

**Adaptive Management Framework for the Central and North  
Coast of British Columbia**

**Institutional Design**

**Final Report**

Report 1 version 3.0

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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.

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# Adaptive Management Framework for the Central and North Coast of British Columbia

Draft Report 1 version 3.0

Sept 2008

## 1 Executive Summary

This report is submitted in partial fulfillment of the terms of reference of project AM02b for the Ecosystem Based Management Working Group (EBMWG). An Adaptive Management Framework (AMF) for the Central and North Coast includes the following elements:

- a set of institutional arrangements to strengthen collaboration between provincial agencies and First Nations communities and organizations for EBM implementation;
- a summary of basic technical knowledge about Ecosystem Integrity and about Human Well Being in the region, structured to help organize and prioritize the needs for new knowledge, and with instructions for updating and expansion;
- a procedure for prioritizing efforts to acquire new knowledge (monitoring and research);
- processes for sharing knowledge and learning;
- a Guidance for Practitioners document that introduces these elements and provides direction for undertaking field studies;

In practice, this report recommends that an AMF should also include a funding mechanism to support high priority research that would otherwise remain unfunded. Of these components, the focus of this report is on the first item: Institutional Design. Further reports on other elements are forthcoming.

### Why Adaptive Management?

The legal Land Use Objectives and collaborative planning framework that have been negotiated over the past decade require tools for implementation of EBM. Adaptive Management provides a systematic mechanism to reduce disputes about the effect of proposed management strategies on key ecosystems and coastal communities. It also:

- Demonstrates implementation of consensus-based planning between First Nations and the provincial government;
- Provides cost-effective decision support to resource management at multiple levels and scales;
- Provides a structured way to organize and share knowledge in order to reduce management uncertainties and unanticipated issues;
- Positions British Columbia and First Nations partners as global leaders in resource management innovation.

### **What strategic issues will Adaptive Management address?**

- AM will help ensure that EBM implementation is directly tied to agreed Land Use decisions.
- Provides an organizational framework and processes for collaboration between provincial agencies, First Nations, local communities, industry and NGOs on monitoring, research and shared learning.
- Supports First Nations and local community involvement in land and resource related monitoring and research.
- Enhances the effectiveness of existing information and monitoring programs and links research evidence more closely to management decisions.

### **Implementing the AMF – Basic Structure**

- The Adaptive Management Framework assumes a continuing government-to-government forum for addressing policy matters and providing strategic guidance to operational management for Ecological Integrity and Human Well Being issues.
- A new Adaptive Management Support Unit engages and collaborates with First Nations, provincial agencies, industry partners, researchers and NGOs to:
  - Identify monitoring and research priorities
  - Assess technical and financial feasibility of priority research
  - Identify potential funding sources and support community level applicants for such funding
  - Coordinate delivery of research and monitoring projects
  - Maintain and share resulting information and knowledge
- A new funding mechanism supports high priority studies and other learning activities that cannot be funded from other sources
- Agreed process for identifying priorities for knowledge investments
- Ongoing mechanisms for collaborative learning and knowledge sharing

### **What will it do?**

The core functions of an AMF are delivering performance **information** relative to resource management objectives and strategies, **shared learning** about strategy implementation and effectiveness and **improved knowledge** of how to achieve Ecosystem Integrity and Human Well Being, as dual goals of EBM. An AMF will generate new knowledge and provide systematic information to managers to allow them to plan and implement initiatives for resource use and human well being more effectively. It will

- provide decision support for public, private, and First Nations managers.
- help managers to systematically reduce uncertainty in decision-making and better achieve EBM objectives.
- generate new information to allow managers to verify that plans are effectively implemented, and to demonstrate progress in reaching objectives.

- integrate a variety of knowledge-generating approaches, from monitoring to applied research, to better address EBM objectives over time.
- reduce conflicts and improve understanding of resource systems and human well being through consultation and knowledge sharing involving all resource interest groups and a variety of knowledge holders.

The AMF will not

- make management decisions
- make trade-offs between ecological and human well being objectives
- specify or change policies / objectives
- alter existing governance or regulatory frameworks
- impose additional reporting requirements on industry

### **Decisions Required to Implement the AMF**

**1) Mandate for an Adaptive Management Support Unit:** This report recommends that the following set of core tasks should be undertaken to implement an AMF.

- Interact with managers and knowledge holders at provincial, First Nations, community, and industry level to clarify planning objectives and management strategies in order to develop research priorities, and refer important gaps in objectives or strategies for decision by policy agencies (LRF, FN councils, local governments).
- Identify priorities for investment in knowledge generation to reduce critical management uncertainties.
- Collaborate in designing feasible and cost-effective studies that have been identified as priorities, if requested by resource managers:
  - valid and effective study design
  - selection of contractors or researchers to undertake proposed study (e.g. drafting of RFP, review of responses, qualifications, etc)
  - support for methodological review, work planning, liaison between managers and researchers, and technical oversight
  - review of draft reports and study results
  - interpret study results and assess operational implications for current practices
- Ensure that lessons are formally captured in a shared format, and that any implications for policy are brought to the attention of the relevant decision makers.
- Build and update a shared knowledge base about EI and HWB objectives and strategies through consultation with knowledge holders.
- Organize knowledge sharing opportunities at multiple scales (community, sub-region, industry, regional) to review results of AM work, improve shared understanding of key issues, and to build collaborative management. This may be supported by communications tools for different audiences such as briefing notes,

technical research summaries, annual reports and synthesis of monitoring data, developing specialized workshops and materials, case studies, etc.

- Build awareness of AM and capacity for undertaking AM work as a tool for EBM.
- Administrative requirements for delivery of these services: ensuring sufficient human and financial resources, evaluating performance of AMF itself, responding to changing community and management needs, special information requests from LRF, etc.

**2) Organization:** In order to deliver this mandate, this report recommends the formation of a small, special-purpose technical Adaptive Management Support Unit (AMSU). This organization would operate under the following principles:

- Relevant to EBM: the organization should focus on the land use objectives and strategies in G2G agreements and contribute to their achievement on the Central and North Coast.
- Collaborative: should engage different partners in sharing information and benefiting from gains in knowledge.
- Minimize costs: structure and operation should minimize the requirement for ongoing staffing.
- Build on existing organizations, skills and information: where functions essential to AM are already provided by other organizations in the province, be able to easily integrate relevant skills, information and expertise to benefit EBM.
- Build confidence and trust of all partners through transparent delivery of valuable services and information responding to EBM requirements.

This report suggests the AMSU be comprised of a small number of professionals (3 or 4) experienced in EI and HWB research and in facilitation, with a minimal administrative support staff to help with communications, budgeting, contracting, travel and logistical arrangements. Communications and coordination skills will be essential to their work. As the mandate requires a high degree of interaction with communities and responsiveness to emerging issues, the group should be based on the Coast and collaborate closely with existing FN and provincial resource management and local economic development agencies.

**Alternative delivery mechanisms:** Many crucial parts of this mandate are not delivered by any other organizations currently. Some existing organizations have the potential to deliver portions of this mandate, but would be constrained in doing so by a more limited scope (e.g. forestry only), or by broader responsibilities (e.g. province-wide), legislative or policy constraints (e.g. legislated mandates) limited resources or expertise. A crucial consideration is building trust: all parties must perceive that information generated by AM is accurate, unbiased and reliable if it is to be used as a collaborative basis for land and resource management. It may be easier to gain such trust and broad support for a new organization than creating a new mandate for an existing organization that is already perceived as representing particular interests.

**3) Institutional Context for AMSU:** An AM organization needs to be able to address issues related to both EI and HWB. Because multiple parties must have confidence in AM results, implementation needs to be impartial, transparent and rigorous. It needs to be cost efficient and financially stable over the long term.

### Alternative Institutional arrangements

- Provincial agency: a provincial agency could be set up to deliver the services of an AMSU on the coast or an existing agency could take on the responsibilities. The disadvantage is that it would be difficult to isolate from potential changes in provincial policy priorities that could influence annual funding, decision-making or organization. Provincial delivery would also make the delivery organization ineligible for certain kinds of philanthropic or external research funding.
- Other existing organizations: Other organizations also have useful skills and experience relative to the proposed mandate, but are judged inadequate for the AMSU role because of a narrow sectoral focus, an exclusive research orientation and/or non-neutrality.
- The recommended option is a Trust mechanism. This would provide a legal and financial framework for operational oversight of an AMSU as well as a research endowment fund. A Trust could receive funds from various donors to ensure long term support to AM. It could be set up in different ways.
  - a) Trust structured to receive and manage funds, but discretion over decision-making rests with a multi-party Advisory Board (analogous to current EBMWG) that gives detailed direction to the AMSU staff. The Advisory Board would decide on criteria for research prioritization and recommend projects to trustees for funding. In order to ensure that no interest group dominated decision-making, all would have to be represented. This will ensure ongoing oversight of monitoring and research decisions but also high transaction costs and time commitments by representatives from FN, environmental NGOs, industry and provincial government. Monitoring and research decisions will depend on the criteria and strength of arguments presented by Advisory Board members. AMSU would implement their decisions.
  - b) Trust structured to receive and manage funds and to specify the decision processes to be applied by AMSU in prioritization and fund allocation. The main difference is there is no decision-making Advisory Board. Research funding guidelines and criteria, and prioritization processes, would be specified in the Trust Agreement through mutual agreement of all parties. This gives very limited discretion to AMSU, but increases transparency in decision-making. The prioritization mechanism would ensure that changes in policies or land use objectives would automatically shift research priorities. Trustees would ensure that AMSU followed the procedures specified in the Trust agreement.

While a Trust could be used in combination with any other structure to manage funds (e.g. a Trust + provincial agency to administer AMSU), this would not deal with credibility and transparency issues. By specifying decision processes in a Trust agreement, all parties have a clear understanding at the outset of criteria and processes

for research funding. This simplifies implementation, builds predictability and transparency for collaborating resource management partners and for outside donors, and reduces transaction costs in implementation. It requires up-front negotiation of a Trust Agreement. Fig. 5 (p. 40) provides a graphic summary of recommended organizational arrangements and interactions with an AMSU.

## 2 Introduction: the task and contents of this report

This report was prepared for the Ecosystem Based Management (EBM) Working Group<sup>1</sup> by Adaptive Resource Management Ltd and associates. The project goal is to develop an Adaptive Management Framework (AMF), as a contribution to the EBM Working Group mandate of developing information to support full implementation of EBM on the Central and North Coast of British Columbia by March 2009.

The iterative approach to this project encourages the review and testing of framework elements during the development process. **The current document is a revised draft report, focusing only on the Institutional Design elements of the project.** A draft final report with including other elements will be submitted no later than November 2008.

The terms of reference for the project include the following deliverables for the Adaptive Management Framework to be summarized in this report (note that additional elements will be included in the final report):

1. *A recommended institutional framework for collaborative implementation of Adaptive Management (AM) in the Central and North Coast that meaningfully involves Provincial agencies, First Nations, local communities and stakeholders in AM planning, project design and implementation. The institutional Framework should also provide for collecting, delivering and disseminating AM information to relevant parties including First Nation and other local communities, resource managers, and Provincial and First Nation decision makers so that AM results are translated into improved knowledge, better management practices and appropriate policy changes.*
2. *A transparent methodology for allocating HWB and EI objectives and strategies to appropriate types of research and monitoring and ranking them in order of priority, based on criteria such as risk, uncertainty, cost, resolvability of uncertainty, influence of the objective on the goal, influence of the goal on other objectives, and other relevant factors.<sup>2</sup>*

A separate Guidance for Practitioners will explain how resource managers and users can undertake AM monitoring and studies. A Knowledge Summary will synthesize key elements of ecological and human well-being knowledge relevant to objectives adopted in G2G agreements, and demonstrate its application. The Knowledge Summary aids in assessing the need for different kinds of AM studies.

This draft report builds on a large number of previous studies relating to EBM and AM for the Central and North Coast, and will refer to these as well as to the published

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<sup>1</sup> EBMWG project AM02b

<sup>2</sup> From funding agreement, Schedule A

literature where relevant. This introductory section is followed by a brief explanation of the methodology followed by the consulting team. The core of the report is contained in sections 4 and 5, which respectively describe the characteristics and purpose of an AMF for the Central and North Coast, and propose an institutional design; that is, a set of collaborative relationships among existing organizations and with a new AM organization; a list of key tasks and roles and an organizational structure for delivery of the AMF. Section 5 will also include suggestions for communications processes, and make recommendations for how the AMF could be implemented. Appendices present a recommended prioritization mechanism for AM studies, and introduce considerations of climate change in the AMF.

### 3 Approach

The purpose of this project is to design and describe a practical framework for adaptive management that will contribute to the implementation of EBM on the Central and North Coast. Adaptive management is not new, but in many ways the scope of its proposed application on the Central and North Coast is unprecedented. The principles were elaborated by celebrated ecologist C. S. Holling 30 years ago (Holling 1978), and there have been many attempts to apply them in experimental and operational frameworks since that time (Lee 1993; Clogg et al. 2004; Allan and Curtis 2005; Price et al. 2005; Stankey et al. 2005). On the other hand, there have been few successful attempts to introduce formal adaptive management over an entire region, across multiple agencies and jurisdictions, involving the public and private sector as well as First Nations (Allan and Curtis 2005; Stankey et al. 2005). Large scale AM planning has been introduced in Australia (Bellamy 2005); and the U.S. Pacific Northwest (Bormann et al. 2007), but in neither case was human well being an explicit goal, nor First Nations a key user group.

The novelty and ambition of this goal was a key factor in the consulting team's approach. While the Ministry of Forests and Range (MFR), the Ministry of Environment (MoE), and some of the larger forest companies have experience with AM in their own operational settings, none of them has implemented an integrated AM framework for EBM, encompassing both EI and HWB objectives, over such a large and diverse region. For that reason, our approach to developing the AMF will provide numerous opportunities for feedback, both from formal advisors and decision-makers as well as from operational users at multiple levels.

The work to date has proceeded in several steps, commencing with a review of existing documents:

- Relevant land use plans and related guidance including ministerial orders, the EBM handbook, government to government agreements, and Land and Resource Management Plan recommendations; also including the Land Use Summary for the North and Central Coast Regions of British Columbia (a comprehensive summary and ordering of objectives, strategies, indicators from relevant land use documents)

- Relevant North and Central Coast background on adaptive management, including the Summary Report of the Ecosystem-Based Management Working Group's Adaptive Management Framework Development Expert and Practitioner Workshop, November 1 & 2, 2007.
- Relevant literature.

The team consulted with the EBMWG on preliminary ideas, and then interviewed 35 key persons from provincial government agencies, First Nations, local governments, research organizations, funding agencies, industry and environmental groups. These interviews sought to discover the experience of respondents with AM or related activities, understand the relationships between different organizations, and how these might be linked to the AMF. Special attention was paid to issues of collection and analysis of data, management reporting, applied research, communications and capacity-building. Interview data, together with iterative feedback from EBMWG members, formed the main input into institutional design. The institutional design was also informed by criteria for the AMF institutional framework, which were either implicit or explicit in the background materials and direction provided to the team. These are discussed in Section 5 below.

Parallel to production of this Institutional Design report, the the team will continue to share key concepts, institutional and procedural suggestions with groups involved in EBM implementation, and pursue additional information in response to feedback. The opportunities for consultation and engagement with these groups will depend on the parallel activities such as EBMWG pilots or regular meetings to which the consulting team can readily link. Further opportunities continue to be explored in the coming weeks and months. These consultation opportunities have included or are expected to include:

- Joint PIMC meeting Prince Rupert (July 24)
- Coastal FN – DSP working session: presentation and discussion of AM and proposed approach (July 29)
- AM03: EBMWG HWB pilots for FN coastal communities (community based monitoring)
- Bella Coola community forest HWB pilot
- EBM Learning Forum – October
- PIMC workshop - October

The AMF project will also link to other ongoing EBMWG studies, making use of relevant project outputs and helping to orient closely related elements in support of the emerging framework. These linked projects include:

- HWB baseline and targets
- HWB initiatives inventory and background
- Focal species habitat, risk assessment and co-location
- Ecological baseline and inventory
- Data management

- Old growth workshops

Linkages to most of these projects have been established and will be pursued as opportunities arise in the coming weeks, to gain additional feedback. Future reports will present the Knowledge Summary and application, as well as the Guidance for Practitioners document.

