Creating an Data Management System to Support Ecosystem-Based Management

Prepared for

Ecosystem-Based Management Working Group

by

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Disclaimer

This report was commissioned by the Ecosystem-Based Management Working Group (EBM WG) to provide information to support full implementation of EBM. The conclusions and recommendations in this report are exclusively the authors', and may not reflect the values and opinions of EBM WG members.

Executive Summary

The EBM Working Group is seeking to provide recommendations to the Land and Resource Forums on a data management system to provide efficient and reliable delivery of data and information to support the implementation of EBM in the future. There is general agreement in the need to develop and implement a system that establishes a clear structure for decision–making, proactively addresses data access and security, and identifies methods and priorities for technical work.

This document summarizes the strengths and weaknesses of the existing data management system and puts forward recommendations relating to the structure and function of a system to manage EBM-related data and information.

The overall vision for information management proposes two main structures:

- an EBM Data Centre for warehousing and distributing spatial and aspatial data to support EBM implementation; and

- a Coastal EBM Information Library for sharing a broad array of reports, records, maps, and other documentation related to ecological integrity and human well-being. The Library includes a repository for storing and sharing First Nations data, where appropriate.

There are 39 recommendations under nine headings:

1. Structure and Function of an EBM Data Management System

    - The EBM Data Centre is a data hub that links data users to various data sources as well as housing EBM-specific data. The goal is for data in the Centre to be to EBM standards and GIS-ready.

    - There are two options for a data server: located with ILMB Coast Region or with an independent institution. There are pros and cons associated with both options.

    - Dedicated human resources and funding will provide continuity and stability of the system for the longer term.

2. Governance

    - A governance body that is independent of the Land and Resource Forums is recommended. The proposed composition, roles and tasks for this body are outlined in the document.

    - There may be benefits to linking the governance of the EBM Data Centre to the Adaptive Management institutional structure.

3. Data Sharing

    - Two key priorities are (1) to build a trusted and collaborative relationship among the data user community and (2) to establish data sharing agreements.

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4. Technical Work

- The technical work for EBM data is kept separate to the governance function. A technical committee acts as a forum for discussion of data and technical issues and advises the governance body about matters pertaining to data work.

- There are numerous actions that should be undertaken to ensure best quality data is available to data users and is accompanied by the requisite metadata. This work is the responsibility of data custodians. A goal is to consolidate datasets to the extent possible and establish guidelines to promote consistency in data structure and formatting.

5. Priorities for Data Work

- The site series surrogate representation layer is a priority for data work as it has numerous technical problems associated with it and it is a fundamental dataset for implementation of the LUOs.

- Other priorities include strategic planning for Vegetation Resources Inventory and Terrestrial Ecosystem Mapping (TEM) and undertaking quality testing of TEM products.

6. Human Well-being Data

- There are several recommendations to facilitate the acquisition and tracking of data associated with human well-being indicators.

7. Data Support for Coastal Communities

- Two resources are proposed to assist coastal communities with data access and sharing:

  – A First Nations Data Liaison person to provide a link to the EBM Data Centre and the Information Library and to assist communities with accessing data and information and sharing data, where appropriate.

  – A Coastal Communities Data Repository as a location for uploading data gathered by communities and allowing that data to be shared according to established levels of access.

8. Communication

- Processes are recommended to catalogue data and ensure that all data users are kept apprised of the most up-to-date information about available data.

- Forums are proposed for discussing data issues and to link data managers and analysts with planners.

9. Information Management

- A web-based information repository is proposed that allows parties involved in EBM implementation to share all types of information, including reports, maps, and audio-visual recordings.

Priorities for data management in the short term are (1) to design and implement the EBM data management system and (2) to support tenure holders in implementing the Coastal Orders. These priorities should be addressed concurrently. A workplan is proposed to establish an EBM Data Centre within the next 6 to 12 months.

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1.0 Introduction

1.1 Background

Strategic multi-stakeholder planning processes and the Government-to-Government Agreements between coastal First Nations and the Province of B.C. set out a vision for the long-term implementation of ecosystem-based management (EBM) on the B.C. coast. This vision is guided by the *Ecosystem-based Management Planning Handbook* (March 2004), Government-to-Government Agreements and the Central & North and South Central Coastal Orders.

There are four main aspects to EBM implementation, as defined in the Definition of Full Implementation of EBM by March 31 2009 (agreed to the Joint Land and Resource Forums on July 10, 2007):

- A Governance Framework that provides and adaptive land use and resource management regime.

- Human Well-being: Socio-economic policies and initiatives that seek to achieve a high level of human well-being[1] over time.

- Ecological Integrity: Conservation measures…that seek to achieve a low level of ecological risk[2] overall in the Central and North Coast, over time.

- Adaptive Management: A collaborative adaptive management system…that will support the further development and implementation of EBM beyond 2009, including an independent research and inventory and data management system.

Best available data is needed to inform decision-making related to all of the various components of EBM in the short and longer term. An efficient and effective management system is required to ensure that the requisite data is readily accessible, up-to-date, reliable, clean, and supported by good metadata. Such a system has to be flexible to accommodate technical data that adheres to strict standards as well as 'soft' information i.e., data and reports that are locally generated and do not conform to formal data standards but that, nonetheless, contribute to the overall knowledge base for EBM implementation.

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[1] Current agreed upon guidance regarding what constitutes "high level of human well-being" is found in Government-to-Government Agreements and the Coast Information Team EBM Handbook; however, this guidance is subject to change through consideration of other information, further research and adaptive management.

[2] Current agreed upon guidance regarding what constitutes "low level of ecological risk" is found in Government-to-Government Agreements and the Coast Information Team EBM Handbook; however, this guidance is subject to change through consideration of other information, further research and adaptive management.

This document summarizes the data needs for EBM implementation, examines the existing data management system with its strengths and shortcomings, and puts forward recommendations for an improved strategy for data management to support EBM.

1.2 Guidance for Data Management in EBM Documents

1.2.1 EBM Framework

While the Ecosystem-based Management Framework (2004) does not directly speak to data management, the context for a data management system is provided by the guiding principle 'EBM is Collaborative'.

> "Collaborative processes are broadly participatory; respect the diverse values, traditions and aspirations of local communities; and incorporate the best of existing knowledge (traditional, local and scientific). They require broad participation in planning and clearly articulated decision-making processes".

1.2.2 EBM Planning Handbook

The *Ecosystem-based Management Planning Handbook* contains the following guidance with respect to Knowledge and Information Management:

> "EBM seeks to incorporate the best of existing information including traditional, local, technical and scientific knowledge…Knowledge management systems should allow for efficient development, storage and dissemination of knowledge that is based on understanding of how information is used".

1.2.3 Coast Information Team

The close-out report for the Coast Information Team, *CIT Experience: Recommendations on processes and structures for success* (2004)*,* recommends the following:

1. Establish data acquisition and distribution as an independent component of the [EBM] program with clear milestones and adequate resources and other support (e.g., executive level endorsement for data sharing).

2. Establish data use protocols at the outside of the program, including:

   - Data provision and distribution agreements with data suppliers

   - Data use and, where appropriate data removal agreements, signed by all data users

   - Standards for documentation of all data and data products

   - Warehousing and distribution of data and data products after project completion.

1.2.4 Adaptive Management Framework Institutional Design Document

Appendix 3 in the *Adaptive Management Framework for the Central and North Coast of British Columbia: Institutional Design* (2008) contains recommendations for the management of information generated through adaptive management (AM) and to support AM-related analyses. These include:

- Information created by the AM Framework should be freely available, easy to retrieve and appropriate for a range of audiences. AM Framework implementation will require ongoing technical capacity and communication design support necessary to do this.

- Methodologies used to generate information need to be well documented, because future research and monitoring studies may wish to be comparable to past approaches.

- The process of gathering and preparing GIS data should be separated from the analysis process.

- Aggregate sets of [AM] indicators that rely on the same source data. Prior to periodic analysis of a set of indicators, create an appropriate coastal (or smaller area if applicable) coverage that includes all the relevant data.

1.3 Challenges with data management for EBM

The coastal planning area is very large and is composed of a number of players representing a multitude of administrative areas. Specific challenges associated with data management to support EBM implementation include the following:

- Data and information is required to support studies and operational planning in a wide variety of topic areas, including ecological, social, cultural and economic.

- Data is acquired from multiple sources and reflects a variety of proprietary interests and sensitivities.

- There is currently no plan for capturing new information generated from EBM and adaptive management in existing data management systems.

- New data layers are regularly being developed and old data layers updated. It can be a challenge to know if one is working with the most up-to-date set of data and the latest version.

- For any one topic area, there may be a number of different datasets representing different input layers, levels of accuracy and amounts of verification.

- Data and mapping may or may not be accompanied by metadata and reports that describe how the layers were derived, who did the work, and what the inputs and assumptions were.

- EBM Implementation will involve working with data that is acquired from, and used by, a range of organizations of varying technical capabilities and levels of resourcing.

- Timing of data updates are critical to operational and field-based project planning - supporting analysis and planning in the fall/winter in preparation for summer and fall operations, inventory projects and research.

1.4 Purpose of a data management system

Effective management of lands and resources rests on a foundation of well-sourced, dependable data, data synthesis and analysis. Good data management is a fundamental to the achievement of cost effective, repeatable, defensible and well informed decision making.

The costs of not having a good data management system in place can be very high, although these costs may not be readily apparent. Examples of costly problems associated with poor data management are:

- Data gathering or analysis activities may be needlessly duplicated.

- Multiple versions of a dataset may exist, with redundant layers and confusion over where each dataset came from and what it contains. Determining the `right` data for a task becomes time-consuming and costly, particularly if the process to track down data has to be repeated every time.

- Analysis may be undertaken using the wrong version of a dataset, and therefore has to be repeated.

- Haphazard modifications or updates may be applied to datasets outside of the control of the data custodian, resulting in uncoordinated multiple versions of the same data and leading to indefensible analysis results.

The ultimate cost of poor data management is that decision-making is not based on authoritative information, which can threaten the overall success of the implementation process.

These issues are common to all decision-making processes that use data. An effective and reliable data management system is essential to successfully implementation of all aspects of EBM implementation.

1.5 Document structure

This report contains five sections:

Section 1: Introduction

Section 2: The Management Context

Section 3: Current Data Management

Section 4: Recommendations for Data and Information Management

Section 5: Implementation of the Data Management System

2.0 The Management Context

2.1 Key components of EBM implementation

Figure 1 shows the various components of EBM implementation directed by the Land Use Objectives in the Coastal Orders and non-legal direction from strategic planning tables and Government-to-Government Agreements.

