%
	SWB mks	5.1		23.6%
Stone Mountain Park	BAFAun	140.1	251.8	55.6%
	SWB mk	65.1		25.9%
	SWB mks	46.6		18.5%
Toad River Hot Springs Park	BWBSmw 2	3.4	4.1	82.2%
	SWB mk	0.7		17.8%
Grand Total		17,530.3	17,530.3	100.0%

What does the data show?

Within the Muskwa-Kechika MA there are 23 areas with 'protected area' status under BC legislation. These areas cover approximately 17,500 sq. km, 27.4% of the M-KMA.

The overall Muskwa-Kechika MA is afforded a greater intensity of conservation management through its guiding legislation and regulation than is provided for in the typical set of rules that give effect to stewardship of Crown land and resources around the province. There is no "general" resource management zone in the M-KMA. The lands outside of its protected areas were designated as different types of resource management zones through the Fort Nelson, Fort St John and Mackenzie LRMP processes. In addition to protected areas, the other resource management zone categories in the M-KMA are either 'special wildland resource management', 'special resource management' or 'enhanced resource management' zones.

Data Source

Table 4-6 presents the source of data that were accessed to compile the tables on areas of Protected Areas and biogeoclimatic zones.

Table 4-6: Protected area data source

Area Analysis Data	Layer Name	Original Location
Biogeoclimatic Zones	WHSE_FOREST_VEGETATION .RES_BIOGEOCLIMATIC	LRDW
Protected Areas	WHSE_PARKS.PA_PROTECTED_AREA_POLY	LRDW

4.1.4 Sustainable Wildlife Populations Indicator

- Hunter success rates[10]

Relevance

The trend in hunter success rates for major species offers a broad indication of population trends in the hunted species. It is not a precise indicator of wildlife population trends as the issue of population sustainability is a function of several factors including, population demographics, total harvest and the percentage of the harvest that is female. However, the most important component of population demography for large ungulates and carnivores is mortality, particularly human-caused mortality.

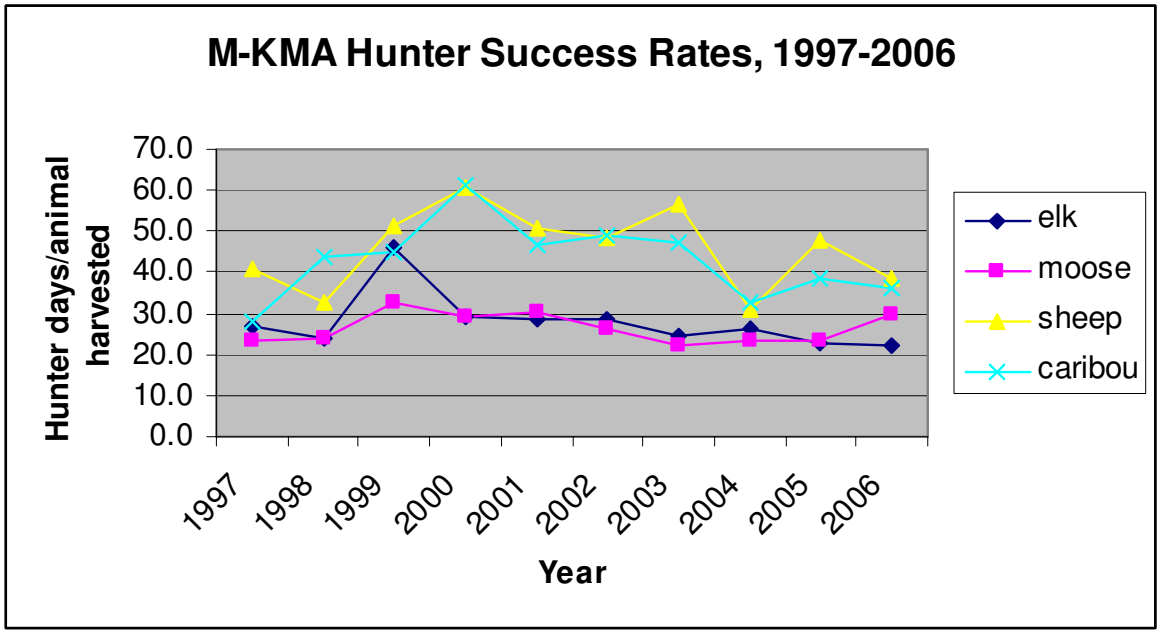
In general, the hunter success rate will climb as populations rise, and as populations decline, so will the hunter success rate. The main caveat to this observation is that weather and government hunting regulations influence the number of hunting days and the number of animals harvested. Poor weather for hunting a particular species

[10] Average number of days hunted by resident hunters for each harvested animal

will lower hunter numbers and hunter days and more restrictive harvesting regulations, such as increasing the minimum number of points in moose antlers, will reduce the pool of potential animals that can be harvested.

Sustainable Wildlife Populations in the Muskwa-Kechika

The following line graph shows the 1997-2006 trend in resident hunter success rates for the M-KMA for each of elk, moose, Stone's sheep and woodland carbou.[11]



What does the data show?

Extrapolating from hunter success rates, elk and moose populations within the overall M-KMA have been reasonably stable over the 1997-2006 decade. Stone's sheep and woodland caribou populations, however, appear to have slumped over the five-year 1999-2003 period but in more recent years appear to be as high if not higher than at the beginning of this decade.

The hunter success rates for elk and moose were relatively stable over the 10-year 1997-2006 period. The hunter success rate for elk stayed within a range of 22.2 and 29.3 days hunted per harvested animal, except for 1999 when the hunter success rate spilled out of this range to 45.9 days per harvested elk. The range for moose was 22.3 to 32.6 days.

[11] Data for these animals were used because there are open hunts for them in the M-K area. Hunter success rates for animals with limited entry hunts are not an indicator of sustainable population trends.

The trends for Stone's sheep and woodland caribou demonstrated a degree of volatility over the 1997-2006 decade, but their hunter success rates showed a similar pattern over this period.

The hunter success rates for Stone's sheep (60.8) and woodland caribou (61.1) hit a trough in 2000. However, over the 2004-2006 period that data is most recently available, the hunter success rates for both of these species has much improved.

Data Source

Data on resident hunter activity by MOE Management Unit by species by year was obtained from the Fish and Wildlife Data and Licensing Section of BC Ministry of Environment. Hunter success rates for each of the Management Units that lie wholly within or overlap into the M-KMA[12] were calculated by the authors based upon this raw data.

4.1.5 Old Growth Indicator

- Area of Old Growth that lies within protected areas
- Area of Old Growth as percentage of Crown Forest Land Base

Relevance

Old forest ecosystems provide for a wide variety of biodiversity values on the landscape. "The oldest forest age classes, old growth forests, are important ecologically, culturally, economically, and socially. Old growth forest ecosystems are considered increasingly important in light of global concerns such as climate change, and they are valued particularly for tourism, recreation, solitude and wilderness experiences. Old growth forests help to maintain the various components of biodiversity, and provide important habitat for a variety of species…" [13]

Land and resource government regulation and planning processes in BC have incorporated research on and objectives for Old Growth forests reflecting their importance to environmental, economic and social considerations.

- Static (area and volume) and temporal measures of Old Growth forest and ecosystems have been used in several sustainable forest management plans and environmental risk assessments in BC.
- The BC Government has issued legal orders establishing targets for Old Growth in planning units and has designated Old Growth Management Areas (OGMAs) in some forest districts.
- LRMPs incorporate management objectives for Old Growth ecosystems.

[12] Management Units 736, 737, 739, 740, 741, 742, 743, 750, 751, 752, 754, and 757.

[13] Ontario's State of the Forest Report 2006, available at http://www.mnr.gov.on.ca/202350.pdf

Old Growth Forest in the Muskwa-Kechika

Data on Old Growth forests for the whole Muskwa-Kechika MA was not available for this report at the time of its publication. A project on identifying Old Growth Management Areas for the Fort Nelson Forest District has developed data on area of Old Growth in landscape units of this forest district. Area of Old Growth (OG) by Fort Nelson Forest District landscape unit in the M-KMA is given in the next table.

Table 4-7: Area of Old Growth in Fort Nelson Forest District Landscape Units located in the M-KMA (April 2008)

Landscape Unit	LU area (sq. km)	CFLB[14] in TSA (sq. km)	OG in TSA (sq. km)	OG in protected areas (sq. km)	OG in protected areas as %age of total OG[15]	Total OG as %age of CFLB in TSA[16]
Alluvial B	90,110	11	11	19,173	99.9%	167,459.8%
Boreal	218,621	47,722	21,225	15,018	41.4	75.9
Churchill	453,913	70,007	34,430	2,675	7.2	53.0
Gathto	393,084	64,527	4,699	43,720	90.3	75.0
Kechika	337,712	267,750	45,754	2,943	6.0	18.2
Major Hart	268,026	131,180	67,125	0	0.0	51.2
Muncho	239,700	67,396	28,969	11,853	29.0	60.6
Netson	323,292	157,363	64,432	72	0.1	41.0
Prophet	163,254	62,575	48,289	2,149	4.3	80.6
Rabbit	288,777	223,845	50,084	0	0.0	22.4
Sharktooth	199,619	46,018	23,697	3,744	13.6	59.6
Sulpher/8 Mile	438,595	219,821	79,255	1	0.0	36.1
Tuchodi	391,942	40,539	7,530	59,875	0.0	166.3
Total for M-KMA LUs	3,806,650	1,398,758	475,504	161,226	25.3	45.5

What does the data show?

Approximately one-quarter (25.3%) of the Old Growth forests in the Fort Nelson Forest District portion of the M-KMA lies within protected areas. The establishment of new protected areas resulting from the recommendations of the Fort Nelson, Fort St John and Mackenzie LRMP tables served to sharply increase the amount of protected Old Growth ecosystems in the Muskwa-Kechika area.

Old Growth area comprises approximately 45% of the Crown Forest Land Base (CFLB) in the portion of the Fort Nelson Forest District that is located in the M-KMA. The percentage of Old Growth within the CFLB is much less within the

[14] CFLB is the acronym for Crown Forested Land Base.

[15] Old Growth in protected areas divided by Old Growth in Protected Areas plus Old Growth in TSA

[16] Old Growth in Protected Areas plus Old Growth in TSA divided by CFLB

overall Fort Nelson Forest District, 24.6%, which means that the M-KMA is a significant source of Old Growth ecosystems within the forest district.[17]

Most Interior forest districts, including Fort Nelson, are currently subject to non-spatial Old Growth management representation targets via an order that came into effect in June 2004.[18] The OGMA project underway in the Fort Nelson Forest District is using Old Growth objectives for Natural Disturbance Units (NDUs) developed for the Prince George Forest Region and accepted as policy direction by the BC Government.[19] All M-KMA Landscape Units, except for Alluvial B LU, are categorized as falling within the Northern Boreal Mountain Natural Disturbance Unit. The Old Growth retention target for this NDU is 37%[20].

Approximately 11.5% of the CFLB in the M-KMA is Old Growth forests located within its protected areas. It is expected that a small amount of Old Growth will also be protected through a formal designation of Ungulate Winter Range (UWR) in the M-KMA. The Fort Nelson Forest District OGMA project will identify areas that can be designated as OGMAs so that 37% of the CFLB in the M-KMA is Old Growth forests having a formal measure of protection.

Data Source

ILMB (Fort St John Client Service Center) supplied CFLB and Old Growth area data for Fort Nelson Forest District LUs. The data was current as of April 2008.

4.2 BIODIVERSITY

4.2.1 Species at Risk Indicator

- M-KMA native species that are *red* and *blue* listed

Relevance

The province uses a two (*red* and *blue*) list approach to categorize species according to their conservation risk. '*Red*' list species have been legally designated as 'Endangered' or 'Threatened' under the *Wildlife Act*, or have been listed as candidates for *red* listing

[17] 17.7% of the CFLB in the non-M-KMA area of the Fort Nelson Forest District is Old Growth area.

[18] "Order Establishing Provincial Non-Spatial Old Growth Objectives", available at http://ilmbwww.gov.bc.ca/slrp/lrmp/policiesguidelinesandassessements/oldgrowth/pdf/Old_Growth_Order_May18th_FINAL.pdf

[19] "In a letter dated April 29, 2002 and addressed to all District Managers in the Prince George Forest Region, the Natural Range of Variability information was formally endorsed and supported by the Regional Managers of the Ministry of Sustainable Resource Management and the Ministry of Forests, as the best information available.", pg 11, BC Ministry of Sustainable Resource Management, Northern Interior Region (April 2004) *Background information and supporting documentation for the process involved in developing the recommended biodiversity objectives in the PG TSA.*

[20] Old Growth as percentage of CFLB

by the Conservation Data Centre of the BC Ministry of Environment. '*Blue*' list species have been designated as species of 'Special Concern'.

In British Columbia, 84 species of native vertebrate animals (16% of provincial total), 9 dragonfly species (10%), 12 butterfly species (7%), and 257 vascular plant species (11%) are on the provincial '*Red* list'. An additional 97 vertebrate animals, 339 vascular plants and 46 invertebrate species are classified on the provincial '*Blue*' list.

Several managed wildlife species are declining or extirpated (locally extinct) in significant portions of their historical ranges. Woodland Caribou are extirpated or declining throughout 42% of their historical range, and potentially greater than 60% if areas of unknown trend are considered. Grizzly Bears are extirpated or threatened in 21% of their historical range.[21]

A publication from an American institute well summarizes government and societal interest in managing and sustaining species health and diversity. "Species are values for a variety of different reasons: they provide products, including food, fiber, and more recently, genetic materials; they are key elements of ecosystems, which themselves provide valuable goods and services; and many people value them for their intrinsic worth or beauty." [22]

Species at Risk in the Muskwa-Kechika

The following table itemizes the species and sub-species native to the M-KMA that the BC Conservation Data Centre has placed on either its *red* or *blue* list.

Table 4-8: *Red* and *blue*-listed species native to the Muskwa-Kechika MA

Species (English Name)	Type	*Blue* Listed	*Red* Listed
Vertebrate Animal			
Plains Bison[23]	Vertebrate Animal		☑
Grizzly Bear	Vertebrate Animal	☑	
Woodland Caribou	Vertebrate Animal	☑	
Fisher	Vertebrate Animal	☑	
Wolverine	Vertebrate Animal	☑	
Northern Myotis	Vertebrate Animal	☑	
Cape May Warbler	Vertebrate Animal		☑
Arctic Cisco	Vertebrate Animal		☑
Philadelphia Vireo	Vertebrate Animal	☑	
Invertebrate Animal			
Hotwater Physa	Invertebrate Animal		☑
Plains Forktail	Invertebrate Animal		☑

[21] BC Ministry of Environment (2002) *British Columbia State of the Environment.*

[22] Part pf an explanation for a species at risk indicator listed by the H. John Heinz III Center for Science, Economics, and the Environment and available at http://www.heinzctr.org/ECOSYSTEMS/forest/at_risk_species.shtml

[23] Plains Bison are red listed but "introduced" Plains Bison are unranked.

Vascular Plant			
Abbreviated *Blue*grass	Vascular Plant	☑	
Alpine Draba	Vascular Plant	☑	
American Chamaerhodos	Vascular Plant	☑	
Arctic Bladderpod	Vascular Plant	☑	
Arctic Dock	Vascular Plant	☑	
Arctic Wood-rush	Vascular Plant	☑	
Austrian Draba	Vascular Plant	☑	
Calder's Wildrye	Vascular Plant	☑	
Curly Sedge	Vascular Plant	☑	
Davis' Locoweed	Vascular Plant	☑	
Dotted Saxifrage	Vascular Plant	☑	
Dwarf Clubrush	Vascular Plant	☑	
Edwards Wallflower	Vascular Plant	☑	
Entire-leaved Daisy	Vascular Plant	☑	
Fragile Sedge	Vascular Plant	☑	
Gorman's Penstemon	Vascular Plant	☑	
Hornemann's Willowherb	Vascular Plant	☑	
Hudson Bay Sedge	Vascular Plant	☑	
Marsh Felwort	Vascular Plant	☑	
Milky Draba	Vascular Plant	☑	
Nahanni Oak Fern	Vascular Plant	☑	
Northern Swamp Willowherb	Vascular Plant		☑
Porsild's Draba	Vascular Plant	☑	
Raup's Willow	Vascular Plant		☑
Rock-dwelling Sedge	Vascular Plant	☑	
Short-leaved Sedge	Vascular Plant	☑	
Small-fruited Willowherb	Vascular Plant	☑	
Smooth Draba	Vascular Plant	☑	
Spike-oat	Vascular Plant	☑	
Taimyr Campion	Vascular Plant	☑	
Tender Sedge	Vascular Plant	☑	
Tundra Milk-vetch	Vascular Plant	☑	
Western Jacob's-ladder	Vascular Plant	☑	
White Adder's-mouth Orchid	Vascular Plant	☑	
Whitish Rush	Vascular Plant	☑	
Yukon Lupine	Vascular Plant	☑	
Nonvascular Plant			
Porsild's Bryum	Nonvascular Plant		☑

What does the data show?

This indicator reports on the relative conservation risk of species. The risk categories of the BC and other conservation risk rating systems are based on such factors as the number and condition of individuals and populations, the area occupied by the species, population trends, and known threats.

Large carnivores and ungulates are important features of the M-K environment and several are blue listed by the Conservation Data Centre as a conservation risk of 'special concern'. The blue listed large carnivores and ungulates in the M-KMA are:

- Wolverine
- Grizzly bear
- Woodland caribou

Plains Bison are red listed but "introduced" Plains Bison are unranked. The Plains Bison found in the Muskwa-Kechika are considered as being "introduced".

Possibly the most well known red listed species found in the M-KMA is the Hotwater Physa, which is found in one location in Canada, Liard River Hotsprings Provincial Park. It is a freshwater snail that feeds on detritus and bacteria along the bottom of the hotsprings. Fisheries and Oceans Canada has established a Recovery Strategy for the Hotwater Physa under the *Species at Risk Act*.[24]

Boreal and Southern Mountain Woodland Caribou are listed as 'threatened' on Schedule 1 of SARA and the Northern Mountain Woodland caribou is listed as 'special concern'. The Graham caribou herd that is located in the M-KMA is a Northern ecotype caribou of the Southern Mountains National Ecological Area and is listed as 'threatened'. The Northern Woodland Caribou ecotype that forms the largest portion of the M-K caribou population is not listed as 'threatened' under SARA but is blue-listed by the BC Data Conservation Centre.

