MUSKWA-KECHIKA MANAGEMENT AREA

PLANNING AND RESEARCH INTEGRATION PROJECT

(M-K-2004-2005-28)

REPORT

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Executive Summary

Under the *Muskwa-Kechika Act (Bill 37)* all management and planning in the Muskwa-Kechika Management Area (M-KMA) must be conducted in accordance with the *Muskwa-Kechika Management Plan*. Five local strategic plans created under the direction of the management plan guide various operational activities. The five local strategic plans named under the *Muskwa-Kechika Act* and the management plan are:

- Landscape Unit Objectives,
- Pre-Tenure Plans,
- Recreation Management Plan,
- Parks Management Plan, and
- Wildlife Management Plan.

Each of these local strategic plans are in various stages of completion. Those which have been completed provide a number of objectives for resource management.

Since it's inception in 1997 the Muskwa-Kechika Advisory Board has directed funding to a number of projects covering a wide range of values and priorities including support of the development of the local strategic plans, promoting awareness, research, and information management.

The Minsitry of Sustainable Resource Mangement seeks to provide recommendations on improvement to the planning and management regime in the Muskwa-Kechika Management Area (M-KMA), to identify the need for additional management decision support tools, and to assist in their development for the benefit of regulators, managers and users. The recommendations will be developed through three objectives:

1. Assessment of the inventory and research for the M-KMA, plus identification of gaps in each.
2. The development of a program for continuing cohesion and completeness in inventory and research for the M-KMA.
3. Development of a report proposing a framework for additional decision-support tools to be used by managers and users.

In meeting the first of these objectives the Minsitry of Sustainable Resource Mangement has contracted Timberline Forest Inventory Consultants and Alpha Wildlife Research and Management to:

1. Catalogue the current state of resource inventories in the M-KMA
2. Catalogue the research currently available for the M-KMA
3. Provide an assessment of:
    a. Gaps in our resource inventory, which are pertinent to the objectives of the Local Strategic Plans and the Muskwa-Kechika Management Plan.
    b. Gaps in our research knowledge relative to land resource management decisions that are likely to arise.

Two needs were identified during the process of assembling M-MKA projects and local strategic plan objectives that limited the ability to conduct a detailed, objective-specific gap analysis:

1) Local strategic plan objectives require considerable refinement, more detailed definition and coordination across local strategic plans before detailed inventory and research needs (gaps) can be identified; and

2) A system to track and manage M-K Advisory Board funded projects is required. This system must identify projects that have been proposed and / or funded, must track the progress of multi-year projects, and should store and manage project deliverables once projects have been competed.

Given these current needs, a more general value-based approach to gap analysis was used and a framework for addressing the refinement and coordination of local strategic plan objectives is provided.

In accomplishing this task, a searchable MS ACCESS database has been developed to archive and manage the catalogue of available research and inventory information as well as the catalogue of management objectives summarized from the available local strategic plans. Objectives and projects (research and inventory) are contained in separate tables within the same MS ACCESS database. Queries and reports have been developed to summarize the information in a number of different ways. Custom reports and queries may be developed to summarize the information to meet specific needs. As objectives are refined and new inventory and research projects completed, this database can be updated and maintained. Much of the information contained within the database has been summarized in the following report. A complete list of objectives and projects has been included in Appendix I and Appendix II of the report, respectively.

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List of Acronyms

AMA	Access Management Areas
ARIS	Assessment Report Indexing System
BCGS	B.C. Geological Survey
CAD	Conservation Area Design
CCRS	Canada Centre for Remote Sensing
ELU	Ecological Land Units
ESS	Earth Sciences Sector
GIS	Geographic Information System
GSB	B.C. Geological Survey Branch
GSC	Geological Survey of Canada
LRMP	Land and Resource Management Plan
MEM	B.C. Ministry of Energy and Mines
MEMPR	B.C. Ministry of Energy, Mines and Petroleum Resources
M-KMA	Muskwa-Kechika Management Area
MOF	B.C. Ministry of Forests
MSRM	B.C. Ministry if Sustainable Resource Management
NGR	National Geochemical Reconnaissance
NRC	Natural Resources Canada
NTS	National Topographic System
OGC	B.C. Oil and Gas Commission
PAG	Public Advisory Group
PDR	Petroleum Development Roads
PEM	Predictive Ecosystem Mapping
PTP	Pre-Tenure Plan
RFI	Recreation Features Inventory
RFP	Request For Proposal
RGS	Regional Geochemical Survey
RISC	Resource Inventory Standards Committee
RMZ	Resource Management Zone
ROS	Recreation Opportunity Spectrum
SFM	Sustainable Forestry Management
SRMP	Sustainable Resource Management Plan
TEM	Terrestrial Ecosystem Mapping
TSA	Timber Supply Area
TSR	Timber Supply Review
URP	Uranium Reconnaissance Program
UTM	Universal Transverse Mercator
VLI	Visual Landscape Inventory
VRI	Vegetation Resources Inventory
WLAP	B.C. Ministry of Water, Land and Air Protection
WHR	Wildlife Habitat Rating
WTP	Wildlife Tree Patch

1.0 Background

The *Muskwa-Kechika Management Plan* was adopted through an order-in-council in October 1997, thereby creating the Muskwa-Kechika Management Area (M-KMA). The Management Plan, based on direction from the Fort Nelson and Fort St. John Land and Resource Management Plans[1] (LRMP), identifies the objectives from each LRMP that are to apply to the M-KMA. Further, the Management Plan defines five local strategic plans that, once completed, will guide operational activities in the M-KMA, consistent with LRMP objectives:

Landscape Unit Objectives

Guides forest and range use under the *Forest Practices Code of British Columbia Act.*

Pre-Tenure Plans

Guides oil and gas exploration and development, as defined by the Memorandum of Understanding Respecting Operational Land Use Planning for Oil and Gas Activity in the Northeast of British Columbia, July 31, 1996.

Recreation Management Plan

Guides recreation, as defined by the Memorandum of Understanding Respecting Recreation Planning in the Muskwa-Kechika Management Area, December 1997.

Park Management Plan

A plan for the management of a park, ecological reserve or recreation area, as defined by Parks, Master Plan Policy, April 15, 1986 and the attached zoning amendment, or the Guidelines Booklet for Management Direction Statements, 1996.

Wildlife Management Plan

A plan for wildlife management, as defined by the Planning Guide to Wildlife Management Areas, September 1996.

Each of these local strategic plans are in various stages of completion. Landscape unit objectives were created for the Obo River and Fox landscape units on October 4th, 2002. Pre-tenure plans were completed and approved for four pre-tenure planning areas in the M-KMA in May 2004. The Recreation Management Plan for the M-KMA was completed in August 2004 and has yet to be approved. The Parks Management Plan and the Wildlife Management Plan are currently in draft stages. Each of these plans identifies key issues and outlines a number of objectives for management within the sector of resources values applicable to the plan.

With the creation of the M-KMA under the *Muskwa-Kechika Act (Bill 37)* the Muskwa-Kechika Trust Fund was created for the following purposes, as defined in the *Muskwa-Kechika Act*:

(a) to support wildlife and wilderness resources of the management area through research and integrated management of natural resource development; and

[1] In 2000, area was added to the M-KMA based on recommendations from the Mackenzie LRMP. However, the *M-KMA Management Plan* has not been updated to include reference to pertinent sections of the Mackenzie LRMP.

(b) to maintain in perpetuity the diversity and abundance of wildlife species and the ecosystems on which they depend throughout the management area.

In support of this the Muskwa-Kechika Advisory Board has directed funding to a number of projects since its inception in 1997. These projects cover a wide range of values and priorities including support of the development of the local strategic plans, promoting awareness, research, and information management.

As stated in the *Muskwa-Kechika Advisory Board Planning and Research Integration Project Request for Proposal No. M-K-2004-2005-28* (the RFP), the MSRM intends to provide recommendations on improvement to the planning and management regime in the Muskwa-Kechika Management Area (M-KMA), to identify the need for additional management decision support tools, and to assist in their development for the benefit of regulators, managers and users. The recommendations will be developed through three objectives:

1. Assessment of the inventory and research for the M-KMA, plus identification of gaps in each.
2. The development of a program for continuing cohesion and completeness in inventory and research for the M-KMA.
3. Development of a report proposing a framework for additional decision-support tools to be used by managers and users.

This project achieves the first of these objectives by providing:

1. A catalogue of the current state of resource inventories in the M-KMA
2. A catalogue of research currently available for the M-KMA
3. An assessment of:
    a. Gaps in our resource inventory, which are pertinent to the objectives of the Local Strategic Plans and the Muskwa-Kechika Management Plan.
    b. Gaps in our research knowledge relative to land resource management decisions that are likely to arise.

The project does not provide a thorough literature review of the body of research and inventory information for the M-KMA. Our assessment of the information is limited to the amount and breadth of information collected relative to resource management objectives. It is anticipated that the results of this project will be used to identify information gaps and areas where a more detailed assessment of the quality of information is warranted.

This Planning and Research Integration project represents the first phase of a larger project to provide strategic direction towards the allocation of the Muskwa-Kechika Trust Fund dollars such that the value of these dollars is maximized relative to the terms of reference of the trust fund and the direction provided by local strategic and higher level plans.

2.0 Methodology

This project was broken down into three distinct tasks:

1. Catalogue and review of objective contained in the local strategic plans for the M-KMA;
2. Catalogue of available inventories and research for the M-KMA; and
3. Assessment of gaps in inventories and research relative to the objectives contained within the local strategic plans.

2.1 Catalogue of Management Objectives

Local strategic plan documents are the primary source of management objectives for the M-KMA. These documents are in various stages of completion and approval and are based on direction from the three Land and Resource Management Plans (LRMP) in the M-KMA. As directed by MSRM, the following local strategic plans, posted on the MSRM M-KMA website were used to catalogue objectives[2]:

- *Local Strategic Recreation Management Plan for the Muskwa-Kechika Management Area – Recommended Draft – August 2004.*
- *Order to Establish the Obo River and Fox Landscape Units and Objectives.*
- *Pre-Tenure Plans for Oil and Gas Development in the Muskwa-Kechika Management Area – May 2004.*

The Wildlife Management Plan and the Parks Management Plan have yet to be completed and approved by government. Draft versions of the Wildlife Management Plan were provided for the purposes of this project. Several attempts were made to acquire access to the Draft Parks Management Plan resulting in significant delays to this project and extensions to the project deadline. Eventually the decision was made (in consultation with MRSM representatives) to continue with this project without addressing the objectives contained in the Parks Management Plan.