## 4 Adaptive Management for the Central and North Coast

In 2006, following Government-to-Government discussions that considered recommendations from the Land and Resource Management Plan process, the provincial and First Nation governments announced land-use decisions for the Central and North Coasts of British Columbia<sup>3 4</sup>. These decisions included an initial suite of land management and socioeconomic objectives along with a commitment to fully implement ecosystem-based management (EBM) by March 31, 2009. Ecological and cultural objectives are now reflected in land-use objectives in ministerial orders.

The definition of EBM found in Government-to-Government agreements includes an adaptive approach:

*Ecosystem-Based Management... means an adaptive, systematic approach to managing human activities, guided by the Coast Information Team EBM Handbook, that seeks to ensure the co-existence of healthy, fully functioning ecosystems and human communities.*

*Full implementation of EBM includes establishing a governance framework that provides an adaptive land use and resource management regime and that includes Government-to-Government collaborative agreements and structures and processes for ongoing stakeholder involvement<sup>5</sup>.*

Government-to-Government agreements also define adaptive management:

*"Adaptive Management" means a systematic approach to resource management that engages the Parties and stakeholders in structured, collaborative research and monitoring with the goal of improving land and resource management policies, objectives and practices over time...*

The EBM handbook (pp. iv, 24) provides further guidance about adaptive management:

*Due to the high values and scientific uncertainties involved, adaptive co-management and monitoring will play a key role in implementation, the goal being to refine knowledge and understanding...*

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<sup>3</sup> Anon. 2006. Land use planning agreement-in-principle (AIP) between Mamalilikulla-Qwe'Qwa'Sot'Em First Nation, 'Namgis First Nation, Tlowitsis First Nation, Da'naxda'xw Awaetlatla First Nation, Gwa'sala-'Nakwaxda'xw First Nation, We Wai Kai First Nation, We Wai Kum First Nation and, Kwiakah First Nation (collectively, the "KNT First Nations" or a "Party") and the Province of British Columbia.

<sup>4</sup> Anon. 2006. Land and resource protocol agreement between Gitga'at First Nation, Haisla Nation, Heiltsuk Nation, Kitasoo/Xaixais First Nation, Metlakatla First Nation, Wuikinuxv First Nation, (collectively the "Coastal First Nations" or a "Party") and Her Majesty the Queen in Right of the Province of British Columbia.

<sup>5</sup> Definition of "Full Implementation of Ecosystem Based Management ("EBM") by March 31, 2009" from Appendix I of EBMWG Adaptive Management Framework Development Request for Proposals: Background Information.

*Adaptive management is a formal process of “learning by doing”, where management activities are designed as experiments to test different management assumptions and hypotheses.*

There are many agencies already engaged in different aspects of resource management for the Central and North Coast. **An Adaptive Management Framework (AMF) will not change any of the current resource management, regulatory, operational or decision-making responsibilities.** It will not affect structures or processes of governance.

However, as all parties shift to Ecosystem Based Management (EBM) as a guiding principle, an effective AMF can support implementation, learning and adjustment. The outputs of an AMF are performance **information** relative to resource management objectives and strategies, **shared learning** about strategy implementation and effectiveness and **improved knowledge** of how to achieve Ecosystem Integrity and Human Well Being, as the dual goals of EBM.

The purpose of the AMF is **to support management decision makers at all levels, from field professionals to program managers to policy decision makers**, and to use evidence of performance in order to improve plan implementation. An AMF will reinforce the collaborative management decisions of multiple resource actors, not just the interests of a single agency or jurisdiction.

## **4.1 Why adaptive management for the Central and North Coast?**

Adaptive management provides a tool to build collaborative implementation of EBM agreements that have already been reached, reinforcing consensus-based planning involving First Nations and the provincial government. AM provides a systematic and cost-effective mechanism to reduce disputes about the effect of management strategies as they are implemented. It provides decision support to EBM managers at multiple levels and scales, from communities to forest industry, provincial agencies and government-to-government decision-makers. Ecosystems are complex and dynamic, and prediction can be difficult. AM provides a structured way to organize and share knowledge and to produce new evidence to reduce management uncertainties and unanticipated issues. Implementing a collaborative AMF would position British Columbia and First Nations partners as global leaders in sustainable resource management innovation.

## **4.2 What will an Adaptive Management Framework do?**

Implementing a framework for adaptive management on the Central and North Coast will help managers to tie decisions explicitly to land use objectives and strategies, and to provide shared evidence on the results of implementation. An AMF provides support for First Nations and other communities to become involved in land and resource

related monitoring and research. Implementing the framework would enable managers to better identify sources of uncertainty in decision-making in order to reduce that uncertainty and better achieve EBM objectives. Implementing an Adaptive Management framework will ensure that existing information and monitoring programs are used effectively, and link research evidence more closely to management decisions.

AM emphasizes the application of the tools and methods of science to build confidence in lessons. This increased confidence helps decision makers to apply learnings in new contexts, observers to validate results and professionals to make better judgments in the field. When implemented, the **AMF does not make decisions or trade-offs**, but produces and communicates information and new knowledge to help managers and policy makers take decisions more confidently and effectively.

The AMF provides a continuing platform for interaction between provincial agencies, industry groups, First Nations, environmentalists, researchers, local governments and civic organizations who have been engaged for more than a decade in the development of consensus-based land use plans on the Central and North Coasts.

### **4.3 Adaptive Management in Practice**

An essential part of AM is the management context. AM studies may involve the use of research tools and methods, but the purpose of AM is to better achieve management objectives by improving strategies, practices and decisions that managers take already. So the starting point in any AM practice is to understand the direction managers want to go, and what is known already about the best way to get there.

Setting objectives is the task of policy decision makers. In the case of the Central and North Coast, regional EBM objectives have been negotiated in the Government-to-Government agreements noted above (section 3). These objectives also refer to the Ecosystem Based Management Handbook (EBMH), which provides background rationale (Coast Information Team 2004a). For the set of EBM objectives related to Ecological Integrity (EI), the G2G agreements define specific strategies by which the background goals articulated in the EBMH can be achieved. The task of managers is to implement these strategies. For the Human Well Being (HWB) component of EBM, the G2G agreements mostly provide broad objectives, and leave scope for different communities to develop strategies to suit their context and preferences. These objectives and strategies provide the starting point for regional-level Adaptive Management.

But practitioners can use the tools of AM at an operational level, within their own company or community, to support local management decisions. The focus of this report is on the regional level to support implementation of EBM based on the G2G agreements, but we recognize that similar principles can be applied (and in fact, are

applied) by managers in the private sector or in communities on the coast.<sup>6</sup> Part of the intent of the AMF is to make it accessible to a variety of potential users, while still addressing the needs of the regional EBM process.

Adaptive management follows a series of logical steps (Box 1). Managers should ask some simple questions for each step. The challenge of adaptive management is not in posing the questions, but in finding low-cost, reliable and clear answers. Each step requires discussion and interpretation. Managers will benefit from engaging other knowledge holders in these discussions to clarify what the issues and uncertainties are. They need to be confident that monitoring or study results will produce reliable and useful new information. The discussion and interaction to build on strategic planning results and clarify knowledge, strategies and relevant indicators (or to interpret results of monitoring and research) produces one of the most important benefits of AM: consensus, trust, relationships and improved understanding between different user groups with a stake in the resource base. Knowledge holders who should be engaged in different steps of AM could include:

- Stakeholders with different world views
- technical specialists with a range of relevant knowledge (e.g. industry, consultants, government staff, NGOs)
- local experts or elders
- outside researchers
- other resource managers

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<sup>6</sup> For example, the City of Prince Rupert has developed an Adaptive Management approach to its land use and corporate planning; and Western Forest Products has run an adaptive management research program for more than a decade.

### **Box 1: Adaptive management steps**

- 1) Where do you want to go? Objectives are provided by policy decisions and strategic planning processes.
- 2) What information exists to help you make a plan? Don't reinvent the wheel: make sure to assemble available knowledge before you decide what to do.
- 3) What is the plan? Based on what you know already and the objectives that have been set by policy decisions, what should be done? This step leads to one or more clear strategies for each objective.
  - a) implementation of these plans should be measurable: select indicator(s) that are clear, relevant to what is known, directly affected by the implementation plan or strategy, and address the overall objective.
- 4) Where are you starting from?
  - a) what is the current measure of the indicator? How is it changing?

These elements are typically provided through strategic planning processes and baseline studies. For the Central and North Coast, objectives and strategies related to forestry and terrestrial ecological integrity are legally established. But for other resources, they are not well defined. And for Human Well Being, policy decisions allow communities to plan and implement their own strategies, rather than prescribing uniform approaches for the entire region.

Once these questions are addressed, further questions may be asked to improve effectiveness of management decisions:

- 5) Are you following the plan? Monitoring relevant indicators will confirm implementation. Failures are often caused simply by not doing what was planned. If this is the case, managers may need to ask why the plans are not being implemented, and what needs to change (Training? Tools? Enforcement? Or should the plan itself be modified?)
- 6) What do you need to know to improve the plan? Community members and technical experts already know a lot about how to manage resources effectively. But there may be some big uncertainties or question marks. What specific questions need to be resolved? Are these answerable through small-scale, or short-term studies, or would they require a huge scientific effort? How can you be more confident about what you know?
- 7) Are you getting closer to your objective, or is it slipping farther away? Monitoring outcomes will help to tell you whether you are achieving what you expected, but if you are not, monitoring does not explain why. Determining cause requires further investigation.

In summary, AM provides opportunities to learn from management decisions and to reduce uncertainties in implementing plans. One of the prerequisites for effective AM is that management objectives and strategies (plans) be clearly defined. Knowledge, whether from science or experience, about strategies and the mechanisms through which they operate should be made explicit as a way to predict the effects of management interventions. From these starting points, AM provides a tool for assessing the uncertainty of assumed causal relationships that underlie the strategies, and the consequences that failure of a strategy would pose (risk). To assess how likely it is that the plan might fail (risk), both current resource condition (indicator) and management direction must be described. Improved knowledge will be more valuable to decision-makers in cases where both uncertainty and risk (of negative consequences) are high. The implications of this are discussed further in Appendix 2, dealing with prioritization of AM activities.

Most of the time, if our knowledge base is good, things work out pretty much as we expect. When monitoring data is available, we can tell what has happened. Typically we learn that what we thought we knew was approximately correct, and we can report this and continue to use this knowledge with greater confidence. This situation requires only modest investment in any kind of adaptive management. But when there is high risk and uncertainty, AM allows managers to take decisions while reducing the uncertainty and clarifying what measures are needed to manage risk.

### **4.3.1 Communications and linkages**

Adaptive management is successful when it leads to changes in management strategies and/or to greater confidence in implementation. This requires interaction between scientists, other knowledge holders, and decision-makers to interpret results and management implications (Stankey et al. 2005; Bormann et al. 2007). The engagement of learners (managers and stakeholders) in understanding and contributing to the AMF is an important factor in successful learning and adoption of results. While this interaction is fed by knowledge inputs from quality research, the benefits come not only from science, but from the interaction itself. An effective AMF must provide various opportunities for shared learning and interaction that are appropriate to different audiences, and that bring different interests together.

### **4.3.2 Adaptive Management for Human Well Being**

The Coast Information Team collated available information on the various forest management strategies that would maintain a range of ecological values (Coast Information Team 2004a, b). For purposes of the AMF, this key scientific information describing cause and effect is summarized in a Knowledge Summary. Models of cause and effect will be integral to the Knowledge Summary.

In contrast, for HWB key components of adaptive management require development. There are fewer and less clearly defined objectives and strategies, less data available for key variables and no synthesis of cause-effect relationships to guide development of

strategies (Rubus EcoScience Alliance et al. 2007; Sheltair Group 2008). Much of the existing data is aggregated at inappropriate or inconsistent geographical scales and is therefore not relevant to communities. Much of the information needed for the Knowledge Summary has not been synthesized; some necessary information probably does not exist. Information can be summarized from relevant fields in the social science literature, however given the nature of social systems, experts tend to be less conclusive in terms of identifying cause and effect. Even when cause-effect relationships are well understood, it is hard to apply them to human behaviour because while there may be statistically valid relationships over a large group or a long time frame, individuals or groups are able to make choices and defy the averages. As a result, the predictive powers of social science are relatively low.

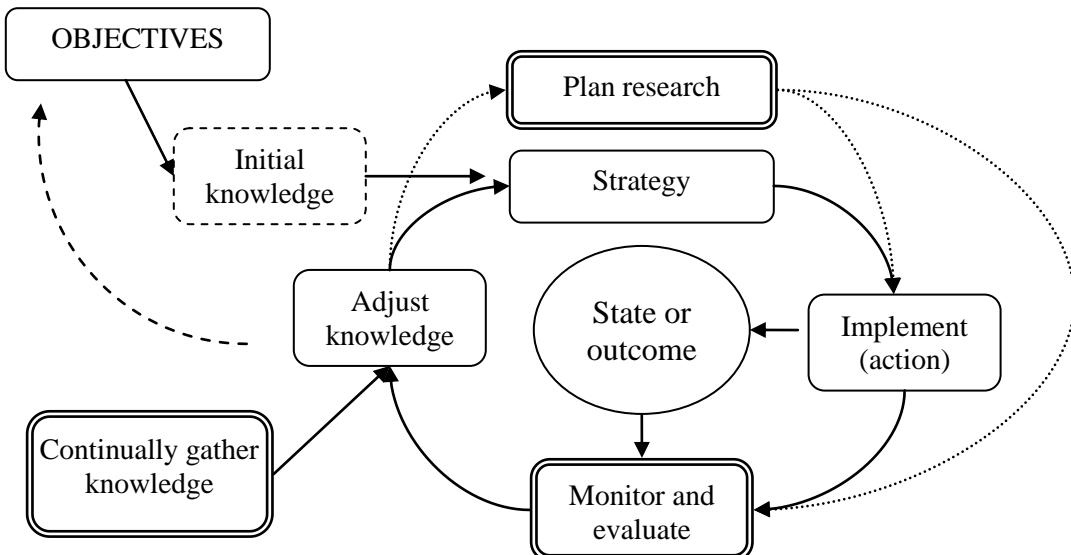
This does not mean that HWB requires a completely different process. The main principles of clarifying knowledge to design strategies and monitor actions are the same. But the value of experimentation or hypothesis testing is limited in the case of HWB because conclusions have lower predictive value in new situations. There is still an important role for AM in monitoring implementation and in generating and sharing knowledge about how different strategies perform, relative to their intended effects. AM also emphasizes the importance of using broader evidence and accumulated knowledge to guide strategies or explain outcomes. These differences have implications for how AM projects are designed and selected (Appendix 2).

#### **4.4 An Adaptive Management Process**

The basic elements of Adaptive Management can be generalized in a diagram as in Figure 1 below. Adaptive management is driven by policy objectives that are determined outside the process by decision-makers. In order to develop plans and strategies to address these objectives, managers must have an understanding of cause-effect relationships that are relevant to the problem. The knowledge to frame such understanding may come from personal experience, or from a variety of other sources. In order to undertake AM, conceptual models should be formally articulated. Strategies are framed by using formal predictive models (which can be as simple as a cause-effect statement or as complex as a large scale computer model). Such models are derived from cumulative knowledge, whether this is traditional, scientific or experiential (and ideally some combination of these).