The Philadelphia Warbler (a bird) and an Arctic Cisco (a fish) are red listed vertebrate species found in the M-KMA.

Data Source

Table 4-9 presents the sources of data that were accessed to compile the table on species at risk in the M-KMA.

Table 4-9: Species at risk data source

Area Analysis Data	Layer Name	Original Location
Terrestrial Ecology	WHSE_TERRESTRIAL_ECOLOGY.BIOT_OCCR_NON_SENSITIVE_SP	LRDW
Wildlife Inventory	WHSE_WILDLIFE_INVENTORY.SPI_WILDLIFE_NONSENSITIVE_SP	LRDW

[24] Available at http://dsp-psd.pwgsc.gc.ca/Collection/En3-4-17-2007E.pdf. The *Species at Risk Act* (SARA) is intended to protect species at risk of extinction/extirpation in Canada, and to promote their recovery. SARA includes prohibitions on killing, harming, harassing, capturing or taking individuals of species listed as Threatened or Endangered on its Schedule 1. A Recovery Plan (Recovery Strategy + Recovery Action Plan) must be developed for each species listed on its Schedule 1 within specified timelines.

4.2.2 Grizzly Bear Indicator

- Population level
- Population as percent of habitat capability[25]

Relevance

An independent scientific panel observed that "Grizzly bears are a classic 'umbrella species' because landscapes adequate to maintain long-term viable populations of this species are ipso facto adequate to maintain a host of other species with similar requirements for large landscapes. Such species include gray wolf, lynx, wolverine, marten, and mountain caribou. From the umbrella role of grizzly bears, it follows that in some of the areas from which grizzly bears have disappeared, the human footprint has become too large to assure the perpetuation of grizzly bears as well as a host of other species." [26]

Grizzly bears have also taken hold in the public consciousness as an apex carnivore that requires large territories having little human activity to thrive. The matter of hunting grizzly bears is often brought up in the BC Legislature and is the subject of ongoing debates between pro- and anti-hunting advocates. Grizzly bear hunting is not allowed south of the 49th parallel and it is a designated species under the U.S. Endangered Species Act. The BC Ministry of Environment's Conservation Data Centre includes the grizzly bear on its *blue* list. The BC Government imposed a moratorium on grizzly bear hunting in February 2001 and the new government removed it a few months later.

Grizzly Bear population in the Muskwa-Kechika

The following table presents results from a recent (2004) estimate of the BC population of grizzly bears. Two Grizzly Bear Population Units, Muskwa and Finlay-Ospika, overlap most of the Muskwa-Kechika MA.[27]

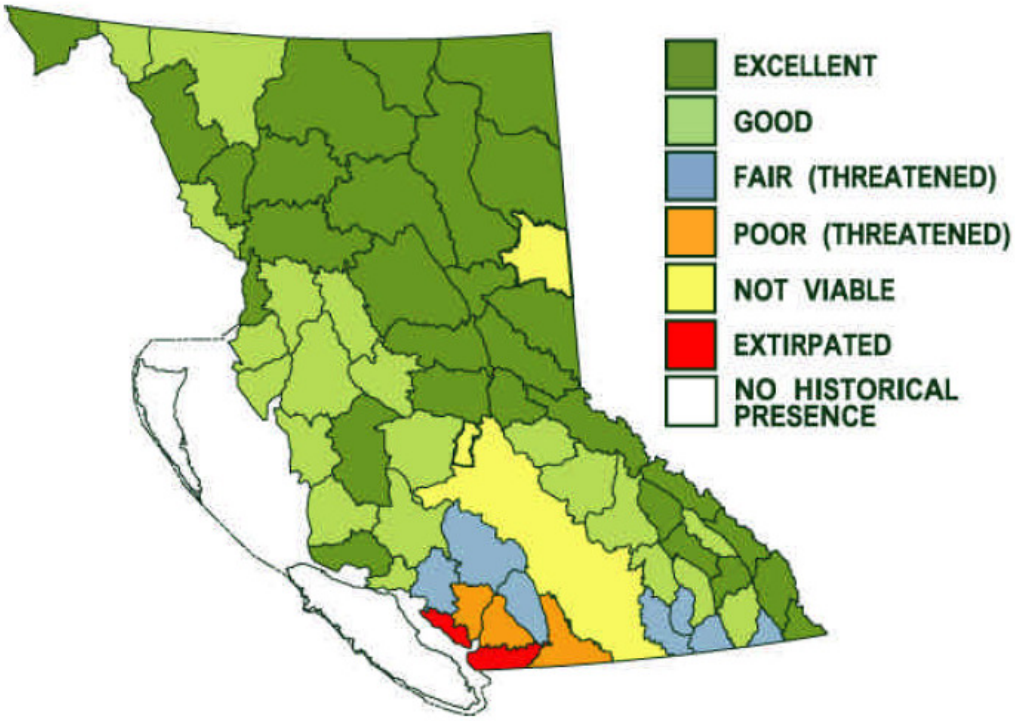
[25] Indicates the balance between population and habitat capability. A high percentage indicates that the population and habitat are in balance.

[26] Peek, J., Beecham, J., Garshelis, D., Messier, F., Miller, S., and Strickland, D. (March 2003) *Management of Grizzly Bears in British Columbia: A Review by an Independent Scientific Panel*. Prepa*red* for BC Ministry of Water, Land and Air Protection.

[27] The estimates were developed on the basis of Grizzly Bear Population Units.

Table 4-10: Grizzly bear population and population as percent of habitat capability in M-KMA			
Parameters	**Muskwa**	**Finlay-Ospika**	**BC Total**
Area (ha)	36,108	30,302	791,182
Habitat capability population estimate (#)	815	721	20,381
Habitat capability density (bears/1,000 sq. km)	23	24	NA
Habitat effectiveness population estimate (#)	815	721	18,766
Habitat effectiveness density (bears/1,000 k2)	23	24	NA
Habitat effectiveness as a percent of habitat capability (%)	100	100	NA
Current population estimate (#)	774	689	16,887
Population density (bears/1,000 sq. km)	21	23	NA
Population estimate as a percent of habitat capability (%)	95	95	NA

The following map shows a colour coded rating of the status of grizzly bear populations for each of the BC Grizzly Bear Population Units.[28]



[28] BC Ministry of Environment (2002) *British Columbia State of the Environment.*

What does the data show?

The population of grizzly bears is doing well in the Muskwa-Kechika MA. There are almost 1,500 grizzly bears spread out over the Muskwa and Finlay-Ospika Grizzly Bear Population Units.

Grizzly bear habitat effectiveness as a percent of habitat capability is rated as 100% in both Muskwa and Finlay-Ospika Grizzly Bear Population Units. The estimated bear population as a percent of habitat capability is high at 95% in both areas, as well. The status of the grizzly bear population is ranked as "excellent" in the M-KMA, as it is in much of northern BC.

Nine areas in BC have grizzly bear populations rated as "threatened"; Blackwater-West Chilcotin, Garibaldi-Pitt, Kettle-Granby, North Cascades, South Chilcotin Ranges, South Selkirk, Squamish Lillooet, Stein-Nahatlatch and Yahk.

Data Source

Hamilton, A., Heard, D., Austin, M. (June 2004) British Columbia Grizzly Bear (Ursus Arctos) Population Estimate 2004. Prepared for BC Ministry of Water, Land and Air Protection. Available at http://www.env.gov.bc.ca/wld/grzz/index.htm

4.2.3 Stone's Sheep Indicator

- Population level
- Population trend

Relevance

Stone's sheep is a subspecies (Ovis dalli stonei) of Dall Sheep (or Thinhorn Sheep). The other Dall Sheep subspecies is northern Dall Sheep proper (Ovis dalli dalli), which is almost pure white. Stone's sheep have a grey-brown colouring with white patches on the rump.

In remarks before the Muskwa-Kechika Advisory Board, Dr Kathy Parker of the University of Northern British Columbia observed that Stone's sheep remains within a small landscape area and is the most likely species to be susceptible to disturbance in the Besa Prophet area of the M-K.[29]

In a report prepared for BC Ministry of Water, Land and Air Protection, AXYS Environmental stated that "There are concerns about the status of Stone's sheep (*Ovis dalli stonei*) populations in northeastern British Columbia, particularly in light of expanding industrial development in the region. The hunter harvest of mature Stone's sheep rams has been recently declining in northeastern British Columbia. Resident hunters and guide outfitters alike have recently raised concern of a declining Stone's sheep population. These concerns are coupled with the potential for adverse

[29] Remarks of Dr Kathy Parker to the Muskwa-Kechika Advisory Board on February 16, 2007.

impacts resulting from future industrial expansion in proximity to Stone's sheep populations."[30]

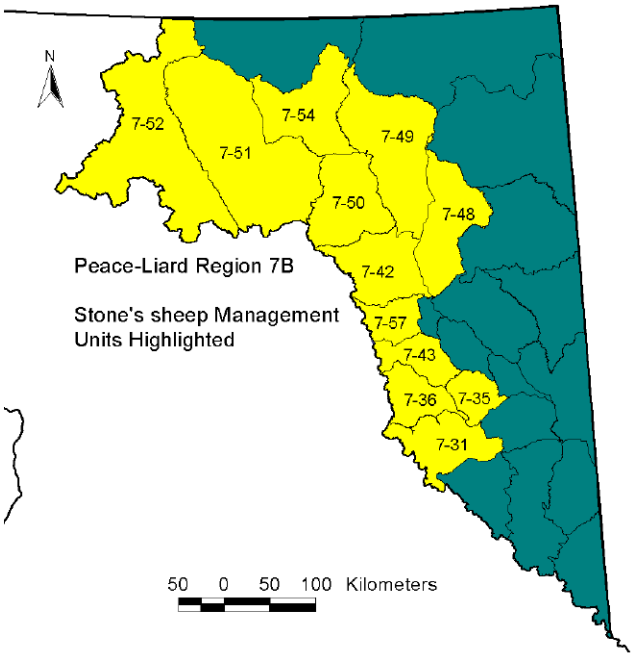
The Stone's Sheep Science Committee is implementing a plan that is focused on researching Stone's sheep for the purpose of identifying management directions and adaptive management issues for a 2009 revision of the Sulpher / 8 Mile pre-tenure plan.

Stone's Sheep in the Muskwa-Kechika

The following table gives the results (by Ministry of Environment Management Unit) of a 2007 aerial survey of the M-K Stone's sheep population. Beside the table is a map of the Management Units in the M-K that feature Stone's sheep.

Table 4-11: 2007 Stone's Sheep Population Estimate

Management Unit	Population estimate
7-35	3
7-36	32
7-42	805
7-43	4
7-50	811
7-51	1,311
7-57	171
Total	3,137



What does the data show?

A total population of approximately 3,000 was observed in the seven Management Units surveyed in 2007. In a 1994 survey of Management Unit 7-52 (not included in the 2007 survey) 949 Stone's sheep were seen. Management Unit 7-54 was surveyed in 2006 and 922 sheep were seen. Given the smaller landscapes that Stone's sheep range over, these nine surveyed MUs could have a population of around 5,000.

The memo note reporting the results of the 2007 survey observed the following, "Total numbers were slightly lower in the 2007 inventory than in similar MUs

[30] AXYS Environmental Consulting Ltd. (March 2005) *Problem Analysis of the Stone's Sheep Situation in Northeastern British Columbia*. Prepared for BC Ministry of Water, Land and Air Protection.

surveyed [in] 2002. However, lamb to ewe ratios and ram to ewe ratios were almost consistently higher in 2007 than [in] 2002 indicating a potential large cohort from 2006." [31]

The hunter success rate for Stone's sheep suggests a decline in the population over the five-year 1999-2003 period but a recent population increase appears evident as the hunter success rate for this species improved in the 2004-2006 period. The following table gives data on hunter days, Stone's sheep harvested and hunter success rate for the 10-year 1997-2006 period.

Table 4-12: Stone's Sheep Hunting Data for M-KMA, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	653.0	860.0	786.0	631.0	593.0	641.0	540.0	363.0	514	565.0
Resident hunter days (#)	4,835.0	6,121.0	5,635.0	4,801.0	5,146.0	4,752.0	4,149.0	2,539.0	3,873	3,835.0
Sheep harvested (#)	119.0	187.0	110.0	79.0	101.0	98.0	73.0	82.0	81	99.0
Hunter days per harvested sheep	40.6	32.7	51.2	60.8	51.0	48.5	56.8	31.0	47.8	38.7

Data Sources

Thiessen, C. (undated) *Species: Stone's sheep*. Memo reporting results of aerial survey. BC Ministry of Environment.

Demarchi, R. and Hartwig, C. (2004) *Status of Thinhorn Sheep in British Columbia.* Rep. No. Wildlife Bulletin No. B-119. BC Ministry of Water, Land and Air Protection.

4.2.4 Caribou Indicator

- Population level

Relevance

In a presentation to the M-K Advisory Board, Dr Kathy Parker of UNBC commented that caribou is the best large-scale indicator species as it uses very large areas of the landscape.[32]

Woodland Caribou is a subspecies of *Rangifer tarandus*, and has several ecotypes that do not have a formal taxonomic designation and three are found in BC: Mountain Caribou, Boreal Caribou and Northern Caribou.

[31] Thiessen, C. (undated) *Species: Stone's sheep*. Memo reporting results of aerial survey. BC Ministry of Environment

[32] Remarks of Dr Kathy Parker to the Muskwa-Kechika Advisory Board on February 16, 2007.

The conservation risk status for each caribou ecotype in BC is as follows.[33]

- Mountain Caribou are on the *red* list
- Boreal Caribou are on the *blue* list
- Northern Caribou in each of the Southern Mountains National Ecological Area and Northern Mountains National Ecological Area are on the *blue* list

The Graham caribou herd, a Northern ecotype caribou of the Southern Mountains National Ecological Area, is listed as 'threatened' by the Committee on the Status of Endangered Wildlife in Canada and *blue*-listed (i.e., vulnerable) by the BC Conservation Data Centre.[34]

In BC, caribou populations are viewed as stable in 16% of their historic ranges, declining in 11% and extirpated in 31% and unknown over 17%.[35]

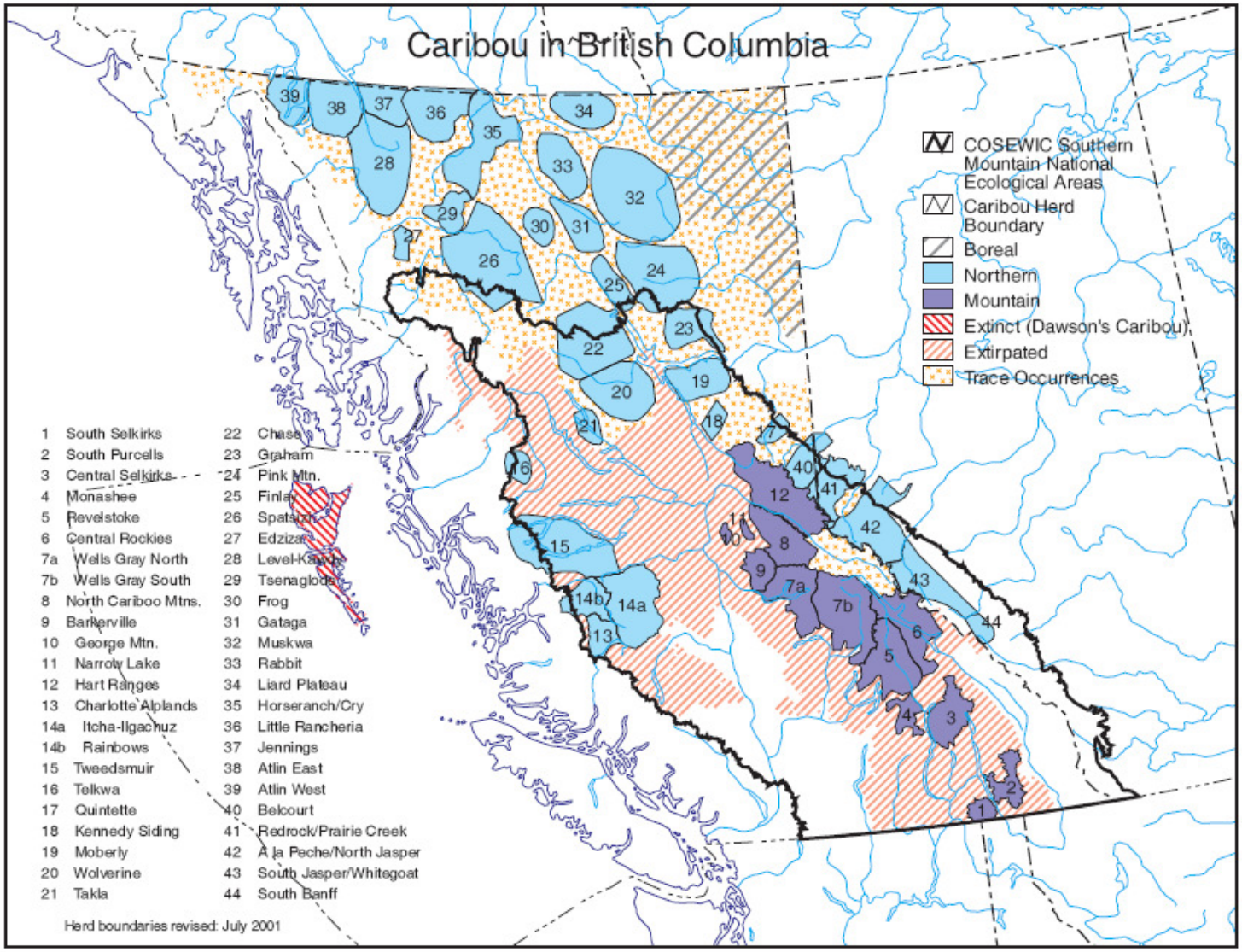
Caribou in the Muskwa-Kechika

There are an estimated 44 caribou herds in BC, and the ranges of six herds (Graham, Pink Mountain, Gataga, Muskwa, Finlay and Rabbit) overlap the boundaries of the M-K. A map showing the approximate ranges of the herds appears below.

[33] Cichowski, D., Kinley, T. and Churchill, B. (2004) Caribou in Accounts and Measures for Managing Identified Wildlife - Accounts V. 2004. BC Ministry of Environment.

[34] Diversified Environmental Services (2003) *Seasonal Movements and Habitat Use of Graham River Caribou.* Prepared for Canadian Forest Products Ltd.