Each local strategic plan was reviewed and the objectives from each of these plans are catalogued into an MS ACCESS database, included on the accompanying compact disk. Objectives are organized into categories and sub-categories and keywords have been established for each objective to facilitate searching and organization of objectives. The source document, source section, and source section heading are also provided for each objective. Four different objectives reports have been created in the MS ACCESS database (see Section 3.1). The first of these reports is provided in Appendix I.

The Fort Nelson, Fort St. John and Mackenzie LRMP documents were reviewed but objectives from these plans were not explicitly included in the gap analysis as the pertinent objectives from the LRMP were to be represented in the local strategic plans.

Some inconsistencies in the documentation on the MSRM M-KMA website were identified. In particular the online version of the M-KMA Management Plan makes reference to sections of the LRMP documents that do not exist in the online versions of the LRMP documents.

[2] Local Strategic Plans were downloaded from the MSRM M-KMA website (http://srmwww.gov.bc.ca/rmd/lrmp/mk/index.htm) between December 13th, 2004 and December 14th, 2004.

2.2 Catalogue of Existing Inventories and Research

Inventory and research information for the M-KMA was collected from a number of sources. These sources include:

- The most recent TSR analysis reports for the Mackenzie, Fort Nelson, and Fort St. John timber supply areas;
- The MSRM M-KMA website;
- Various other B.C. Government websites;
- Annual M-KMA expenditure plans - 1998 to 2004;
- M-KMA Annual Reports – 1998 to 2004;
- M-KMA project deliverables;
- The Northern Land Use Institute Muskwa-Kechika Annotated Bibliographical Database[3];
- Personal Communications (see Section 5.0); and
- Other pertinent literature.

Muskwa-Kechika Management Area annual expenditure plans were the primary source of information for projects that have been funded by the Muskwa-Kechika Trust Fund since 1998. Projects from these documents were cross-referenced with project lists provided by the M-KMA Co-ordinator. Many discrepancies between these lists of projects were identified with some project deliverables unaccounted for. There was uncertainty of which proposed projects had been funded. Through discussion with MSRM and other representatives some of these issues were resolved. In some cases the location of project deliverables remains unknown. These projects are identified in the searchable MS ACCESS project database.

Difficulties encountered in assembling project lists and deliverables point to the need for a system to manage and track projects that have been proposed and / or funded through the Muskwa-Kechika Trust Fund. Although outside the scope of this project and not specifically developed for this purpose, the searchable MS ACCESS project database provided as part of this project accomplishes many of the required tasks and could be modified to track M-K Trust Fund projects and store deliverables once complete.

Pertinent information from projects not funded by the M-K Trust Fund was collected through discussions with various industry and government officials and through a review of known literature. Specific individuals were contacted for information on inventory and research projects pertinent to the M-KMA. These projects are included in the MS ACCESS project database.

B.C. Government websites were queried for standard inventory data for the M-KMA. Information was collected on:

- Vegetation Resource Inventory (VRI),
- Forest Cover Inventory,
- Predictive Ecosystem Mapping (PEM),
- Terrestrial Ecosystem Mapping (TEM),
- Visual Landscape Inventory (VLI),

[3] Significant effort was expended in attempting to incorporate entries from the NLUI database into the searchable project database developed for this project. Arrangements were made with Terra Cognita to develop a data migration tool. Prior to delivery of the NLUI data it was determined by the University of Northern British Columbia (the stewards of the NLUI database) that University lawyers would have to investigate issues around data ownership before the data could be transferred with no indication of when this review might be completed. Based on this, the decision was made to continue without this data.

- Recreation Opportunity Spectrum (ROS),
- Recreation Feature Inventory (RFI), and
- Various non-renewable resource inventories.

These findings are included in the MS ACCESS project database and are described in Section 3.2.

Government officials from the ministries of Forest, Sustainable Resource Management, Energy, Mines and Petroleum Resources, and Water, Land and Air Protection were contacted for information on research and inventory information in the M-KMA.

Finally, the Timber Supply Review documents for the Mackenzie, Fort Nelson, and Fort St. John timber supply areas were reviewed. A summary of the inventory information used in these analyses is also included in Section 3.2.7.

2.3 Gap Analysis

The initial intent of this project was to evaluate the inventory and research needs of each objective relative to currently available information, providing a list of potential projects required to meet local strategic plans objectives. However, an assessment of this level of detail is not possible and / or practical for a number of reasons:

1. Many local strategic plan objectives are general in nature and do not provide sufficient detail to identify specific inventory and research needs and thereby conduct gap analysis.

2. Local strategic plans have been developed independent of one another and therefore have created conflicting and overlapping objectives with varying levels of detail and precision. A process to coordinate and integrate local strategic plan objectives should be undertaken before a detailed gap analysis is conducted.

3. The number of management objectives contained within the four local strategic plans reviewed is so large that effective management and monitoring of these objectives is unrealistic. Indicators that measure multiple objectives should be developed and inventory and research needs assessed on these indicators.

Given these difficulties a more general, value-based approach to gap analysis was used to assess general research and inventory needs across the M-KMA. General values or themes were identified through a review of the local strategic and higher level (LRMP) plans. Key objectives under each value statement were identified and the inventory and research requirements to meet these were established. These requirements were cross-referenced with the catalogue of information in the MS ACCESS project database to determine information and data gaps. Suggested projects that will address these gaps are also provided. Research and inventory needs identified in local strategic plans are incorporated into this analysis. The results of the gap analysis is described in Section 3.3 and will be discussed further in Section 4.0.

3.0 Results

3.1 Local Strategic Plan Objectives

In total 219 objectives were extracted from the four available local strategic plans. Numerous other objectives exist in pertinent sections of the Fort Nelson, Fort St. John and Mackenzie LRMP documents. Table 1 shows the number of objectives contained within each of the local strategic plans reviewed.

Table 1: Number of Objectives by Local Strategic Plan

Source Document	Number of Objectives
Draft Wildlife Management Plan	161
Pre-Tenure Plans	33
Draft Recreation Management Plan	18
Landscape Unit Objectives	7

Each objective has been organized into a category and sub-category in the MS ACCESS database on the CD accompanying this report. Within the MS ACCESS database four different reports have been developed, each providing a different organization of the objectives. These reports can be modified using the basic functionality in ACCESS to filter and sort the objectives in a variety of ways. The four objectives reports can be found under the *Reports* tab of the main database window in MS ACCESS and are as follows:

- ***MKMAObjectives_Cat/Source/SubCat:*** Objectives grouped by category, source document, and sub-category;
- ***MKMAObjectives_Source/SubCat:*** Objectives grouped by source document and sub-category;
- ***MKMAObjectives_SubCat:*** Objectives grouped by sub-category with category, source document, and source document section references; and
- ***MKMAObjectives_Keyword:*** A list of keywords for each objective grouped by source document, category, and sub-category. These keywords are useful for sorting and filtering objectives.

The ***MKMAObjectives_SubCat*** report has been included in Appendix I of this report.

3.2 Resource Inventories

The following sections provide a description of the status of many of the standard inventory products within the M-KMA. Appendix II contains a list of inventory and research projects pertinent to M-KMA, based on the available information.

3.2.1 Vegetation Resources Inventory (VRI)

Vegetation Resources Inventory is a photo-based, two-phased vegetation inventory program consisting of:

- Phase I: Photo Interpretation
- Phase II: Ground Sampling

Within the ground sampling phase, Net Volume Adjustment Factor (NVAF) sampling is a mandatory component that is integral in the calculation of inventory adjustment factors. The Ministry of Sustainable Resource Management, assisted by the Ministry of Forests and forest licensees, is implementing the components of the VRI.

Various VRI initiatives have been completed between 1998 and 2003 by Canfor, Slocan Ft. Nelson (now Canfor), and Abitibi-Consolidated. The south half of the M-KMA and a fringe along the northeast edge have been completed to VRI standards using a variety of approaches of either traditional (1:15,000 hard copy photos) or softcopy (1:40,000 scanned images) methodologies with varying degrees of success and accuracy. The VRI completed along the southeast edge of the M-KMA was completed to the integrated VRI / Terrain mapping standards being used in the Fort St. John, Dawson Creek, Fort St. James, and Prince George TSA

3.2.2 Forest Cover Inventory

The Forest Cover inventory standard is the predecessor to the VRI. This standard was used until 1995 when it was replaced by the VRI.

The entire M-KMA area is covered by forest cover inventories dating from between 1971 to 1980 that were completed for the Ft. St. John, Mackenzie, Ft. Nelson, and Cassiar TSA. This inventory has been replaced wherever the VRI has been completed. These inventories (with the exception being species composition) were interpreted to classes and subsequently the attributes were set to the class mid-points (as opposed to absolute attribute values). These inventories are extremely out of date.

Table 2: Summary of VRI and Forest Cover Inventories

Project Name	Project Description	Year	Study Area
Mackenzie TSA VRI Projects	VRI's	2002-2003	South Half of M-KMA
Fort St. John TSA VRI/Terrain Mapping Projects	VRI and Terrain Mapping	2000-2003	Several partial maps along SE edge of the M-KMA
Fort Nelson VRI Projects	VRI's	1998-2001	Several partial maps along NE edge of the M-KMA
Ft. St. John TSA FC Inventories	Forest Cover Inventories	1972	SE M-KMA
Mackenzie TSA FC Inventories	Forest Cover Inventories	1972 / 1973	SW M-KMA

3.2.3 Ecosystem Mapping (PEM and TEM)

Ecosystem mapping provides a spatially explicit base inventory of the plant communities and structural stages found across a landscape, and provides the foundation for ecosystem-based management of large areas. This mapping is typically accomplished using photo interpretation and extensive ground-truthing (Terrestrial Ecosystem Mapping) or using predictive models and minor ground-truthing (Predictive Ecosystem Mapping).

Terrestrial Ecosystem Mapping (TEM) is the stratification of the landscape into units that reflect differences in climate, geomorphology, bedrock geology, and vegetation. A total of four classifications

are typically mapped, including: ecoregions, biogeoclimatic units, ecosystem units (site series), and seral community types (structural stage). Ecosystem units are delineated on aerial photographs based on bioterrain criteria and confirmed through field sampling.