The short-term focus for EBM implementation is on the implementation of legal Land Use Objectives (LUOs) under the Coastal Orders. This is because of the legislated requirement for forest and range tenure holders to be consistent with the LUOs. However, EBM is much more than the Coastal Orders and applies to all land-based activities and not just forestry. The overall framework for EBM is continual improvement through ongoing information gathering and feedback mechanisms to ensure that best practices occur on the landbase, informed by best available science and local and traditional knowledge.
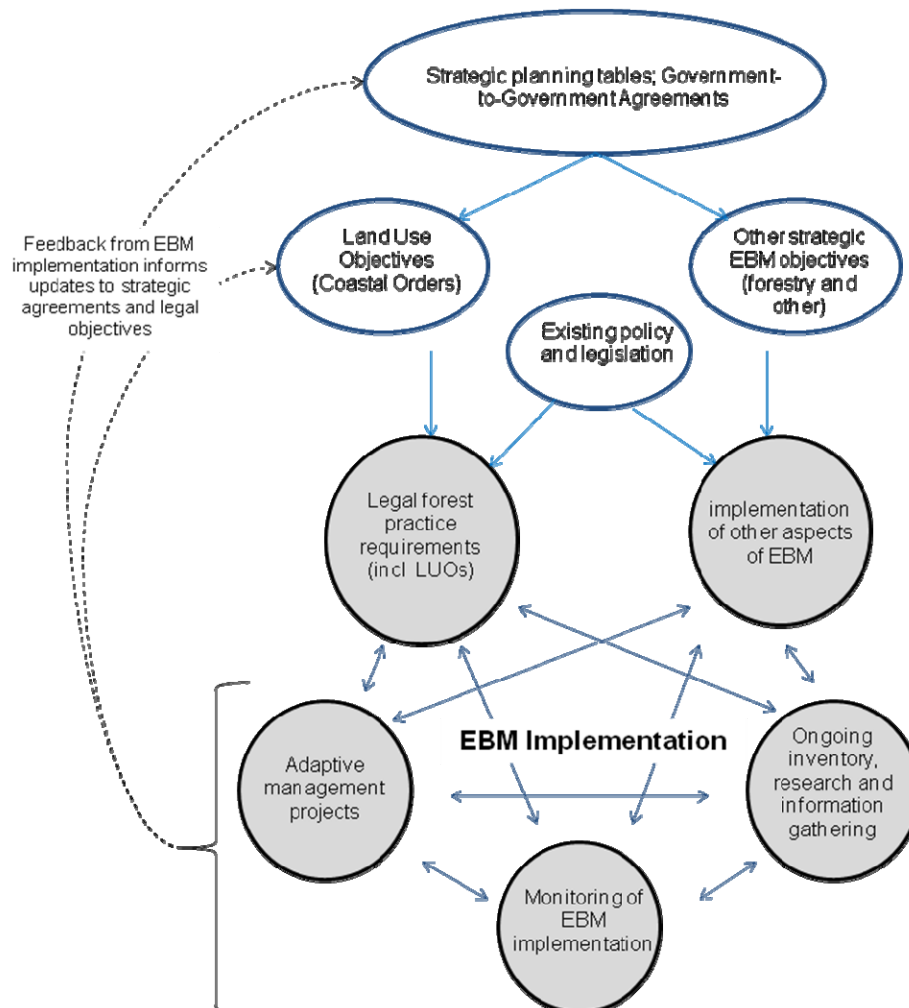
Figure 1. Schematic showing the various components of EBM implementation

2.1.1 Implementation of Land Use Objectives

The Central & North and South Central Coastal Orders set out objectives under section 93.4 of the *Land Act*. The objectives in the Orders are established for the purposes of the *Forest and Range Practices Act* and, therefore, govern the activities of forest and range licensees. Holders of woodlot licences and community forest agreements are not required to prepare results or strategies for objectives in the Coastal Orders.

There are very specific data needs associated with implementation of Land Use Objectives. These are set out in Table 1.

2.1.2 Implementation of EBM other than the LUOs

EBM encompasses a broad array of resource values, uses and activities. Activities other than those governed under the *Forest and Range Practices Act* include tourism and recreation, mineral exploration and development, energy-related development, fishing, hunting, and trapping. While there may not be a legal requirement for these activities to be consistent with EBM, practitioners are encouraged to strive for consistency with the intent of the coastal land use plans, Government-to-Government Agreements and the EBM Handbook. In addition, environmental assessment processes may consider strategic land use direction as part of decision-making.

2.1.3 Adaptive management projects

Adaptive management (AM) is a fundamental component of EBM implementation. AM is defined in the coastal Government-to-Government Agreements as "a systematic approach to resource management that engages [parties] in structured, collaborative research and monitoring with the goal of improving land and resource management policies, objectives and practices over time".

Adaptive management projects will ensure continuous improvement in the knowledge base related to ecological integrity and human well being, guided by the Adaptive Management Support Unit. Adaptive management projects will require best available data and information (spatial and non-spatial) and generate new data and information to support EBM.

2.1.4 Monitoring of EBM Implementation and Effectiveness

Monitoring tracks the progress of EBM implementation with respect to consistency with the Coastal Orders as well as the overall vision for EBM, as set out in the EBM Framework and EBM Planning Handbook.   The results of monitoring programs inform future amendments to strategic management direction (Figure 1) and provide accountability to the planning process.

There are two types of monitoring generally associated with strategic land use plans in B.C.[3]:

Implementation monitoring assesses the extent to which strategic direction in a land use plan is being met. Monitoring of performance of forest tenure holders with respect to legal objectives under the Coast Orders is expected to unfold as part of the ongoing system of result-based MoFR Compliance and Enforcement program in combination with exploratory reports generated by the Forest Practices Board or specific initiatives – reports as directed by the Minister of the Coast Region Implementation Team (CRIT).

Effectiveness monitoring determines whether the implementation of EBM objectives and other management direction is consistent with the vision and intent of EBM. Effectiveness monitoring is one component of adaptive management.

Data derived through monitoring will need to be stored and supporting information catalogued to allow comparative assessments to be made over the long term. Data standards will help to ensure that data is consistent and comparable across study areas and over time.

2.1.5 Ongoing inventory, research and information gathering

Coastal B.C. will continue to be the focus of formal inventory and research projects. The data and reports from these projects contribute to the ongoing knowledge base about the coastal planning area and its resources.

Inventory data and data generated through research will need to be stored and supporting information catalogued to allow its use over the longer term. Data standards will help to ensure that data is consistent and comparable across study areas and over time.

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[3]   Land Use Coordination Office. 2000. *Strategic Land Use Plan Monitoring Procedures: Working Draft.* Victoria, B.C..

2.2 Sources and uses of EBM data

Figure 2 shows the different sources and uses of EBM data.
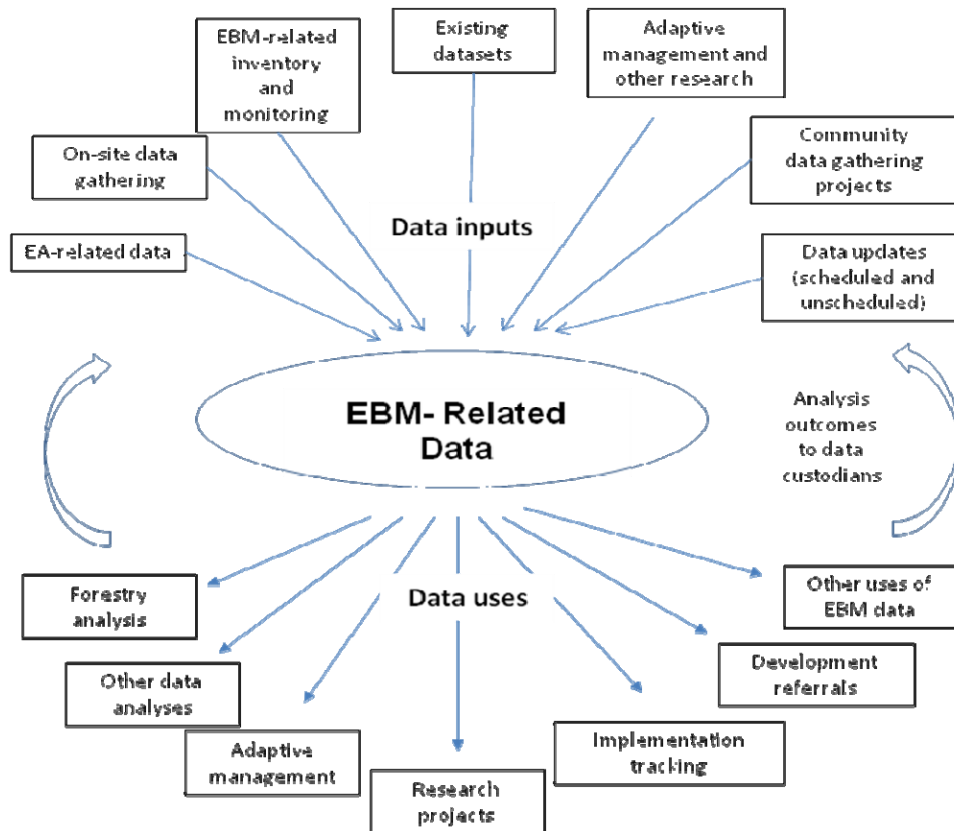
Figure 2. Flow of data and information to support EBM

2.2.1 Data sources

a. Existing datasets

There are many existing datasets that contribute to the range of data used to support EBM.

Corporate government data are prepared to prescribed standards and are housed in the provincial government Land and Resource Data Warehouse and published folders maintained by individual government agencies. The federal government also maintains its own corporate data.

Local data may be held by a variety of sources, including government agencies, forest licensees, First Nations communities, environmental organizations and research institutes. This data is prepared to different scales and standards and may or may not include supporting metadata.

b. Updates to existing data

Data is continually being updated. Data custodians are responsible for updates to their data, which may then become available for EBM-related activities. Some data, such as Statistics Canada data, is updated at regular intervals. Other data is updated based on priorities and available funding.

Updates to forest cover data is scheduled to allow forestry planners to meet mandated deadlines for submission of Forest Stewardship Plans.

c. Data gathered on-site to support development

Data may be gathered during, or in preparation for, industrial development activities. For example, forest licensees gather data associated with the LUO as part of on-site reconnaissance. This data has the potential to provide an emerging record of resources that not readily tracked at a more strategic scale.

Inventories may also be undertaken as part of environmental assessments for major developments.

d. Data from EBM-related projects (inventory, monitoring and adaptive management)

Ongoing inventory and monitoring projects and adaptive management will generate data that will expand the knowledge base over time. Ideally, this type of data gathering will be planned and structured to target key information gaps and enable assessment of trends over time.

e. Coastal community data projects

Coastal communities may conduct their own data gathering projects with respect to indicators of human well-being and/or ecological integrity.