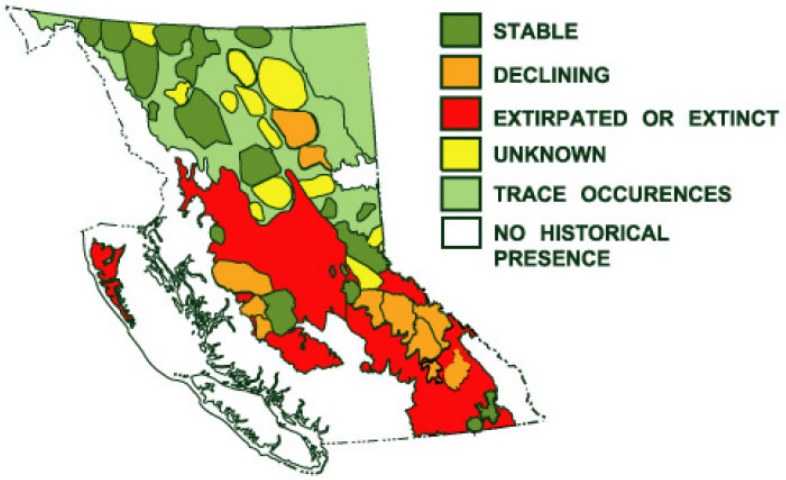
[35] BC Ministry of Environment. (2002) *State of the Environment.*


Caribou in British Columbia
COSEWIC Southern Mountain National Ecological Areas
Caribou Herd Boundary
Boreal
Northern
Mountain
Extinct (Dawson's Caribou)
Extirpated
Trace Occurrences
1 South Selkirks
2 South Purcells
3 Central Selkirks
4 Monashee
5 Revelstoke
6 Central Rockies
7a Wells Gray North
7b Wells Gray South
8 North Cariboo Mtns.
9 Barkerville
10 George Mtn.
11 Narrow Lake
12 Hart Ranges
13 Charlotte Alplands
14a Itcha-Ilgachuz
14b Rainbows
15 Tweedsmuir
16 Telkwa
17 Quintette
18 Kennedy Siding
19 Moberly
20 Wolverine
21 Takla
22 Chase
23 Graham
24 Pink Mtn.
25 Finlay
26 Spatsizi
27 Edziza
28 Level-Kawdy
29 Tsenaglode
30 Frog
31 Gataga
32 Muskwa
33 Rabbit
34 Liard Plateau
35 Horseranch/Cry
36 Little Rancheria
37 Jennings
38 Atlin East
39 Atlin West
40 Belcourt
41 Redrock/Prairie Creek
42 A la Peche/North Jasper
43 South Jasper/Whitegoat
44 South Banff
Herd boundaries revised: July 2001

The following table presents estimates of population, trend, risk status, and density of Northern Caribou by local population for the M-KMA.[36]

Table 4-13: Estimates of Northern Caribou in the Muskwa-Kechika area (2002)					
Local Population	**Population estimate**	**Recent trend**	**Risk Status[37]**	**Range (km^2)**	**Density (# per '000 km^2)**
Graham	300	declining	TR	4,734	63
Pink Mountain	850	declining	VU	11,602	73
Finlay	200	unknown	VU	3,084	65
Gataga	250	unknown	VU	4,437	56
Muskwa	1,250	unknown	NAR	16,786	74
Rabbit	800	unknown	VU	5,936	135

The following map shows a colour coded rating of the population status of the caribou herds in BC.[38]



The following information was excerpted from a BC Ministry of Environment summary report on a 2003 survey of the Graham Caribou herd, which is a Northern Caribou population identified as 'threatened'.

[36] Cichowski, D., Kinley, T. and Churchill, B., op. cit.

[37] Ibid., pg 13, EN – endangered, VU – vulnerable, TR – Threatened, NAR – Not at Risk

[38] BC Ministry of Environment (2002) *British Columbia State of the Environment*.

GRAHAM CARIBOU HERD LATE MARCH 2003 INVENTORY SUMMARY

Survey Dates: 2003/03/16 and 2003/03/17
Survey Area: alpine/subalpine parkland habitats within Graham River Watershed and adjacent ridges north to the Halfway River.
Marked Animals: 8 (10 total; 2 excluded - outside boundaries of survey area at time of survey)
Resighted Animals: 3
Sightability Correction Factor: 2.7
Animals Observed in Sample Units: 46
Population Estimate based on current survey results: 124

Sample Unit Label	Ungulate Classification					Total	# Marked
	Uncl.	Yrlg. Female	Adult Female	Adult Male	Juv. (< 1)		
Aylard Ridge	0	0	8	0	1	9	2
Meadow Creek Alpine	0	0	0	0	0	0	0
Emerslund	0	0	4	0	0	4	0
Butler Ridge	0	0	0	0	0	0	0
Husky Ridge	0	0	0	6	0	6	1
Hackney Hills – South	0	0	0	0	0	0	0
Hackney Hills – North	0	0	5	8	0	13	0
Christina - North	0	0	0	0	0	0	0
Horseshoe-Chowade	0	1	5	1	1	8	0
Schooler-Nebesche	2	0	0	0	0	2	0
Chowade-Cypress	0	0	4	0	0	4	0
Cypress-Halfway	0	0	0	0	0	0	0
Total in SUs	2	1	26	15	2	46	3

What does the data show?

The populations of the Graham and Pink Mountain herds are seen as declining and the population trend status of each of the Finlay, Gataga, Muskwa and Rabbit herds are rated as 'unknown'.

The Muskwa herd is the largest with about 1,250 caribou. The total caribou population in BC was approximately 19,000 in 2002 and approximately 3,600 (~20% of the BC total) travelled either in or near the Muskwa-Kechika area.

The 2003 population of the Graham caribou herd was estimated as 124, less than half of the 2002 estimate. This figure is an extrapolation from sightings of 46 caribou in an aerial survey undertaken in 2003 in the Graham River watershed and adjacent ridges north to the Halfway River.

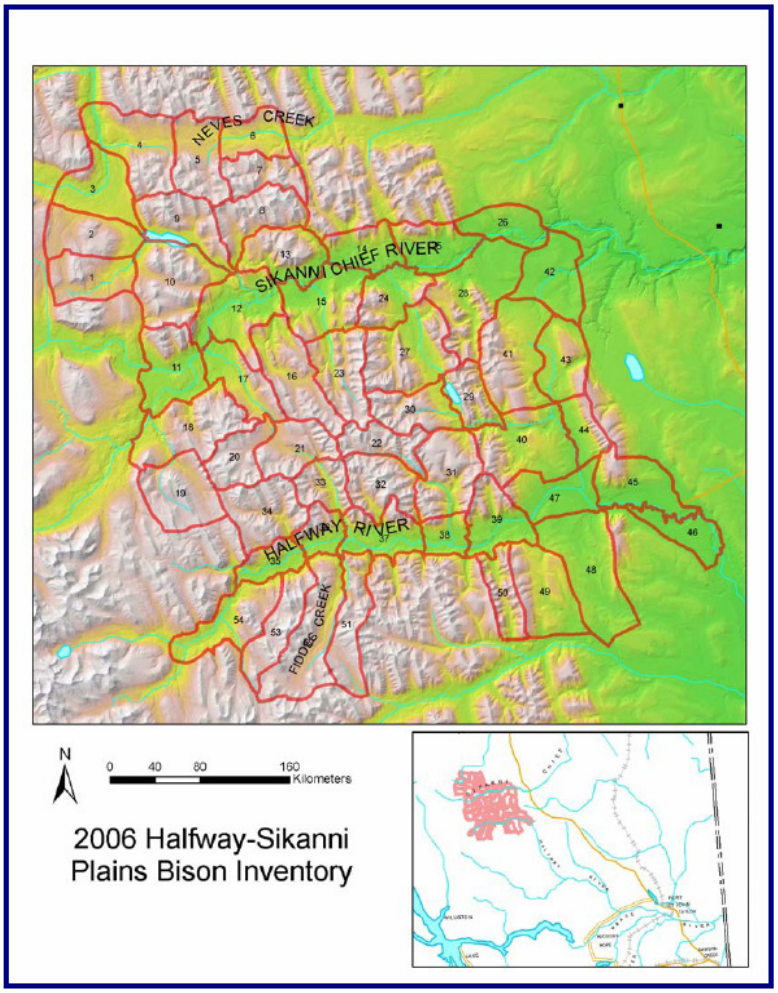
Data Source

Notes on late March 2003 Graham Caribou herd inventory summary provided by Fish & Wildlife Section, Peace Regional Office, BC Ministry of Environment

Cichowski, D., Kinley, T. and Churchill, B. (2004) *Caribou in Accounts and Measures for Managing Identified Wildlife - Accounts V*. 2004. BC Ministry of Environment.

4.2.5 Plains Bison Indicator

- Population level
- Population trend



Relevance

The world's largest free ranging plains bison herd is known as the Halfway-Sikanni plains bison population and has a range of an estimated 1,500 sq. km that reaches into the M-KMA. The map opposite shows the area of its range that was surveyed in the most recent population survey.

Plains bison is a subspecies that is listed as 'threatened' by the COSEWIC. The species is *red* listed by the BC Government but 'introduced' Plains Bison are unranked.

This herd had its genesis in the escape of 48 plains bison from a ranch in the upper Halfway River area in 1971. In 1982, the herd was listed as 'big game' and 'wildlife' under the *Wildlife Act*.[39]

[39] Information in this section developed from Rowe, M. (October 2006) *2006 Halfway-Sikanni Plains Bison Inventory*. BC Ministry of Environment.

Plains Bison in the Muskwa-Kechika

The following table shows the level and trend in the Halfway-Sikanni plains bison population.

Table 4-14: Halfway-Sikanni plains bison population			
Year	**Observed population**	**Modelled estimated population**	**Modelled growth estimate**
1975	50	50	1.38
1979	175	183	1.38
1992	648	666	1.10
2003	876	874	1.06
2006	1,302	1,295	1.14

What does the data show?

The results of the population surveys and population modelling show that the Halfway-Sikanni plains bison herd has been steadily growing in numbers since its emergence in the early 70s. The total population has reached over 1,300 bison as of the 2006 aerial survey undertaken by the BC Ministry of Environment.

The population of the Halfway-Sikanni herd was identified as 'plentiful' in a review of the ecology of bison in BC.[40]

Data Source

Rowe, M. (October 2006) *2006 Halfway-Sikanni Plains Bison Inventory*. BC Ministry of Environment.

4.2.6 Bull Trout Indicator

- Conservation risk to Bull Trout by watershed

Relevance

Bull Trout[41] is used as an indicator because it is widely distributed in British Columbia and known to be sensitive to habitat changes, therefore its status may be representative of overall watershed health, including condition of other fish species in a watershed. It requires clear, clean cold water for successful reproduction and survival. Bull trout have little tolerance of waters warmer than 64 degrees F and it is very sensitive to sedimentation of streams.[42]

Bull Trout was the only fish identified under the Forest Practices Code as 'Identified Wildlife' requiring special management considerations. In British Columbia, Bull

[40] Blood, D. (2000) *Bison in British Columbia.* BC Ministry of Environment, Lands and Parks.

[41] In some parts of the province it is called Dolly Varden.

[42] Knowles, C. and Kumtow, R. (1995) *Saving the Bull Trout*. The Thoreau Institute.

Trout are classified as 'Special Concern' (*blue* listed), and subject to special fishing regulations.[43]

Bull Trout in the Muskwa-Kechika

The next table itemizes the conservation risk[44] for bull trout by watershed in the Muskwa-Kechika region. The definitions for the conservation risk classifications are as follows:

- conservation risk – population is known to be in decline (data available) and threats are identified;
- presumed conservation risk – current threats are believed to be significantly affecting the population and/or population is conside*red* to be at risk;
- conservation risk unknown – no presence/absence information; risk unknown – Bull Trout known to be present, but no information is available on population status or threats;
- presumed healthy – viable for at least twenty years if no new threats are added to watershed and either real data showing populations are healthy or absence of significant threats and known occurrence in watershed;
- no historical presence – Bull Trout are known to be historically absent from the watershed group.

Table 4-15: Conservation risk for bull trout in waters of the Muskwa-Kechika region

Watershed	Presumed healthy	Conserva-tion risk	Presumed conserva-tion risk	Presence unknown	Risk unknown	No historical presence
Beaver River	☑					
Chukachida River	☑					
Coal River	☑					
Dunedin River	☑					
Finlay River			☑			
Firesteel River			☑			
Fox River					☑	
Frog River	☑					
Gataga River	☑					
Ingenika River			☑			
Liard River	☑					
Lower Halfway River			☑			
Lower Kechika River	☑					

[43] Available at http://www.env.gov.bc.ca/soerpt/4fish/trout.htm.

[44] The conservation risk data is based on expert opinion.

Watershed	Presumed healthy	Conserva-tion risk	Presumed conserva-tion risk	Presence unknown	Risk unknown	No historical presence
Lower Muskwa River	☑					
Middle Muskwa River	☑					
Middle Prophet River	☑					
Ospika River			☑			
Toad River			☑			
Toodoggone River					☑	
Turnagain River	☑					
Upper Halfway River			☑			
Upper Kechika River	☑					
Upper Liard River	☑					
Upper Muskwa River	☑					
Upper Prophet River	☑					
Upper Sikanni River	☑					

What does the data show?

Bull trout populations are rated as 'presumed healthy' in the majority of watersheds of the M-KMA. There is a 'presumed conservation risk' in the following seven M-K MA watersheds.

- Finlay River
- Firesteel River
- Ingenika River
- Lower Halfway River
- Ospika River
- Toad River
- Upper Halfway River

Data Source

The conservation risk rating was published in the 2002 State of the Environment report of the BC Ministry of Water, Land and Air Protection, and is available at http://www.env.gov.bc.ca/soerpt/4fish/trout.htm.

4.3 CLIMATE CHANGE

4.3.1 Mountain Pine Beetle Infestation Indicator

- Area of THLB and NHLB identified by beetle hazard type as percentage of total THLB and NHLB

Relevance

The Mountain Pine Beetle (MPB) infestation has destroyed a vast amount of both economic and environmental value throughout the central and southern Interior areas of the province.

Global warming caused by increasing GHG emissions and atmospheric CO_2 concentration has allowed the MPB to significantly expand its range in BC into more northerly areas. A Canadian Forest Service examination of the distribution of climatically suitable habitats for MPB from 1921 through 2000 showed an increase in the range of benign habitats. The area of climatically suitable MPB habitats is anticipated to continue to increase within the historic range of MPB. Much of the boreal forest is projected to become climatically available to the MPB in the near future. Jack pine is viewed as a viable host for MPB and is a major component of the boreal forest so continued eastward expansion by MPB is also viewed as probable.[45]

Lodgepole pine tree mortality caused by MPBs affects different elements of biodiversity in different ways. A report on potential impacts of large-scale salvage harvesting offered hypotheses on potential effects of MPB on species based on their habitat requirements.[46] Of the 182 vertebrate species identified as inhabiting the Vanderhoof, Lakes and Quesnel Forest Districts, three species (woodland caribou, three-toed and black-backed woodpecker) were identified as directly negatively impacted by loss of lodgepole pine habitat. Approximately one-third of identified species were viewed as potentially negatively impacted by a MPB salvage harvest. This report projected that habitat for approximately two-thirds of the 180+ vertebrates may be positively impacted by the opening of a largely solid forest cover into natural open areas, increased shrubs, and increased standing dead and downed woody debris.[47]

Starting in 2002, the Chief Forester temporarily lifted the Annual Allowable Cut (AAC) levels in several Timber Supply Areas (TSAs) and Timber Forest Licence

---

[45] Carroll, A. et al (2006) *Impacts of Climate Change on Range Expansion by the Mountain Pine Beetle.* Canadian Forest Service, Natural Resources Canada.

[46] Bunnell, F., Squires, K., and Houde, I. (2004) *Evaluating the effects of large-scale salvage logging for mountain pine beetle on terrestrial and aquatic vertebrates*. Natural Resources Canada, Canadian Forest Service.

[47] The analysis doesn't consider long-term effects of large-scale pine falldown and potential fire hazard.

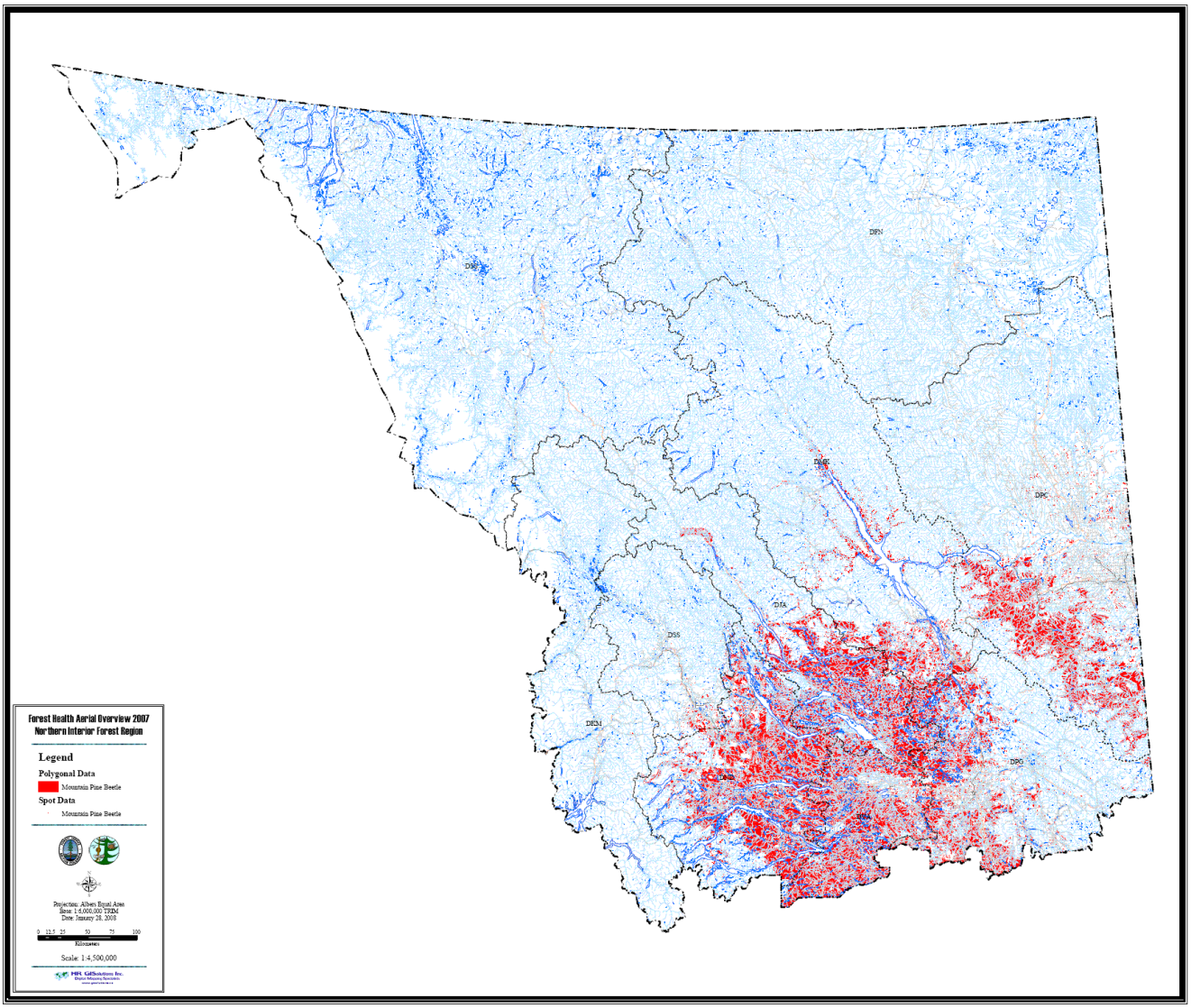
areas (TFLs). These decisions were consistent with the BC Government's policy decision to realize the maximum economic value of MPB affected timber while maintaining a high level of forest stewardship practices. The higher harvest levels have led to more road building and removal of forest vegetation.