Plans should identify specific indicators that measure the degree to which strategies are accomplished. An indicator should be simple to measure and define, directly related to the objective, and relatively insensitive to factors other than the management intervention proposed (Coast Information Team 2004a), p. 16). Strategies also should indicate targets for the relevant indicators, that are thought to lead to desired outcomes. Strategies can sometimes be interpreted as hypotheses to be tested.

**Fig. 1 Generalized Adaptive Management Process**



Strategies are defined to guide operations and management interventions. To implement these strategies might mean resource harvesting, development activities, ecotourism, construction, or other actions – perhaps undertaken by different organizations. Implementation monitoring provides evidence that actions are being taken as planned. In the diagram, double-wall boxes are AM learning activities.

Outcomes from the activity occur over time. In order to confirm that the strategies are effective, these outcomes are compared to the original intention (or hypothesis). If the knowledge base was good, and if strategies were implemented as designed, the outcomes will probably be as expected. There is no need for additional AM investment.

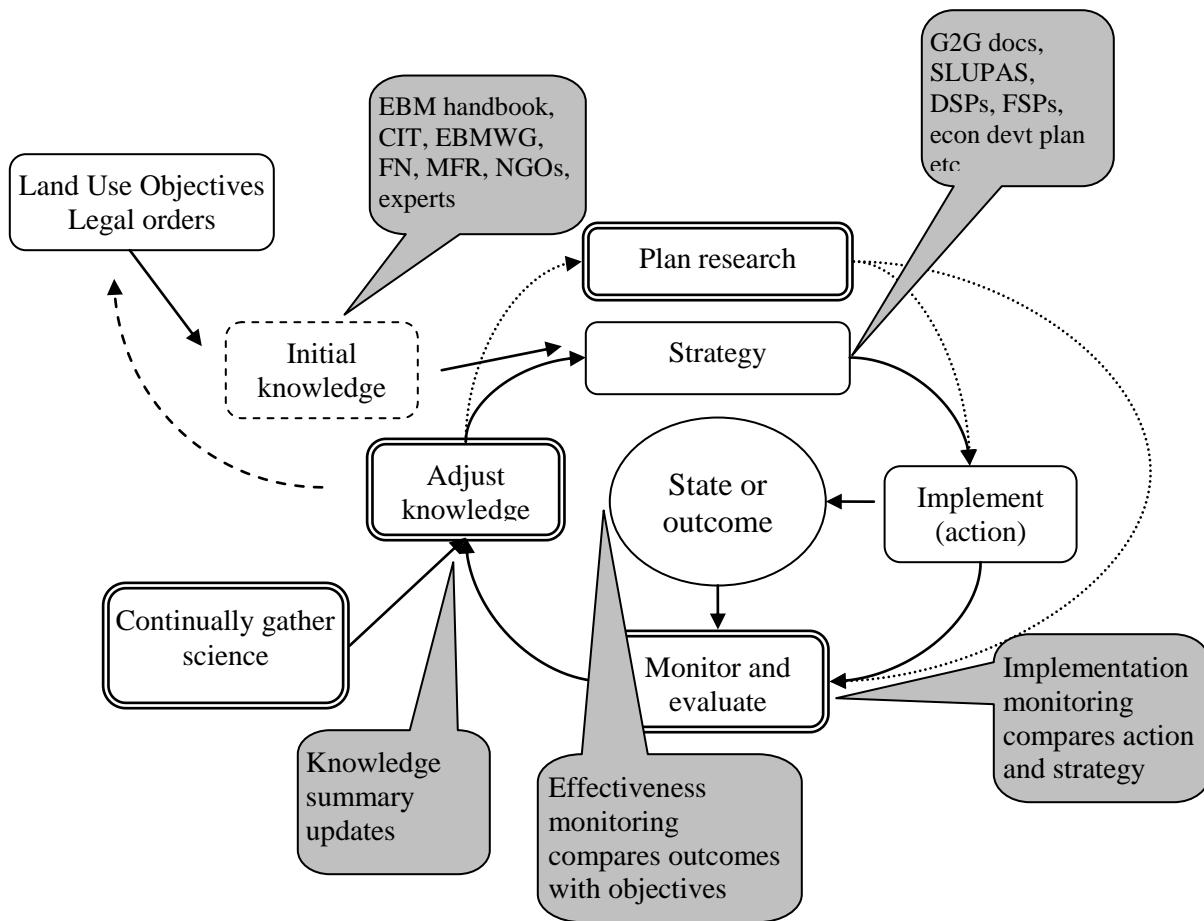
On the other hand, if knowledge is weak, then the knowledge base should be tested. If outcomes are unexpected, this suggests the need to challenge the original strategy and validate the knowledge used in its construction. In particular, it is important to determine whether the strategy failed or some chance event led to the unexpected outcome. It may be that the strategy was derived from faulty assumptions, or for inappropriate context, or that uncertainties were much larger than anticipated, and in order to achieve the objective a different strategy is needed. To determine the problem, and the knowledge needed to resolve it, consultation between managers, resource users and technical experts will probably be required. Specialized expertise may be needed to design a cost-effective research study. The results of careful research may lead to re-defining strategies, or even to re-thinking objectives, if no feasible strategies can be

found. In any case, the knowledge base is enhanced, shared and used for future decision-making.

But we don't have to wait for outcomes (for example, from large-scale harvesting activities) to know that there are higher uncertainties about some things than others. By creating explicit models to explain and predict what is expected to occur as a result of management intervention, uncertainties can be clarified at the outset. When the uncertainties are large, and the consequences of guessing wrong are also large, there is a need for further study (which might take the form of a small-scale experiment to assess outcomes, using the same process as above).

Figure 2 shows what AM might look like for the Central and North Coast, using examples of decisions, products and activities for the region. The Knowledge Summary is used to develop strategies and plans. It is updated and supplemented by technical experience and traditional knowledge. Strategies and plans are exemplified by the ecosystem management decisions of G2G agreements, by detailed Strategic Plans, Forest Stewardship Plans, economic development strategies and by experimental studies testing management options. These lead to activities on the land base, which are monitored and assessed to the extent that they deviate from expected outcomes. The results of monitoring and research studies to reduce uncertainties leads to updates and enhancements to the Knowledge Summary, with results shared between researchers, managers, and peers making other similar decisions.

This AM process can take place at multiple scales of geography and time. EI and HWB objectives are widely shared by organizations at different scales, from provincial agencies to local First Nations communities. Some strategies, particularly for EI are regional, while others, particularly for HWB, will vary by community or sub-region. The AM process, however, is similar for forest management plans at a regional scale, or for a tourism management plan for bear viewing in a single estuary and season. Key regional objectives, as articulated in G2G decisions and land use plans, can be monitored by aggregating results from different activity sources. Land use objectives are widely shared by organizations at different scales, from provincial agencies to local First Nations communities. Learning from adaptive management should be shared regionally to inform other management decisions at various scales.

**Fig 2. AM for the Central and North Coast**

This process is premised on the assumption that EBM will guide land use decisions made by all parties. Across different scales and organizations, there are shared goals and objectives, common strategies, shared processes and tools, shared implementation data, and a common knowledge base. In order to implement the process on the coast, funding and capacity will be required for the AM steps that are not already taking place. The framework includes a process to set priorities for planning, research and monitoring.

Meaningful engagement of decision-makers and stakeholders will be essential to the effectiveness of the framework. Information management, pooling and synthesis of data, and knowledge sharing opportunities must be designed to engage First Nations, provincial agencies, forest operators, communities and environmental NGOs. Different interest groups need to be able to use the products of the AMF in order to confirm their expectations of EBM and to determine how the approach can be made more effective. Processes and results must be transparent and accessible to build public confidence and user engagement. A major part of the implementation process will be building the capacity of user groups to access AMF information, design appropriate strategies, indicators and monitoring schemes, and to contribute results from their experience and research to the shared knowledge base.

While the framework is therefore not premised on central control or direction, it does require a certain amount of coordination, guidance and support. EBM introduces new objectives to guide operational decisions in resource harvesting and to support human well being. Adaptive management can provide a consistent framework to give managers better information and more confidence in decision-making, and make it easier for them to demonstrate progress in achieving EBM objectives. To make this system operational will require supportive and coordinated resources.

## 4.5 The need for baseline monitoring

In general terms, AM aims to

- fully monitor implementation of strategies
- monitor effectiveness at achieving objectives only where warranted, specifically where there is significant doubt about whether or not objectives are being achieved.
- promote validation monitoring to reduce uncertainty about the ability of strategies to achieve objectives.

In addition to implementation, effectiveness and validation monitoring, some circumstances require additional information to be collected by ongoing monitoring or by less frequent data collections. One circumstance is when information is needed to support planning, particularly when benchmarks or starting conditions need to be defined. Most baseline monitoring falls in the category of effectiveness monitoring,

which is very similar to defining starting conditions; some baseline monitoring is useful for determining benchmarks.

Clear objectives, required in the planning phase of AM, typically describe target conditions in comparison to some “reference” condition or “benchmark”. Most ecological objectives refer explicitly or implicitly to the range of natural variability as a benchmark. For example, objectives may include natural conditions explicitly—“maintain stream flow within the range of natural variability”—or imply natural levels—“maintain the diversity and abundance of grizzly bears”. In the case of HWB, “natural” reference conditions do not usually exist, so the benchmark is the prior condition or baseline.

In summary, in addition to collecting monitoring data addressing implementation, effectiveness and validation, data must be collected to set benchmarks and identify starting conditions where such conditions are not obvious. Natural benchmarks are unlikely to change significantly over time, however HWB benchmarks may need to be periodically re-assessed. Starting conditions, where unknown, only need to be collected once. However in the case of HWB, it may be useful to collect data over several years to determine a range of variability of starting conditions. Similarly where ecological systems are significantly altered beyond target levels, it may be useful to determine starting conditions.

Ongoing monitoring of effectiveness should use similar indicators as used to define starting conditions—they both measure the state of the system that is relevant to the objective. Effectiveness monitoring does not need to occur until a significant change in state is expected, based on management strategies implemented. Thus baseline indicators proposed in socio-economic reports should be evaluated to assess their usefulness as starting conditions. If they do not serve these tasks, one has to ask what purpose they do serve. Once objectives and strategies for HWB have been further developed at the community scale, the frequency of monitoring of socio-economic indicators can be better determined, based on the rate of change expected.

## 4.6 Supporting Engagement of Community Partners in AM

It is expected that existing organizations involved in resource management on the coast, including First Nations, provincial agencies, and the forest industry, will start introducing EBM and AM into their practices. This will not be a revolutionary process, as many elements of AM (especially EI strategies, some monitoring) are already in place. But there will be a need to explain the AMF, and to coordinate its various processes so that resource managers and users can access products and use them to improve management.

There will also be demand, especially in the initial phases, for training and capacity building, and to create forums for researchers, topic experts and local resource managers to interact around practical issues of monitoring and research design. These are tasks that should be part of the operationalization of an AMF. Without these

coordinating and supportive measures, some groups are likely to misunderstand the purpose and function of an AMF, and will be unable to successfully apply for funding, or to contribute results to shared learning. This will hamper implementation of EBM.

It will be particularly important for different groups (for example, social and natural scientists, forest industry, communities) to engage respectfully to develop clear management strategies, integrate local knowledge and expertise, and sort out relevant questions and methodologies for AM studies. While the Guidance for Practitioners document will introduce basic considerations relevant to adaptive management, it is unlikely to provide sufficient background for many high priority studies.

In addition to these important introductory training and capacity-building functions, any AMF will be based on high levels of communication to clarify changes to knowledge, share new lessons, and maintain data essential for monitoring G2G objectives. Different audiences will require different forms and degrees of communication support. Some are already highly knowledgeable about scientific and technical aspects of the research problems, but less knowledgeable about community issues and priorities.

Support for consultation and collaboration could assist in developing cost-effective monitoring to address key data gaps, identifying and framing research issues, exploring implementation mechanisms (e.g. collaboration with other First Nations, links to researchers with relevant skills, structuring research protocols). Collection of implementation indicators for key strategies is likely to require agreements and training on procedures, data management and funding. The AMF should also be able to link communities to alternative external resources for research or complementary activities, and provide support for proposal development in order to build local capacity.

Many of the regular tasks undertaken through an AMF (see Table 1, Section 5.2) will require special support in the case of FN communities. Some of these tasks may involve contractors or external resource persons, but the overall effectiveness of capacity building is closely tied to relationships, thus the development of durable long term relationships between the community and AM advisors will be crucial to effective adoption of an AMF.

Helping to clarify management strategies, identify implementation and effectiveness indicators, and support cost-effective monitoring and research in First Nations and other communities will facilitate EBM implementation. The AMF will also improve the quality and accountability of community management decisions by enabling monitoring and demonstration of outcomes that deliver on policies and plans. Information and knowledge sharing can spread good practices and build on positive experience. Initial support for meaningful FN community engagement in the AMF will be essential, but may decline over time as capacity and experience grow.

## 4.7 Benefits to First Nations Communities

An AMF cannot solve the serious social and economic challenges facing coastal First Nations communities, but it can help managers make difficult decisions on the basis of limited information. The Framework will provide FN communities with access to a broad base of knowledge, initially on Ecological Integrity, but gradually also on Human Well Being, and support linkages to knowledge on new topics relevant to achieving objectives and strategies as they arise.

The AMF should be responsive to community concerns, within the limits of its mandate to provide cost-effective information for management. For example, many First Nations already have, or are developing, plans for conservation or economic activity. These can be modified to use adaptive management, if desired, by following the steps outlined in section 4.3 (Box 1) above with support from the AMF.

Uncertainties can be reduced, and better predictions made of probable outcomes, with additional information or advice. For example, decision support could take the form of collecting existing information (literature reviews, consulting local and external topic experts); or conducting monitoring studies on high-risk activities being introduced. In many cases (especially in relation to forestry), baseline and monitoring data already exist for important strategic parameters, so there would be limited need for additional local data collection. However, when new data is needed it would make sense to engage local staff in its collection. If desired or requested, local monitoring and research could be supported by skilled experts who are also capable teachers, mentors and guides in order to build capacity.

Where implementation monitoring of land use strategies is needed to demonstrate compliance with G2G agreements, this could also be undertaken by community level resource managers and technical staff. However, most of these indicators have to be calculated from raw data available in GIS-linked digital data sets. In order to calculate the relevant indicator values to monitor plan implementation, community staff would require GIS skills.

Monitoring needs for HWB are not yet obvious. Proposed indicators for HWB can be constructed from Statistics Canada census data, but once again require GIS expertise to manipulate (Sheltair Group 2008). This data set is updated by Statistics Canada only every 5 years, and changes to definitions and geographical boundaries can render historical comparisons difficult due to the small size of the relevant communities. This means that in some cases, additional local effort may be justified to collect focused monitoring data. Such data collection could provide short-term employment (a few days) for local research assistants. Additional opportunities for short-term local or seasonal employment should be available as a result of EBMWG-supported experimental watershed research studies near several coastal communities, where assistance in data collection and local knowledge will be needed.

## 5 Institutional Design

This section of the report draws on the discussion above to describe tasks and roles in the implementation of an Adaptive Management Framework, and compares options for structuring and organizing the framework in relation to existing agencies with related mandates and responsibilities.

A fundamental conclusion of this exercise is that an AMF will require dedicated resources for coordination and support functions that are not now delivered in the region. We explore different choices for service delivery and introduce several options for how these resources could be organized, before recommending a preferred option. We pay particular attention here to the institutional and communications relationships with First Nations, as they adopt greater responsibilities for resource management on the Central and North Coast.

### 5.1 Institutional Design Considerations

The basic “shape” of an AM process is well documented in the literature and summarized in the previous section, but the details are complicated. For the Central and North Coast, there are already many different management decision-making organizations<sup>7</sup>. While the principles of EBM for the coast have been broadly established (Coast Information Team 2004a), legal objectives that could be enforced by the province are much more limited in scope. First Nations planning and enforcement will also respect the diverse customs and traditions of the different cultural groups and nations involved in collective agreements with the province. And while legal land use objectives may provide grounds for enforcement by either the province or First Nations, the adaptive management process itself does not seem to be a legal requirement.