Coastal communities currently participate in monitoring programs funded by federal and provincial agencies, such as Fisheries and Oceans Canada and BC Parks, or undertake self-funded monitoring. They also participate in observe-record-report compliance tracking. The Coastal Guardian Watchman Network (CGWN) was established to enable coastal Guardians and Watchmen involved in monitoring and reporting activities within their territories, to share information, collaborate and support and learn from one another.

f. Research projects

Data is gathered as part of research projects led by a variety of institutions and organizations, including environmental organizations, learning institutes, government (provincial and federal) and businesses.

2.2.2 Data uses

a. Analyses to support LUO implementation

Forest licensees will require data to meet their legal requirements in the *Coastal Orders and Forest and Range Practices Act*. Some forest licensees are working collaboratively to assemble and share data associated with implementation of the Coastal Orders. Collaborative efforts are particularly important where there are multiple tenure holders within a landscape unit, as the activities of all contribute to the achievement of targets under the LUO.

b. First Nations community resource managers

First Nations community resource manages are involved in forestry planning and have an increasing role in preparing and reviewing forestry operational plans. First Nations communities also use data in their own strategic planning, for example, the development of Detailed Strategic Plans to guide development activities within their territories.

Other First Nations' data needs include:

- data to support referrals as part of consultation and accommodation referrals;
- data on economic, cultural and ecological values to support cost-benefit assessments of economic development proposals.

There are specific references in the Coastal Orders to information-sharing with First Nations, with specific reference to information to support watershed assessment, adaptive management plans and site-specific information.

There is also an interest in having increased GIS capacity within communities. Currently much of the GIS analysis to support decision-making is done outside of the communities; having in-house capability would safeguard against reduced access to GIS operators e.g., due to reduced resources in ILMB.

c. Adaptive management projects

Adaptive management projects will be decided at different scales: within a regional framework based on regional priorities and within a local framework based on local priorities. While it is not possible to anticipate all data needs to support adaptive management, an efficient and effective data management system will facilitate the acquiring, housing and updating of data and information associated with adaptive management.

d. Government agencies

Government agencies use EBM data in fulfilling their agency's mandate for stewardship of lands and resources.

B.C. Parks will use data in developing conservancy management plans. Data pertaining to conservancies and other protected areas will also inform the achievement of targets under the LUO. Any change to the condition of lands and resources within conservancies and other protected areas (e.g., due to development activities) will need to be tracked and communicated to forest licensees.

e. Research

EBM-related activities may provide a useful source of data for research e.g., by ENGOs or learning institutes.

f. Implementation tracking

There are participants in EBM implementation have an interest in reviewing the outcomes of EBM and track the achievement of the LUOs. These data users may include environmental organizations, local communities and Plan Implementation Monitoring Committees. The key concerns of these data users are to ensure that the principles and intent of EBM are being met, that practices are

changing accordingly and that the risk to priority values is being reduced. These concerns tend to be high level rather than site specific.

g. Continual improvement

Forestry Tenure Holders incorporate EBM outcomes, reports, local and community data back into their respective Sustainable Forest Management Plans for continual improvement evaluation.

h. Development referrals

First Nations, municipalities and provincial government agencies may use EBM-generated data as part of the referral process to assess the implications of proposed developments.

i. Other uses of EBM data

There are likely many uses of EBM data that are not defined at this time. A data management system should allow for appropriate access and use of EBM data as needs arise.

2.3 Data to support EBM

Table 1 summarizes the different types of data anticipated for use during EBM implementation, noting any issues associated with data management. A more detailed description of issues associated with specific datasets is provided in sections 2.3.1 – 2.3.5.   All of the datasets listed in Table 1.   A spreadsheet has been prepared to accompany this document that provides more detailed information on data to support EBM.

Table 1. Data to support EBM

Topic area	Role in EBM implementation	Example datasets	Data existing or generated on site	Anticipated data issues
Cultural data	LUO Objectives 3 – 7; planning within FN territories (e.g., DSPs)	Traditional forest resources, traditional heritage features, culturally modified tree, monumental cedar	Existing and On-site	Each family or First Nation owns cultural information and data and controls its use. Data may or may not be accessible to other data users. Licensees need enough information to allow them to appropriately manage for cultural resources and features, consistent with the LUOs.
Aquatic habitat	LUO Objective 9 – 13; planning within FN territories (e.g., DSPs)	Important Fisheries Watersheds	Existing	Schedule to the LUO. No issues anticipated
		High value fish habitat (estuaries, lakes, wet floodplains and streams with spawning or rearing, shorelines)	Existing and On-site	Accessibility of site level data. Concern about liability re sharing site data.
		Aquatic habitat features	On-site	Accessibility of site level data. Concern about liability re sharing site data.
		Stream classification	Existing Verified on-site	Accessibility of site level data. Concern about liability re sharing site data.
		Lakes, wetland marshes	Existing and	Accessibility of site level data. Concern

Topic area	Role in EBM implementation	Example datasets	Data existing or generated on site	Anticipated data issues
			On-site	about liability re sharing site data.
		Forested swamps	On-site	Accessibility of site level data. Concern about liability re sharing site data.
		Upland streams	Existing and On-site	Accessibility of site level data. Concern about liability re sharing site data.
		Active fluvial units	Existing and On-site	Accessibility of site level data. Concern about liability re sharing site data.
Seral stage distribution	LUO Objective 14; planning within FN territories (e.g., DSPs)	VRI or forest-cover	Existing	Key data layer to be addressed. See section 2.4.1 below.
		Site series surrogate representation layer	Existing	Key data layer to be addressed. See section 2.4.2 below.
		TEM	Existing	Mapping to standards but not assessed for accuracy. TFL data not always accessible. Incomplete coverage. See section 2.4.3 below.
Red and Blue-listed Plant Communities	LUO Objectives 15; planning within FN territories (e.g., DSPs)	Listed in a Schedule to the LUO. Source data may also come from existing TEM, site level data	Existing and On-site	Weblink to the CDC that identifies element occurrences and maps of known locations of plants and plant communities.
Stand level retention	LUO Objective 16	Mapping of wildlife tree patches under FRPA	On-site	Need to record the features captured in a WTP for future management decisions.
Grizzly Bear habitat	LUO Objective 17	Class 1 and some Class 2 habitats	Existing	Schedule to the LUO.
Black Bear habitat	LUO Objective 18 (C and N Coastal Order)	Kermode Stewardship areas	Existing	Schedule to the LUO
		Mapping of critical black bear habitat within	On-site	Accessibility of site level data. Concern

Topic area	Role in EBM implementation	Example datasets	Data existing or generated on site	Anticipated data issues
		Kermode S.A.s		about liability re sharing site data.
		Black bear dens	Existing and On-site	Accessibility of site level data. Concern about liability re sharing site data. There is some mapping of dens but this may or may not overlap the scheduled K.S.As
Focal species habitat mapping	Co-location in OGRAs (Objective 14); planning within FN territories (e.g., DSPs)	Marbled murrelet air photo interp, northern goshawk foraging and nesting model, mountain goat habitat suitability, blacktailed deer habitat suitability, grizzly bear Class 1 and 2 habitats, tailed frog suitable streams and basins.	Existing	Wildlife habitat mapping does not always meet data standards; quality of mapping varies depending on the quality of inputs e.g., forest cover; field verification needed to confirm occupancy See section 2.4.4
Focal species inventory data	Co-location in OGRAs; trend monitoring; planning within FN territories (e.g., DSPs)	Tailed frog locations, mountain goat inventory, northern goshawk nest locations, marbled murrelet nest locations	Existing	Focal species data may be sensitive for conservation reasons Data coverages may be incomplete
Red- and Blue-listed animal species	Co-location in OGRAs; trend monitoring; planning within FN territories (e.g., DSPs)	CDC occurrences	Existing and On-site	CDC data may be sensitive for conservation reasons
Regionally important wildlife	Co-location in OGRAs; trend monitoring; planning within FN territories (e.g., DSPs)		Existing	Data for some species of regionally important wildlife may be sparse or of unknown quality
Fish	Monitoring ecological integrity; planning within FN territories (e.g., DSPs)	FISS	Existing and On-site	Not all streams inventoried; absence of data does not indicate an absence of fish

Topic area	Role in EBM implementation	Example datasets	Data existing or generated on site	Anticipated data issues
Visual Management	Planning within FN territories (e.g., DSPs)	Visual Landscape Inventory	Existing	Coverage may be incomplete
Community-based ecological data and information	Monitoring ecological integrity; planning within FN territories (e.g., DSPs)	Locally gathered fish and wildlife data	Existing	Held with local communities; may or may not be accessible to other data users. May or may meet data standards.
Provincial or federal social and economic data	Monitoring human well-being; economic development planning	Statistics Canada census data; BC Stats processing of Stats Canada data; regional district and municipalities; Ministry of Education	Existing	Data is not always gathered and reported by the coastal planning areas or by individual communities. Data gathering occurs at long time intervals and processing of data can take months or years. See section 2.4.5
Community-based social and economic data	Monitoring human well-being; economic development planning	Skeena Native Development Society labour market data; 2008 socio-economic community survey	Existing	Data may not be collected over multiple years; data may not be accessible outside of communities
Provincial Baseline Atlas	Support for ongoing analysis	TRIM, Corporate Watershed Base, DEM, BEC, ecoregion classification, satellite imagery, air photos, orthophotos, administrative boundaries, land use zones and designated management areas	Existing	There may be costs associated with release of some corporate data; need to ensure all parties using the latest version

2.3.1 Vegetation Resources Inventory (VRI)

- Forest cover data is a fundamental layer for EBM implementation. It is used for a wide variety of analyses, including timber analysis and habitat mapping and is the base for derivative mapping, such as predictive ecosystem mapping. The forest cover data on the Coast varies considerably in its currency and accuracy. The data in many areas has been updated to the more up-to-date Vegetation Resources Inventory, however there are still a number of locations that are only covered by the older forest cover data. With the exception of some parkland, most of the Timber Supply Areas in the coastal planning region have been updated to VRI.

- There are issues associated with the accessibility of TFL forest cover data, which some tenure holders view as proprietary information. Because this data is so important for EBM implementation, a lack of access to this data, or delayed delivery of the data, by data owners can impede proper analyses and create delays in project delivery.

2.3.2 Site series surrogate representation layer (SSSR)

The most up-to-date 'official' data for site series surrogate representation is version 10 of the CFCI dataset (February 2008). ILMB has incorporated depletions reported by CFCI licensees and has released an updated dataset (June 2008 Update to Version 10). The depletions recorded are principally those of major licensees from 2005 forward. Ongoing evaluation of future updates and improvements to the SSSR layer will remain a short term focus until effective broad coverage of Terrestrial Ecosystem Mapping is in place.