Mountain Pine Beetle Infestation in the Muskwa-Kechika

The following areas in the M-K MA were identified as having MPB impacted pine trees in the 2007 aerial survey of MPB affected forests undertaken by the BC Ministry of Forests and Range.

- Seven nodes, three with an estimated 10 MPB infested trees and four with an estimated 5 MPB infested trees, in the Lower Halfway River watershed
- One node with an estimated five MPB affected trees in the Toodoggone River watershed.

The map below shows the extent of the red attack areas in the Northern Interior Region Forest Districts, including the three that overlap the boundaries of the M-KMA.



What does the data show?

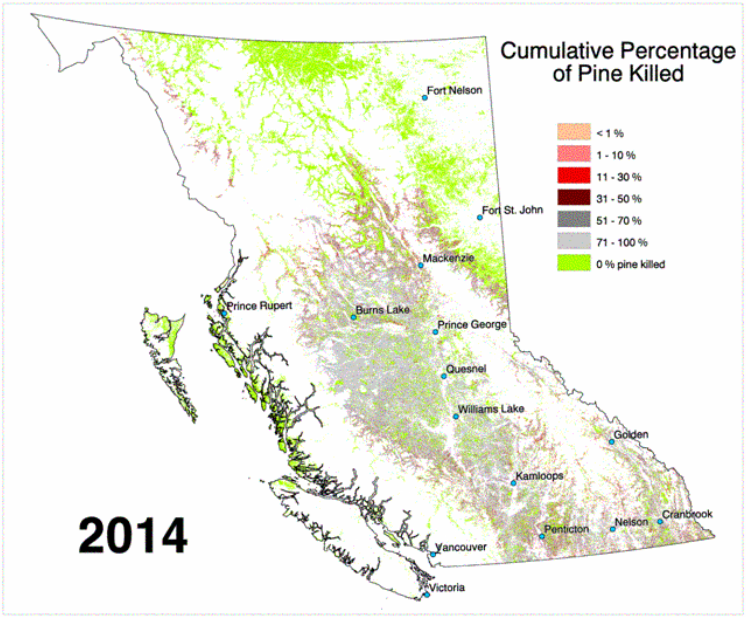
There is an extremely low level of MPB in the M-K MA. The MOFR data shows no polygon (area) data for MPB infestation in the M-K and only a few small areas of infestation, mainly in the Lower Halfway River watershed.

The MPB infestation areas in the M-KMA are rated as 'S' or 'severe'.

The low MPB infestation level is due to the very small area of leading pine stands in the M-KMA.

The map of the MPB red attack areas in the Northern Interior region shows the isolated pockets of MPB infestation above the northern reaches of Williston Lake. In 2007 it reached into the Fort Ware area and the Ospika River watershed.

MPB infestations totalled almost 4.5 million hectares in the Northern Interior Forest Region, of which 95% was situated in the five most southerly districts. However, infestations in the Peace Forest District jumped dramatically from 50,312 ha last year to 736,499 ha in 2007. The level of infestation in the south of the district is at a level where MOFR has abandoned suppression efforts. MOFR has concluded that MPB populations are expanding north, with active areas in the north arm of Williston Lake, Arrow Creek and Osborne River. [48]



There is no firm prognosis for the spread of the MPB in the M-KMA at this time. According to a MOFR forest health specialist, it "…will depend on how much immigration from the larger infestation in the south will influence beetle spread [in the M-KMA]"[49] The shown MOFR map[50] lays out the areas of the province by their estimated level of MPB killed pine in 2014. Only the most southerly reaches of the M-KMA are seen as having beetle killed timber in 2014.

Data Source

The data and map that were accessed to show the extent and severity of the MPB infestation in the M-KMA are available at http://www.for.gov.bc.ca/hfp/health/overview/overview.htm.

[48] Westfall, J. and Ebata, T. (2008) 2007 Survey of Forest Health Conditions in British Columbia. BC Ministry of Forests and Range.

[49] Pers. Comm. T. Ebata, MOFR, May 12, 2008

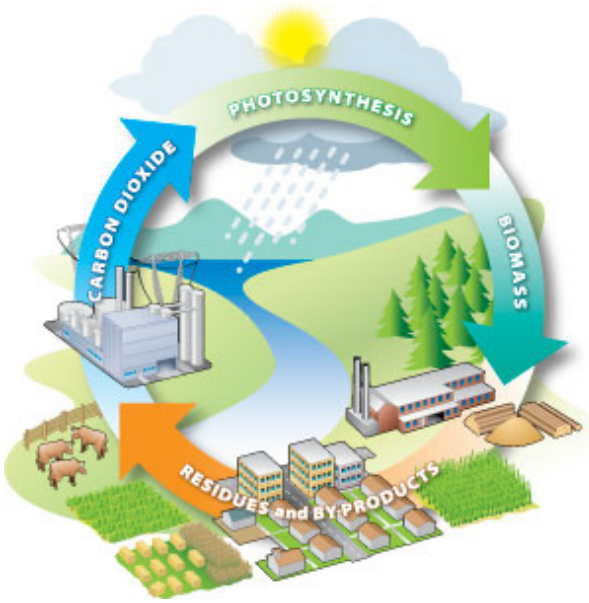
[50] http://www.for.gov.bc.ca/hre/bcmpb/cumulative/2014.htm

4.3.2 Carbon Storage Indicator

- current carbon condition and forecast (over a 250-year period) in above ground and below ground biomass in trees

Relevance

Forests play an important role in reducing greenhouse gases. As part of the carbon cycle, forests remove carbon dioxide from the atmosphere and store it as carbon in plant material and soil in a natural process known as sequestration.[51] In fact, half a tree's mass is carbon; therefore, large amounts of carbon are stored in forests, which are the largest store of terrestrial carbon. The total carbon stored in all of the forests on earth is estimated to be 1,150 billion tonnes.[52] Other ecosystems such as grasslands and wetlands are also significant sinks.



Forests act as a carbon "sink" when more carbon dioxide is removed from the atmosphere than is being released and act as a carbon "source" when more carbon dioxide is released than is removed. A forest can become a carbon source when it is disturbed naturally or by human processes. Natural disturbances such as fires release carbon directly into the atmosphere, while insects and diseases cause a slower release when dead trees release carbon during decomposition. Timber harvesting removes the stored carbon from the ecosystem in the form of logs and woody biomass. Harvested sites and any process that results in trees being cut result in a net source shortly after harvest as the un-utilized biomass decomposes; these sites eventually become sinks as the new forest grows and sequesters more carbon than is released. Processes that convert the forest to non-productive land, such as building roads and land clearing, can reduce the carbon storage capability.

The factors that determine whether a forest is maintained as a carbon sink or source include vegetation changes, nutrients, soil composition, rainfall patterns, wildfires, evaporation rates and the interactions between them.

---

[51] Carbon cycle graphic source: http://www.energyplan.gov.bc.ca/bioenergy/

[52] According to the Cooperative Research Centre for Greenhouse Accounting http://www.greenhouse.crc.org.au/

Carbon storage is measured in above ground biomass (trees, branches), litter, below ground biomass (roots), dead wood, and in the soil. It is (usually) greatest in the soil, either as roots and decaying biomass or as organic carbon in the soil, followed by the biomass above ground.

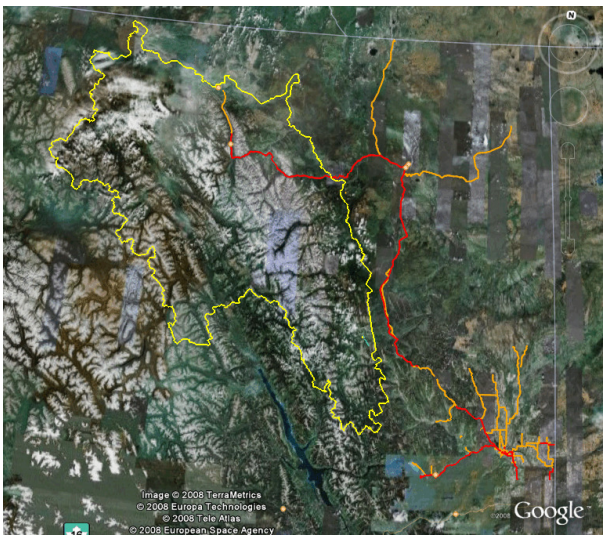
Forests offer an opportunity to balance the emissions resulting from one region (source) with a sink in another region. Driven by the Kyoto Protocol, governments in many developed nations are creating mechanisms to permit the trading of "carbon offset credits" between regions. The BC Government is in the early stages of examining options for similar mechanisms.

Carbon Storage in the Muskwa-Kechika

Carbon storage has not yet been measured for the M-KMA, and there are no benchmarks to use for comparisons over time. However there is information on forest carbon storage for the Fort Nelson Timber Supply Area (TSA) that partially overlaps the M-KMA. We use that research to help understand possible carbon storage in the M-KMA.[53]

Some observations about the M-KMA that may differ from the Fort Nelson TSA, and therefore influence our understanding are the following.

- There appears to be a relatively minor amount natural or human caused disturbance in recent years in the M-KMA, and proportionately less than in adjacent TSAs.
- Any impacts to the carbon storage capacity and balance in the M-KMA likely result from linear developments, highways and transmission lines, land developments, and timber harvesting. Sites that have reforested will likely increase storage (sinks) at some point.
- The M-KMA has generally less forested land than in the adjacent TSAs. The M-KMA is only 26% as productive in terms of forest lands compared to the Fort Nelson TSA (based on 3.9% of the M-KMA being classified as potentially available for timber harvesting, while 14.5% of the Fort Nelson TSA is classified as potentially available for timber harvesting.) The adjacent Google image shows the M-KMA outlined in yellow with a large portion showing as not productive



[53] Forest Ecosystem Solutions Ltd. (May 2006) *Development of Carbon Measures and Baseline Information for Sustainable Forest Management for the Fort Nelson Defined Forest Area*. Prepared for Canadian Forest Products, Fort Nelson Woodlands Division.

forest.

- The M-KMA is less economically viable for timber harvesting (due to lengthy truck hauls) suggesting that there will be fewer implications from forest management than the adjacent Fort Nelson TSA.
- The M-KMA has area specific guidelines for oil and gas exploration and development suggesting that disturbances for this sector will be less than in the adjacent Fort Nelson TSA..
- The MPB is just now just entering the lower reaches of the M-KMA. The MOFR projects that it will continue a light spread in lodgepole pine trees until about 2014 and then taper off. This will likely result in a slight increase in carbon release in the short term as the affected trees die and decay, shifting to an increase in uptake once the new trees begin to grow. The impacts could be lessened if some dead wood is removed and the area promptly reforested.

What does the data show?

Data from the Fort Nelson TSA suggests that:

- The M-KMA is likely a carbon "sink" with a positive sequestration rate, meaning that the area is currently sequestering more carbon dioxide than it is producing. The TSA data shows this trend slowly declining over time. It is not possible to quantify the sequestration rates without additional data and modeling.
- There is approximately 300 tonnes/ha of total ecosystem carbon stored in the M-KMA's forested lands, based on data from the Fort Nelson TSA. The Fort Nelson TSA study indicates there is approximately 1,752 megatonnes (MT) of total ecosystem carbon stored on the 5,741,212 hectares of forested land[54] in the TSA.

[54] Forested land excludes non-productive land, non-forested land, non-commercial cover, alpine forest, no-typing available, road and trails, and is on 58% of the total TSA lands.

- Approximately 33% of carbon is stored in trees and roots, 20% is stored in dead wood and litter, and 47% is stored in the soil of the forested land base, as noted below. Figure 1 shows the total storage over time for the Fort Nelson TSA (which is likely similar for parts of the M-KMA but at much reduced volumes that reflect a smaller forested landbase.)

Table 4-16: Carbon storage in the forest	
Carbon Storage in the forest (based on Fort Nelson TSA)	**% of Total Forested Landbase**
Tree (above ground)	27
Roots (tree below ground)	6
Dead Wood (snags, Coarse woody debris)	15
Litter	5
Soil	47
Total	100

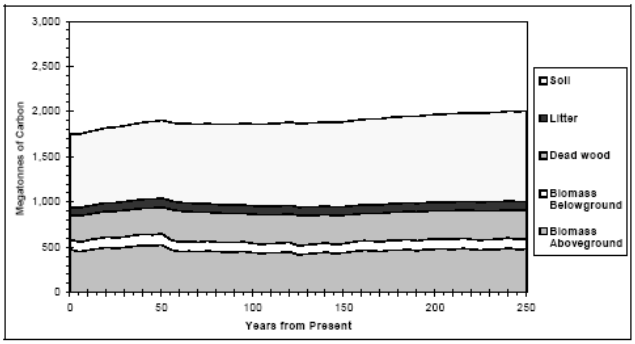


Figure: Total Carbon Storage in Forested Area of the Fort Nelson TSA

Data Source

Data[55] on carbon storage in the Fort Nelson TSA as reported in this section was obtained from the report entitled "Development of Carbon Measures and Baseline Information for Sustainable Forest Management for the Fort Nelson Defined Forest Area." [56]

4.4 WATER

4.4.1 *Stream Crossings Indicator*

- Stream crossings per sq. km

Relevance

Stream crossings density is a stressor indicator and the degree of its density suggests risk of water quality problems due to construction of, maintenance on and traffic over of these bridges and culverts.

This density indicator also allows for comparison of risk between areas.

[55] The TSA data does not account for carbon releases or storage from other uses of the land other than growing the forest, such as industrial activities, agriculture, etc.

[56] Forest Ecosystem Solutions Ltd. op. cit.

Stream Crossings in the Muskwa-Kechika

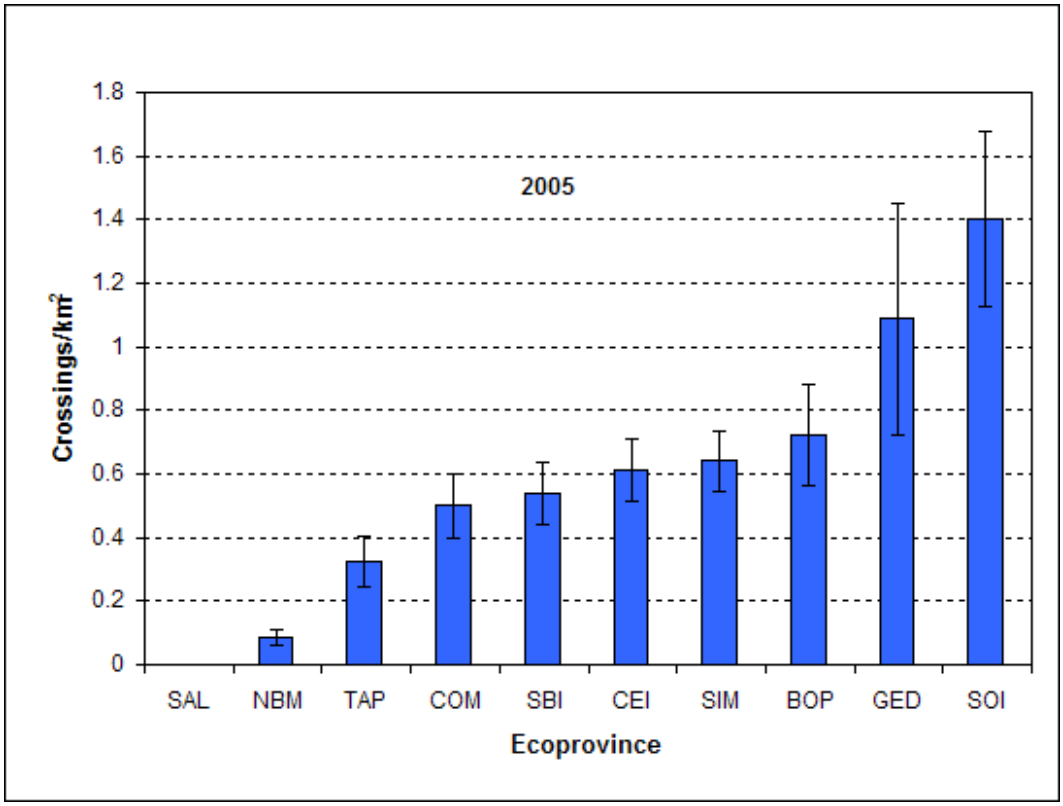
Stream crossing data is not available for the Muskwa-Kechika area specifically but MOFR analyzed the National Forest Inventory Photo Database to develop stream crossing data by ecoprovinces. The following table shows the stream crossing density by ecoprovince in 2000 and 2005 in BC. The Muskwa-Kechika accounts for a large portion of the Northern Boreal Mountain ecoprovince.[57]

Table 4-17: Stream crossing density in BC ecoprovinces, 2000 and 2005

Ecoprovince	2000	2005	%age change, 2000 to 2005
	Stream crossings per sq. km		
Northern Boreal Mountains (NBM)	0.057	0.085	49%
Southern Alaska Mountains (SAL)	0	0	0
Taiga Plains (TAP)	0.262	0.324	24
Coast and Mountains (COM)	0.436	0.500	15
Sub-boreal Interior (SBI)	0.475	0.539	13
Central Interior (CEI)	0.506	0.613	21
Southern Interior Mountains (SIM)	0.567	0.640	13
Boreal Plains (BOP)	0.555	0.725	13
Georgia Depression (GED)	1.041	1.088	4
Southern Interior (SOI)	1.272	1.401	10

The following bar graph compares stream crossings per sq. km for 2005.