The commitment to an AM Framework is premised on the definition of AM as an essential part of the EBM approach in G2G agreements. While there has been strong recognition and support for the value of the process in contributing to the agreed goal of EBM, its adoption and use are not assured. To have resource managers from diverse groups with contradictory interests adopt AM, it will be essential that AM demonstrably adds value to existing practices. It will also have to be implemented in a way that builds trust and confidence of partners.

Incentives to adopt AM will be vital, especially at the outset. There are four main incentives that should be offered to managers of natural resources and human well being:

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<sup>7</sup> This is one of the crucial distinctions between this AMF and most other AM processes that have been introduced in B.C. or the U.S. northwest over the past 15 years. Most of these have focused on management decisions made by a single large resource agency within its own legislative mandate (chiefly in the forest sector). But in this case, EBM addresses not only provincial forest management, but also resource management and human well being plans made by more than a dozen different First Nations, logging companies, tourist operators, and others.

- training, coaching and mentoring support to build familiarity and skills in AM, where this is needed;
- coordinated access to shared, synthesized, and updated monitoring data that is easily available to resource users and the public;
- funding for high priority monitoring and applied research studies;
- broad access to the results both of research studies and the deliberations of expert / manager / user forums.

Adaptive management emphasizes generating new knowledge through the application of systematic and scientific methods. The implementation process, however, has to navigate between parallel research risks: lack of rigour versus lack of relevance. On one hand, the science needs to be rigorous enough that the results of AM studies undertaken by any particular group will stand up to review by scientific peers, as well as to critical public examination by groups whose interests diverge from its sponsors. This does not mean that all studies have to use narrowly scientific methods, or produce replicable results. But the broader the recognition of the methodologies and validation mechanisms used in the inquiry process, the easier it will be to gain acceptance for the results and have them applied elsewhere. Careful technical and methodological assessment is important to avoid the risk that research results will be dismissed as biased or misinformed.

On the other hand, with an emphasis on scientific rigour there is a risk that local communities and resource managers are left on the “outside” of a learning process that has been captured by scientific and technical elites. The institutional design for an AMF should recognize and balance these opposing risks.

In order to achieve its intended objectives, any AMF must employ procedures that are widely perceived by all resource sector players to be collaborative, participatory, transparent, neutral and credible. It cannot be effective if the resulting monitoring, analysis or research is considered biased towards a particular perspective. Because of the long term nature of its mandate, it should also be able to accommodate change in political context: not only changes in elected governments at various levels, but also changes in the allocation of political rights for territorial management as these may evolve through resolution of FN rights and title. A long term AMF provides a platform for building on existing information and knowledge but can accommodate changes to governance structures, planning objectives and strategies over time.

Literature describing AM experience suggests two main reasons why AM fails: 1) a project-oriented management culture is more oriented to “getting things done” than to learning; and 2) government funding for long-term adaptive management is reduced as public priorities shift (Allan and Curtis 2005; Stankey et al. 2005). Appropriate institutional design can reduce the risk of both these outcomes.

In order to address the first challenge, managers must be sufficiently engaged to promote relevant studies and to develop confidence in results. They should have a role

in framing conceptual models (whether for Ecological Integrity or Human Well Being), defining hypotheses or problems for testing, and interpreting the results of studies so that results are useful to them (Marmorek et al. 2006). High-level political support for the process should provide clear direction to local governments, agencies and managers about their roles in its application. To address the second challenge, AM funding should be decoupled from short-term political priorities.

## **5.2 Support Services Required of an AM Institution**

An AMF should deliver three types of support services to managers in different organizations, at different scales ranging from the community up to the regional level:

1. Support monitoring and research to improve the knowledge base for EBM.
  - Support the clarification of management strategies and plans if required so managers will be able to demonstrate how they contribute to EBM.
  - Identify monitoring and research priorities that provide the greatest knowledge benefits for the cost involved.
  - Funding and technical support to monitoring and research, as required, to ensure results are reliable and can be widely shared.
2. Provide reliable information and facilitate processes to support EBM decisions by community leaders, resource managers, government agencies and First Nations governments.
  - Support interpretation and deliberation of results from monitoring and research with managers, knowledge holders and user groups representing different interests to build shared knowledge.
  - Facilitate linkages between knowledge holders and managers across different scales and organizations (e.g. through workshops, topic reviews, directories of expertise, etc).
  - Provide easy access to lessons from monitoring and research for a wide audience.
  - Update LRF on relevant findings and implications.
  - Respond to information requests from LRF, resource managers and communities.
3. Help build capacity of communities to engage directly in implementing AM in order to improve local decision-making.
  - Promote awareness and understanding of AM.
  - Respond to requests for information, clarification or assistance (including proposal development).
  - Help communities identify needs and opportunities for introducing AM.
  - Support training and capacity development.

To the extent that funding will be required to provide incentives for AM implementation and to support high-priority studies, transparent mechanisms for review, approval and authorization are needed to assure probity and accountability. But the intent of these tasks is to facilitate, not control, the effective implementation of an AMF in the region.

Not all AM studies will be funded through a coordinated AMF either. The task list outlined below anticipates that funding decisions may be made elsewhere by organizations with interests that overlap with those of coastal resource managers, such as research funding organizations or universities. Part of the reason that donors and research agencies may be interested in supporting high priority AM studies is that this assures them of capturing the attention of decision makers. An AM institution may assist local decision makers to connect with relevant research teams, both at the proposal development phase (when researchers are applying for funding), and at the results interpretation stage. In the case of First Nations communities, part of this facilitation role may be to assist the communities (if requested) in negotiating research protocols that safeguard their rights, traditions and interests.

### **5.3 Tasks for an AM Institutional Structure**

The list of work tasks below is premised on the description of an AMF in Section 4, and on the criteria outlined in sub-section 5.1 above. The tasks are numbered to correspond to the numbering in Table 1, which follows the text. The table summarizes the tasks and their rationale, and also identifies organizations that already have a similar mandate. Some of the tasks described below could reasonably be undertaken by multiple groups (communication, proposal development, contracting, fund administration), but others (particularly prioritization, funding, coordination, promotion, knowledge updating, data management) are most efficiently handled by a single organization. Most of these tasks can be described as *supportive*, in that they enable and coordinate the implementation of an AMF, while assuring quality and applicability of the results. Key tasks are:

1. Identify and communicate missing information from strategic planning and management inputs. This task can require considerable interaction between knowledge holders, managers and users. An AM institution may facilitate this interaction, or simply use results from planning processes.
2. An AM institution uses the objectives and strategies decided by responsible governance bodies, together with implementation monitoring, knowledge and relationships about strategies gained from science or experience, to identify priorities for additional information or special studies. The basic principle for this prioritization is that investments in knowledge will reduce uncertainties where they matter most (Appendix 2 describes this process in more detail).
3. Research studies that respond to these priorities should be designed interactively to determine answerable questions and the appropriate scope and scale of feasible studies. For example, in a study examining employment from community forest operations, the study design may or may not distinguish between local and non-local employment, between First Nations and non-First Nations employment, between job types, or likely duration /seasonality of employment, depending on the questions and application of results.

4. Once a research study is defined, a detailed proposal may need to be reviewed by local or outside experts or practitioners who have relevant knowledge and experience of the context, the topic, or the proposed methods.
5. Selection of contractors or researchers to undertake the proposed study requires both administrative skills and scientific or technical judgment (to ensure minimum requirements are satisfied). This task may be undertaken by various organizations funding or leading AM studies.
6. Interaction with the researcher will ensure timely and realistic workplans are developed, and will communicate essential background information, contacts, and methodological guidance. Progress reviews ensure that timing of products can be anticipated to fit in with other AMF elements (annual workshops, topic reviews, Knowledge Summary updates, complementary studies) and address unforeseen complications.
7. Provide timely review of draft reports as another quality control mechanism to increase the confidence of managers in the results, and to permit researchers clarify conclusions.
8. Discuss and interpret the results of a research study with operational managers. How would this new knowledge affect their current practices? Is there a need to develop recommendations for policy revisions to senior decision makers?
9. Add new knowledge to the Knowledge Summary. Knowledge Summaries for EI and HWB should be developed and maintained through contributions of managers and other knowledge holders in communities, provincial agencies, forest industry and other research centres.
10. Assemble and maintain data for monitoring tied to formally agreed objectives and strategies.
11. Build awareness and provide training for different user groups: some elements of training could be delivered by different groups, but the organization directly responsible for AMF implementation will be involved in needs assessment, content design, and relationship building with user groups.
12. Communicate lessons from adaptive management for different audiences (e.g. community workshops or conference materials, briefings for decision makers at different levels, management guidelines).
13. In addition to the delivery of adaptive management products and services, as described above, any organization will have to address internal maintenance issues: adjusting services to respond to community and management needs, ensuring sufficient resources and evaluating performance of the AMF itself.

**Table 1: AMF Implementation Tasks and Existing Mandates**

<b>TASKS – core functions of AMF implementation</b>	<b>Rationale</b>	<b>Products</b>	<b>Existing mandate<sup>8</sup></b>
1. Identify and communicate where regional planning and management inputs have not fully specified objectives and strategies	Shows that AMF is incomplete and can only be partially implemented	List of goals with missing objectives. List of objectives with missing or unclear strategies	EBMWG / consultants
2. Determine priorities for information gathering, monitoring and research (implementation / effectiveness / validation)	Regional resources for AM studies are limited, and decision makers want to ensure cost-effective allocation.	List of priorities for implementation monitoring. List of priorities for research to reduce uncertainty. List of priorities for effectiveness monitoring.	EBMWG / consultants FREP (for FRPA) Industry AM (for operational needs)
3. Interact with research users (managers, community leadership) and topic experts as needed to clarify AM study proposals appropriate to need	Topics must be developed into full proposals considering management relevance and research challenges.	Meeting notes Draft Request for Proposal Draft Unsolicited Proposal	None for G2G / MO's FREP (for FRPA) Industry AM (for operational needs)
4. Ensure AM studies are formulated to appropriate level of rigour and relevance	Ensure results are likely to be reliable and lessons relevant to management	Reviewers comments Final Request for Proposal Final Unsolicited Proposal	EBMWG (limited)
5. Administer award of research contracts and studies	Administrative	Contracts Payments	Various (EBMWG, MFR, FSP, FIA, SSHRC, etc) FN , Industry NGOs / foundations
6. Oversee implementation of studies	Advice and consultation if appropriate	Minutes from workplan development and milestone meetings	Universities (more like supervising a grad student than overseeing a contract)
7. Ensure peer review of studies if appropriate	Complex studies need verification	Reviewers comments Response of author Revised manuscript	Various (research programs, FREP, universities)
8. If needed, consult with managers and topic experts to assess need for changes in practices, regulations or policies as a result of AM learning	Implications of research results not always self-evident.	Minutes of meetings with managers and topic experts Recommended policy/practice options	FREP, FPB (for FRPA) Industry AM programs (operations) Community leaders (for HWB)
9. With lead researcher and other knowledge holders, interpret study implications for Knowledge Summary	Build and update Knowledge Summary for EI and HWB,	Revised Knowledge Summary	FREP FORREX Industry AM programs (e.g. WFP)
10. Maintain common information bases on agreed objectives, strategies and implementation, knowledge related to strategies, related studies and expertise	This knowledge base will be widely shared with actors throughout the region and needs to be reliable.	Knowledge Summary Completed Research Compendium Data sets	None
11. Share lessons from AM widely, and contribute to	Different audiences will be more effectively	Research Notes Publications	FORREX (partial) FREP, FPB (for

<sup>8</sup> For a description of organizations listed, see text following table

<b>TASKS – core functions of AMF implementation</b>	<b>Rationale</b>	<b>Products</b>	<b>Existing mandate<sup>8</sup></b>
forums for deliberation of management issues (e.g. CFCI, EBM Learning Forum, FREP communities of practice, TPI, RSP)	reached through different forums or communications mechanisms.	Workshops and conferences	FRPA)
12. Communications and outreach: explain AMF to users, help identify opportunities for managers to adopt AM processes and lessons; build partnerships	AM is not needed for everything but should be applied for EBM; other organizations can support process	Communications/awareness strategy Guidance to practitioners AM workshops Meeting minutes	FORREX (partial)
13. Ensure sufficient resources for AMF, research and information management to implement EBM effectively	Initial requirements will decline once experience is gained and participants can support knowledge sharing	Yearly Budgets and accounting to funders Effectiveness monitoring for AMF itself Meeting Minutes	None

### 5.3.1 Existing Organizations and AM Roles

The “existing mandate” column of Table 1 lists organizations that already have similar mandates for delivery of these tasks. These organizations fall into several categories: 1) the EBMWG, which has a temporary mandate and is actively engaged in preparing information for EBM implementation; 2) research and research administration organizations; 3) current AM practitioners, such as FREP and large forest companies; 4) communities and organizations who already play an active role in managing EBM objectives and related studies, such as for forest management or economic development; and 5) FORREX (the Forest Research Extension Society).

Researchers and research administration organizations may contribute to AMF implementation through their oversight and funding of relevant research studies. But their role in any AMF is likely to be limited for several reasons. First, they have broader research interests and different program priorities. Most academic researchers need to pursue a coherent research program that will build the interest of their peers and of their institution, and support publication to enable them to gain promotion and tenure.

Research funding agencies have their own program priority setting mechanisms, which cover a broader mandate than the coast. The Forest Science Board, which guides the FSP research program, has indicated in the past that they would be willing to manage an AM research program according to specified priorities, along with their regular annual Call for Proposals, if they were provided with the additional funding to do so.<sup>9</sup> FSP proposal calls rely on brief descriptions of priority research areas, with successful proposals selected for funding principally on the basis of scientific merit (proponents are also requested to consult the relevant FN). The selection process ensures that most

<sup>9</sup> Dr. W. Bourgeois, Chair of FSB, indicated an offer of this type was made several years ago but was not accepted by all parties at the time (interview 11 July 2008).

projects are awarded to experienced researchers. This process is intended to result in high-quality scientific work, but on its own, may or may not inform resource managers effectively. FSP has already funded AM research projects on the coast under existing programming priorities, and would probably do so again, if the proposal fit its annual priorities. These are determined by advisory committees comprising senior forestry practitioners and researchers from government, the forest industry and universities. Provincial policy priorities have not historically played a significant role in priority-setting.

The Forest Practices Board (FPB) supports continuous improvement in forest operations and management through audits of current practice in relation to FRPA requirements, and special studies of thematic areas that are relevant to FRPA implementation. The Board is becoming interested in EBM and AM as emerging forest practices.<sup>10</sup> Once in place on the coast, EBM implementation might be subject to an FPB audit on an experimental basis. FPB's knowledge of forest operations, regulation and evaluation mechanisms would probably be helpful to any AMF, through capacity building to regional forest managers and other AMF implementers.

FORREX implements the provincial Forestry Extension Program, funded in part by the Forest Investment Account (FIA). FORREX is also supported by industry partners and by close linkages to both forest researchers and practitioners. They specialize in services of interpreting and communicating research results for practitioners in the different areas of forest management, from ecology and silviculture to planning, harvesting and socio-economics. FORREX is more active with industry partners in the interior than on the coast, but their skills and background would be valuable in the planning and delivery of AM research results, capacity building, and practitioner support. They also have experience in building dialogues between researchers and practitioners.<sup>11</sup>

While all of these organizations have complementary roles to play in implementing an AMF, none of them are able to deliver alone the scope of services identified as part of an AMF in section 4.1. Effective introduction of an AMF will require not only research funding, but technical support for linking management strategies to EBM objectives, for developing monitoring and research proposals, and for interpreting results and updating knowledge summaries. It will require not only extension services in forestry, but also in community economic and social development and related aspects of HWB. An AMF will need to facilitate interaction to clarify knowledge between different sectoral interests (e.g. tourism, conservation, forestry, fisheries) across different scales and organizations.