The SSSR layer is based on forest inventory (older forest cover data and Vegetation Resources Inventory). This layer has been pieced together from multiple forest cover layers and it has recognized inaccuracies. Limitations of this dataset include:

- Forest cover data does not accurately reflect the true age of older stands, providing, instead, age classes in the forest cover data represent a wide range of ages (age class 8 = 140 – 250; age class 9 = 250+). This creates problems for ecological and timber supply analyses which require that age be relatively accurately expressed[4].

- In some cases the forest cover data appears to underestimate age class 9 but over estimate age class 8. Various modifications have been applied that create their own problems and have results in a lack of consistency in the definition of older forests across the planning area[5].

- Data needs to be cleaned up to remove typing and sorting errors and to create a consistent structure for the dataset, including a consistent use of terms.

- Because analysis units for representation are based on the productivity of forest polygons (leading species and site index), it is challenging to track changes in age class over time as a

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[4] Holt, R.F. and C. Rumsey. 2009. *EI03 Ecological Baseline Assessment., Appendix 4* Prepared for the Ecosystem-based Management Working Group.

[5] *Ibid.*

result of harvesting activity. Tracking representation over time is complicated where regenerating stands are of a different species composition than pre-harvest.

- There is no direct cross-walk between the site series surrogate and actual site series (based on TEM mapping). Ecologists have suggested that the term 'site series surrogate' is a misnomer[6]. Efforts are underway to improve TEM coverage across the coastal planning area.

- Due to a lack of a direct link to site series, it may be challenging for biologists to assess implications of site series representation for wildlife habitat supply. Ecologists have questioned whether some of the SSS are representative of 'real' ecosystems.

- The SSSR layer was created for a specific purpose: to track the implementation of SSS representation under the LUO. It is a highly generalized layer and should not be used broadly for other analyses e.g., timber analysis.

2.3.3 Terrestrial Ecosystem Mapping (TEM)

TEM is based on air photo interpretation, using a similar method to forest cover mapping. There are prescribed standards for TEM mapping, however there is currently no requirement for TEM products to undergo an accuracy assessment. Therefore the quality of the mapping and its suitability for use in mapping of ecosystems and habitats is currently unknown, although accuracy assessments could be introduced.

Given that TEM is a fundamental layer for EBM implementation and the large investment that is going into extending coverage of TEM throughout the coastal planning region, some form of quality assurance is important to ensure the quality and reliability of the product and to provide accountability to ongoing funding of projects.

2.3.4 Focal Species Habitat Mapping

Habitat mapping for seven focal species was reviewed and updated as part of an EBM Working Group focal species project (2009). The outcome of this project was a set of habitat layers for the entire coastal planning region for grizzly bear, marbled murrelet, northern goshawk, tailed frog, mountain goat, and coastal blacktailed deer. Recommended improvements to these map layers are summarized in the focal species project report.

2.3.5 Human Well-being Data

The Sheltair Group prepared a Technical Report on *EBM Human Well Being Indicators* (2008). The report presents the metadata associated with the various indicators used to monitor human well-

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[6]   Price, K. 2008. *Using Site Series Surrogates to Calculate Ecosystem Representation.* Prepared for the Ecosystem-based Management Working Group.

Green, R.N. 2008. *Comparison of Site Series Surrogates with TEM-based Site Series in the Central Coast LRMP Area.* Prepared for the Ecosystem-based Management Working Group.

being, describes limitations with the various data and puts forward recommendations for human well-being data.

2.3.6 Protected Areas Data

BC Parks has an important role in the provision of data to support EBM implementation. The availability of resources within conservancies and other protected areas will contribute to the achievement of LUOs.

3.0 Current Data Management

3.1 Existing management of EBM-related data

To date, most data management associated with EBM has been to support EBM Working Group projects, preparation of Detailed Strategic Plans, and to prepare for implementation and tracking of the legal orders.

a. Integrated Land Management Bureau (ILMB), Coast Region

ILMB, Coast Region, has held the primary responsibility for data management to support EBM activities. To date, its activities include:

- Maintaining an ftp site for wildlife habitat mapping and inventory of focal wildlife species, hydroriparian mapping, and high value fish habitat.

- Managing sensitive wildlife and habitat data.

- Maintaining and updating the official version of the Coast Forest Conservation Initiative (CFCI) site series surrogate representation (SSSR) layer to support the implementation of biodiversity objectives under the Coastal Orders.

- Supporting data updates to support EBM-related activities e.g., MoE habitat data

- Distributing data to contractors and other data users working on activities of the EBMWG.

- Assisting individual data users to acquire corporate or other data.

- Data cataloguing

- Providing technical advice regarding appropriate limitations and uses of data

- Providing recommendations to data custodians on standards

b. Ministry of Forests and Range

MoFR are the custodians of provincial VRI data, terrain mapping and licensee operational data (outside of TFLs). MoFR is the key agency using the RESULTs database to updated forestry-related data on an ongoing basis. MoFR and ILMB are jointly involved in updating the SSSR layer, using RESULTS.

c. Ministry of Environment

MoE coordinates inventory and habitat mapping projects and is the custodian of data associated with wildlife and fish. Specific data layers may be shared with ILMB for the purposes of EBM.

d. Forest licensees

i. *FSP Collaboration Group*

The FSP Collaboration Group has been initiated by CFCI tenure holders to create a draft Framework Agreement that would see licensees working together on interpretation of the LUOs, methodologies

and data management to implement the Coastal Orders. The Collaboration Group is looking to the LIM Section to provide data support for the site series surrogate layer, but will generally be maintaining its own data to support integrated planning and information sharing pertaining to the LUOs.

ii. Individual tenure holders

Individual licensees manage their own data and its distribution. Their approach to managing and sharing data varies depending on the company and the type of tenure (e.g., TFL vs TSA). Generally, TSA data is open access while TFL data tends to be proprietary and is not readily accessible.

e. First Nations

First Nations are structured into three working groups for the purposes of resource planning: North Coast-Skeena Stewardship Society, Turning Point and Nanwakolas. First Nations communities generally hold their own data but may seek assistance from outside parties, such as ILMB, to undertake analyses.

f. Environmental Non-Governmental Organizations (ENGOs)

ENGOs have contributed to data updates and improvements e.g., updates to the North Coast SSSR dataset. They also hold specialized data relevant for EBM planning based on their own research, particularly relevant to focal species habitat.

g. Third party data

This data resides in a number of locations and is generally available upon request, with suitable data sharing agreements in place e.g., Canadian Wildlife Service, research institutes.

3.2 Strengths and weakness of the existing data management system

3.2.1 Data accessibility

In general, EBM data should be managed based on a principle of collaboration and open sharing of data and information. This may not always be the case, but, to the extent possible, a data management system should be set up in a way that promotes data accessibility. Data accessibility refers to the ability of the various parties to acquire data and to the accessibility of information related to data.

Strengths:

The current system allows ready access to many data layers. ILMB has been able to provide data users with access to the requisite corporate data, including data in the Provincial Baseline Atlas and habitat mapping held with the Ministry of Environment. The existing ftp site provides a simple structure for distributing EBM data.

Weaknesses:

One of the most common issues raised with regard to the current data management system is the lack of access to proprietary licensee data, in particular data held by holders of TFL tenures. Key concerns relate to lack of access to some inventory, resulting in gaps in coverage,

delays in delivery of promised data, and inequities in data access. Access to proprietary data is less challenging where mutual benefit is achievable.

First Nations data is also held by the data owners (which may be a Nation or family) and only available upon request. There is general acceptance that First Nations data should continue to be treated as confidential and distributed at the discretion of the data owners.

Not all parties involved in EBM implementation are aware of the data layers that are available e.g., on the EBM ftp site. In addition, the site is confusing to use because there are many duplicate and redundant datasets on the site and it is difficult to know what the various layers are and which are preferred for use.

3.2.2 Data security

Data security ensures control over distribution of datasets, to manage appropriate access to data layers, consistent with data sharing agreements. Data security is not the antithesis of data accessibility; data access can be facilitated by establishing data sharing agreements among the relevant parties that allow data sharing to proceed smoothly.

Strengths:

Individual data owners are able to manage the distribution of data layers directly.

Where ILMB is able to distribute restricted data, they do so under the provisions of data sharing agreements.

Data sharing agreements have been signed between many parties on the coast, providing the groundwork for a longer term arrangement.

Weaknesses:

In the absence of data use agreements, a process of decision-making has to occur every time that data is requested by a new party.

If data is acquired by different parties on an *ad hoc* basis, the ability to control the distribution and use of data is reduced. The further that data is distributed from its source, the greater the likelihood that it will be used inappropriately. This situation should not apply if the data is distributed under a data use agreement.

3.2.3 Data quality and reliability

Data must be adequate standard to provide consistent and reliable analysis results and to be trusted to inform decision-making.

In general, the principle of using best available information is applied during operational planning; often supported with detailed local level data. Typically those who rely on the existing data to operate a viable enterprise or make effective planning or business decisions will be knowledgeable of existing data limitations or data gaps.

The provincial government has existing standards for data quality that ensure a minimum standard of data cleanliness and metadata for any layers warehoused in the LRDW or other published data folders. When using data from those sources, there is a high level of certainty that the data is to standard and is well-documented.

Licensee data may be of adequate standards for their purposes, even if it does not meet EBM standards.

Weaknesses:

Data used for EBM may be of a wide range of quality and reliability, depending on the custodian. There is also a lack of consistency in data between geographic areas, creating uncertainties that have to be worked with.

Data standards are driven by the custodians collecting the data under a given projects ToR; what may be suitable for today may be impracticable for 10 to 15 years from now.

Not all parties are able to devote resources nor have the competencies to access and manage data and information effectively.

Where there are problems with a dataset, data users are likely to apply their own fixes, resulting in different versions of the data being used and potentially unreliable results.

If data is not updated to the provincial government standard it cannot be warehoused with the LRDW or other published folders managed by the provincial government. However, there are ways to manage data that is not to standard within the provincial government system.

3.2.4 Documentation

In the absence of metadata that describes the source of a dataset, the date it was completed, inputs, assumptions appropriate uses, a data file can become unusable over time, or resources must be devoted to tracking down the information. Metadata should include a data dictionary that describes the attribute fields in the database.

Strengths:

Data published by the provincial government, e.g., in the LRDW, is required to have accompanying metadata.

Progress has been made with respect to tracking down and documenting metadata for some of the key datasets to support EBM, such as the habitat layers.

Weaknesses:

There is currently no set of metadata standards in place for EBM data.

There are big gaps in the documentation of EBM-related data, particularly for older datasets. Metadata does not exist or it does exist and no-one knows about it. Once this information is gone, it is very difficult to recover.

Without appropriate documentation, it is challenging to control the version of individual datasets, particularly where these are in the public realm and being used by multiple parties.

3.2.5 Ease of use

Data may be difficult to use, making it costly to use or resulting in inconsistent use among different data users.

Strengths:

Data specifically targeted for EBM-related analyses is being prepared to the various study area boundaries, making it easier to use.