[57] A map of the ecoprovinces appears in Appendix II.



What does the data show?

The level of stream crossing density in the Northern Boreal Mountain ecoprovince (which the M-KMA accounts for a large portion of) was the lowest in the province by a large margin in both 2001 and 2005. Although the density index for this ecoprovince rose by almost 50% in 2005 over 2001 the streams crossings per sq. km level found in this ecoprovince is relatively low, approximately one-quarter of the next highest level in BC.

The oil and gas exploration areas of Northeast BC experienced the largest increase in stream crossing density (.0170) between 2001 and 2005 in BC due to the strong economic activity in this sector over the past several years. They are largely situated in the Boreal Plains ecoprovince, and lie to the east of the Muskwa-Kechika area.

Data Source

The stream crossing density data was sourced from the publication entitled Environmental Trends in British Columbia: 2007 and is available at http://www.env.gov.bc.ca/soe/et07/06_ecosystems/technical_paper/ecosystems.pdf.

4.5 AIR

4.5.1 Industrial Operations Indicator

- Number and type of industrial sites

Relevance

Air quality and quality of life go hand in hand. Clean air is essential to the health of humans and plant growth. Large amounts of pollution produced from the burning of fossil fuels is a major source of smog, the most cited air quality problem facing urban areas. Smog is produced when ground-level ozone combines with fine air borne particles, creating a distinctive yellowish haze along the horizon.[58] Ground level ozone, the main component in smog, is a colourless, irritating gas that forms just above the earth's surface when sunlight reacts with or "cooks" air pollutants. Although ozone persists year long, levels are heavily influenced by the weather and can become especially intolerable during the hot summer months.

Particulate matter (PM) with diameters less than or equal to 2.5 micrometers ($PM_{2.5}$) presents the greatest health hazard because it can penetrate deep into the lungs.[59]

The impacts of poor air quality pose serious concerns, particularly for those with pre-existing respiratory or heart conditions, the elderly and young children. However, even healthy adults can feel the adverse effects of poor air quality. Ozone exposure can reduce lung capacity, aggravate asthma, cause chest pain, chronic bronchitis, allergies, and irritate the eyes, nose and throat. The severity should not be underestimated as, according to Health Canada, air pollution is associated with thousands of premature deaths every year in Canada, and thousands more hospital visits.[60] In addition, ozone can damage plants, hinder forest growth and reduce crop yields.

Air quality is calculated by measuring the types and mass of harmful airborne substances. A Canada Wide Standard (CWS) was endorsed in 2000 by all provinces but Quebec to guide management of particulate matter (PM) and Ozone.

Air emissions in the Muskwa-Kechika

There are no larger-scale industrial operations in the Muskwa-Kechika MA, such as either a sawmill or mine. The industrial operations in the area are relatively small, and limited to three natural gas wells.

---

[58] Environment Canada, 2005. website:

http://www.ec.gc.ca/soer-ree/English/Indicator_series/new_issues.cfm?tech_id=31&issue_id=8

[59] Environment Canada, "Smog Fact Sheet", 2002. website:
http://www.msc.ec.gc.ca/cd/factsheets/smog/index_e.cfm

[60] Health Canada, 2006. website: http://www.hc-sc.gc.ca/ewh-semt/air/out-ext/air_quality_e.html

What does the data show?

Air quality is very high in the Muskwa-Kechika region because there is a nominal amount of criteria air contaminants emitted from the region's very small industrial footprint.

The intent behind indicators is to capture both negative and positive impacts. In this instance the impact is wholly positive due to the lack of air quality stressors in the M-KMA.

Data Source

Author's research on local industrial operations.

5. Economic Progress

5.1 Regional Economy

5.1.1 Unemployment Indicator

- Percentage unemployment rate (%) for Northeast Development Region and Dawson Creek

Relevance

The unemployment rate is an important indicator of economic wellbeing and its direction often reflects other basic economic growth indicators, such as GDP. The advantage of this indicator is that it is available at sub-provincial levels, such as economic regions and certain municipalities, whereas other economic indicators are only available at provincial and national levels.

It is also an indicator of quality of life as a region or community with low unemployment levels usually has fewer social ills that are associated with unemployment, such as family instability, excessive alcohol consumption, and property crime.

Unemployment in the Muskwa-Kechika

The next table presents the annual unemployment rates for the five-year 2003-2007 period, along with the March 2008 unemployment rate, for the Northeast Development Region, the municipality of Dawson Creek[61], and for comparison purposes, the province of BC.

Table 4-18: Annual unemployment rate, 2003 – 2007, and March 2008 unemployment rate

	March 2008	2007	2006	2005	2004	2003
Northeast Region	4.4	4.2	4.8	5.9	7.2	8.0
Dawson Creek	6.0	3.1	4.1	6.2	5.9	5.2
BC	4.4	4.2	4.8	5.9	7.2	8.0

What does the data show?

Between 2007 and 2003, the unemployment rate in the Northeast Development Region was almost halved. The driving factor behind the region's improving employment levels was the expansion of its petroleum resource exploration and development.

Since mid-2007, however, the slowdown in the US housing sector has resulted in production curtailments and shutdowns in the region's forest industry operations,

[61] The federal government calculates an unemployment rate for only one municipality in the northeast, Dawson Creek.

including Abitibi-Consolidated operations in Mackenzie, Canfor's Chetwynd sawmill and Canfor's Tackama plywood and PolarBoard OSB plants in Fort Nelson. The year-over-year unemployment rate in the Northeast Development Region jumped 0.6 percentage points to 3.8% (3-month moving average) in March marking the first time since December 2006 that the region did not have the lowest unemployment rate in the province. This severe recession in the region's forest industry has driven up the regional unemployment rate, although it remains well below the 2003 level of 8.0%.

Data Source

Unemployment rates for the Northeast Development Region, as well as some cities, are BC Stats estimates, calculated using data supplied by Statistics Canada. The data is available at http://www.bcstats.gov.bc.ca/data/lss/labour.asp.

5.1.2 Income Indicator

- Average income
- Percentage change in income

Relevance

The average income figure is a widely watched measure that contributes to an understanding of the wealth of a community or an area. It reflects the overall economic wellbeing of the local economy. As with the unemployment indicator it is also an indicator of quality of life as a region or community with higher income levels usually has fewer social ills and is better able to support collaborative efforts that enhance community life, such as hospital fundraising drives and construction of recreation facilities.

The changes in income level portend the direction of the local economy. A community that has rising incomes is usually attracting new residents and often exhibits good levels of community spirit.

Income in the Muskwa-Kechika

Average incomes and annual percentage changes (shown in brackets) in incomes in the Peace River and Northern Rockies Regional Districts, along with BC as a whole for comparative purposes, are given in the next table.

Table 4-19: Average Income by Regional District, 2001-2005

	2005	2004	2003	2002	2001
Peace River RD	$39,789 (8.9%)	$36,543 (5.5%)	$34,632 (5.8%)	$32,742 (2.1%)	$32,055
Northern Rockies RD	46,421 (4.6%)	44,391 (7.7%)	41,222 (11.5%)	36,975 (1.4%)	36,447
BC	35,834 (6.1%)	33,766 (4.9%)	32,187 (2.8%)	31,316 (1.1%)	30,982

What does the data show?

The Peace River and Northern Rockies Regional Districts have incomes well above the provincial average over the 2001-2005 period. The gap widened over the five-year period, from approximately 15% to almost 25%, in the case of the Northern Rockies Regional District, which is dominated population wise by Fort Nelson.

The rising average incomes in the northeast are due to the recent rapid expansion in the petroleum resource exploration and development sector.

Data Source

The income data is based on Canada Revenue Agency taxfiler data and was sourced from BC Stats and is available at http://www.bcstats.gov.bc.ca/data/dd/income.asp

5.2 Regional Economic Diversification

5.2.1 Economic Diversity Indicator

- Economic diversity index

Relevance

The economic diversity index helps explain how reliant a local economy is on any one or two sectors. The Interior of BC has many resource dependant communities that rely on one industry for their economic wellbeing. This situation becomes a problem of course when that industry enters a sharp downturn.

A community that has a few strong sectors is better able as a community to withstand a downturn when one sector runs into economic difficulties.

Economic Diversity in the Muskwa-Kechika

BC Stats has calculated economic diversity index numbers for all areas of the province outside of Greater Vancouver. It uses a 1 – 100 scale where a higher index number indicates a higher level of diversity. The following table gives the diversity index numbers for a few northeast communities and other BC communities for comparative purposes. There is no economic diversity figure for the lightly populated M-KMA.

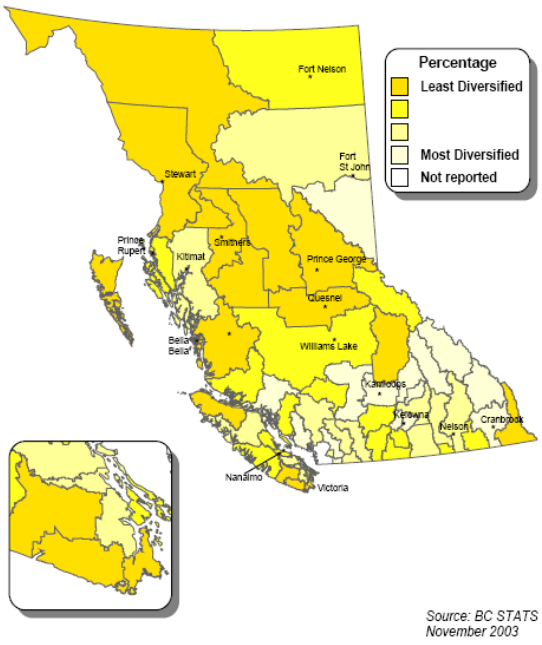
Table 4-20: Economic diversity indices, 2001-1996-1991[62]

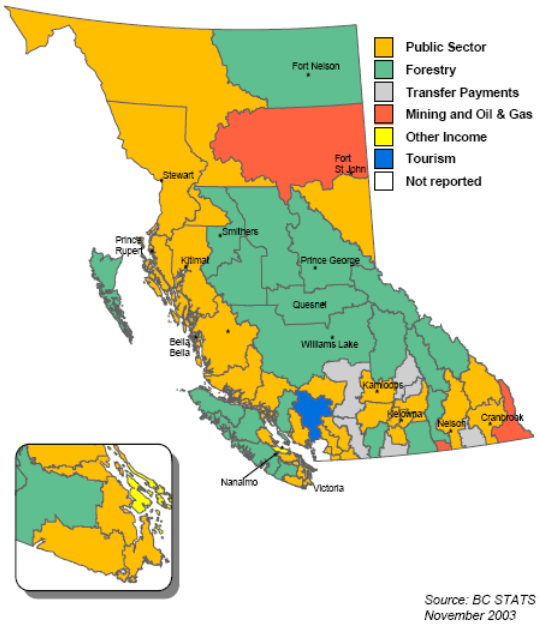
Communities	2001	1996	1991
Fort Nelson	68	56	69
Fort St John	70	75	74
Dawson Creek	74	72	74
Prince George	64	65	68
Victoria	58	59	65

[62] The diversity indices are calculated from employment data collected during the Census undertaken by Statistics Canada. The employment data by industry from the 2006 Census is not yet available.

Williams Lake	67	68	72
Kamloops	72	75	75

The following maps use colour codes to categorize the level of diversity by area (map on the left) and to highlight an area's main economic sector (map on the right).





What does the data show?

Dawson Creek has the most diversified local economy in the northeast. The other main communities around the Muskwa-Kechika reflect less economic diversification. Fort St John has become strongly identified with the oil and gas sector, much to its benefit over the past few years. Although BC Stats didn't produce a diversity index number for Mackenzie, it has a forest industry dominated economy, which has run into severe economic difficulties over the past year, with shutdowns of the Abitibi-Consolidated sawmill and pulp operations and the corporate financial difficulties of Pope and Talbot that have spilled over into its Mackenzie pulp mill. Fort Nelson has built up a strong reliance on the forest industry so it is also experiencing economic challenges because of recent shutdowns by Canfor of its OSB and plywood facilities in this town.

Alaska Highway rubber tire tourism has been a small but important force in the economies of Fort Nelson and other communities along its length in BC but these tourists have been declining in numbers in recent years. With gas prices expected to remain at record high levels, it is unlikely that this segment of the northeast tourism sector will grow back to former levels for several years.

Data Source

The source for the economic diversity indices and associated maps was the following publication, Horne, G. (January 2004) *British Columbia's Heartland at the Dawn of the 21st*

Century 2001 Economic Dependencies and Impact Ratios for 63 Local Areas. BC Stats, BC Ministry of Management Services.

5.3 TOURISM

5.3.1 Provincial Park Visitation Indicator

- Provincial park campground and day use area visitation

Relevance

The indicator shows levels of and trends in use of front country park lands and facilities for outdoor recreation. The measure is helpful in understanding the size of and trends in the market for frontcountry activities and demand for park visitor services, facilities, and resources for activities.

The indicator has limitations because it references number of parties so it does not provide information on the length of their visits.

Provincial Park Visits in the Muskwa-Kechika

Table 4-21 shows the estimated attendance in number of parties for camping and day use facilities at front country provincial parks in the M-KMA.

Table 4-21: Attendance at provincial park facilities in Muskwa-Kechika MA, 2003-2007 (no. of parties)

Park facility	2007	2006	2005	2004	2003
Liard River Hotsprings					
Camping	5,764	6,321	6,565	6,777	6,810
Day Use	9,435	13,641	10,711	24,226	33,876
Muncho Lake - Macdonald					
Camping	1,020	1,005	1,121	1,157	1,384
Day use	3,745	4,316	4,740	2,864	3,742
Muncho Lake – Strawberry Flats					
Camping	1,065	1,020	1,093	1,126	1,324
Day use	4,390	4,894	5,224	3,675	4,800
Summit Lake					
Camping	1,259	1,032	778	818	853
Day use	4,742	4,058	611	4,977	5,399

What does the data show?

The trends in attendance levels for camping and day use facilities in Liard River Hotsprings, Muncho Lake (Macdonald and Strawberry Flats) and Summit Lake were steady over the five-year 2003-2007 period, with the distinct exception of day use attendance at Liard River Hotsprings. Day use attendance at this well known stopping off point along the Alaska Highway has dropped precipitously over the shown period, and in 2007 was less than a third of the 2003 level at approximately 9,500 parties.

The fall-off in provincial park visitation in the Muskwa-Kechika area is directly due to lower tourist traffic volumes on the Alaska Highway that are a result of the rapid climb in gas prices over the past five years. Muskwa-Kechika provincial park

visitation is likely to stay in the short-term at approximately 2007 levels because higher gas prices are forseen and will deter long distance travel for many.

The two small (15 sites) front country campgrounds in Muncho Lake Provincial Park show steady estimates of visitor parties for camping and day use over the 2003-2007 period. The 90 km drive through Muncho Lake Provincial Park has a reputation as being the most scenic along the Alaska Highway.[63]

Data Source

Visitation estimates were provided by Liard Area-Peace Region, Parks and Protected Areas, BC Ministry of Environment.

5.3.2 Tourism Infrastructure Indicator

- Tourism infrastructure - number of tourism facilities, number, location and area of guide-outfitter territories and number of commercial recreation tenures

Relevance

The supply of built accommodation helps suggest the level of marketplace demand for tourism experiences in an area. The types of tourism accommodation point to the tourist market segments that visit an area.

Tourism Infrastructure in the Muskwa-Kechika

The tourism accommodation infrastructure of the Muskwa-Kechika MA includes the following.

Table 4-22: Lodge and motel accommodation

Rocky Mountain Lodge	Mile 397 (Alaska Highway)	Located in the MacDonald River Valley, 1.5 km from the entrance to Stone Mountain Provincial Park. RV and tent camping, rooms, meals, gas and diesel, store, hiking, wildlife
Toad River Lodge	Mile 422	Tent sites, cafe, showers, laundry, sanidump, gas, motel, rooms, cabins,
The Poplars Campground	Mile 426, 6 km west of Toad River, inside boundary of Munch Lake Park	30 RV sites, log cabins, showers, water, tent sites, sewer dump, gas, diesel, propane, welding, tire repair, gift shop
Double "G" Service	Mile 456	Motel and campground, gas, café, grocery store
Northern Rockies Lodge	Mile 462	21 guest rooms in a modern lodge, licensed dining room plus chalets in summer for a total of 45 guest rooms, RV

[63] Observation in a widely used travel web site, http://www.britishcolumbia.com/parks/?id=165

		Campground along Muncho Lake has 35 sites with water, electric (20 AMP's) and sewage. From our lodge we offer daily fly-in fishing trips, wildlife viewing safari tours, hiking and outpost cabin vacations
Liard River Hotsprings Lodge	Mile 497	Lodge with 12 guest rooms, gift shop, restaurant and RV sites
Coal River Lodge	Mile 522	Located at intersection of coal and Liard Rivers, RV sites, camping, restaurant and motel
Fireside Motel	Mile 543	

Provincial campgrounds - MacDonald and Strawberry Flats in Muncho Lake Park, Liard River Hotsprings and Summit Lake.

Forest Recreation Site - Gathto Creek Recreation Site in the Upper Muskwa River watershed

Guide-Outfitters – The M-KMA is blanketed by guide-outfitter territories. There are a total of 28 guide-outfitters with territories that either lie wholly within or straddle M-KMA boundaries. Five guide-outfitters have larger territories by a wide margin. Shown in the table below are their names, their territory in the M-KMA and the watersheds in their territories

Table 4-23: Guide-outfitters with territories in the Muskwa-Kechika MA

Guide-Outfitter	Territory area in M-KMA	Percent in M-KMA	M-KMA watersheds
Dale Drinkall	10,879	99.7	Frog River, Toad River, Gataga River, Liard River
Darwin Cary	4,789	100.0	Frog River, Upper Kechika River, Turnagain River
Ken Clarke	4,584	98.8	Middle Muskwa River, Toad River
Thomas Vince	4,370	79.6	Lower Kechika River, Turnagain River
Arthur Thompson	4,114	100.0	Coal River, Toad River, Liard River

The lodge operations of the guide-outfitters, largely fly-in and out operations, include the following.