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<sup>10</sup> Dr Bruce Fraser, Chair: interview July 9, 2008

<sup>11</sup> Ajit Krishnaswamy, Director FORREX Socio-economics program, interview June 19, 2008

## 5.4 Building on existing sources of information

Many different agencies collect information on the status of resource and ecosystem parameters already. Professional staff and community members have extensive knowledge of ecosystem behaviour and of field practices. Some of this information will be important for structuring existing knowledge relative to objectives and strategies. The AMF will not duplicate data collection efforts already underway. It will take advantage of expertise and of knowledge sharing mechanisms being developed by other agencies (see Fig 3).

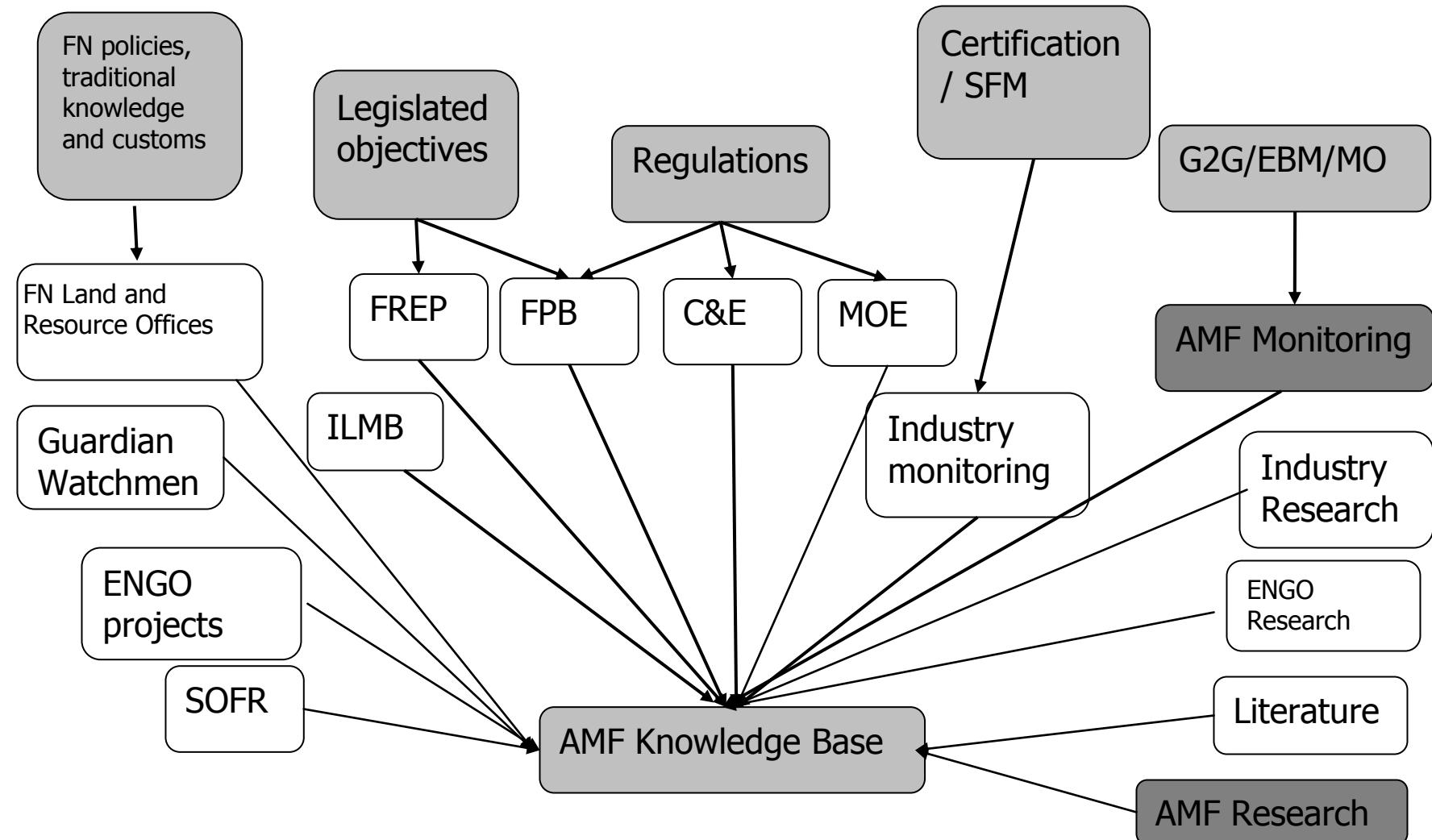
Research is conducted by several organizations that can provide important inputs to the knowledge summary and AMF. The MFR has research staff in Victoria and in the Coast Forest Region. The University of British Columbia and the University of Northern British Columbia have forestry programs and related natural sciences programs including focused research groups such as the Centre for Applied Conservation Research at UBC. In addition to academically oriented research funding programs (Natural Sciences and Engineering Research Council), government, university and private sector researchers can obtain funding from the Forest Science Program of the Forest Investment Account (FSP /FIA). Non-government organizations and the forest industry also participate in and fund research.

The provincial Forest and Range Evaluation Program monitors outcomes related to land use objectives set under the Forest and Range Practices Act. Most monitoring to date has addressed implementation of strategies, but new studies are addressing effectiveness. The provincial Compliance and Enforcement Program monitors compliance with regulations set under the same act, but focuses on operational, site-level issues. In a similar fashion, industry monitors practices related to objectives set by forest product certification bodies. Also recently, the Guardian Watchman program has begun monitoring, mainly related to aquatic ecosystems. The Forest Practices Board audits forest practices, using techniques ranging from implementation monitoring to research.

Information used for monitoring can often be extracted from existing inventories. The provincial government and, in some areas, the forest industry maintain inventories describing a range of forest attributes. The Ministry of Environment creates inventories of wildlife habitat.

Most of the recommended HWB indicator data is derived from Statistics Canada census information and updated every 5 years (Sheltair Group 2008). The EBMWG is jointly funding with Turning Point the development of community-based monitoring pilots to look at how alternative data might be collected cost-effectively at the community scale. Availability of HWB indicator data will be crucial to the application of an AMF to HWB objectives.

**Fig 3: AMF will build on existing sources of information and knowledge (EI illustrated)**



## 5.5 User Groups and Communications Mechanisms for AMF products

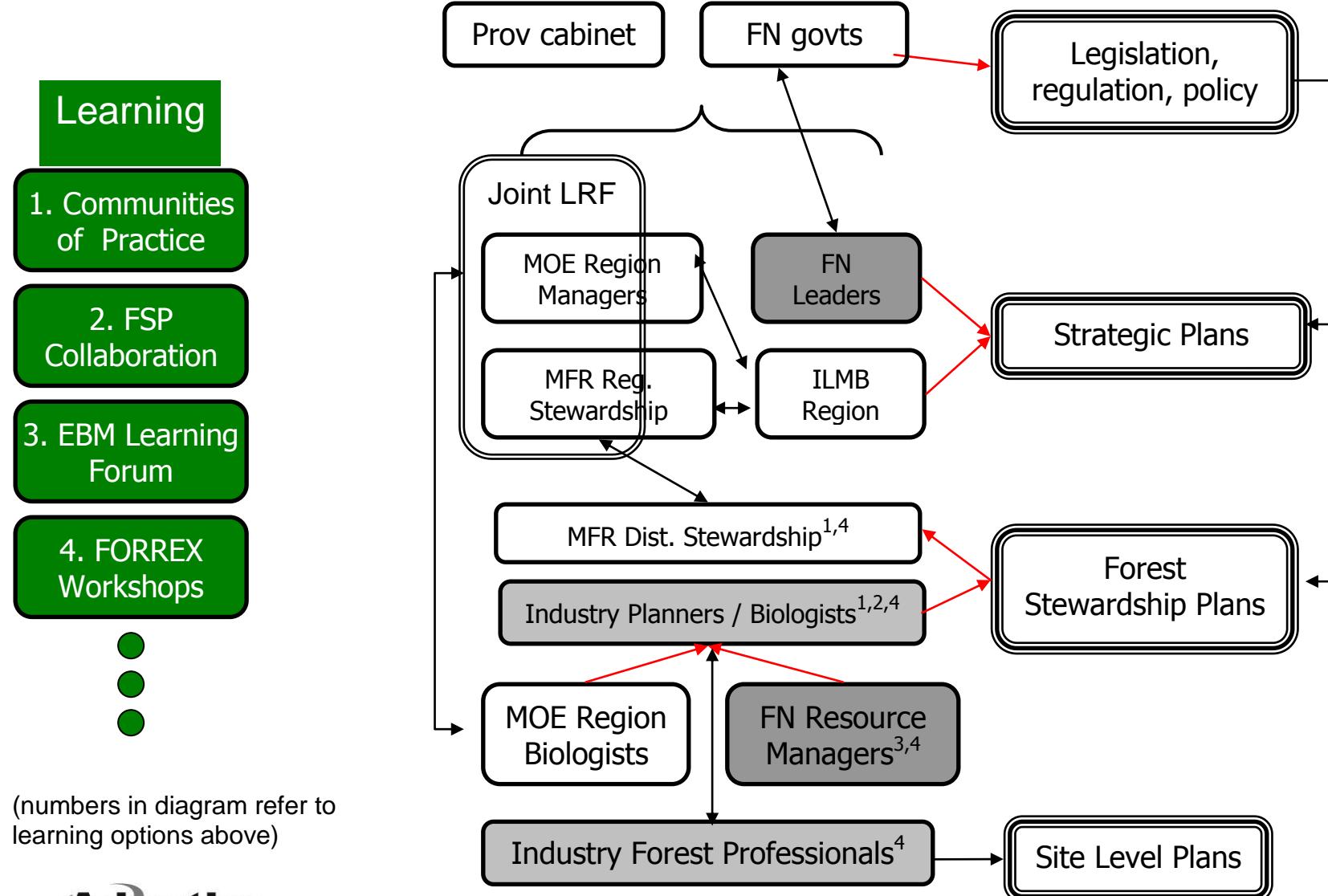
The most important outputs from an AM organization are priorities (identifying needs for planning, monitoring and research) and study results, particularly those that lead to expansion and revision of the Knowledge Summary. While research priorities will also be of interest to research organizations outside the coast region who might conceivably undertake relevant studies, the main users of AM information will be managers.

In terms of Ecological Integrity (EI), there are two target audiences: professionals who implement forest management strategies and plans (operational and landscape-scale) to meet legislated objectives; and senior managers and executives who develop policy and legislation (Fig. 4). Professionals can be divided into those most involved with operations (e.g., field foresters) and those most involved in Forest Stewardship Plans. The latter include industry planners and MFR District and Region stewardship staff and MOE Region Senior Biologists. Senior managers at the District and Region provide the link between the operational and policy levels.

Strategies to meet most of the legislated objectives are developed by industry and approved by MFR District. MFR District also sets local policy. MOE provides advice regarding strategies for habitat management. FREP checks on implementation of strategies. The Forest Practices Board (FPB) checks on FRPA implementation and in some cases effectiveness. Industry monitors certain values (mostly implementation indicators) to meet provincial reporting requirements or certification. First Nations Land and Resource Offices play an increasingly important role in strategic planning, management and monitoring, and in consultations on resource development.

There are a variety of existing mechanisms and processes through which the AMF can be designed to engage with these management decision makers (see Fig 4). A handful of examples are illustrated here. Footnote numbers in the manager boxes refer to numbered communication mechanisms along the left side of the illustration that are particularly relevant to those groups. Other communications mechanisms could also be employed, and the AMF will need to invest in special purpose products for awareness and capacity building among FN communities (see section 4.6 above).

For HWB, decision-making is located at a number of levels: local (Village and Municipal governments) and First Nations governments (including Band Councils and/or hereditary systems), Regional District, health and school districts and Provincial governments. HWB legal objectives are currently cultural and economic, areas in which First Nations governments are key decision-makers. First Nations initiate grant applications for economic development projects and community services, and have access to substantial funding for conservation and economic development through the Coast Opportunity Fund (COF). All of these factors point to First Nations governments as key potential users of AM products, and reinforce the need for support of the type discussed in section 4.6 above.

**Fig. 4 Communications and Information sharing mechanisms: examples for EI**

## 5.6 Adaptive Management Support Unit

The factors discussed in previous sections all point to the need for a small organization dedicated to ensuring coordination and support of AMF processes:

- scope of the tasks identified for AMF implementation (Table 1 above)
- number and diversity of organizations with which the AMF must interact
- data management responsibilities needed to support the AMF (see Appendix 3)
- liaison and communications responsibilities that are intrinsic to effective implementation.

We refer to this organization as the Adaptive Management Support Unit (AMSU). We see this as a lightly-staffed professional unit of 3 or 4 credible senior professionals with basic support staff, whose skill set bridges research and practice, with an emphasis on communications, facilitation, teaching and coaching (see Fig 5 below). This organization would not need to deliver all aspects of the AMF itself: it can contract expertise and skills from a variety of other organizations with specialized skills to support the process, as identified in Table 1 above. Initial core tasks, which may shift over time, include:

- collaborate with resource managers from the province and First Nations governments to clarify implementation monitoring needs and identify data sources related to coastal land use objectives;
- collaborate with regional and community decision-makers to clarify strategies, implementation mechanisms and monitoring approaches for HWB objectives;
- use prioritization mechanisms to identify priorities for research studies involving both EI and HWB;
- build HWB knowledge summary with knowledge holders and user groups;
- prepare information materials to explain and demonstrate the AMF to user groups;
- collaborate with communities to develop local AM plans (which may include guidelines for implementation monitoring, training local monitors and collecting indicator data in cases where it does not already exist);
- arrange contracts for specialized studies, training, synthesis and transfer of research results, etc;
- maintain communications with provincial resource management agencies, forest industry, communities, FN governments and environmental NGOs re: shared data for implementation monitoring, indicators, implications for strategies, and related planning issues to ensure information products, communications tools meet management needs;
- report to LRF and the public on status of EBM implementation.

Consideration should be given to how the location, equipment, profile and organization of this small operation can contribute to the land use and HWB objectives of the Central and North Coast agreements while effectively addressing its mandate (e.g. located in the North, employ or train FN staff, provide internet access to information, linkages to FN decision makers, etc).