Generally with the right metadata provided a skilled user can effectively interpret existing data that is available.

It may be possible to still use difficult datasets as long as there is agreement as to modifications to be applied to make the data less complicated or challenging to use.

Weaknesses:

Some data is just difficult to use. It is challenging to work out fixes for the data without affecting the integrity of the dataset.

Some datasets, notably the human well-being statistics, are reported to jurisdictional boundaries that poorly approximate the study area boundaries, affecting how representative the information is for the study area. Some statistical data is not available for individual coastal communities.

3.2.6 Extent of coverage

Data coverage is continually improving over time.

Where possible, there should be complete coverage of data used for EBM, preferably for the coastal planning region as a whole, but at least for the area of each of the Coastal Orders.

Strengths:

There are several key data layers that provide complete coverage for the EBM planning area.

Weaknesses:

Data updates are sporadic and cover a variety of locations through time; typically 'needs' dependent due to cost. One of the technical tasks of a new data management system should be to assemble data layers and assess each for quality of data and extent of coverage.

3.2.7 Management of site level data

Through time, more and more on-site data will be collected as part of forest management. This data is housed with individual tenure holders but has the potential for being uploaded to a shared repository to create a data legacy that can accumulate and be available for EBM over time. This data is also considered important for tracking EBM implementation.

<u>Strengths:</u>

There is an interest among some EBM data users in setting up a system to accumulate site level data over time.

Improvements in technology are making it easier to log data as it is acquired e.g., electronic tracking and reporting programs. This data is more readily available in an electronic format compared to hard copy, 'deadfile' storage facilities.

<u>Weaknesses:</u>

There is currently no system in place for collection of site level data and little data sharing occurs.

A shared repository for site level data will only be successful to the extent that data owners participate over time. Some data owners may choose not to voluntarily contribute their data.

Some licensees are concerned about the liability associated with providing their site level data.

There is no process in place to verify data that is gathered during on-site reconnaissance.

3.3 Examples of other data management systems in B.C.

There are a number of examples in B.C. of data management systems that have been established to support collaborative data and information among multiple stakeholders. These include fully independent systems and systems housed within ILMB.

Independent data management systems

The Northwest Data Sharing Network (NWDSN) and the Kootenay Spatial Data Partnership are examples of fully independent data management systems. The NWDSN (http://www.nwdsn.org/) is a not-for-profit society whose mission is "timely, co-ordinated, co-operative, and innovative use of the geo-spatial data sets to reduce ownership data costs and improve decision-making about land use in [the]region". The Network is governed by a Board of Directors, with membership by data owners (provincial government and forest tenure holders). Members pay an annual fee ($2500 for full members and $1250 for partial members). The Network fosters partnerships with other parties regarding data access and data sharing.

Executive Director, Don Morgan, has commented that some of the key aspects of success of the NWDSN are:

- time and effort was put into developing trust and a relationship among members as a foundation for ongoing decision-making,

- governance and technical roles are clearly separated, allowing technical work to proceed unfettered by more political issues

- Board leadership has a combination of governance ability and technical knowledge related to data and its management.

- the data management structure is housed independent of its member organizations, which provides a greater sense of ownership and legitimacy among members.

Provincial government-based systems

The Integrated Land Management Bureau (ILMB) has the mandate to "provide client-focused, high quality, integrated Crown land and resource management and information services to British Columbians". GeoBC is ILMB's conduit to data and information sources provided by various provincial ministries and agencies in the Natural Resource Sector (http://www.geobc.gov.bc.ca/).

A project is underway with GeoBC to improve forest licensee access to datasets required in the implementation of the *Forest and Range Practices Act*. The project is governed by management-level representatives from the various natural resource agencies.

Provincial data management systems are increasingly sophisticated and effective at managing data from a wide range of sources and doing so in an interactive and user accessible manner.

4.0 Recommendations for Data and Information Management

These recommendations have been developed assuming the following purpose of an information management system for EBM:

To enable the timely, co-ordinated, consistent, and collaborative use of best available spatial and aspatial datasets and other information among multiple users to support EBM implementation coast-wide.

Objectives:

- A collaborative environment for sharing data and information, consistent with the principles of EBM.

- Efficient access to data and information within a secure environment.

- Standards for data exist and are adhered to by data custodians.

- Datasets are of optimal quality, currency and reliability.

- Metadata exists for all datasets.

- 'EBM-authorized' data layers are used consistently and with a shared understanding of their limitations and appropriate uses.

- Effective communication of available data and information to all data users.

- A cost-effective system for data owners and data users.

4.1 Vision for Information Management

Data and information management are treated here as two separate but linked functions. The management of spatial and aspatial data is the focus of this report, however, there is a broader picture of overall information management for EBM, which includes all traditional, local, technical and scientific knowledge in its various forms. These might include reports, visual and auditory recordings, mapping, other graphic depictions as well as spatial and tabular data.

Figure 3 provides a concept for an overall information management structure for EBM implementation. This structure separates technical data management from other information. The components of this information management structure are described in the recommendations below.
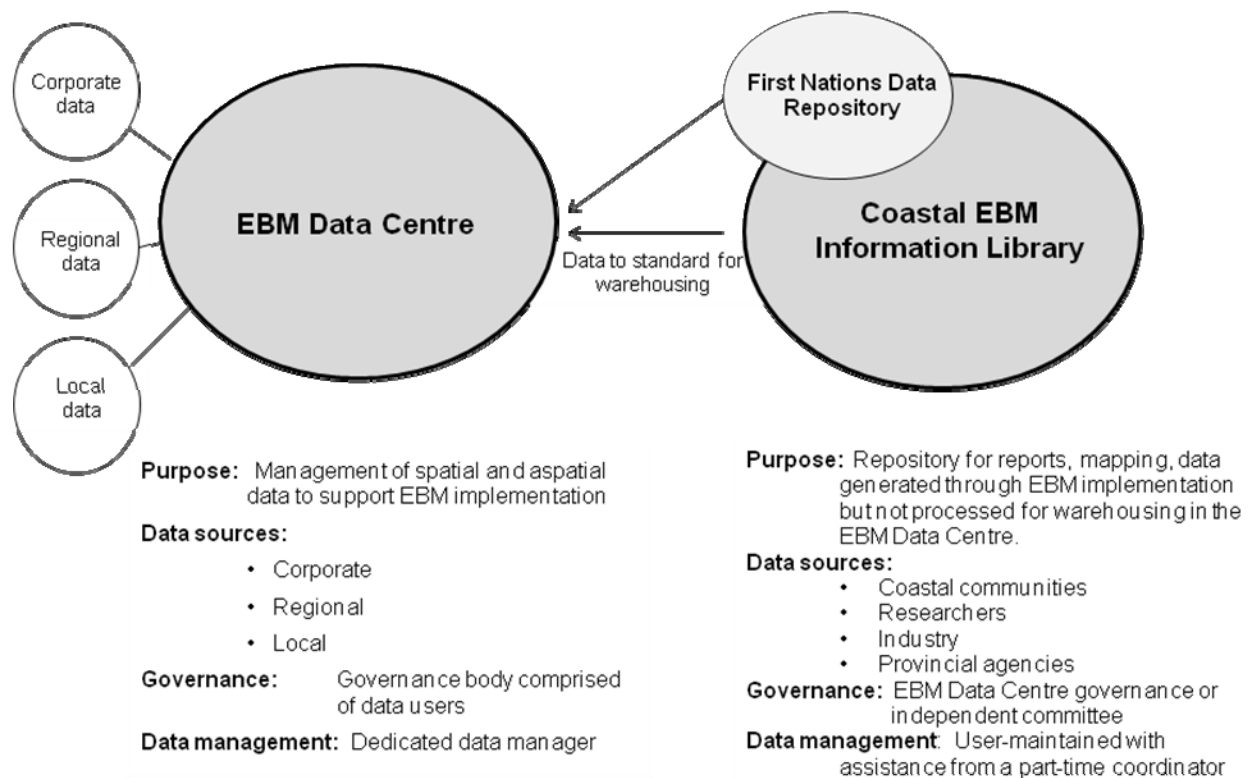
Figure 3: Proposed structure for data and information management to support EBM

4.2 Recommendations for Data Management

4.2.1 Recommendations Relating to the Structure and Function of an EBM Data Management System

R1.   Establish an **EBM Data Centre** as the main data hub for EBM implementation.

The Data Centre

- provides a warehouse for EBM-specific data, such as site series surrogate data and habitat suitability mapping,

- is a repository for local data generated through on-site block surveys, adaptive management projects, inventory and monitoring,

- separates governance from technical work,

- is linked to data sources held and managed by provincial and federal government agencies, industry and research institutes,

- may be linked to the Adaptive Management Support Unit.

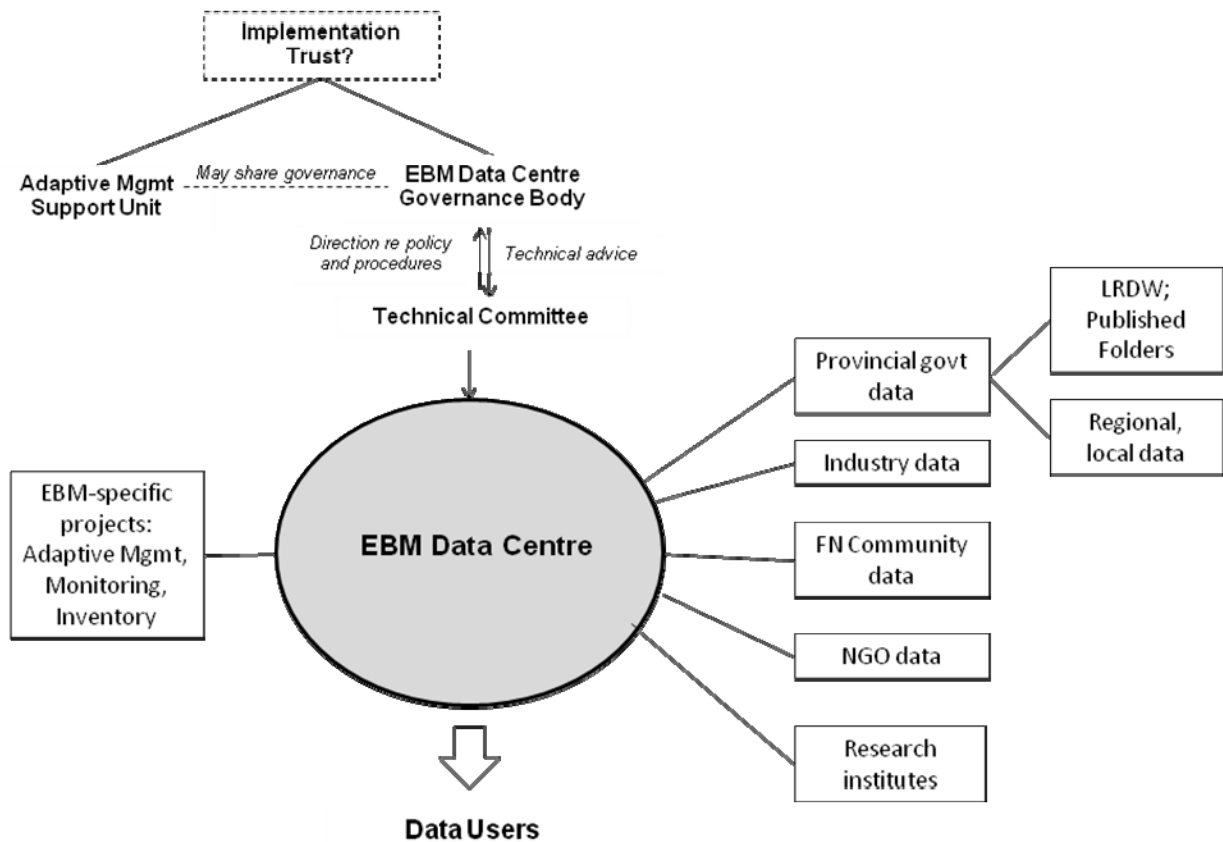A proposed structure for an EBM Data Centre is shown in Figure 4.