Predictive Ecosystem Mapping (PEM) is designed to use available spatial data and knowledge of ecological-landscape relationships to automate the computer generation of ecosystem maps. Spatial data typically includes forest cover, digital elevation models, biogeoclimatic units, and may also include bioterrain information.

Ecosystem mapping (PEM and TEM) has been completed for several portions of the M-KMA. The MSRM data warehouse identifies five project areas with completed TEM projects, and 4 project areas (completed under the same, "Muskwa PEM" project name) that have completed PEM. Approximately 30% of the M-KMA has available ecosystem mapping data; some areas have overlapping PEM and TEM data. Most of the mapping that exists is along the leeward slopes of the M-KMA, although the Akie-Pesika project is on the windward slopes of the Rocky Mountains.

The Madrone report to the M-K Advisory Board (Madrone, 2000), on ecosystem mapping gap analysis identifies two additional ecosystem mapping projects in the M-KMA (#7 and #8 in Table 3). The exact location standards used in these inventories and the location of data and other deliverables for these projects are not known.

Table 3: Summary of Ecosystem Inventories

Project Name	Project Description	Year	Study Area
1. Akie-Pesika TEM and WHR	1:20,000 TEM and WHR for 11 spp	1996-2001	Portions of Upper Akie
2. Dunedin TEM and WHR	1:50,000 TEM and WHR for 9 spp	1998	Portions of Sulphur/8 Mile
3. Smith Vents TEM and WHR	1:50,000 TEM and WHR for 8 spp	1998	Portions of Terminal and Fishing Areas
4. Besa Prophet TEM and WHR	1:50,000 TEM and WHR for 11 spp	1999	Portions of Prophet Area
5. NE Burns TEM and WHR	1:50,000 TEM	1999	Portions of Northern Rocky Mountain Park and Muskwa West
6. Muskwa PEM and WHR (4 areas)	1:50,000 PEM and WHR for 11 spp in 4 Pre-Tenure Plan areas	2002	Portions of Besa-Halfway, Muskwa West, Stone Mountain, 8 Mile / Sulphur, and Churchill Area
7. Liard Hotsprings	1:20,000 TEM	1994-1995	22,000 ha within the MK adjacent to and overlapping with the Smith / Vents TEM
8. Muskwa Foothills	1:250,000 TEM	1991-1992	

An additional PEM in the Fort Nelson TSA was completed in January 2005. This PEM is described as a non-standard PEM product that "was developed for an Ecosystem Representation Analysis as required for CSA certification". Therefore, this PEM might be unsuitable as input for other analyses such as wildlife habitat mapping or site index adjustment." This PEM covers the entire Fort Nelson TSA.

All of the mapping posted to MSRM's TEM and PEM data warehouses will have databases and spatial information consistent with RISC standard, and will be relatively simple to merge, and build upon in the future. The ecosystem mapping project names are listed below as they appear in the MSRM warehouse.

1. Akie-Pesika TEM
2. Dunedin TEM
3. Smith Vents TEM
4. Besa Prophet TEM
5. NE Burns TEM
6. Muskwa PEM
    a. PTP1
    b. PTP2
    c. PTP3
    d. PTP4

All but one TEM project have wildlife habitat ratings associated with them. The northeast Burns TEM did not report wildlife habitat ratings as a component of the project. Table 4is a matrix of the different species with completed habitat ratings for each project area.

Table 4: Species Matrix of Completed Wildlife Habitat Ratings.

Project Name	marten	fisher	lynx	grizzly bear	elk	caribou	moose	stone sheep	mountain goat	wolverine	northern goshawk	black bear	mule deer	white tailed deer	bison	cape may warbler	bay-breasted warbler	three-toed woodpecker
1. Akie-Pesika TEM	X	X	X	X	X	X	X	X	X	X	X							
2. Dunedin TEM	X	X		X	X	X	X	X					X			X		
3. Smith Vents TEM	X	X		X	X	X	X						X				X	
4. Besa Prophet TEM	X			X	X	X	X	X	X			X	X	X	X			
5. NE Burns TEM																		
6. Muskwa PEM	X	X		X	X	X	X	X	X						X		X	X

Figure 1 shows the location of some of the ecosystem mapping projects within the M-KMA. This figure is base on the spatial information available on the MSRM data warehouse and does not contain all ecosystem mapping projects competed to-date. Two PDF maps, also downloaded from the MSRM data warehouse show the location of all PEM and TEM mapping in the province. These maps are included on the accompanying CD.

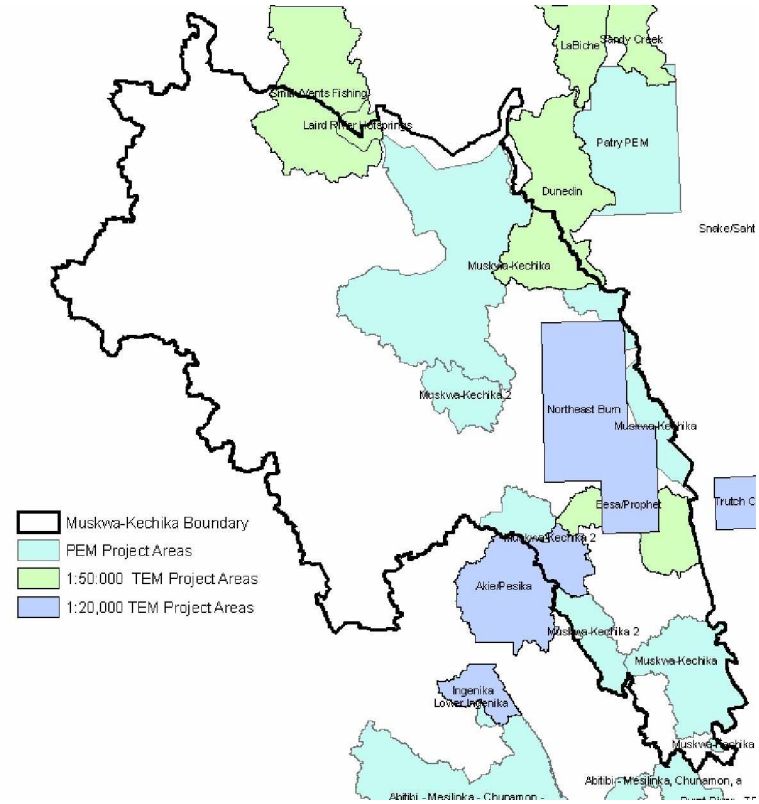

Figure 1: Diagram of Ecosystem Mapping Projects within the M-KMA[4].

3.2.4 Visual Landscape Inventory (VLI)

Visual Landscape Inventory involves the identification, classification, and recording of the location and quality of visual resources and values.

Visual Landscape Inventories have been completed for the northern two-thirds of the M-KMA but predominantly to the old 1996 capture standard (no ground-truthing). Also a portion of the Alaska Highway corridor was completed in 1997. These inventories were completed by the MoF.

3.2.5 Recreation Opportunity Spectrum (ROS)

A Recreation Opportunity Spectrum is a mix of outdoor settings based on remoteness, area size, and evidence of humans, which allows for a variety of recreation activities and experiences. The descriptions used to classify ROS settings are on a continuum and are described as: rural, roaded resource, semi-primitive motorized, semi-primitive non- motorized, and primitive.

Recreation Opportunity Spectrum (ROS) inventories have been completed for the north two-thirds of the M-KMA between 1996 and 1998. These inventories were completed by the MSRM.

[4] This figure is based on the spatial data currently available from the MSRM data warehouse. Not all of the ecosystem mapping projects are represented on this figure.

3.2.6 Recreation Features Inventory (RFI)

A Recreation Features Inventory is a component of the Recreation Inventory. The identification, classification, and recording of the types and locations of biophysical recreation and cultural features, existing and potential recreation activities, feature significance, and feature sensitivity. Recreation Features Inventories have been completed between 1991 and 1996 for the north two-thirds of the M-KMA. These inventories were completed by the MSRM.

Table 5: Summary of Visual Landscape, Recreation Opportunity Spectrum, and Recreation Features Inventories

Project Name	Project Description	Year	Study Area
Forest Nelson District VLI	Inventory of visual landscape of the entire Ft. Nelson Forest District	1993	North two-thirds of M-KMA
Alaska Highway VLI	Inventory of visual landscape of a portion of the Alaska Hwy corridor in the Ft. Nelson Forest District	1997	NE side along Alaska Hwy.
Ft. Nelson ROS	Ft. Nelson Forest District	1996-1998	North two-thirds of M-KMA
Ft. Nelson RFI	Ft. Nelson Forest District	1991-1996	North two-thirds of M-KMA

3.2.7 Inventories Catalogued Through the Timber Supply Review Process

Under the *Forest Act*, the province must determine an allowable annual cut every five years for each timber supply area (TSA) and tree farm licence (TFL). This process includes the collection of the most current inventory information for incorporation into timber supply modelling. The M-KMA includes parts of three TSA: Fort Nelson, Fort St. John and Mackenzie. The inventory information used in the TSR process for each TSA are shown in Table 6, Table 7, and Table 8 respectively. Further information on each of these information sources can be found in the corresponding Timber Supply Review Analysis Report from the MoF Forest Analysis Branch website (http://www.for.gov.bc.ca/hts/tsas.htm).