- Turnagain River Adventures
- Muskwa-Prophet (large lodge and spa)
- BC Safaris Ltd.
- Big Nine Outfitters High & Wild Wilderness (large lodge)
- Folding & Terminus Mountain Outfitters (large lodge)
- Gundahoo River Outfitters (lodge is just off the Alaska Highway)
- Liard River Adventures (lodge is near Liard River Hotsprings)

- Scoop Lake Outfitters (off the Kechika River)
- Sikanni River Outfitting Inc. (Large lodge, near the Alaska Highway)
- Stone Mountain Safaris Ltd (large lodge in Toad River)
- Tuchodi River Outfitters

The following table documents the tourism oriented Crown tenures issued as of March 2008 within the boundaries of the M-KMA.

Table 4-24: Tourism oriented Crown tenures (as of March 2008)

Tenure activity	Number of tenures	Tenure type
Guided freshwater recreation	15	Commercial Recreation
Guided nature viewing	7	Commercial Recreation
Hunt camps	5	Commercial Recreation
Hunting/fishing camps	85	Commercial
Trail riding	4	Commercial Recreation
Private camps	3	Commercial Recreation
Multiple use	14	Commercial Recreation
Miscellaneous	2	Commercial Recreation

What does the data show?

The tourism accommodation in the Muskwa-Kechika MA can be roughly divided into two groupings. There is the Alaska Highway accommodation built to cater to the rubber tire tourist segment travelling this well known road. The other focus is the largely wilderness located accommodation supplied by guide-outfitters. They traditionally have catered to hunters but wildlife and wilderness viewing visitors have become a niche in the guided trade of the Muskwa-Kechika area.

The reduction in visitors is evidenced through the closure of J&H Wilderness Resort.

Data Source

Data on tourist accommodation was obtained from the BC Tourism accommodation web site. The information on guide-outfitters accommodation was supplied by ILMB. The next table presents the source for the commercial tenure data.

Table 4-25: THLB data source

Area Analysis Data	Layer Name	Original Location
Commercial tenure	WHSE_TANTALIS.TA_CROWN_TENURES_VW (table)	LRDW
Guide-outfitters	WHSE_WILDLIFE_MANAGEMENT.WAA_TRAPLINE_AREAS_SP	LRDW

5.4 RECREATION

5.4.1 Hunting Activity Indicator

- Number of hunters by species
- Hunter days by species

Relevance

The large mammal population of the M-KMA has been a food hunting target for regional First Nations for hundreds of years. Since the construction of the Alaska Highway the M-K's large mammal population has also become an important hunting target for local non-Aboriginal hunters and guided non-resident hunters. This large mammal population is also now the basis for small but stable guided hunting businesses and their employment and local purchasing.

The number of hunters and hunter days by species points to shifts in activity over time and differences in intensity of hunting effort between species. The figures can't be added to yield totals for number of hunters and hunter days because some hunters carry more than one species tag on a hunt. However the data is very helpful in understanding trends over time in hunting activity for each species.

Hunting Activity in the Muskwa-Kechika

The following table documents the hunting activity by species for the ten-year 1997-2006 period for the M-KMA.

Table 4-26: Hunting activity by species for the M-KMA (1997-2006)

Elk

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	1,385	1,461	1,589	1,418	1,548	1,362	1,371	766	1,152	1,302
Resident hunter days (#)	9,905	10,753	12,072	11,420	13,400	10,599	10,123	5,576	8,893	9,868

Moose

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	1,732	1,710	1,773	1,663	1,527	1,469	1,364	933	1,152	1,177
Resident hunter days (#)	12,151	12,258	13,373	12,231	13,939	11,935	10,112	7,157	8,526	8,373

Sheep

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	653	860	786	631	593	641	540	363	514	565
Resident hunter days (#)	4,835	6,121	5,635	4,801	5,146	4,752	4,149	2,539	3,873	3,835

Caribou

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	518	582	501	455	461	395	352	190	285	295
Resident hunter days (#)	3,313	3,740	3,295	3,115	3,874	2,652	2,567	1,251	2,042	1,873

Goat

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	137	171	143	92	100	91	104	68	155	143
Resident hunter days (#)	1,078	1,271	1,058	739	692	497	726	388	1,088	948

Grizzly Bear

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Resident hunters (#)	39	54	46	97	21	59	76	71	121	87
Resident hunter days (#)	347	386	380	764	178	480	705	583	1,067	762

Black Bear

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Resident hunters (#)	115	138	137	173	135	222	158	91	147	173
Resident hunter days (#)	765	1,081	1,039	1,250	1,211	1,331	1,192	637	1,206	1,456

Mule Deer

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Resident hunters (#)	79	71	95	68	62	91	84	37	79	122
Resident hunter days (#)	735	267	481	393	629	619	767	133	491	1,014

What does the data show?

Moose and elk hunting account for the largest numbers of hunters and hunter days in the M-KMA by large margins. The two hunts have had similar numbers of hunters and hunter days over the 1996-2007 decade. Both hunts have fallen off by about a third since their 2001 peaks.

Stone's sheep and northern caribou rank next in importance on the basis of hunter numbers and hunting days. By 2007 both of these hunts were down by about 40% from their 1998 peaks.

The number of hunters and hunter days are affected by regulated access to the species. For example the moratorium on grizzly bear hunting in 2001 much reduced the number of hunters and hunter days for this species in that year.

Data Source

Data on resident hunter activity for each of the Management Units that lie wholly within or overlap into the M-KMA[64] was obtained from the Fish and Wildlife Data and Licensing Section of BC Ministry of Environment. .

5.5 FORESTRY

5.5.1 Forestry Indicators

- Area of Timber Harvesting Landbase (THLB) by contribution class

[64] Management Units 736, 737, 739, 740, 741, 742, 743, 750, 751, 752, 754, and 757.

- Timber harvest
- Stumpage revenues to the BC Government

Relevance

The THLB area indicates the extent of the timber resource opportunity, at a broad level, generally considered suitable and available for timber harvesting on Crown land. The contribution classes indicate the extent to which they are counted on as part of the provincial timber supply. They reflect the economic viability or the level of resource management constraints imposed on the forest from other resource uses. The more the area is constrained (such as for wildlife habitat), or uneconomic (such as mountain tops), the less it is considered available for timber harvesting.

In general, areas identified as contributing are suited for commercial forestry, such as low elevation treed areas that can be harvested while not significantly impacting other resource values. Partially contributing areas are suited for commercial forestry as well, though they likely have challenges or competing uses that may require or offer a lighter forestry footprint, such as for wildlife habitat in heavily forested areas or marginally economic timber values.

Areas classified as not contributing are generally not suited to commercial forest management, such as rock and alpine areas. They do not pre-suppose forestry activity, but the likelihood is very low. Areas classified as excluded are lands that are encumbered for purposes other than Crown forestry uses, such as parks or reserves.

The volume of timber that is actually harvested (historic) or is likely to be harvested (projection) indicates marketplace demand. A ratio of actual harvest to available timber for harvest in an area also broadly indicates cost competitiveness of an area's timber as well as marketplace demand for it.

Stumpage, the tax revenue paid by harvesters of Crown timber to the BC Government, is another indicator of trends in marketplace demand and also can indicate cost competitiveness of timber.

Forestry Activity in the Muskwa-Kechika

There is currently no commercial forestry activity in the Muskwa-Kechika MA.

Approximately two years ago, Canfor harvested a few blocks in the Cypress Creek area of the M-KMA, which lies in the Fort St. John Forest District (and the Upper Halfway River watershed).

In October 2002, an order under the *Forest Practices Code of British Columbia Act* established landscape units and objectives for the Fox and Obo River areas, which lie within the Mackenzie Forest District, Mackenzie Timber Supply Area and southwestern corner of the M-KMA. There are no forestry landscape objectives for other areas of the M-KMA.

The following table lays out the area of the M-KMA by THLB contribution class.

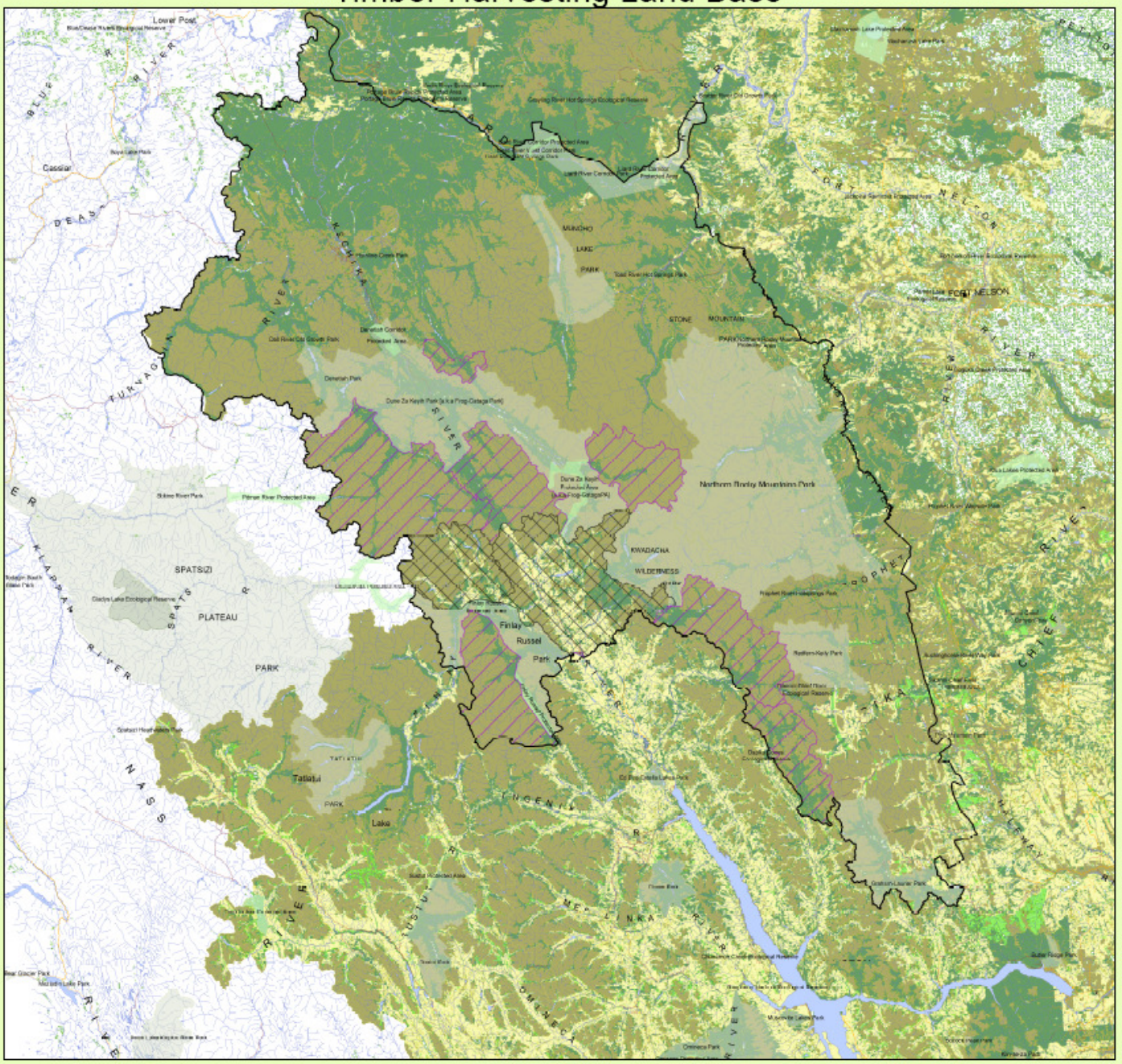
Table 4-27: Area of Muskwa-Kechika THLB (ha)

THLB Map Designation	Timber Harvesting Land Base category (THLB)	Area of M-KMA (sq. km)	Percentage of THLB (%)
Greater than 75% of Area	C - Contributing to the	2,270.9	3.6%

Available for Harvesting	timber harvesting land base		
Less than 75% of Area Available for Harvesting	P - Partially contributing to the timber harvesting land base	183.0	0.3%
Non-productive	N – Not contributing to the timber harvesting land base	20,422.4	32.0%
Unavailable for Harvesting Areas	X – Excluded from the timber harvesting land base	40,932.7	64.2%

The following map shows the locations of the areas that are available and unavailable for timber harvesting.

Muskwa-Kechika Management Area: Timber Harvesting Land Base



What does the data show?

The Muskwa-Kechika MA is not an attractive target for timber harvesting. A very small portion of its total area is suitable and available for forestry development, approximately 2,500 sq. km or 3.9% of the total M-KMA. Almost the entire M-KMA, 96.1%, of the area is either unsuited or unavailable for timber harvesting. The contributing and partially contributing THLB area is distributed around the fringes of the landbase, with only the Fox River, Upper Halfway River and Upper Sikanni Chief watersheds having more than 200 sq. km each of contributing THLB area.

Any part of the M-KMA is also a great distance from sawmills in Mackenzie and Fort Nelson, which adds a substantial transportation cost increment to harvesting M-K MA timber. The recent downturn in the Interior BC forest industry has led to either mill closures or temporary shutdowns in Fort Nelson and Mackenzie, much dampening the interest of forestry companies in the more remote and therefore more expensive timber of the Mackenzie, Fort Nelson and Fort St John TSAs. These factors have combined to minimize current interest in undertaking forestry in the Muskwa-Kechika.

Roads reach into the Upper Halfway River and Upper Sikanni Chief watersheds. A forestry road extends above Williston Lake into the Fox River watershed. Logging has occurred along the lower slopes of the Rocky Mountain Trench from Fort Ware to the north end of Williston Reservoir and beyond, along the east and west sides of the Finlay River, along Ingenika Arm toward Tomias Lake and along the Swannell River.

Data Source

Table 4-28 presents the source of data that was accessed to compile the THLB table.

Table 4-28: THLB data source

Area Analysis Data	Layer Name	Original Location
THLB	THLB analyses from land use planning processes	ILMB

5.6 Mineral Exploration and Development

5.6.1 Mineral Exploration and Development Indicators

- Number of metallic mineral producers, past producers, developed prospects, prospects, and showings
- Area of metallic mineral potential

Relevance

These indicators show (at a high level) the mineral development activity and potential for new metallic mineral development. Concentrations of occurrences or

sites provide an indication of potential and the amount of industry interest in an area's mineralization.

The rating of areas is undertaken by BC MEPR experts who classify them on a probabilistic basis of discovering future mineral deposits. On a provincial basis, the relative ranking identifies areas of higher potential.

Exploration and development activity in BC has expanded greatly with the recent increases in prices of base metals, such as copper and zinc, and precious metals due to strong demand from the huge emerging economies of China and India.

Within the BC Government's MPB action plan is an emphasis on accelerating mineral and energy development within the MPB infestation areas. To this end, Geosciences BC has undertaken to assemble and further develop geological information and data about the areas under MPB attack

Access to mineral resources is provided under the *Mineral Tenure Act*, which provides for a two-zone system of land management in BC. The two-zone system ensures that mining and mineral exploration applications are considered, subject to all applicable laws, in all areas except parks, ecological reserves, protected heritage properties or areas where mining has been prohibited by an order under the *Environment and Land Use Act*.

Mineral Exploration and Development in the Muskwa-Kechika

The following tables itemize recent mining industry activity and mineral potential in the Muskwa-Kechika MA.

Table 4-29: Mineral exploration and development activity and potential in the M-KMA

Mineral	M-KMA	Gataga River watershed	Toad River watershed	Turnagain River watershed	Upper Prophet River watershed	Other watersheds
Producers (#)	-	-	-	-	-	-
Past producers (#)	1	-	1	-	-	-
Developed prospects (#)	9	-	5	-	-	4
Prospects (#)	24	5	2	3	2	12
Showings (#)	198	34	24	19	21	100

Table 4-30: Mineral Resource Assessment for the M-KMA

	Very High	High	Moderate	Low	Very Low
Area of M-KMA (sq. km)	7,506	18,402	24,728	8,223	5,003

What does the data show?

There are no operating mines in the M-KMA and no mine developments in the offing. There is a nominal amount of exploration amount of metallic mineral exploration activity for a relatively large area of the province.

Only one past producer is listed in the MINfile database for the Muskwa-Kechika area; the Magnum or Churchill Copper Mine was located at the headwaters of Magnum Creek. The mine's mill was situated downstream at the confluence of Delano Creek and Racing River. The mine was located along a road that stretched for approximately 56 km from the Alaska Highway north of Summit Lake. The deposit was discovered in 1943 but mined only in 1974 and 1975.[65]

Most of the prospecting activity in the M-K has occurred in the Gataga River and Toad River watersheds to date, as evidenced by their higher number of developed prospects, prospects and showings. The Magnum Mine was located in the Toad River watershed. The MINfile note on this past producer characterized the prominent mineralization of the area as follows, "The region is known for widespread vein-hosted copper mineralization, generally restricted to fracture systems in Proterozoic sedimentary rocks, but the Magnum Mine is the only deposit that has been brought to production." [66]

Within the large area of the M-KMA, there are only 65 active mineral tenures.

A large portion of the Muskwa-Kechika area, approximately 7,500 sq. km (11.6%), of the M-KMA has been rated as having a very high likelihood for discovery of metallic mineral deposits of economic interest. The watersheds with larger areas rated as either high or vey high potential are as follows.

- Coal River
- Fox River
- Frog River
- Liard River
- Toad River
- Toodoggone River

Data Source

The following table presents the sources of data that were accessed to compile the metallic mineral data.

Table 4-31: Metallic mineral data source

Area Analysis Data	Layer Name	Original Location
Metallic mineral	WHSE_MINERAL_TENURE.ARIS_MINERAL_REPORTS	LRDW
" "	WHSE_MINERAL_TENURE.EMPR_MINERAL_TENURE_POLYS	" "
" "	WHSE_LAND_USE_PLANNING.RKPM_KARST_POTENTIAL_AREA_SP	" "
" "	WHSE_MINERAL_TENURE.MT	" "

[65] Source: MINfile, available at http://minfile.gov.bc.ca/Summary.aspx?minfilno=094K++003

[66] Ibid

	A_SITE_POLY	
" "	WHSE_MINERAL_TENURE.MINPOT_MINERAL_POTENTIAL	" "
" "	WHSE_MINERAL_TENURE.MINFIL_MINERAL_FILE	" "
" "	WHSE_MINERAL_TENURE.ENGIS_POSTED_TITLE_REG	" "
" "	WHSE_MINERAL_TENURE.ENGIS_ACTIVE_TITLE_REG	" "

5.7 OIL AND GAS

5.7.1 Oil and Gas Exploration and Development Indicators

- Number and location of active, producing wells
- Number and location of cased wells
- Number and location of completed wellheads
- Number and location of abandoned wellheads
- Number and location of cancelled wellheads
- Number, area and location of active oil and gas tenures

Relevance

Petroleum resource exploration and development recently overtook the province's forest industry as the largest source of industrial tax revenues for the BC Government. The northeast of the province is the location of this principally natural gas exploration and development industry. The map of linear development on page 15 clearly shows the intensity of petroleum resource cut, seismic and transmission line development to the east of the Muskwa-Kechika MA.