Figure 4. Proposed structure for an EBM data management system

R2. Develop a simple data server (e.g., an ftp site) and a cataloguing system to manage data and associated support information (metadata, data dictionaries) in the short term. It will be possible to investigate a more complex system over time.

Features of an EBM data server:

- Basic requirements: hardware, interface software, data manager

- Has the physical capacity to store and efficiently manage all EBM-related data.

- Is able to warehouse data as well as provide web access to information (e.g., maps).

- The data manager provides technical support to the system as well as personal assistance to link data users with their requested data.

- Has adaptive capacity and is independently responsive to direction from the EBM Data Centre Governance Body.

- Is trusted by all data users as the gatekeeper for EBM data.

- Responds efficiently to requests for data access.

- Provides regular updates to the data catalogue.

- Is cost-effective and accessible to data users.

- Is stable enough to guarantee continuity of service to 2014 at a minimum.

The Governance Body for the EBM Data Centre will decide on an appropriate location for the data server. Options include:

Option 1: Locating the data server within an independent institution e.g., UNBC.

Pros:

- A fully independent system may contribute to a greater sense of common ownership and legitimacy among members.

- An independent system may be perceived as more able to be adaptive and responsive to the data user community.

- A system at arms length of any one member of the data user community is less likely to be caught up in the politics of data sharing and management.

- It may be easier to secure funding from external parties for a data management system that is fully independent.

Cons:

- Given that ILMB has the mandate to provide information services, an independent server will be duplicating effort to some extent.

- Incremental resources may be required to set up and administer an independent system. There will need to be a transition in moving from the ILMB-based system to the new system.

- There must be secure funding to ensure continuity of the system over the longer term.

Option 2: Continuing to locate the data server within ILMB, Coast Region.

Pros:

- A structure for a data management system for EBM is already up and running.

- ILMB staff working on the existing system are (1) familiar with LUO requirements and have relationships with other EBM players; and (2) have familiarity with the government data system.

- A commitment to long-term resourcing of the system can be embedded in a formal agreement between the Province and coastal EBM partners.

- There are ways (e.g., through a project charter) to formally enable the data manager to be answerable to the Governance Body independent of their provincial government employer. This includes declaring the data management system to be exempt from normal government policies.

Cons:

    – There may be concerns among some data users or external parties that ILMB is not adequately neutral or independent.

    – Some data providers ma be reluctant to provide data to a 'government site'.

    – There are clearly problems with the existing system, despite an awareness of what is required. If this option is selected, it is advisable to determine why the existing set-up has not been optimally effective and put steps in place to resolve any impediments.

R3. If Option 2 is chosen, the location of the data server should remain with ILMB, Coast Region, This is to ensure that the data management function is not centralized (e.g., with GeoBC) to the extent that it may become less accessible and responsive to the Governance Body and data users.

R4. Make effective use of internet technology when setting up the data server. The coastal planning region covers a very large area and communities are geographically dispersed, however most communities have remote internet access. An internet-based system will facilitate equal access to data and promote communication among data users (a web-based system is also recommended for a Coastal EBM Implementation Library, as described in section 4.2.9).

R5. Dedicate one person to manage the EBM Data Centre. This person maintains the data server deals with data sharing agreements, and uploads and disseminates data according to data sharing protocols and levels of security.

The Data Centre Manager is not responsible for cleaning data and ensuring it is to standard; that is the role of individual data custodians. There are some exceptions.

It is expected that coordination of the EBM Data Centre will require one full-time equivalent (fte) position until the system is up-and-running (approximately 1 – 2 years) and 0.5 fte after from then on. Additional work to clean-up data may be contracted out, on an as-needs basis.

R6. Establish a process to safeguard the institutional memory of the data management system in the event that the Data Centre Manager has to leave their post e.g., having a back-up person in place or training staff in the data management system.

R7. Establish clear lines of authority and accountability between the Governance Body, the Technical Committee and Data Centre Manager. Ensure that the Data Centre Manager is clear on who he/she takes direction from and is answerable to. If necessary, establish a formal agreement to ensure this arrangement is secure for the longer term.

R8. Identify and establish processes and agreements to ensure long-term resourcing of the EBM Data Centre. A key factor in the success of the data management system is to ensure that the system is stably housed for a minimum of 5 years (to March 2014). Options for long-term resourcing may include some or all of the following:

- Including data management as part of targeted funding to support EBM implementation;

- Making the Data Centre self-funding e.g., there is a membership fee for regular access to data or a charge per data request.

- Committing resources to data management in Government-to-Government Agreements or other EBM implementation agreements.

A cost-effective data management system should provide an incentive for ongoing support in terms of funding and resources.

4.2.2 Recommendations Relating to Governance

Data management has two separate components, both of which are essential to any data management system: governance and technical work (Figure 5). One of the first steps in implementing a data management system is to establish some form of Governance Body to oversee the system and provide policies and strategic operating procedures that can be implemented at a technical and operational level. It is important that there is collaborative oversight of data management at a high level to ensure consistency and continuity in the approach to managing and using EBM data,

Important features of the governance system are:

- It separates governance-related decisions and direction from technical matters.

- Decision-making on the various aspects of data management is collaborative and strives for consensus. One of the strengths of a coordinated data management system is that there is over-arching agreement on data-related issues rather than having to continually deal with problems on a one-off basis.

- It allows the formulation of a common set of data and metadata standards, custodianship policies and strategic operating procedures. Once these are in place, the technical work flows from that foundation.

The key questions with respect to governance are:

- What kind of governance structure is needed? What is the link to the Land and Resource Forums and how is accountability maintained?

- What is the composition of the governance body?

- What are its tasks and responsibilities in the short and longer term?

R9.   Establish a governance structure for the EBM Data Centre. Suggested roles and tasks of a Governance Body are listed in Appendix 3.

There are two options for a Governance Body:

Option 1: A Governance Body that is guided by, but fully independent of the LRFs. This body would not report to the LRFs.

Pros:

- Decisions concerning data management are independent of the larger politics of EBM implementation. This helps to ensure that the requisite data management is not hampered by higher level issues associated with EBM implementation.

Cons:

- This option requires setting up a separate governance structure with potential for incremental resourcing. For example, an independently funded body (e.g., a trust) would require some kind of manager or director.

Option 2: The Governance Body is a committee of the LRFs. This committee would report to, and be, at least partly funded by, the LRFs.

Pros:

- The Governance Body would be part of the existing EBM implementation structure, potentially facilitating its implementation.

Cons:

- Decisions concerning data and data management risk being caught up in broader EBM-related issues, slowing the data management process.

Recommendation: Option 1. The Governance Body is independent of the LRFs.

R10. Provide opportunity for all parties who have a direct interest or involvement in EBM implementation to be represented on the Governance Body, including:

- First Nations communities,

- forest licensees (including the FSP Collaboration Group),

- environmental non-governmental organizations (ENGOs);

- other non-governmental organizations; and

- relevant provincial government agencies (Ministry of Environment, Stewardship Division and B.C. Parks, and Ministry of Forests and Range). BC Parks has an interest in EBM data for the preparation of conservancy management plans and to track the contribution of conservancies to the achievement of LUO targets.

R11. Appoint representatives to the Governance Body who have the knowledge and authority to make decisions on matters related to data and its use. They should be able to make decisions independent of the workings of the LRFs. Where possible, representatives on the Governance Body will have technical expertise in data and/or data management.

R12. Consider linking the institutional structure for EBM Data Centre with the Adaptive Management Support Group. This could include a shared governance role to make most efficient use of human resources, with the proviso that participants know enough about data and its management to make informed decisions.

4.2.3 Recommendations Relating to Data Sharing

R13.   Undertake measures to build trust and promote multi-sectoral cooperation on data issues. An recommended action is to convene a workshop of data owners and data users to discuss issues and develop a protocol for collaborative data sharing.

R14.   As a priority, establish data sharing agreements appropriate to the types of data, data uses and data owner requirements. These agreements could build on data sharing agreements already in place for EBM Working Group activities, accounting for the different requirements of a long term arrangement for EBM implementation.

R15.   Address issues related to data sensitivity by identifying appropriate levels of access and restrictions on use and stipulating these in data sharing agreements. This includes working with First Nations communities to develop data sharing agreements that address concerns regarding confidentiality and use of First Nations data.

R16.   Investigate opportunities for an umbrella data sharing agreement with the provincial government to allow access by all members to government corporate data.

R17.   Undertake an assessment of ways to 'create a level playing field' with respect to data sharing. This includes allowing for different technical capacities and data user needs when deciding on data formatting and distribution mechanisms. It also includes implementing measures to improve capacity for some data users, as necessary. Examples of capacity building could include training, and support and advice for technology upgrades.

4.2.4 Recommendations Relating to Technical Work

The technical work of the EBM Data Centre is guided by standards, policies and procedures established by the Governance Body. This includes priorities for technical work.

R18. Establish a Technical Committee to provide recommendations to the EBM Data Centre Governance Body on specific matters related to data management e.g.,

- Preparation of an information management plan

- Standard operating procedures, including data access and upload, data standards, security

- Recommendations on map service(s) and their operation

The Technical Committee can also act as a technical forum for data and technical issues.

Specific data work (e.g., data clean-up) is primarily the responsibility of the data custodian, but, where necessary, may be undertaken by members of the Committee or contracted to external service providers.

R19. As a priority, undertake local data administration, including assessment of available data and metadata and identification and resolution of data issues e.g., spatial data overlaps, gaps in data and metadata.