**Fig 5: Adaptive Management Support Unit interactions with other actors (simplified sketch)**

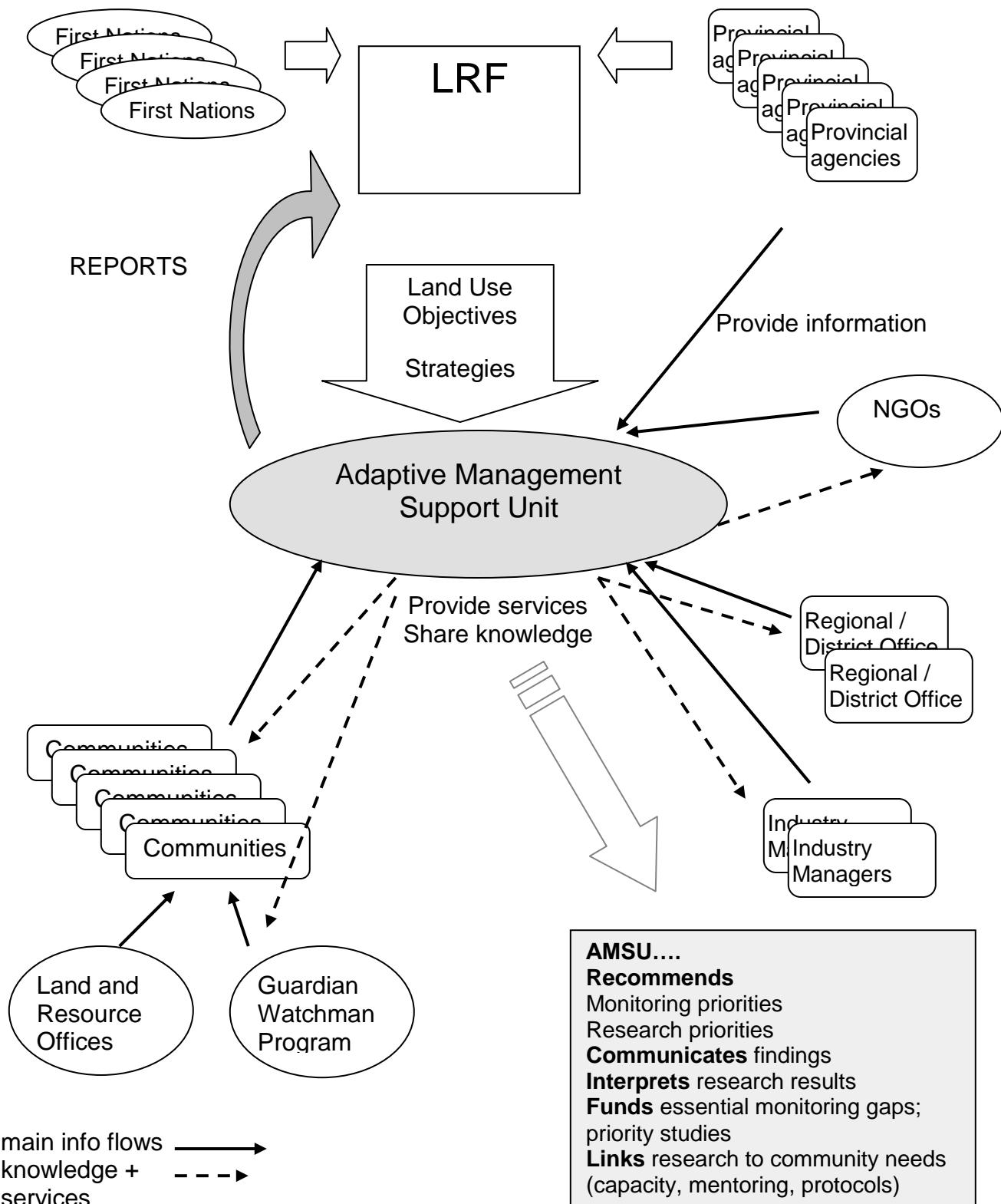


Fig. 5 provides a simplified illustration of the relationships between key players involved in EBM on the Central and North Coast. The AMSU establishes regional research priorities (see prioritization process described in Appendix 2 below). The AMSU also collects basic information from provincial and industry sources for calculating implementation indicators in accordance with the strategies already defined by land use agreements, and reports these to the LRF and all other parties. The AMSU updates a regionally shared knowledge base from information provided by independent scientific research (which may or may not be funded through the AMF), information provided by environmental NGOs, and from results of AMF-sponsored targeted research projects. The AMSU engages contractors to support information management, awareness building and capacity development among partners, and to produce specific information products as required by users.

The AMSU does not require any additional reporting by the forest industry, but makes use of existing data supplied to the provincial government. Neither does the AMSU impose any direction or regulation on any of the players. It shares information about EBM monitoring and new knowledge generated across the region, and, if needed, facilitates interaction of various resource managers and research groups linked to the AMF (e.g. industry with First Nations and researchers to interpret research needs and study results with operational managers).

The AMSU relies on information provided from a variety of sources, including from community level monitoring which may be undertaken by Land and Resource Offices or by Guardian Watchman organizations across the region. Similarly, communities are key recipients and beneficiaries of shared learning and management support and can request AMSU facilitation to link with external sources of expertise or research guidance.

The AMSU interacts with FREP, MFR Research Branch, and with District Forest offices to share knowledge, address questions related to EBM implementation and solicit expert advice for design and interpretation of research studies that may be proposed by other actors or identified as a high priority for AM funding.

The AMSU could actively seek and coordinate opportunistic support from a wide range of existing monitoring activities undertaken for example by industry and MFR, parallel research networks, large-scale research projects, and prepare proposals for competitive research funding of small-scale research projects.

The profusion of information arrows on Fig 5, and the many relationships between AMSU and diverse management organizations at multiple levels, should not be confused in any way with providing direction or influence over AMSU. The main tasks of AMSU are information management and communications. Some information is used to identify and recommend priorities for monitoring and research investment, but we recommend elsewhere that this process be highly transparent precisely to avoid any appearance of bias or influence on the AMSU by particular interests (see section 5.8 and Appendix 2).

## 5.7 Institutional Design—Structure

Consideration of organizational options for the AMSU are governed by a set of criteria derived from the nature of the framework and the key tasks to be delivered. These criteria include the following

- Relevance to EBM: the organizational structure should focus on the land use objectives and strategies in G2G agreements and contribute to their achievement on the Central and North Coast.
- Collaborative: should engage different partners in sharing information and benefiting from gains in knowledge.
- Transparent: processes should be open and self-explanatory. Selection of research priorities should not be guided by sectoral or political interests, but by greatest returns to investment in knowledge generation.
- Minimize costs: structures should minimize the requirement for the creation of new organizations or ongoing staffing, and should minimize the need for costly negotiation and debate at the implementation level.
- Build on existing organizations: where functions essential to AM are already provided by other organizations in the province, be able to easily integrate relevant skills, information and expertise to benefit EBM.
- Ability to pursue opportunistic funding from a variety of public or philanthropic sources for research or directly related capacity building.
- Build confidence and trust of all partners through transparent delivery of valuable services and information responding to EBM requirements.

Many existing organizations have useful skills, experience and expertise to contribute to an AMF, although none are presently constituted to deliver the type of services a collaborative AMF demands. These organizations can provide crucial services to the key actors who will use the AMF, such as data, training, oversight, communications, and facilitation services. They can also provide expert advisory assistance, or deliver independent research studies and special high-value projects in response to identified AM priorities. These contributions should be coordinated through the AMSU (Table 2).

**Table 2: Suggested roles of various agencies in relation to AMF**

Initiative	Type of resource contribution	Type of question asked	Potential link to future AM program	Constraints to engagement with AMF
FREP	Monitoring data and methods related to FRPA	Implementation and currently initiating effectiveness	Contribute to implementation monitoring of LUOs and	Current mandate is FRPA; limited overlap with EBM

Initiative	Type of resource contribution	Type of question asked	Potential link to future AM program	Constraints to engagement with AMF
			perhaps effectiveness monitoring	
MFR C&E	Monitoring data	Implementation monitoring (site scale)	Contribute to implementation monitoring of LUOs	Different mandate
FPB	Expertise, Joint research or studies of EBM	Mainly compliance and effectiveness	Shared research priorities could lead to FSP support for studies	FPB mandate limited to FRPA by legislation
FIA / FSP	Research funds Extension support	Priorities set by advisory committees	Funding?	Limited capacity for AM info mgmt, coordination, outreach
Guardian-Watchmen programs	One-the-ground monitoring-local staff and local knowledge	Variable	Local monitoring, likely in collaboration with coordinating researchers/AMSU	Local interest only Require funding, training, coordination
FORREX	Extension services Communications Research / practitioner dialogues	Most effective way to communicate research needs and results	Potential role in extension, communications, facilitation of research / manager interaction	Oriented to forest sector, will require additional resources

One alternative for housing an Adaptive Management Support Unit would be in the provincial government, either in a line agency responsible for resource management on the coast, or in an agency such as ILMB with planning and support functions. The skills and capacity for technical oversight exist in both cases, although the technical strengths of a line agency would be more narrowly focused. Both of these options have operational drawbacks. Even if set up as a neutral service agency, any AMSU would be subject to changes in government, policy or funding as provincial political priorities shifted beyond its control. This could compromise the ability of any provincial agency to deliver support, information and advice that are perceived by users to be impartial. The importance of building trust and confidence in the operation of the AMF cannot be overemphasized. For the same reasons, the AMSU could not be delivered by First Nations, the forest industry or ENGO's.

Another option would be to establish a new provincial Board, with oversight from senior provincial officials (e.g. Deputy ministers), and with an agreed mandate, to oversee the AMSU. This would have the advantage of creating some policy "distance" and greater perceived independence in the relationship with government. However, as there are no existing organizations of this type whose mandate includes the tasks identified above for the AMSU, it would mean creating a new government structure, with the attendant political and administrative costs. There might also be issues with transparency of decision-making if some party disputed Board decisions on research priorities, program support or investment.

Another drawback to provincial operation of the AMSU is that it would require annual budget and staffing approvals, which could place the operation at risk due to changes in fiscal context or organizational structure beyond its control. In addition, provincial delivery renders the organization ineligible for certain types of research or philanthropic funding.

We recommend instead a trust mechanism to oversee the operation of an independent AM Support Unit staff, reporting to trustees and the LRF.

## 5.8 A Trust Mechanism: two options

A trust is a legal device that imposes a set of rules on the ownership of property. The original owner(s) draw up the rules, and hand the property over to a trustee(s) who is duty-bound to follow those rules, subject to enforcement by the courts. In the case of an AMF, the trust is not for the benefit of individual beneficiaries, but for a named purpose that would benefit the broader community. Such trusts must have a purpose that the law considers to be charitable. Here, the charitable purpose is impartial monitoring and research, and dissemination of information to assist EBM. A Trust can receive and manage funds from multiple sources either in the form of endowments (where only the proceeds can be used for operating purposes) or grants. This provides flexibility to pursue the broadest range of opportunistic funding related to learning priorities from research bodies, foundations or other governments. An Adaptive Management Trust could be established in two different ways, with very different operational implications.

### **5.8.1 Option 1: Trust provides financial oversight only**

In one case, the Trust could be established in a similar fashion to the EBMWG Sub-trust. It provides a mechanism to manage an endowment from the Coast Sustainability Trust in order to conduct research and provide information leading to the implementation of EBM. This kind of trust would be somewhat analogous to provincially-created land management trusts in British Columbia, such as the Muskwa-Kechika Trust Fund<sup>12</sup> or the Columbia Basin Trust,<sup>13</sup> which were established by legislation to allocate endowment revenue through the political process of regional advisory groups. In each case, funds are allocated by an advisory body that has effective decision-making authority, and are disbursed by a trustee on the recommendation of that advisory body. This mechanism provides the advisory body with broad flexibility to make decisions and provide oversight. However, it also requires that advisory committee members devote a good deal of time to deliberation, and it runs the risk of having some decisions dominated by narrow political interests or the personal biases of experts.

This mechanism may be appropriate if political considerations should be paramount in decision-making, or if the process and substance of decision-making are difficult to predict in advance and must be able to respond flexibly to changing contexts. In cases of this type, the decision-making process can be time-consuming and needs adequate resources.

In our case, discretion over decision-making would rest with a multi-party Board (analogous to current EBMWG) that provides detailed direction to the AMSU staff. The Board would decide on criteria for research prioritization and recommend projects to trustees for funding (process analogous to current EBMWG operation). In order to ensure that no interest group dominated decision-making, all would have to be represented. This will ensure ongoing oversight of monitoring and research decisions but also high transaction costs and time commitments by representatives from FN, environmental NGOs, industry and provincial government. Monitoring and research decisions will depend on the criteria and strength of arguments presented by Board members. AMSU would implement their decisions. Trustee(s) would disburse funds as directed (see Fig. 6 for illustration).

### **5.8.2 Option 2: Trust specifies prioritization mechanism**

For an Adaptive Management Framework, the need for decision-making is quite limited: prioritization of monitoring and research requirements and allocation of available funding to support monitoring, research, knowledge updates, information sharing and capacity development. If the intent is to have these decisions based mainly on considerations of scientific evidence and management relevance, as recommended in Appendix 2, the decision process can be constrained quite narrowly in the Trust Agreement itself.

The main difference from Option 1 is that no decision-making Board is needed. Administrative decisions (such as hiring or operational budgets) are recommended directly by AMSU to trustees or to LRF for direction to trustees. Research funding guidelines and criteria, and prioritization processes would be specified in the Trust Agreement through mutual agreement by all parties. This would give

<sup>12</sup> [www.qp.gov.bc.ca/statreg/stat/M/98038\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/M/98038_01.htm) and [www.muskwa-kechika.com/trustfund/](http://www.muskwa-kechika.com/trustfund/)

<sup>13</sup> [www.qp.gov.bc.ca/statreg/stat/C/96053\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/C/96053_01.htm) and [www.cbt.org/about/main.asp?fl=2&pg=history](http://www.cbt.org/about/main.asp?fl=2&pg=history)

very limited discretion to AMSU, but would ensure transparency in decision-making. The prioritization mechanism links changes in policies or land use objectives directly to new research priorities. Trustees are legally obliged to ensure that AMSU follows the procedures specified in the Trust agreement, but could not direct specific research priority choices.

The advantage of this option is that it removes personal or political bias from the decision process. The settlors of an Adaptive Management Trust (the contributing members of the Trust) negotiate in advance the process for prioritization, and write it into the Trust document. AMSU staff follow the specified process, develop priorities, assess feasibility and prepare recommendations for funding of AM activities. All parties know in advance how the decisions will be made. Disputes over priorities are reduced. External donors can see how research priorities arise. This simplifies implementation, builds predictability and transparency for collaborating resource management partners and for outside donors, and reduces transaction costs in implementation. Only if all parties agree to revisit the Trust agreement can its mechanisms be altered.

An Adaptive Management Trust would provide procedural guidance to the staff of an Adaptive Management Support Unit. Oversight would be provided by trustees, but information reporting and policy recommendations arising from AM work would go directly to LRF. Should they choose to do so, industry, government and/or environmental NGOs could second staff to the AMSU to support start-up. Note that staff secondment would only be a reasonable option if the mandate and decision processes of the AMSU were agreed in advance by all parties (i.e. through a Trust Agreement) so that there would be no scope for outside influence on AMSU processes and decisions.

This structure could also benefit from two advisory groups comprising scientific experts and community representatives. Their tasks would be to assist the AMSU in reviewing proposed AM activities for scientific quality and local relevance respectively. They would not be decision-making bodies, but they would provide an independent assessment of the scientific quality and local relevance of the different AM projects that the AMSU would be submitting for funding support by the Trust.

While a Trust could be used in combination with any other structure to manage funds (e.g. a Trust + provincial agency to administer AMSU), this would not deal with credibility and transparency issues. By specifying decision processes in a Trust agreement, all parties have a clear understanding at the outset of criteria and processes for research funding. It requires up-front negotiation of a Trust Agreement.