Pre-tenure plans for petroleum resource development for several areas within M-KMA boundaries represent important steps in M-KMA resource planning. There is a pre-tenure plan adopted in May 2004, which contains chapters for each of four pre-tenure plan areas, Halfway-Graham, Besa-Prophet, Muskwa West and Sulpher / 8 Mile. A pre-tenure plan for the Upper Sikanni area was adopted in 1995.

Oil and Gas Exploration and Development in the Muskwa-Kechika

The following table itemizes recent oil and gas industry activity in the Muskwa-Kechika MA.

Table 4-32: Oil and gas drilling and tenure activity

Status	M-KMA	Upper Sikanni Chief River watershed	Upper Halfway River watershed	Upper Muskwa River watershed	Other watersheds
Active wells (#)	3	3	-	-	-
Cased wells (#)	2	1	1	-	-
Completed wellheads (#)	1	-	1	-	-
Cancelled wellheads (#)	4	1	1	2	-

Abandoned wellheads (#)	24	9	3	3	9
Active petroleum and natural gas tenures (#)	62	24	30	3	16[67]
Active petroleum and natural gas tenures (ha)	724	382	206	26	107[68]

What does the data show?

Compared to the very high level of activity in areas to the east of its boundaries, petroleum resource exploration and development within the M-KMA has been modest and concentrated in the Upper Sikanni Chief and Upper Halfway River watersheds.

The Oil and Gas Commission's database lists only three producing wells in the M-KMA. Over the time period of Oil and Gas Commission statistics, 24 wellheads have been abandoned. There is one abandoned wellhead listed for the mid 1950s (Stanolind in the Middle Muskwa River watershed), a few in each of the 1960s and 1970s, but most of the exploration activity in the M-K occurred in the 1990s. There are 62 active petroleum and natural gas tenures located in the M-KMA.

The active wells and their operators, locations and resource focus are the following.

- CNRL SIKANNI D- 005-I/094-G-03 - Canadian Natural Resources Limited (CNRL), Upper Sikanni Chief River, natural gas
- HUSKY SIKANNI C- 053-J/094-G-03 – Husky, Upper Sikanni Chief River, natural gas
- CNRL ET AL CHICKEN B- 033-B/094-G-06 - Canadian Natural Resources Limited, Upper Sikanni Chief River, natural gas

Data Source

Table 4-33 presents the source of data that were accessed to compile the tables on areas of petroleum resource exploration and development in the M-KMA.

Table 4-33: Petroleum resource exploration and development data sources

Area Analysis Data	Layer Name	Original Location
Bottom Hole - Event	WHSE_MINERAL_TENURE.OG_BOTTOM_HOLE_EVENT_SP	LDRW
Bottom Hole - Status	WHSE_MINERAL_TENURE.OG_BOTTOM_HOLE_STATUS_SP	LDRW
Surface Hole - Event	WHSE_MINERAL_TENURE.OG_SURFACE_HOLE_EVENT_SP	LDRW
Surface Hole - Status	WHSE_MINERAL_TENURE.OG_SURFACE_HOLE_STATUS_SP	LDRW
Petroleum/Natural Gas active tenures	WHSE_MINERAL_TENURE.ENGIS_ACTIVE_TITLE_REG	LDRW

[67] Several active tenures straddle two watersheds

[68] As above

5.8 ENERGY

5.8.1 Renewable Energy Indicator

- Number of renewable energy tenures/licences and number of renewable energy developments

Relevance

The growing awareness about global warming and its implications for climate change have spurred renewed attention on the environmental advantages of renewable energy sources such as biomass, hydro, wind and solar. The BC Government's 2007 Energy Plan has set a policy goal of ensuring 90% of the province's total electricity continues to be clean or renewable. BC Hydro has issued proposal calls to Independent Power Producers (IPPs) in the past few years that have led to the construction of many run-of-river small hydro electricity projects, some woodwaste power projects and several wind farm projects. BC Hydro has electricity purchase agreements (EPAs) with independent power producers for 21 green power projects, which have 915 GWh of annual electricity generation capacity. The list includes 19 small hydro, one biomass and one landfill gas projects.

Renewable Energy Development in the Muskwa-Kechika

The BC Government has issued five tenures in the M-KMA for investigating the potential of wind generated electricity.

What does the data show?

The renewable energy industry activity in the M-K has been limited. There are no energy producing projects and none in the construction stage. The investigation activity has been limited to wind power and no tenures or water licenses have been issued for hydro electricity purposes.[69]

Data Source

Data on commercial tenures related to renewable energy was obtained from the following source.

Table 4-34: Renewable Energy data source

Area Analysis Data	Layer Name	Original Location
Commercial tenure	WHSE_TANTALIS.TA_CROWN_TENURES_VW (table)	LRDW

[69] Three water licenses are current within M-KMA boundaries; the listed purpose for each licence is as follows, domestic water, dust control and waterworks.

5.9 TRAPPING

5.9.1 Furbearer Harvest Indicator

- Furbearer harvest by species

Relevance

There is a long tradition of trapping in the Muskwa-Kechika area and in the adjacent Fort Nelson region. The map below shows the boundaries of the estimated 52 trapline territories that lie either wholly or partially within the M-KMA's boundaries.

The selected indicator shows recent trends in trapline harvests and the main species that are trapped.

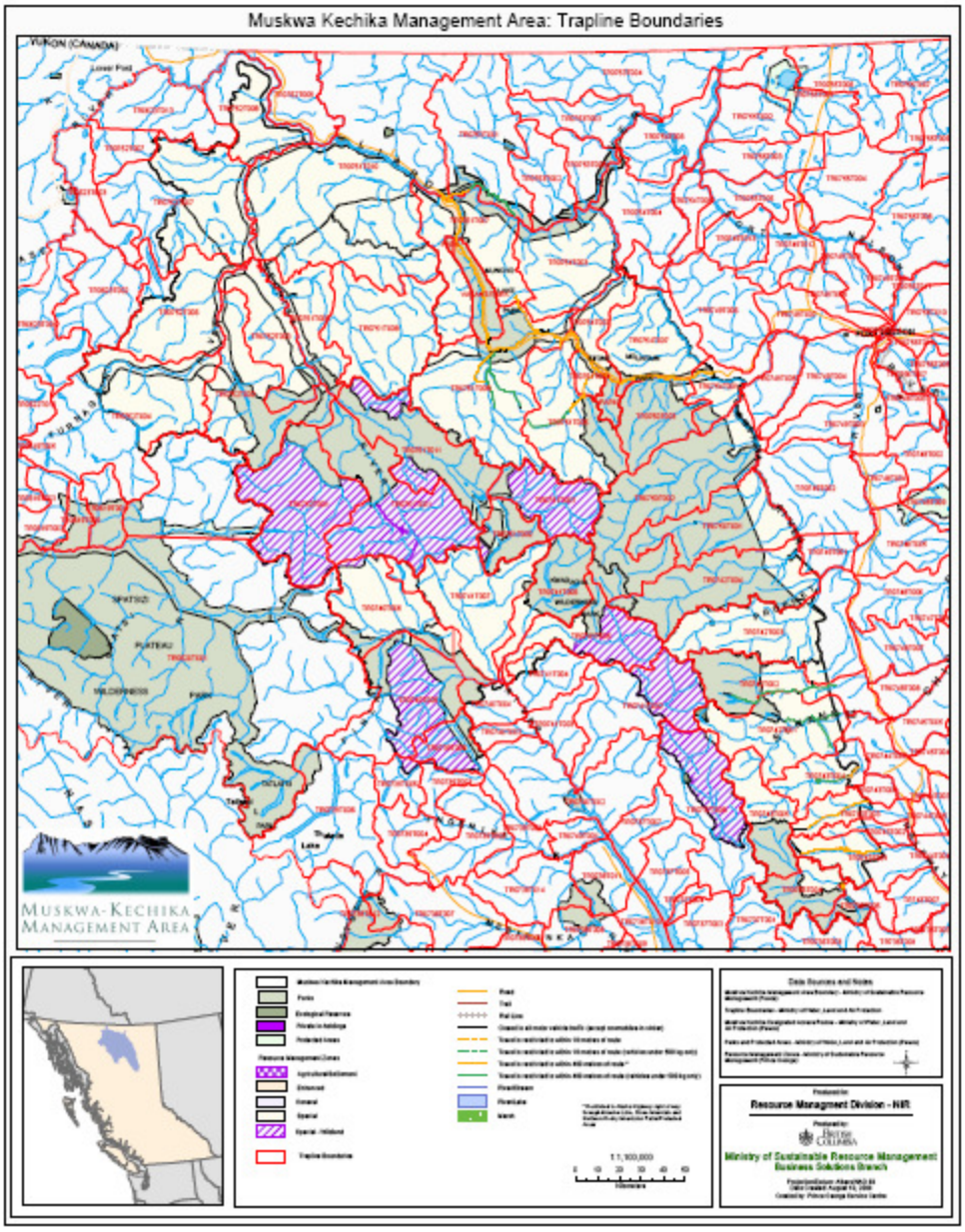
Furbearer Harvest in the Muskwa-Kechika

The following table presents the furbearer harvest in the M-KMA over the over most recently available period, 2001-2005.

Table 4-35: Furbearer harvest in the MK-MA (2001-2005)

Species	2005	2004	2003	2002	2001
Black Bear	0	4	7	5	4
Beaver	78	86	46	48	20
CAST	0	0	0	0	16
Coyote	14	7	18	10	12
Fisher	3	3	2	6	3
Fox	1	3	2	1	4
Lynx	28	33	28	28	51
Marten	268	298	157	193	165
Mink	4	9	1	21	5
Muskrat	0	0	0	1	0
Otter	2	3	0	6	1
Squirrel	45	19	102	200	117
Weasel	2	11	3	2	2
Wolf	17	13	25	20	28
Wolverine	14	15	32	12	33

The following map shows the boundaries of the trapline territories in the M-KMA.



What does the data show?

Marten is the main trapped species in the M-KMA in recent years. For the most recent available five-year period, the marten harvest has also been on the increase, reaching 298 pelts in 2004, before dropping slightly to 268 pelts in 2005. The bulk of these pelts were trapped within the boundaries of Management Units 739 and 754, which

Marten is the most important trapped furbearing species by value, accounting for nearly three-quarters of the total value of wildlife pelts sold in BC (about $1.1

million). Based on value, beaver (8%), otter (4%), wolverine (3%) and lynx (3%) are the next most important fur-bearing species.70

Data Source

The furbearer harvest data for the Muskwa-Kechika MA was sourced from Fish and Wildlife, Data and Licensing Section, BC Ministry of Environment

[70] BC Stats (August 2005) *British Columbia's Hunting, Trapping & Wildlife Viewing Sector*. Service BC, BC Ministry of Labour and Citizen's Services.

6. Social Development

6.1 POPULATION

6.1.1 Population Indicator

- Total population and Aboriginal population of Fort Nelson, Fort St. John, Northern Rockies Regional District and Peace Regional District
- Trend in populations

Relevance

Levels and trends in populations of communities and regions reflect their overall economic and social wellbeing. A higher rate of population change points to the possibility of atypical economic pressures, possibility an upturn in a key economic sector. Either higher or lower than normal rates of population change have important social implications. The oilsands producing areas of Alberta present an example of the implications of the extremes in social pressures due to rapid economic growth. Although the population and economic growth in the Fort St John area has been lower than in Fort McMurray, some of the same social issues have been reported for this northeast BC community as evidenced in the burgeoning oil sands communities of Alberta, including high house price inflation, shortages of suitable rental accommodation and high rates of alcohol and drug use and their related social ills.

Population in the Muskwa-Kechika region

There are anecdotal estimates of population for the small unincorporated communities located within the boundaries of the M-KMA but no official figures. There are tiny First Nations communities at Muncho Lake and Fireside. A small group of Teh Wa Dena or People of Stone Mountain reside at Muncho Lake[71], which has an estimated population of approximately 20[72].

There are also small permanent settlements at Toad River (estimated population of approximately 80) at Mile 422 on the Alaska Highway and at Liard River (estimated population of approximately 100) at Mile 496.

The following tables present population data for regional districts, municipalities, and First Nations communities that are located in the areas *surrounding* the Muskwa-Kechika MA.

Table 4-36: Regional and BC Population, 2003-2007					
Area	**2007**	**2006**	**2005**	**2004**	**2003**

[71] Sourced from http://www.kaskadenacouncil.com/heavenspass.html

[72] Sourced from http://www.britishcolumbia.com/regions/towns/?townID=3616

Peace River RD	62,372 (2.0%)	61,165 (1.3%)	60,398 (0.4%)	60,153 (4.8%)	57,407
Fort St. John	18,774 (2.9%)	18,249 (2.9%)	17,739 (2.6%)	17,291 (2.1%)	16,934
Northern Rockies RD	6,311 (-2.1%)	6,447 (0.1%)	6,439 (1.8%)	6,324 (4.7%)	6,043
Fort Nelson	4,622 (-2.4%)	4,735 (0.6%)	4,707 (1.9%)	4,618 (5.3%)	4,385
BC	(1.4%)	(1.4%)	(1.3%)	(1.2%)	

Table 4-37: Regional Aboriginal Population		
Area	**2006**	**2001**
Peace River RD	978 (-3.1%)	1,009
Fort Ware 1	239 (11.2%)	215
Northern Rockies RD	445 (-10.1%)	495
Fort Nelson 2	359 (-7.9%)	390
Prophet River	86 (-14.0%)	100
Stikine RD	390 (38.3%	282
Liard River 3	0 (-100%)	102
Lower Post	113 (303.6%)	28

What does the data show?

The permanent population that resides within the Muskwa-Kechika MA is relatively small, approximately 200.

The regional population trend has demonstrated considerable variability over the recent five-year 2003-2007 period. Both the Northern Rockies and Peace River Regional Districts experienced low or negative growth years and also an unusually high growth year in 2004. By comparison, the provincial population growth was steady at between 1.2 and 1.4% over this five-year period. The population of Fort St. John however had steady and high growth, 2.1 to 2.9%, over the 2003-2007 period due to the status as the regional service centre for the strong petroleum resource industry on the province's northeast.

The Aboriginal populations living in both regional districts, either in Aboriginal communities or incorporated municipalities, dropped by significant amounts over the 2001 and 2006 Census years.

Data Source

The population estimates for regional districts, municipalities and First Nations communities were obtained from the web site of BC Stats.

6.2 HEALTH

6.2.1 Population Mortality Indicators

- Life expectancy
- Potential years of life lost due to natural causes[73]
- Potential years of life lost due to accidental causes
- Infant mortality rate[74]
- Potential years of life lost due to suicide/homicide

Relevance

There are several potential health indicators but the most definitive are the mortality indicators. Differences over time and between areas signify changes in the main factors that contribute to and detract from living a long life. The selected indicators include life expectancy, which is a basic indicator of the extent to which people are able to live a long life. It can be used to indirectly consider a dimension of quality of life as well because the conditions that affect length of life also are major contributors to quality of life. Improvements in life expectancy reflect improvements in social and economic conditions, lifestyle, and access to health services and medical advances.

The indicator Potential Years of Life Lost (PYLL)[75] from natural, accidental, homicide and suicide causes focuses on premature deaths that can, in theory, be prevented or postponed. PYLL is an overall indicator of population health, as well as the effectiveness of prevention measures.

The infant mortality rate is a long-established measure, not only of child health, but also the social well-being of a society. A low rate reflects a healthy population, with good care and attention paid to the health of mothers and children.

Mortality in the Muskwa-Kechika

The following table presents data on several mortality indicators for the total populations of the Fort Nelson Local Health District and Peace River North Local Health District and for the Aboriginal population of the Peace-Liard region.

[73] Potential years of life lost (PYLL) for males and females, from all causes and selected preventable causes, expressed as an age standardized rate per 1,000 standard population. PYLL is the number of years of life "lost" when a person dies before an established cut-off point.

[74] The number of infants who die in the first year of life, expressed as a rate per 1,000 live births.

[75] PYLL considers deaths before age 75 and weights them by age. A person dying at age 25, for example, has lost 50 years of life (75 minus 25=50 PYLL). To allow for meaningful comparisons, PYLL is expressed as an age standardized rate per 1,000 population.

Table 4-38: Mortality in the Total and Aboriginal Populations of the M-K region					
	Life expectancy (yrs)[76]	Potential years of life lost due to natural causes (yrs per '000)[77]	Potential years of life lost due to accidental causes (yrs per '000)[78]	Infant mortality rate[79]	Potential years of life lost due to suicide/homicide (yrs per '000)[80]
Fort Nelson LHD	82.0	33.7	18.5	0.0	3.2
Peace River North LHD	79.9	33.9	14.3	2.0	4.3
Aboriginal population – Peace-Liard region	77[81]	110[82]	NA	6.7[83]	NA
BC	80.9	33.2	8.6	4.2	5.1

What does the data show?

The main takeaway from the shown mortality data is the difference in life span and potential years of life loss between the overall population of the region and its Aboriginal residents.

The life expectancy of the region's Aboriginal population is slightly lower and the difference is likely in part due to the reporting periods for the total and Aboriginal population data. There is a wide gap, however, between the two population groups in the region in terms of years lost to potentially avoidable causes. The Peace-Liard Aboriginal population has a PYLL rate than is about two times that of other regional residents. The PYLL rate for the Peace-Liard Aboriginal population however is about 20% lower than the average for the overall BC Aboriginal population.[84] Accidental deaths are a major contributor to the higher PYLL rate for the Aboriginal population.

The other main takeaway from the mortality data is the higher PYLL rate from accidental causes in the Fort Nelson and Peace River regions compared to the BC average. The PYLL rates due to natural causes are similar between northeast BC and the rest of the province.

---

[76] 2002-2006 avg.

[77] 2001-2005 avg.

[78] 2001-2005 avg.

[79] 2001-2005 avg.

[80] 2001-2005 avg.

[81] 1995-1999 avg.

[82] Includes natural, accidental and suicide/homicide causes, 1991-1999 avg.