R20. Undertake dialogue with data custodians to promote consistency with standards for data and metadata. To the extent possible, data to support EBM implementation should be clean (GIS ready) and contain appropriate metadata and any other accompanying information (e.g., QAs, reports). Data should not be posted on the Data Centre server until it is GIS-ready and fully documented in metadata and data dictionaries.

R21. Provide a metadata template for data custodians that is easy to use and accessible. Appendix 2 provides an example of a simple template developed by the Ministry of Environment that could be applied to EBM data.

R22. Where possible, consolidate datasets into a single regional or sub-regional layer. Work with data custodians to promote consistency of structure for data from different sources. This will make it easier to consolidate data and prevent data users from having to do their own work to harmonize datasets every time.

R23. Establish a consistent process for reducing the size or complexity of datasets that would otherwise be difficult to use.

R24. To the extent possible, formatting of data should be compatible with the full range of data users, including data users of lower technical capacity. However, the priority is to provide an effective data management service and this goal should not be unduly limited by the technical capacity of some data users.

R25. Set up a system to allow voluntary uploading of site level data to create a 'data legacy' e.g., aquatic habitats, red and blue-listed plant communities, stand level attributes (see section 3.2.7). This process should be easy to use and based on existing programs e.g., entering polygons directly into VRI files using RESULTS. A familiar system that is simple to use will be more likely to encourage voluntary participation.

4.2.5 Recommendations Relating to Priorities for Data Work

R26. The site series surrogate representation (SSSR) layer is required for tracking of SSS representation (Objective 14 of the Coastal Orders). It is one of the more complicated layers required for implementation of the LUOs (see section 2.4.2). The following is recommended to facilitate the maintenance and use of this layer:

- There is one approved layer that is used by all EBM data users.

- There is one data custodian assigned to this layer, who is the only person who manages data updates and version control.

- The data is cleaned up and consolidated to the extent possible and issues resolved regarding the problems with the layer and the 'fixes' to be applied.

- All data users have a shared understanding of the limitations of the dataset and the implications of these limitations for analysis and decision-making. This includes a shared understanding of the appropriate scale for use of the dataset and what is and is not an appropriate use.

- Agreement is also needed about the timing of updates to the data layer and the types of updates that will occur.

R27. Prepare a strategic plan that sets priorities for completion of Vegetation Resources Inventory (VRI) and terrestrial ecosystem mapping (TEM).

R28. Undertake quality assurance testing of terrestrial ecosystem mapping (TEM) for the Coast. As the intention is to expand coverage of TEM and work towards achieving EBM objectives based on site series, it is imperative that practitioners have some sense of the reliability of the methods.

4.2.6 Recommendations Relating to Human Well-Being Data

R29. The following is recommended with respect to management of HWB data (from The Sheltair Group technical report on EBM Human Well Being Indicators)[7]:

- Development arrangements or agreements between the EBM Data Centre and data providers, identifying what data is needed, when if becomes available, any associated costs and the required level of data disaggregation.

- Archive data for the baseline year (2006), including all files.

- Consider a custom extraction of data from Statistics Canada.

R30. Work with agencies involved in the acquisition and processing of socio-economic data (e.g., Statistics Canada, Ministry of Education, Ministry of Health, Indian and Northern Affairs Canada) to design the acquisition and structure of data so that it is more useful for monitoring in the coastal planning region.

4.2.7 Recommendations Relating to Data Support for Coastal Communities

First Nations communities are integrally involved in the implementation of EBM. To be effective in this role, they need to be apprised of, and have opportunities to contribute to, the data and information in the EBM Data Centre. This includes data and information to help with decision-making in the territories.

Key issues are:

- Communities are seeking access to data and some do not have access.
- Communities are interested in sharing data and want to know what other data is available.

The magnitude of these issues is related to the technical capacity within individual communities.

R31. Dedicate funding to support one full or half-time First Nations Data Liaison person to engage in outreach with First Nations communities e.g., with resource practitioners and members of the Coastal Guardian Watchmen Network. The person hired for this position should have an

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[7] The Sheltair Group. 2008. *Ecosystem-Based Management Human Well-Bring Indicators: Technical Report.* Prepared for the Ecosystem-Based Management Working Group.

awareness of the various data in the EBM Data Centre; be able to assist communities with accessing data in the Data Centre or from other locations; and can assist communities with ensuring that information gathered by communities is entered into the system.

Some data, such as TUS data is unlikely to be shared but other data e.g., ecological data, may be well-suited to be available through the EBM Data Centre. If a regional monitoring strategy goes ahead, the Data Liaison person would provide support for housing the data/info coming out of that strategy (where appropriate).

This role requires more than assistance from a Data Centre manager; it requires someone to develop a long-term relationship with the communities and work with them to assemble information about data needs, communicate information about available data, train community members re data access etc.

R32. Create a Coastal Communities Data Repository as part of the Coastal EBM Implementation Library (see section 4.2.9). Design this Data Repository so that:

- it is easy to upload data and information;

- it is structured so that inputs can be summarized in a way that is useful to communities (e.g., traditional ecological knowledge);

- allows different levels of access, depending on the types of data uploaded and their sensitivity.

Build the Data Repository as a collaborative exercise with coastal communities. The goal is to create a system that promotes sharing of data and information but does not unduly burden people.

4.2.8 Recommendations Relating to Communication

R33. As a priority, complete a catalogue of available data and communicate this to the data user community.

R34. Develop and implement a process for ongoing cataloguing of new and updated versions of data on a continual basis. Ensure that the most up-to-date version of the catalogue is accessible to all data users e.g., through web-based live updates.

R35. Immediately notify all data users of updates to key datasets, as identified by the Governance Body or data custodians. In addition, regularly notify data users of new datasets.

R36. Hold a regular forum (every 1 – 2 years) where all users come together and discuss data issues.

R37. Where possible, involve data managers and analysts in planning sessions so that they know the context of requests for data and analysis.

4.3 Recommendations for Information Management

R38. Develop an interactive web-based information repository (a 'Coastal EBM Information Library') to allow the various participants in EBM implementation to post reports, data, audio-visual resources and other information on an ongoing basis.

The Coastal EBM Information Library would be much like a wiki, in that individuals can upload information to the site themselves or provide links to other relevant websites. The structure of the site should provide a user-friendly method for participants to upload and catalogue data by topic area or resource. The structure of the site should allow searching by geographic location, scale, topic area, and institution.

This site should not be limited to technical / GIS knowledge; it should be able to hold all useful information related to EBM.

R39. Develop a web-based map viewing tool that lets data users view and overlay map products on-line.

5.0 Implementation of the Data Management System

5.1 Steps in implementing the EBM and Coastal Communities Data Centres

5.1.1 Short-Term Priorities and Workplan

There are two priorities for data work post March 2009:

- To enable tenure holders to implement the Coastal Orders.

- To design and implement a data management system.

It is important that both of these priorities are addressed concurrently. There is a risk that the imperative of LUO implementation will divert energy and resources and that the existing system will continue, with all of its inefficiencies and limitations. In the long run this would be a more costly and frustrating approach for all parties. Also there is a risk that, the longer work on a data management system delayed, the more data owners and users will invest in working with the existing system and the harder it will be to shift to a new set-up.

Implementing a data and information system will require a committed effort and application of resources in the short term. Table 2 sets out a proposed workplan for implementing short-term priorities, based on the recommendations listed in sections 4.2 and 4.3.

Table 2. Proposed workplan for short-term implementation priorities

Outcome	Task(s)	Milestone(s)	Priority	Proposed completion date
Data management planning				
1. First planning steps	• Hold one or more workshops to discuss: – The structure and function of an EBM data management system, including relationship to the LRFs and AMSU – The formation of a governance body and technical committee – Priorities for implementing the data management system. – Resourcing the system in the short and long term The workshop should be open to all parties involved in EBM implementation, including representatives of First Nations communities, forest licensees (including the FSP Collaboration Group), environmental non-governmental organizations (ENGOs); other non-governmental organizations; and relevant provincial government agencies (ILMB, Ministry of Environment, Stewardship Division and B.C. Parks, Ministry of Forests and Range).	A Governance Body and Technical Committee established Agreement on the structure and function of the data management system. A mission statement and set of principles for the system. Set of short and longer term priorities identified. Short-term funding secured A preliminary workplan completed to March 2010 that sets out steps and priorities.	High	June 2009
2. Data sharing agreements	• Data users identify anticipated data needs • Data owners identify levels of data access for each dataset • Data users and owners work collaboratively to integrate data use and data security interests. • Establish data sharing agreements specific to data needs and levels of data access • Where possible, establish umbrella agreements e.g., for access to provincial corporate data	Workshop to integrate data use and data security needs. Completion of a data sharing protocol that sets out agreed principles and structures for data sharing Completion of data sharing agreements	High	Within 12 months

Outcome	Task(s)	Milestone(s)	Priority	Proposed completion date
3. Data catalogue	• Complete a catalogue of data, noting sources, currency, extent of coverage, and data limitations (see spreadsheet `Data to Support EBM February 2009 submitted with this report) • Technical Committee to advise on an ongoing system for cataloguing and communicating data updates	Completed catalogue of current data availability Process in place for updating the catalogue and communicating updates	High	Current data catalogue: May 2009 Cataloguing system: September 2009
LUO Implementation				
4. Agreement on use and updates to site series surrogate mapping	Hold one or more workshops to seek a mediated resolution on issues associated with the site series surrogate representation layer.	Agreement on site series surrogate data – how to improve it, how to proceed with its use in LUO implementation	High	Next FSP planning cycle
5. Process for integrating protected areas data into EBM planning	BC Parks and forest licensees meet to discuss collaborative information sharing related to tracking implementation of the LUOs.	Agreed-to process for information sharing; Protected areas data is readily available to EBM implementation	High	Next FSP planning cycle
6. Strategic VRI and TEM plan	Identify strategic priorities for mapping of VRI and TEM	Priorities identified	Medium	

Outcome	Task(s)	Milestone(s)	Priority	Proposed completion date
Other possible projects (subject to Governance Body approval)				
7. Information Library	• Governance Body to consider developing an Information Library. • If approved, Technical Committee (or contractor) to advise the Governance Body on technical options for a web-based Information Library.	Plan of action for implementing an Information Library	To be decided	
8. First Nations Data Liaison	• Governance Body to consider funding a position for a First Nations Data Liaison • If approved, secure funding and engage someone for the position	Funding secured and First Nations Data Liaison in place	To be decided	
9. First Nations Data Repository	• Governance Body to consider developing a First Nations Data Repository. • If approved, the FN Data Liaison to work with communities to define the needs and preferences regarding a data repository • Technical Committee (or contractor) to advise the Governance Body on technical options for a First Nations data repository, based on specifications from communities.	Plan of action for a First Nations Data Repository	To be decided	

5.2 Estimated resourcing needs

Resourcing of the EBM Data Centre is expected to be heaviest in the first 1 - 2 years and then taper off to a smaller annual cost. This work is already underway in the existing ILMB system.