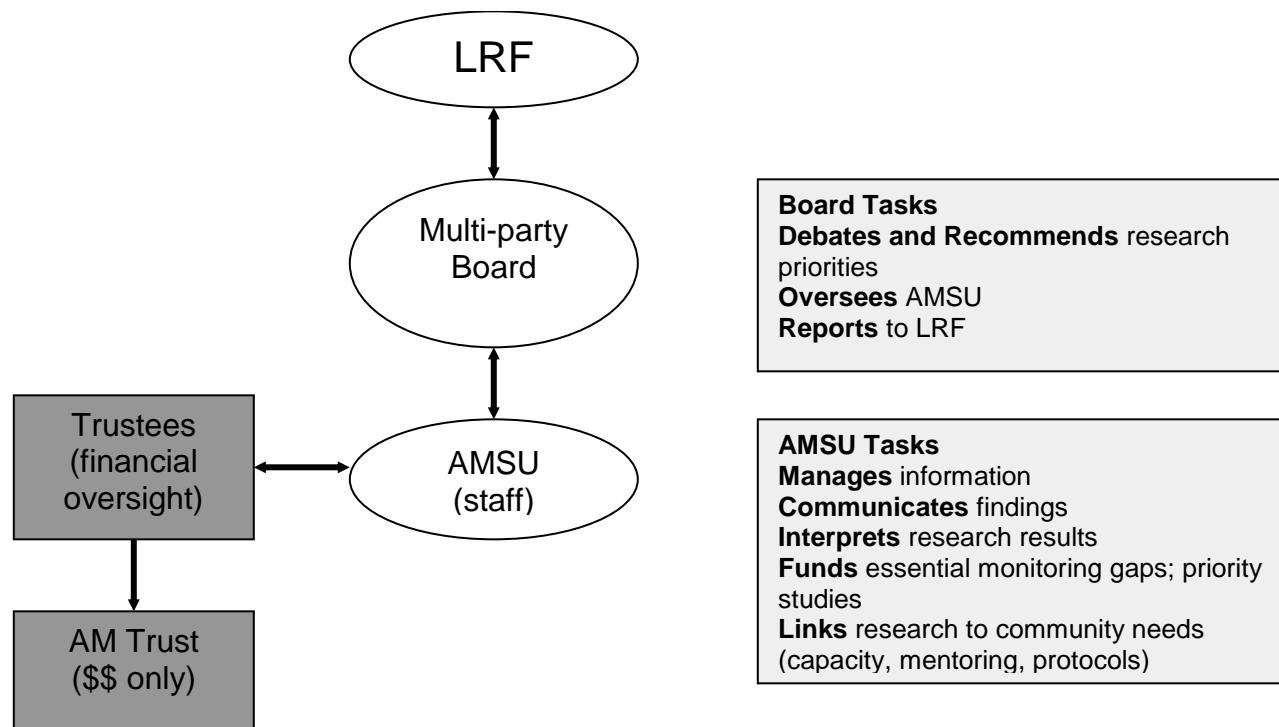
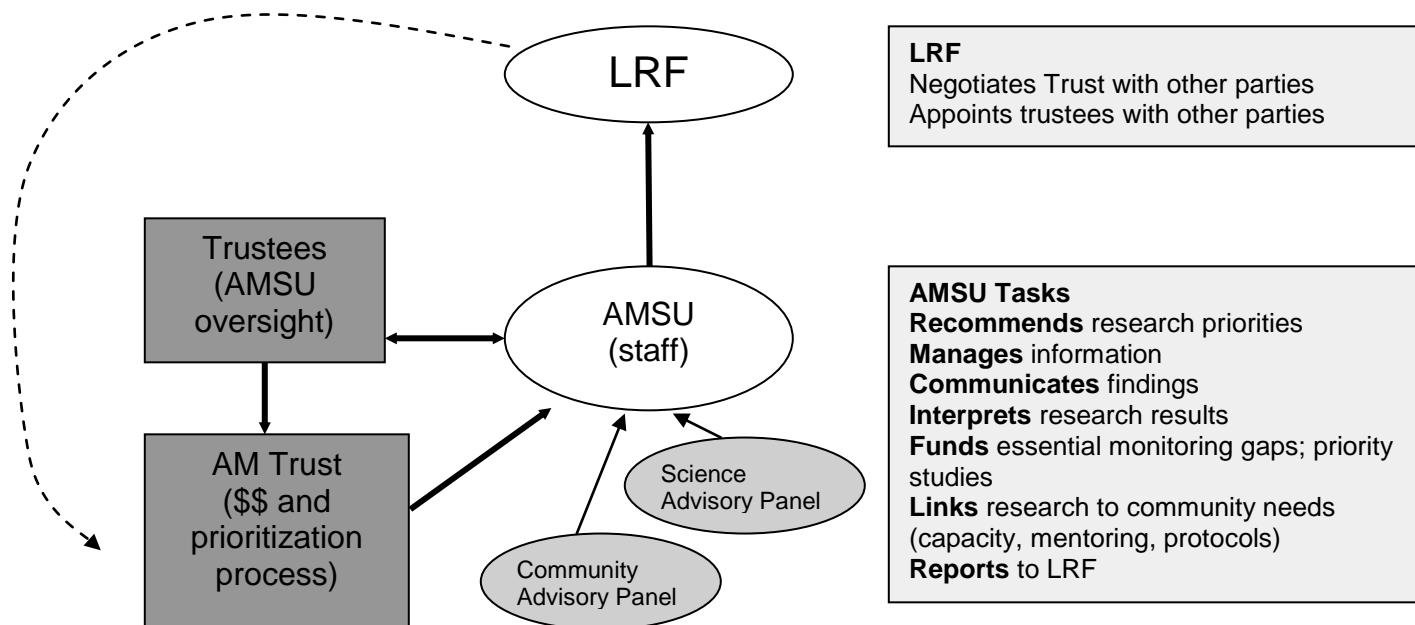
This kind of regional trust mechanism that guides decision-making has been recently recommended by the Skeena Independent Science Review Panel, to be applied to adaptive management of Skeena fisheries across multiple government organizations (Walters et al. 2008). A similar mechanism has been in use for the past four years for adaptive management by the Babine Watershed Monitoring Trust (Price et al. 2005).

The Babine Watershed Monitoring Trust was designed to meet three specific criteria agreed by the participants (private ecotourism operators, forest industry, provincial government and environmental NGOs):

1. allow diverse and conflicting interests to participate in monitoring, assured that no one of them could control the decision-making or results;
2. ensure that the selection of monitoring and research projects and their results would be impartial, reliable, transparent and freely available;
3. apply scarce monitoring resources to those plan objectives that were most at risk.

The participating organizations considered several possible structures, but none were seen to meet these criteria. By organizing as a trust, the participants ensured that trustees could not make decisions based on personal interest or preference. A durable trust agreement could be crafted with flexible terms that met monitoring governance needs but which would not be shaped by political pressure (Overstall 2007).

**An example of how knowledge and judgment of uncertainty and risk can be used to determine the need for monitoring or research is provided in Appendix 5.**

**Fig. 6. Trust Options****Trust Option 1: Financial Mgmt Only****Trust Option 2: Specifies Prioritization**

## 6 Funding an Adaptive Management Framework

The financial requirements for an AMF were not part of the consulting team's Terms of Reference, so no detailed costing of operational or research requirements has been undertaken. The recommendations above, however, make it clear that resources will be needed to set up even a small support unit. In addition to operating costs, two other resource categories will be important for the implementation of an AMF: funding for high priority research activities that would otherwise not be funded; and support for communications and capacity development.

There are a variety of options to source funding for AM activities, including the direct contributions of participating partner organizations. For example, operating costs could be reduced substantially by in-kind contributions from some of the partners, such as:

- salaries contributed by provincial government, industry or First Nations organizations through secondment of technical staff to AMSU;
- office space and infrastructure provided by provincial government or other organization.

Many monitoring and research activities that contribute to the overall AMF will be undertaken by communities, researchers or resource management agencies using funds they obtain independently. Provincial agencies may fund and implement high priority topics within their own budgets. Academic researchers with their own funding support may use the regional AM priorities to fine-tune their own proposals to make their research more relevant to managers on the coast. And there are a wide variety of possible collaborative arrangements: First Nations may receive funding from AMSU to implement research in collaboration with relevant technical support as required; industry may collaborate with academic researchers to study particular dimensions of a high priority issue with AMSU funding; etc.

The Coast Opportunity Funds provide relevant options for First Nations communities to seek funding both for adaptive management monitoring and research that will preserve ecological integrity, and for specific economic development initiatives to improve human well being. Planning for economic development could include foundations for AM such as strategic plans and suggested monitoring needs. These funds are not likely to be made available for activities that would otherwise be supported by governments<sup>14</sup>, so one of the questions that applicants will need to make clear is the collaborative nature of the AM enterprise, their independent role in contributing to it, and the benefits to First Nations themselves.

Another potential source of funds could be the Forest Investment Account's (FIA) Land Based Activity program. This is the largest of FIA's five programs, and funds activities planned and delivered by forest licensees. In 2006-7, the program supported approximately \$45 million of activity through almost 800 separate projects around the province.<sup>15</sup> LBIP investments are related to Land Based

<sup>14</sup> Don Wright interview, July 17, 2008

<sup>15</sup> <http://www.for.gov.bc.ca/hcp/fia/>

Investment Rationales prepared for each forest management unit in the province, which guide licensee applications. The objective of the program is to improve the land base productivity, but about half the funding in the program has historically gone to information gathering and management (remote sensing, Vegetation Resource Inventory, surveys, timber supply analysis and monitoring). The Forest Investment Council, an advisory body to the Minister of Forests and Range on management of the FIA, have discussed the eligibility of EBM projects for FIA funding.<sup>16</sup> It could be argued that high priority AM projects would improve management effectiveness and help to achieve EBM, thereby contributing to FIA goals of developing a globally-recognized, sustainably managed forest industry. However, there is no provision in LBIP to fund any entities other than licensees.

FIA's Crown Land Use Planning Enhancement program (CLUPE) provides funds for building capacity, strategic planning and implementation monitoring. The program is administered by the Ministry of Agriculture and Lands, and specifically emphasizes support to First Nations and other local communities for planning-related investments.<sup>17</sup> These activities are also part of adaptive management.

Finally, researchers have access to competitive forest and ecosystem research funding from a variety of sources: the Forest Science Program provides funding in B.C. to applied forestry research, according to priority topics that are set by its Advisory Committees (including members from MFR, the forest industry and research scientists) every year. Additional forest research in B.C. is supported by Natural Resources Canada, through the Pacific Forestry Centre and other forest research networks. National research funding is provided through the National Sciences and Engineering Research Council (NSERC) and the Social Sciences and Humanities Research Council (SSHRC), although in both cases these funds are aimed primarily at academics and adjudicated mainly on academic, rather than practical, products and value. The latter provides funding for economic development and social science research that could be relevant to human well being issues.

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<sup>16</sup> Forest Investment Council, draft minutes meeting of February 28, 2007 <http://www.for.gov.bc.ca/hcp/fia/minutes/20070228.pdf>

<sup>17</sup> <http://www.for.gov.bc.ca/hcp/fia/CLUPE.htm>

## 7 Summary of Institutional Design Recommendations

This section collects the main recommendations for Institutional Design from this report and refers the reader to the appropriate parts of the report for further elaboration.

**Recommendation 1: Incentives for implementing AM** – Incentives to adopt AM will be vital. Four main incentives should be offered to managers of natural resources and human well being:

- training, coaching and mentoring support to build familiarity and skills in AM, where this is needed;
- coordinated access to shared, synthesized, and updated monitoring data that is easily available to resource users and the public;
- funding for high priority monitoring and applied research studies;
- broad access to the results both of research studies and the deliberations of expert / manager / user forums. [section 5.1]

**Recommendation 2: Creation of an Adaptive Management Support Unit** – In order to support adaptive management on the coast, we recommend the creation of a new Adaptive Management Support Unit (AMSU), comprising 3 or 4 professional staff, based on the Coast and interacting extensively with resource managers from First Nations communities, the forest industry, and provincial agencies. The new organization will rely on relevant skills, knowledge and expertise provided by other organizations and collaborate in sharing information and new knowledge [section 5.6]

**Recommendation 3: AMSU Mandate** – The mandate of a new AMSU should be to provide coordination, guidance and support for collaborative implementation of Adaptive Management by resource planners and managers at various levels. This will require the unit to communicate with policy-makers, operational managers, and knowledge holders from First Nations, provincial agencies, the forest industry and communities to deliver three kinds of services: 1) supporting monitoring and research to improve the knowledge base for EBM; 2) providing reliable information and facilitating EBM decisions by communities, resource managers, provincial and First Nations agencies; 3) Helping build capacity of communities to engage directly in implementing AM in order to improve local decision-making. This will require the AMSU to undertake tasks such as:

- recommend regional priorities for investment in knowledge generation to reduce critical management uncertainties;
- clarify planning objectives and strategies through consultation with managers and knowledge holders, and identify important gaps to policy agencies at different levels, in order to be able to assess priorities;
- collaborate in designing feasible and cost-effective studies that have been identified as priorities, if requested:
  - valid and effective study design
  - selection of contractors or researchers to undertake proposed study (e.g. drafting of RFP, review of responses, qualifications, etc)

- support for methodological review, work planning, liaison between managers and researchers, and technical oversight
- review of draft reports and study results
- interpret study results and assess operational implications for current practices
- ensure that lessons are formally captured in a shared format, and that any implications for policy objectives are brought to the attention of the relevant decision makers.
- build and update a shared knowledge base about EI and HWB objectives and strategies through consultation with knowledge holders. [section 5.3, 5.4]

**Recommendation 4: Communications and information sharing** – The AMSU should assemble and maintain available data relevant to EBM implementation, and aggregate monitoring information for key regional Land Use Objectives, to be made available to LRF, managers and the public in various sectors. It should organize knowledge sharing opportunities at multiple scales (community, sub-region, industry, regional) to review results of AM work, improve shared understanding of key issues, and to build collaborative management. [section 5.4, 5.5, Appendix 3]

**Recommendation 5: Institutional Structure** – While there are several options for organizing the AMSU, the arrangement with the most long-term advantages would be through an independent Adaptive Management Trust established by collaborating organizations on the Coast: First Nations, provincial government, forest industry and NGOs. The trust agreement should provide for administration of funds from a variety of sources and should specify negotiated provisions for monitoring and research prioritization as part of its oversight of AMSU. [section 5.7, 5.8]

**Recommendation 6: Prioritization Procedure** – A process for sorting and selecting monitoring and research priorities should be rational and transparent, and should have clear linkages to specified management objectives and strategies. Learning should build on existing knowledge, which should be made explicit in order to support the prioritization procedure. The prioritization process should recommend first those activities that will generate the greatest returns in knowledge, recognizing that knowledge is most valuable when uncertainty is high, when a wrong choice could lead to failure of a key policy objective; and when that objective is closely linked to the success of several other objectives. The recommended process builds on informed judgments about uncertainty and risk as presented in the Knowledge Summary, and produces priority knowledge-generating activities in five categories: objectives required, strategies to be developed, implementation indicators needed, reducing uncertainty, and studying high risk issues. Most AM activities will be devoted to the latter two categories. [Appendix 2]

**Recommendation 7: Data management** – Because information relevant to EBM implementation on the Coast is scattered in many different sources and formats, management of information will be a key task for AM. Information created by the Adaptive Management Framework should be freely available, easy to retrieve and appropriate for a range of audiences. A standard methodology for calculating indicators used by many different organizations should be developed and tested. Data gathering and preparation should be separated from analysis so that indicators requiring similar types of data can be grouped for analysis. [Appendix 3]

**Recommendation 8: Climate change** – There is no need for an Adaptive Management Framework to treat climate change differently from other kinds of ecosystem dynamics. The scientific evidence for climate changes on the Coast is emerging, and as this knowledge becomes more clear and predicted ecosystem impacts less uncertain, it can be readily factored into the knowledge base and used to adjust management strategies or monitoring investments. This illustrates the strengths of an adaptive management approach. [Appendix 4]

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## 9 Appendix 1: List of Acronyms

ACM	Adaptive comanagement
AM	Adaptive management
AMF	Adaptive management framework
AMP	Adaptive management plan
AMSU	Adaptive Management Support Unit
C&E	Compliance and Enforcement
CFCI	Coastal Forest Conservation Initiative (large forest companies)
CIT	Coast Information Team
CLUPE	Crown Land Use Planning Enhancement
DSP	Detailed Strategic Plan
EBM	Ecosystem based management
ECA	Equivalent Clearcut Area
EI	Ecosystem integrity
ENGO	Environmental non-governmental organization
FI	forest industry
FIA	Forest Investment Account
FN	First Nations
FORREX	Forest Research Extension Society
FPB	Forest Practices Board
FREP	Forest and Range Evaluation Program
FRPA	Forest and Range Practices Act
FSB	Forest Science Board
FSP	Forest Science Program
G2G	Government to government
HWB	Human Well-Being
ILMB	Integrated Land Management Bureau
LBIP	Land Based Investment Program
LRF	Land and Resources Forum
MO	Ministerial Order
MoE	Ministry of the Environment
MFR	Ministry of Forests and Range
RFP	Request for Proposals
RSP	Rainforest Solutions Project
SFM	Sustainable Forest Management
SLUPA	Strategic Land Use Planning Agreement
SOFR	State of the Forest Report
SSHRC	Social Sciences and Humanities Research Council of Canada
TEK	Traditional Ecological Knowledge
TPI	Turning Point Initiative
UBC	University of British Columbia

## 10 Appendix 2: Setting Research and Monitoring Priorities: Prototype

### 10.1 Purpose and principles

The overall aim of adaptive management is to use research and monitoring to learn about and thereby improve management. A first step in developing a research and monitoring program is determining what to study. Due to the numerous and disparate objectives contained in multiple plans affecting the North and Central Coast, this can be a daunting task. A prioritization procedure is a decision-support tool for identifying information gaps and for setting research and monitoring priorities.