Table 6: Inventory Information used in TSR III for the Fort Nelson TSA (Forest Ecosystem Solutions, 2004)

Data	Source*	Vintage	Update	Scale	Comments
Inventory					
Vegetation Resources Inventory	MSRM	2002/2003		1:20,000	Total of 836 (1:20 000) mapsheets. Of which, 249 are Phase II VRI and 587 are "rolled over" VRI.
Ecological					
Biogeoclimatic classification (version 5.0)	MOF	1995	2003	1: 20,000	
Natural Disturbance Units	MSRM	2001	2002	1:20, 000 to 1:250,000	
Karst potential map	MOF	1999		1:250,000	
Budworm incidence mapping	CFS – Pacific Forest Region	1998/2002		1:50,000	
PEM/TEM coverage	Various sources – see description			1:50,000	
Administrative					
Ownership	MOF	2000	2002	1:20,000	From FC1. Woodlots codes are not included.
Woodlots	MOF – Fort Nelson Forest District	2003		1:20,000	
Operating Areas	MOF – Fort Nelson Forest District			1:20,000	
Landscape Units	MSRM	1998	2003	1:250,000	
Region and district boundary	MOF – Fort Nelson Forest District	2000	2003	1:20,000	
Agricultural Land Reserve	LRC		2003	1:20,000	
Forest region and compartment	MOF – Fort Nelson Forest District	2000	2002	1:20,000	
Operational					
Forest Development Plan	Canfor/ BCTS	2002-2007		1:20,000	Includes wildlife tree patches and other reserves - all reserves have been coded as WTP; also includes roads
Depletions	MSRM	2002		1:20,000	
Terrain Stability	Canfor (Kokanee Forest Consulting, Klohn-Crippen, JM Ryder & Associates)	2000		1:20,000	
ESA	MSRM	2001	2002	1:20,000	
Range Burns	MOF – Fort Nelson Forest District	1999		1:20,000	
Water					
Domestic water licences	MSRM - Water licensing office	1997	2003	1:20,000	Point of Diversion
Wildlife					
Caribou Wildlife Winter Range	WLAP		2000		
Protected Area Strategy (PAS)	MOF	2001			
Recreation					
Visual landscape inventory (VLI)	MSRM	1997	2002	1:250,000 1: 50,000	The inventory is 1:250,000 except for the inventory around the Alaska Hwy and Klua Lakes, which were done to an accuracy of 1:50,000.
Recreation feature inventory (RFI)	MSRM	1991			
Recreation opportunity spectrum (ROS)	MSRM	1996		1:20,000?	
Planning					
LRMP – RMZ, ERDZ, SMZ	MSRM	1997	2002	1:250,000	
Natural Disturbance					
Spruce budworm infestation	CFS	1990	2002	1:20,000	
Roads and Seismic					
TRIM I and II	MSRM	1987, 1996		1:20,000	Used for roads, seismic lines, pipelines, streams.
Compiled road coverage	FESL			1:20,000	Variety of sources
Seismic and oil and gas roads	OGC	2000 -2003		1:20,000	

*MOF= Ministry of Forests, MELP= Ministry of Environment, Land, and Parks, WLAP= Ministry of Water, Land and Air Protection, LRC = Land Reserve Commission, LUCO= Land Use Coordination Office, OGC=Oil and Gas Commission, FESL=Forest Ecosystem Solutions Ltd., CFS = Canadian Forest Service

Table 7: Inventory Information used in TSR II for the Fort St. John TSA (B.C. Ministry of Forests, 2002)

Data	Inventory source	Vintage	Update	Input scale
Forest cover inventory	Ministry of Forests (MoF)	Inventory year (% of TSA) 1984 (11%) 1989 (28%) 1971 (31%) 1989 (30%)	Dec. 31, 1999	1:20,000
The following inventories are Fort St. John Forest District non-standard inventory files				
Visual resource inventory - scenic areas, visual inventory VQOs	MoF	1997	1997	1:50,000
Biogeoclimatic ecosystem classification (BEC) zoning	MoF Research Branch	1997		1:250,000
Landscape units (LU)	MoF/Ministry of Sustainable Resource Management (MSRM)	1996	1999	1:20,000
Land and resource management plan (LRMP) resource management zones	MoF	1996		1:250,000
Class A parks	MSRM	1999		1:20,000
Forest roads	MoF	1999		1:20,000
Riparian buffers	MoF	1999		1:20,000
Grazing tenures	MoF		1999	1:50,000
Woodlot licences	MoF		1999	1:20,000
Pulpwood agreement boundaries: PA 12 PA 13	MoF	 1989 1989	 1998	 1:50,000 1:20,000
Caribou management zones	MoF	1989		1:50,000
Operability	MoF	1998	2000	1:250,000
Recreation	MoF	1989	1998	1:20,000
Ownership	MoF	1989		1:20,000
Agriculture land reserve	MoF	1989	1999	1:250,000
Range burns	MoF / MSRM	1998	1998	1:250,000
Forest Development Plan	MoF	2001–2006	2001	1:20,000
Wildlife burns	MSRM	1999		1:50,000
Seismic roads and trails	Trim	1995	1999	1:50,000

Table 8: Inventory Information used in TSR II for the Mackenzie TSA (B.C. Ministry of Forests, 2001)

Data	Source	Vintage	Update	Scale
Forest cover inventory	MoF	1999	1998/1999	1:20 000
Biogeoclimatic	MoF – Research Branch	1998	1998	1:250 000
Natural disturbance type (NDT)	MoF – Research Branch	1997	1998	1:250 000
Resource management zones – (proposed)	MoF/MELP	1996 – 1997		1:250 000
Protected areas (proposed LRMP)	MoF/MELP			1:250 000
Physical operability logging system	MoF	1998	2000	1:250 000
District haul zones	MoF	1995	2000	1:250 000
Visual landscape inventory (recommended VQOs): 1) Current known scenic areas 2) LRMP proposed scenic areas/VQOs	MoF	1998	1999	1:250 000
Landscape units (draft)	MoF	1996	1998	1:250 000
Biodiversity emphasis options 1) Interim 2) Revised–April/98 RLUP	MoF/MELP	 1) 1996 2) 1998		1:250 000
Planning cells	MoF	1991	2000	1:50 000
Terrain stability	Licensees/FRBC	1998	1998	1:20 000
Recreation inventory	MoF	1993 -1998	1998	1:50 000
Wildlife habitat				
– Caribou management strategy	MELP/LRMP	1998		1:250 000
– Grizzly bear management strategy	MELP/LRMP	1999		1:250 000
– Moose management strategies	LRMP	1999		1:250 000
– Arctic grayling management strategy	MELP	1995		
Mugaha marsh sensitive area proposal	MELP	1998		1:20 000
Woodlot update	MoF	1988	1998	1:20 000
McLeod Lake Treaty 8 map	MoF	1999		1:20 000

3.2.8 Non-Renewable Resource Inventories

Non-renewable resources in B.C. include minerals, coal, petroleum, and natural gas. Exploration for non-renewable resources is conducted through various types of point samples. One exception to this is area-based geophysical sampling and coal exploration. These inventories have not been tied to specific projects and are maintained in a variety of data warehouses. As such, these inventories have not been included in the project and objectives database but are described below. Many of these reports have been included as Appendices to this report.

The agencies are involved in warehousing this data are as follows:

- The B.C. Ministry of Energy and Mines (MEM);
- The B.C. Geological Survey (a branch of MEM) (BCGS);
- Natural Resources Canada (NRC);
- The Geological Survey of Canada (a branch of NRC) (GSC); and
- The B.C. Oil and Gas Commission (a Crown Corporation) (OGC).

BCGS and GSC have extensive databases on minerals, coal, petroleum and natural gas surveys in this province. The OGC holds data on petroleum and natural gas surveys, as well. Common to most of these surveys is the use of the National Topographic System (NTS) 1:250,000 scale grid system to organize findings. The M-KMA falls within the following 12 NTS 250k grids: 94B, C, E, F, G, J, K, L, M and N; and 104I and P.

Also common to many of these surveys is the Open File style of reporting findings within the geology community to convey data by means of text, maps and / or tables. Industry, provincial and federal geology publications often follow this convention. Further, all point sample data is presented with coordinates in decimal latitude / longitude and / or Universal Transverse Mercator (UTM) to facilitate spatial searches.

The MEM website provides access to BCGS maps and databases through MapPlace web-based GIS search engine, while the NRC website provides access to GSC maps and databases through its GEOSCAN web-based library search engine.

What follows is a brief synopsis of each database, with the summary of data searches within the M-KMA presented in tables and appendices.

ARIS Database

Those who undertake mineral explorations submit exploration results in assessment reports to maintain their mineral tenures in compliance with the *Mineral Tenure Act* and the *Coal Act*. The mineral reports are reviewed for compliance with the *Mineral Tenure Act r*egulations and indexed in the ARIS (Assessment Report Indexing System) database. The library of more then 24,000 reports, on paper and fiche, is available for public viewing and copies are available through a distribution agent. The ARIS database products index (fiche, paper and diskette) and index maps (fiche and paper) are designed to simplify access to the library of original reports, thus making exploration investment decisions and estimations of mineral potential easier.

The B.C. Geological Survey Branch (GSB) has over 26,000 approved mineral exploration assessment reports filed by the exploration and mining industry since 1947. These reports provide information on geological, geophysical, geochemical, drilling, and other exploration-related activities throughout B.C. The GSB maintains ARIS to provide for interactive viewing along with other GSB databases at MapPlace. Assessment Reports are kept confidential by the Crown for one calendar year after submission. Appendix III summarizes the ARIS publicly available for the M-KMA.

MINFILE Database

MINFILE is the MEM digital mineral inventory database of over 11,600 mineral, coal and industrial mineral occurrences in B.C. MINFILE is used extensively by industry and government in areas of exploration planning, resource information, land-use planning, and research. Capture of information in the computer database is 90% complete, of which 81% is released.

The MINFILE database has information on:

1. More than 12,100 metallic mineral, industrial mineral and coal mines, deposits and occurrences documented in British Columbia.
2. Names; commodities; status (showings to major producing mines).
3. Location (NTS map, longitude/latitude, UTM, elevation and mining division).
4. Mineralogy and alteration.
5. Deposit character, classification, and type (based on B.C. mineral deposit profiles).

6. Host rock (lithology, stratigraphic names and ages).
7. Geological setting (tectonic belt, terrain, physiographic area, and metamorphism).
8. Inventory (assays, reserves/resources, and production).
9. Capsule geology and work history.
10. References and publications.

Appendix V summarizes the MINFILE records for the M-KMA.

B.C. Age 2004 Database

B.C. Age 2004 is an MS ACCESS database containing all reported non-proprietary isotopic age determinations for bedrock units from B.C. This release contains 7759 age determinations from 4828 rock samples, summarizing 622 published articles, theses or unpublished reports. The data is fully relational, and may be queried by the user based on absolute age (in Ma), location (NTS map sheet, terrain polygon, or decimal latitude longitude, as specified by the user) or source (e.g. author, journal title, etc.). This data has also been integrated into MapPlace.

Appendix VI summarizes radiometric age data collected under B.C. Age 2004 within the M-KMA.

B.C. Aggregate Inventory

The B.C. Aggregate Inventory is a sand and gravel inventory program administered by GSB, providing a current and comprehensive digital data base of aggregate inventory information, the technical expertise required to assist in provincial land-use issues, and predictive models to determine aggregate reserves related to different landforms. The data also includes the Ministry of Highways' public pit inventory data.