[83] 1991-1999 avg.

[84] The 2001 Provincial Health Officer's report listed the average PYLL as 142 for the BC Aboriginal population.

The infant mortality rate for the Peace-Liard Aboriginal population is noticeably higher than for the overall population of the region, which is much lower than the BC infant mortality rate.

Sudden Infant Death Syndrome (SIDS) is the major contributor to higher death rates among Aboriginal infants in the province.

Data Source

Data is sourced from the following

- BC population health data – BC Stats, Socio-Economic Profiles Local Health Areas and available at http://www.bcstats.gov.bc.ca/data/sep/lha/lha_main.asp
- Aboriginal population health data - Office of the Provincial Health Officer (2002) *The Health and Well-being of Aboriginal People in British Columbia, Report on the Health of British Columbians provincial Health Officer's Annual Report 2001*. BC Ministry of Health Planning.

6.3 Forest and Wilderness Recreation

6.3.1 Forest and Wilderness Recreation Opportunity Indicators

- Number of forest recreation sites and trails and their facilities
- Number of BC Parks campgrounds and their facilities
- Area of ROS – 3 (Semi-primitive motorized) as percentage of total area of M-KMA

Relevance

Forests and wilderness offer important settings for recreation experiences by local and regional residents. BC Crown forests are managed for multiple uses including water supply, wildlife habitat, timber harvesting, non-timber forest products harvesting, tourism and recreation.

Outcome indicators for forest and wilderness-based recreation on Crown lands would be the number of recreationists over the course of a year in the M-KMA, the number of their visits and the number of their recreation days. This activity data has not yet been collected so the supply of settings for recreation activities is presented in this section.

Recreation Opportunity in the Muskwa-Kechika

Table 4-39 presents area data for the 'Semi-Primitive, Motorized' ROS class in the M-KMA.

Table 4-39: M-KMA area by ROS class (ha and %)		
ROS Classification	**Area of ROS class (ha)**	**ROS class as percent of MK-MA area (%)**
ROS-3 Semi-primitive, Motorized (SPM)	2,601	4.1
Total	63,861	100.0

There is one forest recreation site in the M-KMA at Gathto Creek.

There are five small provincial campgrounds within or near the boundaries of the M-K MA: Liard River Hotsprings, Strawberry (Muncho Lake), MacDonald (Muncho Lake), Stone Mountain and Tetsa River.

What does the data show?

The M-KMA offers an abundance of forest-based and wilderness recreation resources and their associated opportunities for regional residents but the infrastructure for accessing and using these resources is modest. There are few established campgrounds and the road network is limited, in part due to access regulations directed at preserving the wilderness characteristics of the M-K.

Another constraining factor is the very small amount of forestry activity and concomitant forestry road building in the M-K. In many other parts of the province, forestry roads have become important access routes for hunters, anglers, hikers and campers.

Only 4.1% of the M-K is listed as semi-primitive, motorized access. The watersheds in the M-KMA with relatively more areas classed as either 'Semi-Primitive, Motorized', 'Roaded Natural', 'Roaded Modified' and 'Rural' are the following.

- Liard River
- Middle Muskwa River
- Upper Sikanni Chief River
- Upper Halfway River
- Beaver River
- Toad River

The Recreation Opportunity Spectrum data confirms that a large portion of the Muskwa-Kechika MA remains in a wilderness state. Over 90% (92.3) of its total area is classified as either 'Primitive' or 'Semi-Primitive, Non-Motorized'. The largest portion of the M-KMA, 69.8%, is classified as 'Primitive'.

Data Source

Table 4-40 presents the source of data that were accessed to compile the tables on areas of ROS classes and forest recreation sites in the M-KMA.

Table 4-40: ROS and forest recreation site data sources		
Area Analysis Data	**Layer Name**	**Original Location**
Recreation Opportunity Spectrum	WHSE_FOREST _VEGETATION.REC_OPPORT UNITY_SPECTRUM_INV	LRDW
Forest Recreation Sites	WHSE_FOREST_TENURE.FTE N_REC_SITE_POINT	LDRW

6.4 WORKER SAFETY

6.4.1 Worker Mortality and Morbidity Indicators

- Number of work-related fatality claims
- Number of short-term and long-term disability claims
- Rate of work-related fatality claims plus short-term and long-term disability claims

Relevance

Numbers of and trends in on the job injuries and deaths area are direct outcome indicators that point to the social wellbeing of a community or a region. An area with high levels and/or increasing trends in worker injuries and deaths has a serious social problem and immediate steps should be taken to bring down the level and reverse the trend.

Worker Mortality and Morbidity in the Muskwa-Kechika

The following table shows the recent levels and trends in work-related fatalities and short-term and long-term disability claims for the Peace River-Liard region[85]. WorksafeBC records and organizes its claim data by employer location that it has on file. It does not have location data for incidents that occur in remote locations, on temporary work sites, on highways, etc. It also does not track employees in a company by location so Worksafe BC can only produce injury and fatality rate data (such as injuries per '000 employees) by BC as a whole and not for sub-areas of the province.

A work-related fatality and disability claim rate was created for this project by dividing the fatality and disability claims by population for each of the Peace River-Liard region and the province of BC.

[85] Combination of the Peace and Northern Rockies Regional Districts

Table 4-41: Number and rate of work-related fatality and disability claims[86], 2003-2007					
Number of claims and rate of claims	**2007**	**2006**	**2005**	**2004**	**2003**
Peace River-Liard Regional District					
Number of fatality claims	2	7	6	3	10
Number of short- and long-term disability claims	788	903	861	767	770
Number of fatality and disability claims	790	910	870	770	780
Rate of fatality and disability claims (per '000 population)	11.5	13.5	13.0	11.6	12.3
Province of BC					
Number of fatality claims	139	160	188	134	170
Number of short- and long-term disability claims	65,877	63,450	61,983	60,026	58,664
Number of fatality and disability claims	66,016	63,610	62,171	60,160	58,834
Rate of fatality and disability claims (per '000 population)	15.1	14.7	14.6	14.3	14.2

What does the data show?

The rate of work-related fatality and disability claims in the Peace-Liard region is lower than the BC average in each year of the shown five-year 2003-2007 period. In 2007, the Peace-Liard rate was approximately 20% lower than the BC average work-related fatality and disability claim rate.

The trend in the Peace-Liard rate has remained flat over the 2003-2007 period, staying within a range of 11.5 to 13.5 claims per '000 population. Unfortunately, the BC rate has steadily climbed over this five-year period.

The number of fatality claims in the Peace-Liard region appears to be declining but the five-year trend may be too short a period in which to make a firm declaration about the fatality claims trend.

Data Source

Data was sourced from WorksafeBC annual statistical reports (available at http://www.worksafebc.com/publications/reports/statistics_reports/default.asp) and directly from the Statistical Services department of WorksafeBC.

[86] Claims first paid by WorksafeBC in shown year

6.5 FIRST NATIONS

6.5.1 First Nations Indicators

- Areas and locations of First Nation traditional territories
- Number and locations of pre- and post-contact archaeological sites

Relevance

Through court decisions a legal principle has been established that the BC Government has an obligation to consult with First Nations with respect to decisions that have the potential to impact Aboriginal rights and title. These principles were affirmed at the political level in the New Relationship Policy statement of the BC Government and in the 2005 Speech from the Throne ("It [New Relationship Policy] must recognize the Crown's legal and moral duty to consult where decisions impact constitutionally protected aboriginal rights and title.").[87] The New Relationship Policy is based on recognition of Aboriginal title ("…founded on respect, recognition and reconciliation of Aboriginal rights and title").[88]

Several First Nations have longstanding ties to parts of the Muskwa-Kechika area so planned undertakings targeted at Crown land and resources in their traditional territories are subject to consultation.

Traditional Territories in the Muskwa-Kechika

The following table presents the estimated area of traditional territory by First Nation and by watershed in the Muskwa-Kechika MA. The data is taken from the BC Government's database on "consultative areas" and represents the BC Government's understanding of the geographic areas within which First Nations have expressed an interest in being consulted on proposed land and resource activities.[89] For the purposes of this report they are presented as an estimate of size and location of traditional territories. They should not be interpreted as a definitive statement about traditional territories in within the boundaries of the M-KMA.

Table 4-42: Estimated area of "consultative areas" by First Nation by watershed in M-KMA (ha)

First Nation	Area of "consultative areas" in M-KMA (ha)	Main Watersheds
Fort Liard First Nation	188.8	Liard River
Fort Nelson Band	14,137.2	Liard River

[87] Available at http://www.leg.bc.ca/38th1st/4-8-38-1.htm#NewRelationship

[88] Available at http://www.gov.bc.ca/arr/newrelationship/new_relationship_overview.html

[89] Ministry of Sustainable Resource Management (July 2004) *First Nations Consultation Guidelines.*

Fort Nelson Band	2,327.5	Liard River
Halfway River First Nation	9,410.8	Middle Prophet River
Halfway River First Nation	5,927.5	Toodoggone River
Prophet River First Nation	10,310.4	Middle Prophet River
Prophet River First Nation	340.5	Gataga River
Kaska Tribal Council	51,396.0	Toodoggone River
Tahltan Central Council	2,246.7	Toodoggone River
Tsay Keh Dene Band	4,234.2	Upper Halfway River
West Moberly First Nations	933.5	Upper Halfway River
West Moberly First Nations	2,926.9	Upper Halfway River
Blueberry River First Nation	3,355.4	Upper Halfway River
Blueberry River First Nation	15.5	Upper Prophet River

Archaeological sites in the Muskwa-Kechika

There are 201 protected archaeological sites within the boundaries of the Muskwa-Kechika MA that are listed in the Provincial Heritage Register. These are pre- and post-contact sites that have been designated under the *Heritage Conservation Act (1996)*.

Most (161) of the archaeological sites are located in the following five watersheds.

- Upper Sikanni Chief River – 41 sites
- Upper Muskwa River – 29 sites
- Middle Muskwa River – 28 sites
- Upper Halfway River – 35 sites
- Liard River – 28 sites

What does the data show?

The abundance of pre-contact archaeological sites in the Muskwa-Kechika area is one piece of strong evidence that demonstrates the very longstanding ties of First Nations to this area. The 158 pre-contact sites account for the large majority (78.6%) of the total number of archaeological sites in the M-K.

The Kaska Tribal Council has the largest traditional territory interest in the Muskwa-Kechika area, mainly in the Toodoggone watershed, based on the BC Government's database on "consultative areas". Other First Nations listed as having traditional territory interests within M-KMA boundaries include the following: Fort Nelson Band, Halfway River First Nation, Prophet River First Nation Kaska Tribal Council, Tahltan Central Council, Tsay Keh Dene Band, West Moberly First Nations, and Blueberry River First Nation

Data Source

Table 4-43 presents the data sources that were accessed for the traditional territories and archaeological sites indicators.

Table 4-43: Consultative areas and archaeological sites data sources

Area Analysis Data	Layer Name	Original Location
First Nation consultative areas	WHSE_ADMIN_BOUNDARIES. CBD_BOUNDARY_POLY_SVW	LRDW
Archaeological sites	Provincial Heritage Roster	BC Ministry of Tourism, sport and the Arts

7. Appendix I – Reporting Model

- Ecological Conservation Pillar
  - Environmental management theme
    - Linear development indicator – km of linear development and density of linear development (km of linear development per sq. km)
    - Wilderness indicator – Area of ROS-1 (primitive) and ROS-2 (semi-primitive non-motorized) as percentage of total M-KMA
    - Protected Areas indicator – Protected Area (ha) as percentage of total M-KMA (ha) and biogeoclimatic zone (BEC variant) representation in Protected Areas (ha and %)
    - Sustainable wildlife populations indicator – Hunter success rates
    - Old Growth indicator – Area of Old Growth in protected areas and area of Old Growth as percentage of Crown Forest Land Base
  - Biodiversity theme
    - Species at risk indicator – M-KMA native species that are *red* and *blue* listed
    - Stone's Sheep indicator – Population level and trend
    - Bull Trout indicator – Conservation risk by watershed
    - Grizzly Bear indicator – Population level and population as percent of habitat capability
    - Caribou indicator – Population level
    - Bison indicator – Population level and trend
  - Climate Change theme
    - Mountain Pine Beetle infestation indicator – Area of THLB and NHLB identified by beetle hazard type (extreme and high) as percentage of total THLB and NHLB
    - Carbon storage indicator – current carbon condition and forecast (over a 250-year period) in above ground and below ground biomass in trees
  - Water theme
    - Stream crossing indicator - Stream crossings per sq. km
  - Air theme
    - Industrial operations indicator – Number and type of industrial sites

- Economic Progress Pillar
  - Regional economy theme
    - Unemployment indicator – Percentage unemployment rate for Dawson Creek and Northeast Development region

        - Income indicator - average income for adjacent Regional Districts
    - Regional economic diversification theme
        - economic diversity indicator - economic diversity index for regional communities
    - Tourism theme
        - Provincial park visitation indicator – Provincial campground and day use area visitation
        - Tourism infrastructure indicator - number of tourism facilities and commercial recreation tenures and number, location and area of guide-outfitter territories
    - Recreation theme
        - Hunting activity indicator – Hunters and hunter days by species
    - Forestry theme
        - Timber harvesting landbase indicator - Area of THLB by four classes (N, P, C and X) as percentage of total M-KMA
        - Timber harvest indicator – Number of issued cutting permits, billed timber harvest, and BC Government stumpage revenue
    - Minerals theme
        - Mineral exploration indicator - Number of metallic mineral producers, past producers, developed prospects, prospects, and showings
        - Mineral development activity indicator – Number of mines and estimated employment
    - Petroleum resources theme
        - Oil and gas development activity indicator - Number and location of active and producing wells
        - Oil and gas exploration activity indicator - Number and location of cased wells, number and location of completed wellheads, number and location of abandoned wellheads, number and location of cancelled wellheads, and number, area and location of active oil and gas tenures
    - Energy theme
        - Renewable energy development indicator – Number of renewable energy tenures/licences and number of renewable energy developments
    - Trapping theme
        - Furbearer harvest indicator - Furbearer harvest by species

- Social Development pillar
    - Population theme
        - Population indicator - Total and Aboriginal population of M-KMA, Fort Nelson, Fort St. John, Northern Rockies Regional District and Peace Regional District and trends in their populations
    - Health theme

- ☞ Population mortality indicators - Life expectancy for total and Aboriginal population for Health Area, Potential Years of Life Lost due to each of natural causes, accidental causes and suicide/homicide, and the number of infants who die in the first year of life, expressed as a rate per 1,000 live births

- Forest and wilderness recreation theme
  - ☞ Forest and wilderness recreation opportunity indicators - Number of forest recreation sites and provincial campgrounds and area of ROS – 3 (Semi-primitive motorized) as percentage of total M-KMA
- Worker safety theme
  - ☞ Worker mortality and morbidity indicators- Number of fatality claims, number of disability claims and rate of work-related fatality claims plus short-term and long-term disability claims
- First Nations theme
  - ☞ Territorial extent of First Nations within M-K indicator – of First Nations
  - ☞ Archaeological sites – Number of pre- and post-contact Archaeological sites

8. Appendix II – Map of Ecoprovinces of BC[90]

[90] Map sourced from http://www.bcgrasslands.org/quickguide.htm

9. Appendix III – Linear development data reported by watershed

Table: I-1: Linear Development by watershed in Muskwa-Kechika Management Area

	Watersheds																								
Linear Type	**MK-MA**	**Beaver River**	**Chuka-chida River**	**Coal River**	**Dunedin River**	**Finlay River**	**Firesteel River**	**Fox River**	**Frog River**	**Gataga River**	**Ingenika River**	**Liard River**	**Upper Liard River**	**Lower Halfway River**	**Upper Halfway River**	**Lower Kechika River**	**Upper Kechika River**	**Middle Muskwa River**	**Upper Muskwa River**	**Middle Prophet River**	**Upper Prophet River**	**Ospika River**	**Toad River**	**Too-doggone River**	**Turn-again River**	**Upper Sikanni Chief River**
Total Area (sq. km)	63,861	260	5	3,906	1,172	873	217	4,294	4,886	3,693	588	4,633	455	1,314	2,058	2,776	3,245	4,053	3,900	25	3,139	982	7,116	3,377	5,070	1,826
Linear Development (km)	7,147	41		53	411			106	27			530	14	355	858	66	319	851	1,036	28	532	31	958	47	139	743
Density	0.11	0.16		0.01	0.35			0.02	0.01			0.11	0.03	0.27	0.42	0.02	0.10	0.21	0.27	1.14	0.17	0.03	0.13	0.01	0.03	0.41
Roads - paved	234											83			3			48	7				91	0		3
Density	0.00											0.02			0.00			0.01	0.00				0.01	0.00		0.00
Roads - gravel	309							1				58			19		2	7					178	10		34
Density	0.00							0.00				0.01			0.01		0.00	0.00					0.03	0.00		0.02
Roads - unimproved	2,551	15		50	106			65	11			277		176	154	58	247	210	177		149		402	30	138	288
Density	0.04	0.06		0.01	0.09			0.02	0.00			0.06		0.13	0.07	0.02	0.08	0.05	0.05		0.05		0.06	0.01	0.03	0.16
Roads - overgrown	24								2			4		5	7	2					1		2	1		2
Density	0.00								0.00			0.00		0.00	0.00	0.00					0.00		0.00	0.00		0.00
Recreation Trails	198													2	157							30				9
Density	0.00													0.00	0.08							0.03				0.01
Trails	344				32			40	12			3		21	50	6	63	30	34		15		34	4		0
Density	0.01				0.03			0.01	0.00			0.00		0.02	0.02	0.00	0.02	0.01	0.01		0.00		0.00	0.00		0.00
NWMP Trail	68													26	42							0				
Density	0.00													0.02	0.02							0.00				
Seismic (OGC) - 1996-2004	366				15										84			3	48		59					157
Density	0.01				0.01										0.04			0.00	0.01		0.02					0.09
Seismic (OGC) - 2002-2006	67														17			32	3							15
Density	0.00														0.01			0.01	0.00							0.01
Cutlines	2,952	26		1	257			0	2			104	14	123	325		4	519	762	28	305		247	0		233
Density	0.05	0.10		0.00	0.22			0.00	0.00			0.02	0.03	0.09	0.16		0.00	0.13	0.20	1.14	0.10		0.03	0.00		0.13
Airstrips	34			2	1				1			2		3	1	0	5	1	7		4	0	4	1	1	2
Density	0.00			0.00	0.00				0.00			0.00		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00