Resource requirements are estimated as follows:

Human resources:

Position	Tasks	Resources required (first 12 - 24 months)	Resources required (long term)
EBM Data Centre Manager	Setting up the data server, data warehousing, dealing with data sharing agreements, data uploads and dissemination	0.5 – 1 fte	0.25 – 0.5 fte
First Nations Data Liaison	Assist coastal communities with accessing and sharing data	0.5 fte	0.5 fte
EBM Library Coordinator	Set up and maintain the Coastal EBM Implementation Library	0.25 – 0.5 fte	0.25 fte
Technical support	Ongoing support with data clean-up and consolidation. Note: this work is only necessary to the extent that data custodians are not providing data to agreed standards and formats.	1 fte	0.25 – 0.5 fte

Technical resources:

Data server costs (if out-sourced):

NW Data Sharing Network pays UNBC $10,000/year for server and care of the physical infrastructure. This is a partnering arrangement; commercial rates would likely be higher[8].

Process support:

Administrative support to coordinate Trust activities and external server, if that is the preferred option.

Funding for workshops:

$1000 each for venue, AV equipment and refreshments

$1000 - $1500 each for facilitation services, perhaps higher for mediation services.

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[8] D. Morgan. Executive Director, NW Data Sharing Network. Personal communication)

Appendix 1. Summary of data sources

Data can be broadly categorized into 'corporate' and 'local' data. Corporate data is a term to describe datasets that are managed in the provincial interest, although they may not cover the entire province. Local data is held regionally. A spreadsheet has been prepared to accompany this document that provides more detailed information on data to support EBM.

a. Land and Resource Data Warehouse

Provincial corporate data is managed by the ILMB in the Land and Resource Data Warehouse (LRDW), which is "the corporate repository for integrated land, resource and geographic data that supports a variety of business requirements for the natural resource sector, other government agencies, industry and the public" (http://www.lrdw.ca/).

Corporate data is prepared and managed to provincial standards. Some of this data is freely accessible. Some must be purchased from ILMB.

LRDW data includes:

- Data in the Provincial Baseline Atlas, including

    - Map data: Base map (1:250,000 and 1:2,000,000), Terrain Resource Information Management (TRIM) mapping, Corporate Watershed Base (CWB), Digital Road Atlas, raster base maps

    - Imagery: air photos, orthophotos, satellite imagery, gridded Digital Elevation Model (DEM) with 25m grid spacing, hillshade

    - Geospatial reference data (e.g., TRIM control points)

- Ecological classification: Biogeoclimatic Ecosystem Classification (BEC), Ecoregion Classification

- Forest inventories: Ministry of Forests and Range is the main custodian of forest inventories, but most Vegetation Resources Inventory (VRI), forest cover inventory and terrain mapping is held on the LRDW. Forest inventory held by Tree Farm License holders is proprietary and is owned and managed by the tenure holder (see below).

- Approved land use designations, such strategic planning zones, wildlife habitat areas and ungulate winter ranges, wildlife management areas

- Legal interests, rights designations, and administrative boundaries.

b. Individual government agencies (provincial and federal)

Various provincial government agencies manage specific datasets relevant to land and resources management at regional or local scale.

Provincial government data sources:

- The B.C. Conservation Data Centre manages data associated with provincially red- and blue-listed species.

- Ministry of Forests and Range are the custodians of some (non-TFL) forestry-related data such as forest cover data/ VRI, forestry and range tenures, terrain mapping, forestry roads, reporting on the economics of forestry activities (jobs, volume harvested, billing, etc). MoFR also manages non-timber forest products such as berries, salal, and mushrooms.

- Ministry of Tourism, Culture and the Arts

  - Archaeology Branch, manages data associated with Archaeological Overview Assessments (AOAs), archaeological sites, and traditional use studies (TUS). Typically, permission of the relevant First Nation is required before AOA and TUS data can be shared.

  - MTCA also manages commercial recreation tenures and data associated with management of the recreation resource.

- Ministry of Energy, Mines and Petroleum Resources (MEMPR) manages data associated with mineral and energy resources, permitting and tenuring.

- Ministry of Agriculture and Lands manages land tenure data other than tenures managed by the Ministry of Forests and Range, MTCA, and MEMPR .e.g., *Land Act* tenures, aquaculture tenures.

- Ministry of Environment,

  - MoE, Environmental Stewardship Division, coordinates inventory and mapping projects to meet their own stewardship mandate. Because they see that mandate being accomplished through EBM, they have geared funds to projects that will assist with EBM implementation.

  - Environmental Stewardship also manages the harvesting of wildlife and resident fish and associated permitting of resident hunting and fishing as well as tenuring of traplines, guide outfitting, and guided angling.

  - Environmental Protection Division gathers and maintains data associated with environmental quality and environmental management regulatory programs.

  - Water Stewardship Division manages data and information about water quality and use.

  - Parks and Protected Areas Division (BC Parks) maintains data and information specific to parks, conservancies and other protected areas.

- B.C.Stats prepares various profiles based on Statistics Canada data

- Ministry of Education maintains statistics concerning school enrolments and school district profiles.

- Ministry of Health maintains data on indicators of health.

- Crown corporations, such as BC Hydro, may also have data relevant to coastal planning.

- The Environmental Assessment Office

Federal government data sources:

- Data associated with anadromous fish assembled and managed by Fisheries and Oceans Canada

- Canadian Wildlife Service gathers and maintains data associated with wildlife, primarily birds.

- Statistics Canada assembles and manages Census data that reports on data related to population and growth rate, labour force, household income, economic diversity.

- Canadian Hydrographic Services e.g., bathymetry data

c. Proprietary data

- TFL data may be proprietary and only available through permission of the data owner. Data layers include forest cover/ VRI and terrestrial ecosystem mapping, where funded by the tenure holder.

- Proprietary cultural information is owned by individual First Nations or families within a Nation and is only available with written permission of the information owner.

d. Community data

Communities may generate and hold their own data, collectively or within individual coastal communities. For example:

- In 2008, Ference Weicker and Company were retained by an alliance of First Nations to undertake socioeconomic community survey to inform territorial marine use plans and to support other economic development initiatives in the communities. The EBM Working Group obtained permission to use relevant survey results related to human well-being indicators[9].

- The Skeena Native Development Society (SNDS) has been collecting labour market data in First Nations communities in the Skeena area since 1996 using proxy surveys.

Regional districts and municipalities maintain data related to land ownership, commercial activities, and zoning within their areas of jurisdiction.

e. Research institutions

Researchers with universities and other institutions may have data generated through their research projects.

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[9] The Sheltair Group. 2008. *Ecosystem-Based Management Human Well-Being Indicators: Technical Report.* Prepared for the Ecosystem-Based Management Working Group.

Non-governmental institutions may also be involved with synthesizing data relevant to the coastal planning area. For example, the University of Victoria produced a B.C. Atlas of Wellness in 2005 that assessed various indicators of wellness based on data from a wide variety of sources icluding Statistics Canada and Ministry of Health.

f. Ecosystem-based Management Working Group

Through its various projects EBMWG has generated new data, gathered pertinent data from other sources or synthesizes existing data into products that contribute to EBM (http://ilmbwww.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/project_results.html).

Appendix 2.   Sample template for metadata

The following metadata template is taken from a template developed by the Ministry of Environment in the 1990s. It is included here as an example and is not proposed as the definitive format. This example does not include a template for a data dictionary, although it is an important component of metadata.

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A.   Mandatory information

Data files must contain metadata to document the following:

1. TITLE   Short name for this data

2. DESCRIPTION   What kind of data is it ?

3. SOURCE   Where did this data come from ?

4. CREATION DATE   When was the data digitally captured?

5. ACCURACY   How well does this data represent the position of geographic features?

6. REFERENCE BASE OF   What base mapping was used to locate features?
    DATA COLLECTION

B. Optional information

Other possible key values are:

1. CUSTODIAN   What person or agency is responsible for updating this data set?

2. WARNING   Any warnings that users should see before they use this data.

3. HISTORY   What is the origin of the data? What are the important stages/problems/etc. in its history?

4. RESOLUTION   What is the minimum size of a unit or feature?

5. REGISTRY   How is it referred to in the corporate metadata repository?

6. MODIFIED   Date, agency or person, and how it was modified. For example: '07/09 (SSB) Add FCODE symbology'.'

7. FUTURE   What changes/additions/etc. are planned for this data and by whom?

8. DISTRIBUTION   What limitations/copyrights are there on distributing it?

Appendix 3. Roles and Tasks of a Governance Body for the EBM Data Centre

Proposed roles and tasks of the Governance Body are:

- Define a mission statement and set of principles for data management;

- Establish policies associated with its own governance structure and process, e.g.,

    - Agreement on custodianship of each dataset

    - Rules and regulations

    - Cost issues – do members and/or non-members have to pay for use of data?

    - External partnerships; non-member access

- Establish standard operating procedures, based on technical recommendations related to data access, security, and data standards e.g.,

    - Define sensitivities associated with proprietary data and identify data that is openly shared, shared with restrictions and not shared.

    - Joint agreement re levels of data access, how to be managed. Data only accessible to those authorized to see it, use it and, where applicable, change it.

    - Jointly agreed to standards for data and metadata and data lifecycle control, as recommended by the Technical Committee.

    - Agreed-to priorities for data clean-up.

    - How to deal with data that is not to standard?

- Establish data sharing agreements consistent with the levels of data access identified by data owners.

- Identify the recommended data layers for use in EBM implementation, their limitations and appropriate uses. This task applies to EBM-specific data (e.g., site series surrogate data, habitat suitability mapping); the management of most data rests with the data custodian.

    - What are the most suitable layers (and versions of those layers) for use in EBM implementation?

    - How will these layers will be formatted and updated and what attributes will be included, what layers to delete? Who will be responsible for this work? Once this is decided, data can be used by outside parties for analysis but not changed.

    - What are the limitations of the available data and how does this affect how the data will be used?

- What is the timing of updates, as required, for specific EBM Implementation data layers (e.g., site series surrogate representation layer)?

- Establish a process for capturing and cataloguing site level data.

  - Develop, and support the implementation of, a system for managing site level data that is identified on an ongoing basis e.g., during site reconnaissance, so that it contributes to the knowledge base over time.

  - Address concerns re sharing this types of data

- Establish an effective coast-wide communication system.

  - Develop, and support the implementation of, a method of communicating information on data updates and the data management system to the various data users.

- Plan strategically to address data issues.

  - Identify and secure funding for projects related to data to support EBM, on a priority basis. Examples of projects might include: set up an internet-based data sharing and map viewing platform, a process to improve local data administration, etc.

  - Undertake an annual review of existing and emerging needs and apply measures to address these.