COALFILE Database

The COALFILE Database is a large library of coal assessment reports dating from 1900 which is maintained in Victoria by the GSB. These assessment reports have been submitted by exploration companies in compliance with the *Coal Act*.

Exploration data from the assessment reports have been summarized and stored in a digital database called COALFILE. Information in COALFILE is organized in six record types or files. These files consist of:

1. Summary of data in reports;
2. Comments concerning the reports;
3. Record of maps in the reports;
4. Trench information;
5. Audit or Pit information; and
6. Borehole information.

Table 9 summarizes the one COALFILE record within the M-KMA.

Table 9: Reported Coal Finding in the M-KMA.

Report No.	Year	Area	NTS Maps	Latitude	Longitude	PDF Files
580	1972	PR COAL*	094B10 094B15	56.7510	-122.9110	580p2-45.pdf http://www.em.gov.bc.ca/DL/COALReports/

*PR = Peace River

Multi-Sensor Geophysical Surveys

Geophysical surveys include any method of resource exploration that makes use of the physical properties of the earth. They exploit any unusual property that the sought deposit might possess. Most geophysical survey methods are active, in that a signal of some type is introduced into the ground via an electric current or a small explosion (i.e. seismic) and the response is measured. Passive geophysical surveys are those that measure a naturally occurring signal coming from the earth, such as the exploration for fluorescing minerals using UV light.

Electromagnetic, induced polarization and aerial and ground magnetic surveys are the most common geophysical surveys for mineral exploration. Seismic, gamma ray spectrometry, and gravity surveys are the most common geophysical surveys for petroleum and natural gas.

Geophysical surveys are generally undertaken by GSC. Due to the significant costs involved only three geophysical surveys have been conducted within the M-KMA. This data is provided through the MapPlace website and reported in the Geoscan database.

They are:

- 1996 Fort Nelson Survey;
- 1997 Cassiar Mountains Survey; and
- 1999 Findlay River/ Toodoggone River Survey.

Appendix VI summarizes these three geophysical surveys using data from the federal GEOSCAN database.

Property File Database

The Property File Database is a library that contains over 90 lineal metres of reports and maps that are generally unavailable elsewhere, and is maintained in Victoria by the GSB. These documents can be extremely valuable to researchers.

Property File contains:

1. Unpublished reports.
2. Theses and papers.
3. Field notes.
4. Company prospectuses and pamphlets.
5. Historical information.
6. Geology, geochemistry, geophysics and drill information.
7. Claim maps, sketches of workings and photographs.

Property File also contains general information on each NTS area, the National Mineral Inventory cards, topographic maps and some work histories. Research material is indexed and cross-referenced in the MINFILE database.

Regional Geochemical Survey

The B.C. Ministry of Energy, Mines and Petroleum Resources (MEMPR), now MEM, has been involved in reconnaissance-scale stream sediment and water surveys since 1976. This joint federal-provincial initiative was originally referred to as the Uranium Reconnaissance Program (URP). In 1978 the provincial program was renamed the Regional Geochemical Survey (RGS) and in 1987 the Province began to independently administer surveys conducted in British Columbia. As part of Canada's National Geochemical Reconnaissance (NGR) program, the RGS program continues to maintain sample collection, preparation and analytical standards established by the Geological Survey of Canada. To date, over

45,000 stream sediment and water samples have been collected from 43 - 1:250 000 NTS map sheets covering approximately 70 % of the province. The resulting field and multi-element analytical data are compiled into B.C.'s largest and most comprehensive stream sediment and water geochemical database.

MapPlace provides access to RGS data, but it appears that little if any was undertaken in the area that is now the M-KMA except for the following three Open Files:

- Open File 1996-18. Geochemistry of the Gataga Mountain Area (Parts of NTS 94L/7,8,9,10,11,14,15);
- Open File 1999-6. Geochemistry of Alkaline Lake Waters of the Northern Kechika Trough, B.C. (NTS 94M/2, 3, 4, 5, 6, 12; 104P/8, 9, 10, 15, 16); and
- Open File 2001-7. Geochemical Exploration Models, Volume 2: Shale Hosted Deposits on North-Eastern B.C. (NTS 94F/13, 94K/4 AND 94K/13).

Rock Geochemical Surveys

Rock geochemical surveys look to find six metals within rock samples delivered to MEM. The metals are gold, silver, copper, lead, zinc, and arsenic. Some of the minerals are precious, while others are pathfinders that may indicate the presence of other minerals. The findings of rock geochemical surveys can be used to detect anomalous levels and facilitate further exploration. Appendix VII summarizes the rock geochemical surveys findings within the M-KMA.

Petroleum and Natural Gas

The eastern quarter of the M-KMA sits within the Western Canadian Basin. As such there are petroleum and natural gas well sites within the M-KMA for both exploration and production. However, there is a discrepancy between petroleum and natural gas exploration data provided by GSB and OGC.

The list of petroleum and natural gas well sites provided by GSB is presented in Appendix VIII, but includes far more well sites than the list of petroleum and natural gas well sites provided by OGC presented in Appendix IX. Many of the well sites listed in Appendix VIII, however, were proposed sites and not necessarily developed. Appendix IX summarizes petroleum and natural gas exploration surveys conducted in the M-KMA known to GSB.

What follows is a brief description of the digital spatial (and tabular) surface data held by the OGC.

Wells: The OGC currently has all well site locations (points) available for download on their FTP site. These are updated nightly. By the fall of 2005, the OGC will start collecting well pad data (polygons) and post it on the day of its approval. However, certain details on each well site are held in confidence by the OGC for varying lengths of time to maintain competitive advantage.

Pipelines: The OGC has been collecting Pipeline Right of Ways (polygons) on the day of approval throughout 2005. This data will be made available in the coming months.

Facilities: The OGC has all facility locations (points) available for download on their FTP site. These are updated regularly as new facilities are added.

Geophysical (seismic): The OGC currently has a very inaccurate, outdated and incomplete final plan seismic line dataset (arc). By the fall of 2005, the OGC will start collecting all geophysical line data (proposed and final cut) and post it on the day of its approval.

Petroleum Development Roads (PDR): This is a specific status road managed by the OGC. They have a PDR dataset (arc) available for download on their FTP site. It is usually updated yearly. By the fall of 2005, the OGC will start collecting all PDR datasets and post it on the day of its approval.

Access Roads: Currently the OGC has no information on access roads. By the fall of 2005, the OGC will start collecting all Access Road datasets and post it on the day of its approval. Access roads are not Petroleum Development Roads.

Ancillary and Other Applications: Currently the OGC has no information other than that attached to pipeline applications. By the fall of 2005, the OGC will start collecting all ancillary and other applications datasets and post it on the day of its approval. Examples of features that are ancillary and will require other applications are campsites, decking sites, temporary workspaces, etc.

Data currently available is posted to ftp://www.ogc.gov.bc.ca/outgoing/OGC_Data/

OGC data may become available through the B.C. Land and Resource Data Warehouse (http://lrdw.ca/) in the near future.

GEOSCAN Database

The Canada Centre for Remote Sensing (CCRS) Scientific Publications Database has been integrated into the GEOSCAN database, comprising more than 45,000 records of publications released by CCRS or Geological Survey of Canada (GSC) authors. GEOSCAN is now the repository for all Earth Sciences Sector (ESS) bibliographic information. To limit your search to CCRS or GSC publications, use the "Document Type" pull-down menu. Clients can perform their own searches on-line or enlist the assistance of the ESIC Reference Service. Custom-formatted outputs are available upon request. Interfaces allow for searching of subsets of GSC publications. Table 10 presents several searches made through GEOSCAN using NTS block numbers and various key words.

Table 10: Initial Search of GEOSCAN for the M-KMA.

Search Parameter	Number of Hits
94B	5
94C	17
94E	8
94F	2
94G	10
94J	3
94K	3
94L	0
94M	3
94N	0
104I	19
104P	2
Muskwa	21
Muskwa-Kechika	1
Kechika	74
M-KMA	0

3.3 Identified Gaps in Inventory and Research

Based on the large number of objectives contained in local strategic plans of the M-KMA there are numerous gaps in available inventory and research information that currently prevent many of these objectives from being realized. However, based on this review of the planning documents for the M-KMA, it is apparent that the greatest need for the M-KMA is to develop a coordinated planning approach to resource management that consolidates, coordinates the many objectives and resolves apparently conflicting objectives from the five planning sectors created through the local strategic plans.

Planning in the M-KMA is driven through the creation of five local strategic plans; each plan at varying stages of completion, created seemingly independent of the other four plans. This has resulted in a large number of objectives created at widely varying scales and levels of precision and detail, over overlapping areas, and sometimes with conflicting objectives.

The initial intent of this project was to evaluate the inventory and research needs of each objective relative to currently available information, providing a list of potential projects required to meet local strategic plan objectives. However, as discussed earlier, many objectives require further refinement and more detailed definition before inventory and research needs can be properly assessed. In addition, issues with conflicting and overlapping objectives should be resolved before gap analysis is conducted.

While conducting gap analysis on many objectives in their current form is problematic, there are several common values contained in the numerous higher level and local strategic plans affecting the M-KMA. These general values and associated objectives have been used to assess some general inventory, research and planning requirements for the M-KMA and provides the M-K Advisory Board with a number of key projects that will provide a solid foundation to management in the M-KMA. The following section provides a review of general M-KMA values, the main objectives identified in the higher level and local strategic plans, data gaps and suggested projects. It is our recommendation that management in the M-KMA should occur under the guidance of an integrated, spatially explicit Sustainable Resource Management Plan which is described in Section 4.0. These projects should be integrated and incorporated into this plan and revised accordingly.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Air Quality	v Maintain acceptable air quality	v No terms or definitions of "acceptable air quality" v No current status information readily available v No air quality monitoring plan in place v No management plan available, should air quality deteriorate	v "Air Quality Strategic Plan" should be developed to address data gaps	This strategic plan should be developed in association with an overall Sustainable Resource Management Plan
Biological Diversity - OVERALL	v Maintain Natural Biodiversity v Maintain Functioning and self-sustainable Ecosystems	v Incomplete Base Inventories, including Ecosystem Mapping, Vegetation Cover, habitat supply, etc v Development and Implementation of a conservation plan (CAD project may have this as an objective, but the deliverables for the CAD project are not available	v Complete PEM/TEM and VRI v Assemble base inventory coverages v Multi-species (coarse and fine filter) habitat mapping and field verification should be assembled and completed using base inventories v Establish natural range of variability for ecosystem structure, composition, landscape context, etc	These objectives are commonly used as a 'catch-all' for many of the other objectives listed under biological diversity. Once base inventories are completed and assembled, other biodiversity related objectives can start being addressed High quality Ecosystem Mapping is necessary to effectively implement landscape level ecosystem-based management. Biodiversity conservation should be integrated with industrial activities in order to develop effective programs.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Biological Diversity – FISH	v Maintain high quality fisheries in natural settings v Maintain fish habitat for bull trout v Maintain fish habitat for arctic grayling v Maintain fish habitat for all fish at risk v Maintain genetic diversity of wild fish stock	v Final fish habitat maps/ratings tables v Spatially explicit fish habitat management plan v Incomplete/Unknown impacts of recreation, angling, etc on fish stock v Genetic analysis of priority fish species	v Finalize fish habitat maps/ratings v Develop Fish habitat Management Plan, within an SRMP – coordinate with recreation and tourism, as well as resource development, include a monitoring program for fish populations v Characterize populations across their distributional range v Assess impact of motorized boats on priority fish species v Compare current fish harvest with historical v Analyze impacts of angling on populations	Several related fish inventories have been completed in the past 5 years, and now is a good time to develop a Fish Management Plan that may also include some targeted studies on priority fish population trends and genetics review – this should be included in an overall SRMP. A monitoring program to assess fish population trends would be highly beneficial.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Biological Diversity – WILDLIFE	v Maintain or increase populations of wildlife species designated not at risk v Control populations of targeted species when necessary for conservation v Monitor population health v Maintain a conservative harvest	v Suitability mapping, population surveys, baseline health indicators, cumulative effects assessment to determine acceptable limits of change, appropriate harvest levels, monitoring programs for furbearers and big game: v Marten v Mountain goat v Coyote v Gray Wolf v Black Bear v Cougar v River Otter v Elk v Moose v Lynx v Mule Deer v White-tailed deer v Stone Sheep v Waterfowl	v Assemble all quality habitat supply maps into multi-species habitat coverage v Develop/Update habitat ratings to fill in the gaps v Field verification of habitat mapping where not available, utilize existing survey data where available to validate maps v Map critical habitat features, such as mineral licks v Determine important elements/threats to immigration habitat v Impacts of human activities on select species v Identify appropriate harvest levels for each species v Develop monitoring program	There are many survey and mapping projects available for portions of the M-KMA, but they need to collated and assessed for quality. The base polygons from PEM and VRI should be mandatory as the spatial polygons for all future habitat mapping. This will allow consistency across projects, ease of data management and some control over quality and applicability of project results. A multi-species management program (including monitoring) needs to be implemented. For such a program to be useful, it must explain or predict how species will be associated with the vegetation and physical structure of a particular area.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Biological Diversity – SPECIES AT RISK	v Maintain or increase Caribou numbers v Maintain ecological integrity of the Caribou zone v Minimize disturbance in natality sites and winter range	v Coordinated data management and monitoring program	v Develop monitoring program v Establish baseline health indicators v Collate all spatial and aspatial data for ease of use and analysis v Increase natality v Identify mortality causes v Identify and protect calving grounds	Extensive time and resources have been spent on Caribou in the M-KMA. Yet, recovery plans still lack specific objectives. Once inventory data have been reviewed and organized, it is necessary to develop specific projects to meet seasonal gaps in databases, and answer quantifiable objectives. A high-, medium- and low-quality habitat program should be developed within a multi-species management program.
	v Maintain or increase Plain's Bison numbers v Provide or maintain adequate early seral stage habitat for Plain's Bison v Structure, function and distribution of Plains Bison habitat and behaviour remains in a natural range v Minimize disturbance at sensitive times	v Updated population numbers and trends v Seral stage management strategy and monitoring program	v Cumulative effects assessment modeling to determine acceptable limits of change v Develop monitoring program v Establish baseline health indicators	Seral stage mapping was completed with bison as an objective – this should be incorporated into a population and health study that includes Bison as one of several species of interest.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Maintain or increase populations of other mammals at risk, including Wolverine, Grizzly bear, fisher, northern long-eared myotis, short-eared owl, sandhill crane, black-throated green warbler, wood bison, peregrine falcon, Cape May warbler, Connecticut warbler v Minimize disturbance at sensitive times	v Updated population numbers and trends v Life history requirements incorporated into management plans v Coordinated data management and monitoring program v Spatially explicit distribution of most SAR is unknown	v A multi-species management program that integrates habitat use with vegetation inventories, and forecasts and monitors habitat supply over time	While extensive effort has been focused on the Caribou, there is little information on other species at risk. This needs to be addressed in a coordinated manner with field guides, SAR awareness sessions for the public, and management and recovery strategies, monitoring programs.
	v Develop and implement management and recovery strategies for vascular plants / invertebrates / amphibians at risk	v Unknown habitat requirements of plants / invertebrates / amphibians at risk v Spatial distribution unknown	v Develop and implement management and recovery strategies for vascular plant / invertebrates / amphibians at risk, within a multi-species management program. v Assess the ability of Riparian Management Guidelines to provide protection to amphibians. v Establish a monitoring program across successional stages employing invertebrate and non-vascular taxa as indicators.	This objective found in higher level plans could be met relatively easily with a coordinated species at risk management / recovery / monitoring plan.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Biological Diversity – PLANT COMMUNITIES AT RISK	v Develop and implement management and recovery strategies for plant communities at risk	v Spatial distribution of plant communities at risk unknown v No management / recovery strategies available v Monitoring program not developed	v Complete Rare / Sensitive Ecosystem Mapping, using PEM/TEM as base v Develop and implement management and recovery strategies for plant communities at risk, within a multi-species management program	These projects could easily be integrated with the vascular plants / amphibians / invertebrates at risk projects
Biological Diversity – HABITAT	v Manage fire to meet habitat objectives within the natural range of variability	v Fire history of M-KMA v Natural Range of variation of seral stages	v Identify and update fire history of M-KMA v Complete seral stage mapping of M-KMA v Assess utilization of prescribed fires in M-KMA to meet wildlife habitat objectives	Fire history studies may be a low priority relative to the other baseline inventories
	v Prevent and control invasive plants v Protect native species from introduced fish	v Database of potential invasive plants and fish v Distribution of existing invasive plants and fish v Management and monitoring strategy for invasive plant and fish	v Develop database of potential invasive plants and fish v Map potential distribution of existing invasive plants and fish v Develop management and monitoring strategy for invasive plant and fish	

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Manage protected areas to encourage conservation, research opportunities and recreation v Maintain representative ecosystems in a natural range v Manage and maintain connectivity of habitats v Minimize habitat fragmentation	v Incomplete ecosystem mapping v Incomplete seral stage mapping v Connectivity and fragmentation analysis and forecasting plan	v Complete ecosystem mapping and seral stage mapping v BEC-based ecosystem representation analysis v Identify habitat use by priority or indicator species to develop a multi-species habitat management program. v Connectivity and fragmentation analysis i.e. patch size distribution and forecasting v Establish natural disturbance patterns and effect on habitat	A multi-species management program requires sound vegetation inventories and ecosystem mapping. Once these multi-species management areas have been identified, one can effectively manage landscapes for connectivity and fragmentation.
Socio-Economic Resources	v Provide opportunities for growth and expansion of agricultural activities	v Agricultural opportunities unknown	v Map existing and potential agricultural locations v Develop agricultural management plan	Agricultural activities should be managed according to a SRMP employing a multi-species management program. This is particularly important for the conservation of SAR.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Maintain opportunities for oil and gas exploration, development and transportation v Minimize impacts of oil and gas activities on non-energy sectors through avoidance or mitigation measures	v Pre-tenure plans not completed for all areas v Monitoring strategy for pre-tenure plans not available	v Finalize pre-tenure plans not completed for all areas v Develop a monitoring strategy for all pre-tenure plans v Stronger mechanism for making data packages for all oil and gas activities available publicly v Document adaptive management opportunities and approaches	Oil and gas activities should be included in a SRMP, and must take into account vegetation types and habitat use identified in multi-species management programs.
	v Maintain or enhance the continued sustainable supply of timber	v What is timber supply availability specific to M-KMA v Updated productivity estimates v Impacts of oil and gas on timber supply in M-KMA	v Complete site index adjustment project on M-KMA v Timber Supply Review specific to M-KMA v Detailed forest management plan should be incorporated with overall SRMP v Determine current status of patch and seral stages v Develop strategy to update all disturbances on landscape	Logging activities should be included in a SRMP, and should take into account vegetation types and habitat use identified in multi-species management programs.
	v Maintain opportunities for mineral exploration, development and allow for access	v A spatially explicit mineral exploration and extraction policy	v A spatially explicit mineral exploration and extraction policy	Mining activities should be included in a SRMP, and must take into account vegetation types and habitat use identified in multi-species management programs.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Provide and maintain guide outfitting opportunities	v A spatially explicit guide outfitting database and management policy	v A spatially explicit guide outfitting database and management policy	Outfitting activities should be integrated in a multi-species management program, and pay particular attention to SAR.
	v Provide and maintain trapping opportunities	v A spatially explicit trapping history database and management policy v Updated harvest estimates from trappers	v A spatially explicit trapping history database and management policy v Update harvest estimates using a log book recording trapping effort. v Monitor population dynamics through carcass collections.	Trapping activities should be included in a SRMP, and must take into account vegetation types and habitat use identified in multi-species management programs.
	v Maintain or increase access for the ranching sector to grazing opportunities	v Range mapping unavailable / outdated	v Update known and potential range areas v Partner with other agencies to develop grazing enhancement fund (FSJ LRMP) v Assess the impact of ranching on wildlife habitat and plant invasion.	
Water Quality	v Maintain water quality and quantity v Maintain watershed hydrological regimes v Protect headwaters	v Management and monitoring planning	v Develop a watershed management plan and water quality and quantity monitoring program v Establish a series of indicators to monitor water quality in managed landscapes	The monitoring and management plans can be developed in association with other agencies, resource extractors, etc for cost efficiencies

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
Soil Productivity	v Soil resources are able to sustain productive ecosystems v Minimize off-site impacts due to soil disturbance	v Soil classification mapping v Pre-development soil conditions	v Overview soils classification mapping v Update and maintain pre-development site assessment forms for resource extractors	
Recreation and Tourism	v Provide quality public and commercial recreational opportunities and values, consistent with resource management objectives	v Recreation features inventory (RFI) v Recreation Opportunities Spectrum (ROS)	v M-KMA specific RFI and ROS v Update recreation management plan with results of RFI and ROS	The RFI and ROS would provide significant guidance for the recreation management plan
	v Maintain or enhance access to crown land, subject to area-specific management guidelines v Coordinate access and development to minimize negative effects on other resource values, such as wildlife, recreation, protected areas, guide outfitting	v Access management areas (AMA) not identified spatially v Access management plan for AMA's v Enforcement and monitoring plan	v Identify specific AMA where other resource values necessitate particular access strategies v Develop access management recommendations for each unique AMA v Implement management recommendations – this may include updating signs, public awareness campaigns, etc v Enforcement of access restrictions v Monitor motor vehicle access v Assess levels of riverboat use	An access sensitivity mapping methodology project was completed in 2001. The recommended methods of that project should be reviewed and subsequently implemented. Coordinating this project with base inventories through an overall SRMP would be a cost-effective means of obtaining this data

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Maintain existing communications, transportation and utility corridors v Provide opportunities for new communications, transportation and utility corridors	v None	v Include existing and future transportation corridors in SRMP	An overall M-KMA development plan that integrates social, economic and environmental concerns would allow for better planning of new corridors
	v Mitigation of impacts from recreation, commercial access and development v Minimize negative effects of recreation on wildlife v Reduce wildlife killed on transportation corridors	v The number of wildlife killed on transportation corridors v Are development, recreation and / or tourism activities negatively impacting wildlife?	v Develop database to track human-wildlife encounters v Assess impacts of development on past habitat supply and populations v Identify methods of managing access to limit predation v Specific investigations of black bear human conflicts to determine if problems are due to the ecology of the species (e.g., bears are more carnivorous than herbivorous) or to human management issues (e.g., garbage, proximity of urban centers, etc.) v Improve public education related to impacts of recreation on wildlife	

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v Manage for visual quality along access corridors, trails, lakes, and adjacent to protected areas	v Visual landscape inventory (VLI) incomplete	v Complete VLI in M-KMA v Visual quality objectives should be updated	
Community Acceptance	v Jobs and community stability should be maintained or increased utilizing strategies at all levels of management planning and permitting v Communicate information about jobs and community stability as a result of activities in the M-KMA	v Record of employment days/years resulting from activities in the M-KMA v Monitoring plan and communication strategy for employment record and future opportunities	v Develop method of tracking employment created within M-KMA v Develop monitoring plan and communication strategy for employment record and future opportunities	
	v Maintain opportunities for all First Nations v Maintain opportunities for Heritage and Cultural activities v Recognize and maintain archaeological sites v Recognize and maintain heritage trails v Avoid infringement of v Communicate information to First Nations	v Incomplete archaeological inventories v Incomplete or unavailable database of heritage trails v Communication strategy	v Complete archaeological inventories v Complete or update database of heritage trails v Develop a communication strategy, with targets for communication and extension	First Nations' concerns and issues must be integrated into SRMP.

VALUES	MAIN OBJECTIVES	MAIN DATA GAPS	SUGGESTED PROJECTS	COMMENTS
	v M-KMA data to be managed to allow researchers and public access to required information in a timely and coordinated fashion	v Data management strategy missing or ineffective	v Develop spatial and aspatial data management system, v Utilize open source software to provide web mapping applications v Policy on data creation and utilization by researchers and others v Develop a database to catalogue, archive, search and retrieve digital reports	

4.0 Discussion and Recommendations

There are 219 separate objectives contained in the four local strategic plans reviewed as part of this project. Undoubtedly the completion of the Parks Management Plan will introduce additional management objectives. Local strategic plans appear to have been prepared largely independent of one another and lack coordination across the five planning sectors dictated by the *Muskwa-Kechika Management Plan* and *Muskwa-Kechika Management Act.* In particular, objectives are set for multiple, sometimes overlapping and conflicting values with little or no guidance as to how these conflicts might be resolved. Each local strategic plan deals with a portion of the M-KMA. There may be areas where local strategic plans overlap and areas where there is no planning direction from local strategic plans. Objectives and targets from local strategic plans are set at widely varying scales with significantly different levels of detail and precision. There is also considerable variation within individual local strategic plans in the level of detail in defining objectives and targets.

Planning needs to be coordinated and consolidated and should precisely define how objectives are to be met through specific indicators, targets and measures in order to be achievable and incorporated into management activities. Information requirements for each indicator should be clearly defined. Of the current set of local strategic plans, only the pre-tenure plan and landscape unit objectives provide clearly defined indicators and targets that are, for the most part, measurable and verifiable. A large portion of the remaining objectives lack sufficient detail to reasonably define data requirements, develop indicators, establish baseline status or develop monitoring strategies. Once measurable and verifiable indicators have been developed for each objective, information gaps and data requirements can be established and prioritized. This process should occur through the development of a spatially explicit Sustainable Resources Management Plan for the M-KMA. This plan would direct M-K Trust Fund allocations, eliminating inventory and research gaps consistent with SRMP objectives, indicators and targets.

The Conservation Area Design (CAD) final report sums up the state of the base inventories and subsequent modeling: “The underlying models have yet to be validated, tested or checked for sensitivity to estimated parameters. Additionally, most models are built upon data that also has underlying weaknesses and spatial resolution limitations.” (Heinemeyer et al, 2004, page 9). In addition, the assumptions that were made in the CAD project itself resulted in a series of maps and analyses that are useful only at the macroscopic level, and are not useful for adequately managing biodiversity.

Some of the assumptions that had to be made in the CAD truly demonstrate how limited the CAD models and maps are for anything more than a general overview of the ecological values that exist in the M-KMA. For example, the Ecological Land Units (ELU’s) generated as a surrogate for ecosystem mapping, are so coarse that any mapping, modeling or analyses based on such units is unreliable and likely misleading, and may be more of a disservice to biodiversity management than having no analysis completed. Suggesting that a white spruce stand with 5% slope is ecologically the same or even similar to a black spruce stand with 80% slope is clearly an over-simplification of a model in order to account for missing data. This example is one of many that highlight the need for proper base inventories to form the foundation of biodiversity management strategies.

4.1 Deficiencies of Current Planning Documents

In the last decade, various agencies and interest groups have generated a series of documents relative to the M-KMA, all depicting genuine concerns to produce a balanced management of industrial activities and biodiversity conservation. Unfortunately, taken as a group, all of these documents identify an inordinate amount of objectives (see Appendix I), some of them redundant, but many with contradictory

statements. As a result, when considering only the areas relevant to the M-KMA, the reader fails to identify a concerted approach in the management of specific values, especially biological diversity (defined here as the variety and variability among living organisms and the ecological complexes in which they occur, NSF 1989). Furthermore, research programs conducted in the M-KMA during the last 10 years are characterized by an apparent lack of information and / or coordination relative to vegetation inventories, communities' structures, species richness, and ecological processes (e.g., animal-habitat and predator-prey relationships).

Past inventories often favoured big game, at the expense of furbearers, non-game species, species at risk, etc. Many of these documents propose vague conservation strategies, largely due to incomplete datasets, some confusion about the use of different concepts (e.g., ecosystem *vs*. habitat), and the adoption of reductionist approaches (e.g., aspatial ecosystem-based strategies, use of single elements as surrogates for species with complex, structured habitat requirements, etc.) based on untested theoretical concepts or outdated references.

4.2 A Need for a Spatially Explicit Sustainable Resource Management Plan

In order to address most agencies' objectives, it is necessary to develop a spatially explicit Sustainable Resource Management Plan for M-KMA with the purpose of promoting both biodiversity conservation and sustainable activities (i.e., cultural, recreational and industrial). A review of previous work suggests that such a plan would address the needs of coarse- and fine- filter species within a stratified landscape, where forest mosaics of various ages, compositions and origins are interspersed with non-forest cover types. The plan would correspond to a multi-step process integrating scientific methods and management programs that have already been field-tested and proven effective for biodiversity conservation:

- Adequate vegetation community inventories (e.g., Timberline 1999, 2001, 2004, 2005).
- Spatially explicit distributions for priority (e.g., species and community at risks, Proulx et al. 2003, 2004; LRMP-identified and commercial species) and indicator species and communities. These distributions relate to habitat use by animals during the most critical times of year; predictive distribution maps developed on the basis of habitat composition and structure are thoroughly field-tested with state-of-the-art protocols (e.g., Proulx and O'Doherty 2005). Spatially explicit distributions correspond to habitat types used by animals at regional levels. The selection of priority/indicator species and communities must encompass various spatial and temporal scales on the basis of a series of sound criteria (e.g., McLaren et al. 1998, Bani et al. 2002). Such a list includes species that have been associated with late-successional stages (e.g., Proulx et al. 2005a), or mosaics of various seral stages (Proulx 2005a, Proulx and Kariz 2005). It is important to note that, although large animals (with large area requirements) may be selected as indicators (e.g., Noss et al. 1996, Wallis de Vries 1995, Heinemeyer et al. 2004, Proulx et al. 2005b), smaller organisms (e.g., non-vascular plants, arthropods, small mammals, furbearers) are better suited to assess microenvironments and some ecological processes (Kerr 1997, Carey et al. 1999, Vujanovic and Brisson 2001, Komonen 2003, Moen and Jonsson 2003, Proulx 2003b).
- Determination of multi-species management areas for coarse- and fine- filter species; in these areas, various habitat conservation measures (e.g., OGMAs, reserves, WTPs, connectivity corridors, etc.) may be implemented with properly managed industrial activities (Proulx 2005b).
- Integration of management constraints associated with the development of various industries, because the effective management of the human resource is critical to productive management of the natural resource (Lavin 1987).
- Integration of monitoring programs to permit planners, PAG, Fist Nations, various interest groups, and government agencies to adapt management scenarios to changing socio-economic and biological constraints.

A Spatially Explicit Sustainable Resource Management Plan for M-KMA does not currently exist, but many of its components (Figure 1) have already been developed and validated by Bernier et al. (2001), Proulx and Bernier (2003), Proulx (2005b), and Proulx and Bernier (2005). Details of such a plan exceed the scope of this report. It is worth mentioning, however, that this plan (Figure 1) properly addresses all the objectives identified by various agencies and interest groups in their respective documents (Appendix I). It shares many of the conservation concepts presented in a recently developed Conservation Area Design (CAD) for the M-KMA (Heinemeyer et al. 2004), but is more holistic in approach, balancing social, economic and environmental values in the M-KMA. We recommend that a Spatially Explicit Sustainable Resource Management Plan be integrated with CAD's macroscopic view of M-KMA regions to delineate multi-species habitat areas (i.e., a refinement of Heinemeyer et al' [2004] core areas) and develop a multi-resource management plan.

Stressing the Importance of Spatially Explicit, Organism-based Habitat Models

Once adequate vegetation and ecosystem datasets have been gathered for the whole area under management, M-KMA managers must steer away from aspatial management programs and untested ecosystem-habitat models, where surrogates are often subjectively selected to identify ecosystems or communities with greater biodiversity potential. Aspatial management programs have been used in the past for the establishment of OGMAs (e.g., MSRM, 2004) without knowing if this approach would result in the identification of stands of acceptable quality for the maintenance of late-successional stages, wildlife communities, and species and communities at risk. In the last decade, several pseudo-spatial, theoretical models have been proposed (e.g., Forman 1995, McIntyre and Hobbs 1999, Bunnell et al. 2003, Wells 2005, and others) based on unverified assumptions. As a result, associating species with such ecosystem models do not ensure that priority species will be located in most suitable habitats. In Doak and Mills' (1994) words, "a species or system may simply not operate in the way envisioned by the theories applied to it".

> Levins (1966) showed that models of biological systems could be general, realistic, or precise. They may only be two of the three. Reductionist, aspatial or pseudo-spatial models tend to be general and realistic. When faced with biodiversity conservation issues, spatially explicit, organism-based models (e.g., Proulx 2005), should be considered because they are realistic and precise.
>
> Roger Powell
> North Carolina State University
> (2005, pers. commun.)

Habitat information is fundamental to matrix management (patch size and orientation, contrast, connectivity, richness, etc.) and, in turn, to any comprehensive plan aiming to conserve biodiversity in managed landscapes. The understanding of distribution patterns for specific species, which have been selected either because they represent well specific communities or because of their conservation status, is critical for determining:

3) The structural and floristic attributes that need to be retained to conserve particular species (Adams and Morrison 1993, Proulx 2001);
4) How many of these stand and / or landscape characteristics are needed (McComb and Lindenmeyer 1999, Proulx 2001); and
5) How such attributes should be spatially arranged (Nelson and Morris 1994, Proulx 2003a).

According to Root et al. (2003), three serious issues confront conservation planners worldwide. First, entire communities rather than single species need to be the focus of conservation efforts. Second, empirical information about vulnerable communities and their constituent species may be sparse. Third, species may be interacting with one another in complicated ways. Integrating the habitat needs of fine-

and coarse-filter species (Proulx 2005b) is a good starting point for prioritizing the conservation of specific successional stages and protecting biodiversity.

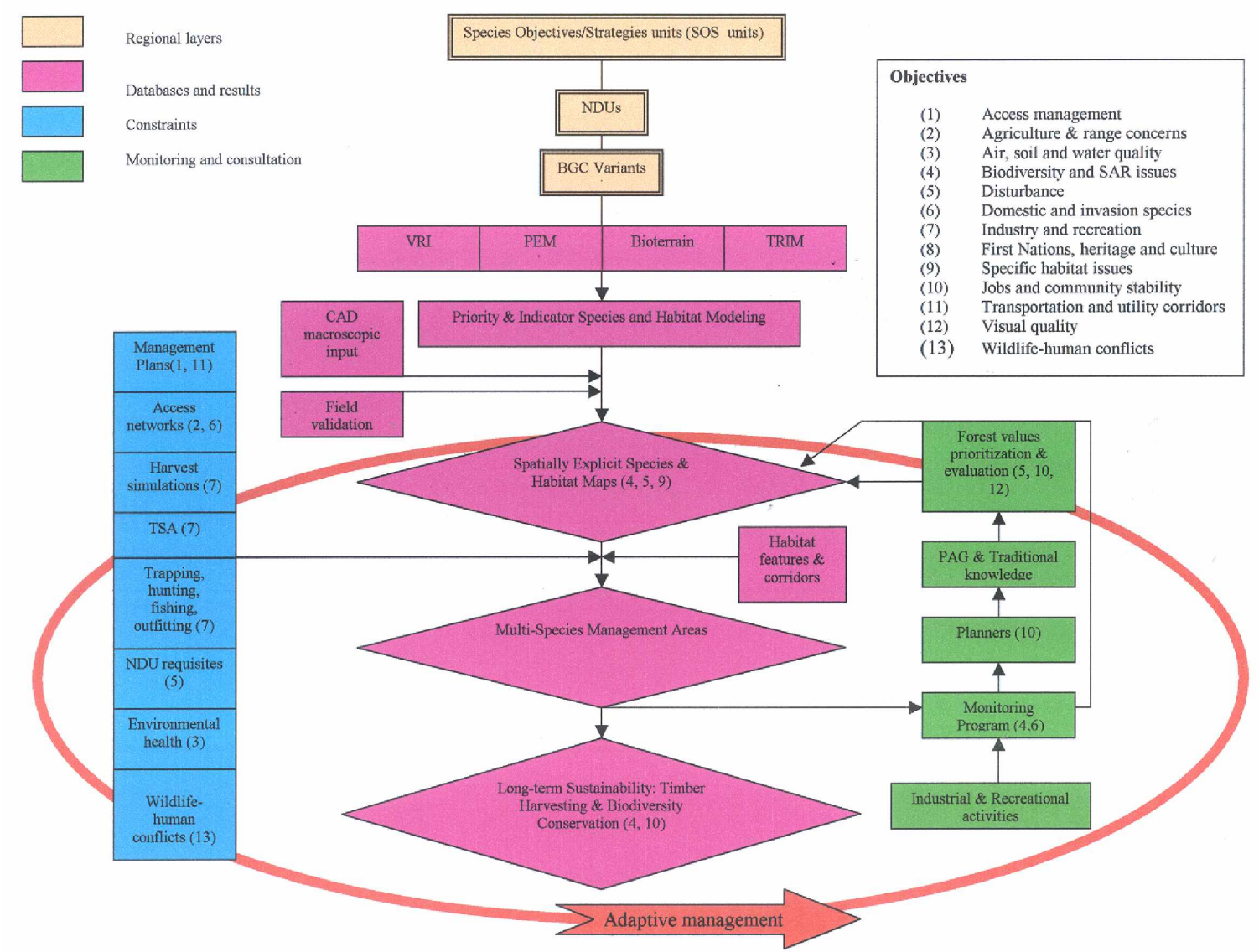

Figure 2: A Spatially Explicit Sustainable Resource Management Plan for the M-KMA.

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Table 11 provides a general description of how the SRMP for the M-KMA might be developed and implemented. Baseline (VRI / PEM) inventories should be completed in the first three years, providing a foundation for all future management research, inventory collection and monitoring. Predictive distribution maps for priority species should be developed using existing VRI and PEM datasets and be expanded as new inventory data is completed. Table 11 is a simplified example of how the development of an SRMP would be integrated with ongoing and past project work in the M-KMA.

Table 11: General Timeline for Implementation of an SRMP.

<table>
<tr><th>Year</th><th colspan="5">Action</th></tr>
<tr><td>0</td><td colspan="5">Submission of Timberline/Alpha Wildlife report, and presentation to M-KMA Board</td></tr>
<tr><td>1
2</td><td rowspan="3">Development of a Spatially Explicit SRMP</td><td rowspan="3">Completion of VRI/PEM datasets. Assessment of past VRI/PEM work (if judged necessary).</td><td rowspan="3">Predictive distribution maps for priority species & field validation using existing VRI/PEM datasets, and new ones generated during years 1 to 3.</td><td colspan="2">Traditional knowledge and industry consultations</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Wildlife population dynamics and ecological processes investigations.</td><td rowspan="2">Establishment of multi-species management areas, connectivity corridors (see Figure 1)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">SRMP implementation and update</td><td colspan="4">Long-term sustainability plan. Wildlife-conflicts education programs</td></tr>
<tr><td>6+</td><td colspan="4">Monitoring (starting with year 6) every 3 years.
Adaptive management.
Adjustment of multi-species management areas.</td></tr>
</table>

In summary, based on our review of the information available through the duration of this project we make the following recommendations to the M-K Advisory Board:

1. Develop an inventory strategy that will allow an efficient, standardized means of completing the ecosystem mapping and vegetation resources inventory for the M-KMA.

2. Consolidate and coordinate the overlapping objectives from multiple plans into a single Sustainable Resource Management Plan for the Muskwa-Kechika Management Area. Many separate planning zones will be based on pre-existing resource management zones.

3. Develop a 10-year plan for achieving priority objectives i.e. Species at Risk mapping and research may take a higher priority over other species, etc.

4. Develop and implement a data management plan for the M-KMA. This plan should address not only the management of spatial data through a GIS but also the management of digital reports and other digital deliverables in a searchable archive. The data management plan should consider the use of freely available open source software and the distribution of this data through an internet-based interface.

5. Develop indicators for each objective in the SRMP with clearly defined inventory and research needs, measurement methodology, and monitoring and reporting requirements. Responsibilities for monitoring and reporting should be clearly defined.

6. Develop a coordinated monitoring strategy that encompasses the monitoring and reporting requirements of all plans under the SRMP and assigns responsibility for monitoring and reporting.

7. Support more partnerships with other agencies and resource businesses that are working toward satisfying similar objectives in and around the M-KMA.

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John Deal, Canadian Forest Products Ltd: Caribou Inventory and Research.

Louise Fox, Pacific Geoscience Centre, Geological Survey of Canada: Non-Renewable Resource Inventories.

Scott Fraser, Ministry of Water, Land and Air Protection: Parks Management Plan.

Geoff Haines, Business Analyst, Oil and Gas Commission: Non-Renewable Resource Inventories.

Pierre Johnstone, Ministry of Water, Land and Air Protection: Wildlife Management Plan.

Chon Kim, formerly MOF Branch: Forest Cover Inventories.

Bob Lane, PGeo Regional Geologist, Central/Northeast Region, Ministry of Energy, Mines and Petroleum Resources: Non-Renewable Resource Inventories.

Ray Lett, PGeo Geochemist, Geological Survey and Development Branch, Ministry of Energy, Mines and Petroleum Resources: Non-Renewable Resource Inventories.

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