The emphasis in this section is on a prioritization process to address the **regional requirements for implementation of EBM** on the Central and North Coast. The implementation process will be driven by objectives described in G2G agreements and in land use documents that comprise planning inputs for multiple levels of government. Different parts of these agreements will be relevant to the work of different agencies. Monitoring information will be collected in different forms for different purposes by various organizations. The priorities arising from this process can be used to guide monitoring and research investments by any agency on the Coast, but it is intended to assure that key regional priorities are not overlooked, so that feasible high-priority research and monitoring activities can be supported through the AMF itself as required.

The process will generate a set of activities that are categorized as high priority. We also suggest criteria that can be used to distinguish relative priority *among* different items in the high priority category. In practice, if our knowledge is reasonable, the management structure is fairly complete and basic information is being collected, the list of high priority topics should be a relatively short one. However, there will always be some flexibility within this list. Some questions may not be addressed because of the cost (or the length of time required) of conducting research needed to obtain a reliable conclusion. Others may proceed more quickly because they can be funded independently, or because they coincide with the research interests of independently funded academics.

The prioritization procedure we develop here is based on the following general principles:

- Priorities should be guided by the overall purpose of the AMF, which is to increase knowledge and improve management.
- Prioritization should recommend first those activities that will generate the greatest returns in knowledge.
- Knowledge is most valuable when uncertainty is high; when a wrong choice could lead to failure of a key policy objective; and when that objective is closely linked to the success of several other objectives.
- The prioritization process should minimize the role of experts or different value groups. Regardless of the criteria used, everyone involved in defining research direction has preferences and biases. In an environment where land use decisions and science are contested, the different values of various groups should not play a direct role in prioritization.

In other words, the prioritization process and results obtained should be highly transparent and directly related to EBM objectives. The selection of priorities should not depend on the preferences of

whoever does the selection process: anybody working with the same initial information and following the process should get the same result. The process should be replicable and fair. This kind of process reduces the likelihood of disputes and builds confidence in the Adaptive Management Framework.

The prioritization procedure could be used by anybody with access to the Knowledge Summary and implementation indicators. However, it provides essential support to the AMSU by reviewing region-wide objectives and identifying knowledge gaps and regional AM study priorities. **We see the prioritization process as being most useful for building shared understanding of key issues, rather than simply allocating funds.** Funding may be found from a variety of sources (see section 6 of this report).

## 10.2 The Role of a Knowledge Summary

Learning builds on existing knowledge. Current knowledge about land management in the Central and North Coast resides in a Knowledge Summary. As well as supporting management decisions, the Knowledge Summary can be probed to assist with setting research and monitoring priorities.

The Knowledge Summary is structured to present information for managers about the seven questions (Box 1, Section 4.3) that are related to a simple adaptive management cycle (plan: Q1-4, implement, monitor: Q5-7, adjust: Q2-3). Information necessary to answer any of these questions may be missing (see Table 3 below).

A Knowledge Summary will be constructed for key ecological objectives as part of this project in preparing elements of an AMF. However, much less effort has so far been devoted to assessing and documenting knowledge addressing human well being for the coast. It is expected that over time, a Knowledge Summary for the most important elements of human well being will be constructed through research and experience, and this project will provide a foundation and initial content for such work. But in the meantime, the Knowledge Summary for HWB cannot be applied in the same way as it can for EI. We therefore propose a two-track process for prioritizing research and monitoring needs. The principles guiding prioritization will be the same, but the procedures vary.

The Knowledge Summary ought to be regarded as a “living document” to be improved upon as better information emerges. As they become available, pertinent results from monitoring and scientific studies can be incorporated into the Knowledge Summary. When the Knowledge Summary is updated, the monitoring priorities will also require reassessment. We provide examples below.

**Table 3. Questions to guide adaptive management and information needed**  
 (from Box 1, section 4.3)

Question	Information needed to answer questions
1. Where do you want to go?	Goals and objectives
2. What information exists to help you make a plan?	Cumulative scientific knowledge, proven explanatory theories, experience, traditional knowledge, other cases and examples
3. What is the plan?	Strategy (or plan), expressed as an implementation indicator and target
4. Where are you starting from?	Implementation indicators: current status
5. Are we following the plan?  If no, adjust management	Compare implementation indicators to plan
6. What do you need to know to improve the plan?  If yes, consider adjusting plan	Research results that reduce uncertainty, including validation monitoring
7. Are you getting closer to the objective or is it slipping away? If farther, consider adjusting plan	Effectiveness indicators

### 10.3 What a Prioritization Procedure Offers

A Prioritization Procedure provides a rational and transparent means of identifying where research and monitoring efforts are best allocated. It ensures that research and monitoring are cost-efficient and that the results are relevant to management decision-making. The Procedure accomplishes this by:

- Using existing scientific information from the Knowledge Summary to develop study priorities.
- Selecting study topics that have clear linkages to specific management objectives and strategies, as shown in the Knowledge Summary.
- Identifying those objectives and strategies that don't require monitoring or research.
- Identifying objectives and strategies to study and logically prioritising research and monitoring activities by:
  - Using current conditions and desired future conditions (expressed as a target) to assess risk
  - Determining which objectives are at greatest risk of not being achieved.
  - Determining objectives with the highest uncertainty of being achieved, given the strategy.

We use the terms uncertainty and risk, and define them below. However, the process is basically common sense. When undertaking any new initiative, it is normal to clarify first what the intent is, and then use existing knowledge to predict what is the best way to go about it. When we are unsure how this will turn out, we typically collect more information. We start with those issues that are the most significant and most uncertain and try to find more information about those first. The AMF prioritization is basically the same process: we structure management activity systematically, so that it is easier to identify knowledge gaps in predicting complex systems, and then tackle the biggest ones first. The details of the process rely on the structure of the Knowledge Summary, but the guiding concepts are simply stated.

Judgment is not eliminated from the prioritization process, but it is focused on questions related to knowledge and uncertainty. The development of the Knowledge Summary relies heavily on the judgment of local experts, scientists, and experienced managers. These personal and professional judgments are applied to questions of what is known, what can be predicted, and the risk that predicted outcomes will fail to achieve intended results at varying indicator levels. But the process relies less on judgment to pick study priorities. Priorities arise from querying the nature and content of current knowledge—a synthesis of judgement from multiple sources.

## 10.4 Information Used in the Prioritization Procedure for Ecological Integrity

1. **Land Use Plan Summary** – Identifies the goals, objectives and strategies (expressed as implementation indicators and targets) that are contained in the land use plans covering the North and Central Coast. Key components of the Land Use Plan Summary include
  - **Goal** – an overarching, guiding intent; a broad direction.
  - **Objective** – a specific end that must be achieved in support of a goal.
  - **Strategy** - the “means” to achieve the end. It can be expressed as an implementation indicator and a target.
  - **Implementation indicator** – a metric that responds directly to management intervention and that influences achievement of an objective.
  - **Target** – a desired quantitative state of an implementation indicator.
2. **Knowledge Summary** – Contains explicit scientific rationale explaining why strategies should achieve objectives. This provides decision support to managers. This same information on cause-effect relationships, when combined with additional information on research and monitoring cost, can be used to identify information gaps and to determine research and monitoring priorities. *The contents of the Knowledge Summary comprise key pieces of information used for prioritization.* Key components of the Knowledge Summary are the following:
  - **Concept Maps** – simple conceptual models that show relationships among goals, objectives and strategies; and also include unmanaged factors.
  - **Supplementary information for concept maps:**
    - Uncertainty about achieving the goal

- Influence of the goal on achievement of other goals
- Influence of the objective on achievement of the goal
- Time period for rehabilitation of the resource value, if the objective is not achieved.
- **Risk** – the probability of a strategy not achieving an objective. Risk curves graphically show the *estimated* level of risk across the full range of each indicator's values. Risk curves may be very rough estimates. Based on best available information (which can change), estimates are made of risk level at different values of the indicator.
- **Uncertainty** – the range of possible levels of risk associated with each indicator value; uncertainty forms a band around the risk curve that tells us how sure we are about our risk rating. Another way to think of this is how confident we are that we understand the cause-effect relations that underlie our assessment of risk (i.e. are we sure that "if we do A then B happens").
- **Implementation indicator status** – current indicator levels are based on inventory data or reasonable estimates; future indicator levels come from targets contained in the land use plans. Both levels are desirable in order to assess risk of failing to achieve objectives.
- **Research/monitoring cost** – A score estimating the relative ease of research or monitoring (e.g. on a scale of 1 to 4).

**3. Procedures for interrogating the Knowledge Summary to set priorities**— These “procedures” are used to determine priorities for gathering each type of information listed in Table 3 . They are part of a prioritization scheme that will be described in detail in the next phase of this project. An overview of the procedures is presented below:

- First, they identify where agreed goals lack objectives and strategies, by referring to the concept maps in the Knowledge Summary and by considering the magnitude of the uncertainty created by the missing information. If an objective has no strategy but it is not at any risk of failure, then the uncertainty of not having a strategy is low, i.e. it doesn't matter. However, in some cases objectives are at risk and need strategies that they don't yet have. This step makes explicit which case is which.
- Second, the procedure verifies that estimates of current indicator status exist or can be roughly approximated. These indicators are mostly calculated and updated from existing sources (as described in section 5 of this report). The current indicator level is compared with future levels as specified in strategy targets. In order to assess the risk of failing to achieve the objective, it is essential to know both where we stand now and where we are headed.
- Third, for each strategy-and-objective pair, risk and uncertainty of that risk are rated from the information in the Knowledge Summary and the indicators identified in Step 2. Risk and uncertainty are each scored on a three-point scale of high, medium and low. Risk and uncertainty influence the relative priority of research to reduce uncertainty and to detect negative consequences (i.e., effectiveness monitoring).

- The steps above identify priorities for different kinds of activities. In the final step supplementary information (cost, feasibility, etc) can be rated with a simple score. This information is used to help differentiate projects *within* the priority categories.

*In the terminology of the EBMWG Experts Group workshop (Nov 1 – 2, 2007), these prioritization steps constitute the “filtering” mechanism, and the lists of priorities generated (described below) represent the different “bins” of priority activities needed for AM research.*

## 10.5 Research and Monitoring Priority Lists

The information (or criteria) from the Knowledge Summary, with these prioritizing (filtering) procedures applied, results in five independent lists of information gathering tasks, mostly ranked on a three or four point scale (i.e. 1 as most important, 4 as least important). Each list will likely contain a number of activities within each ranking level. Within each of these ranking levels, further differentiation is possible, if additional information is available. This will be more straightforward in the case of the final two lists below, which will be the focus of most of the research and monitoring investment.

1. **Establishing objectives** – The first list identifies goals with missing objectives. It points out that a policy goal is at risk unless objectives are developed and leads to recommendations to policy decision-makers (LRF). Objectives need to be set by social choice processes (policy decisions) outside the AMF before strategies can be fully developed. This list is ranked by the magnitude of the uncertainty created about achieving the goal due to the missing objective. This list makes no specific suggestions about research but could generate a demand for background policy research to support LRF decision-making.
2. **Developing strategies** – This list identifies objectives that have one or more missing strategies that limit potential achievement of the objective. The list is ranked by the magnitude of uncertainty created by the missing strategies. Strategies provide implementation indicators and targets used in further analysis. Setting strategies may or may not include public input, but should include compiling supporting scientific rationale. Strategies are developed by different levels of decision-makers and managers, from the regional level (LRF) to provincial agencies, First Nations and communities. Strategy development requires making decisions based on available knowledge.
3. **Collecting implementation indicator information** – This list identifies strategies for which the current level of implementation is not known. The highest priority for collecting data is assigned to indicators for which existing data are either completely missing or insufficient to determine or estimate risk, followed by indicators for which risk can only be roughly estimated. For EI, most indicators can be calculated based on information that is already collected, however this calculation requires some technical expertise (GIS analysis of digital data sets). It is essential to know the value of indicators under current and/or future conditions before the priority for further research and monitoring activities can be determined.
4. **Improving knowledge and reducing uncertainty about risk** – This list identifies strategies with uncertain outcomes and the factors that cause the uncertainty. The highest research priority is given to indicators with a high level of uncertainty about the risk of not achieving their

objective. In other words, these are cases where we do not yet understand clearly the connection between the level of the selected indicator and the likelihood of the desirable ecological outcome. This uncertainty is explained in the Knowledge Summary for EI. Greater weighting goes to future conditions of high uncertainty (i.e., uncertainty associated with target indicator levels specified in strategies), because those indicator targets can still be adjusted and refined to more appropriate management levels to achieve the objectives, once we learn more. Because of the amount of research already done on coastal ecosystems, many indicators will have low priority ratings in this category, or will be difficult or expensive to study.

- 5. Detecting negative consequences associated with management activities** – This list identifies objectives that are unlikely to be met. The highest monitoring priority for this list are those indicators where there is a high risk of not achieving the objective and where we know with confidence that the risk is high. Indicators that have current values pointing to high risk are a higher priority than those where the risk is expected to occur in the future. This list identifies areas for further study where things are not going well: current values of indicators are at dangerous levels, and strategies do not seem to be working.

For each of these lists, priority ranks of 1 and 2 are recommended for further investment. In the case of the first two lists, the investment mostly comprises the time of planners, managers and policy decision makers. For the third list, some investment may be needed in data collection or analysis. But most of the monitoring and research effort will be devoted to issues within the final two lists. Within these two priority categories for these final two lists, supplementary feature scores can be used to help make decisions about which topics, or activities, to support. An evaluation of the costs and practicalities, (or “ease”), of monitoring each of these indicators should also be used to refine priorities.

These lists of priority topics will be generated by the AMSU in the first instance. Because the lists are derived from shared information and from the Knowledge Summary, the results should be obtained by anybody using the same process. The AMSU will forward draft lists to a scientific advisory group for review. At this stage, advisors can consider supplementary information, reliable methods for collecting data and the costs implied. They can also review the process, or the Knowledge Summary inputs to this process, when priorities seem to be counter-intuitive or unexpected.

Indicators with priority ratings below 1 or 2 do not require monitoring because of low risk and low uncertainty. It should be noted that, if strategies are well defined and the knowledge base is substantial, many indicators should indeed fall into category 3 or 4.

**An example of how knowledge and judgment of uncertainty and risk can be used to determine the need for monitoring or research is provided in Appendix 5.**

## **10.6 Prioritization procedure for Issues not addressed in the Knowledge Summary**

The prioritization process described above should work well for EI issues, particularly where these are well covered by the Knowledge Summary. A similar process has been tested and applied for several years to guide research investments for AM by the Babine Watershed Monitoring Trust.<sup>18</sup>

<sup>18</sup> Knowledge base and monitoring priority examples can be found at <http://www.babinetrust.ca>

Once the knowledge base is constructed and the various objectives and strategies sorted out in the Knowledge Summary, the process is not time-consuming or particularly complex.

However, because the Knowledge Summary does not yet exist and will take some time to produce, this prioritization process needs some modification for the Human Well Being component of EBM. The same concepts, questions and categories described above also apply when the Knowledge Summary is incomplete, but the assessment of risk and uncertainty is obviously different.

As discussed in section 4 of this report, strategies for the HWB component have not yet been formalized in regional level plans and there is limited data from which to construct useful indicators. Without clearly defined strategies and indicators, the specific prioritization mechanism presented above cannot be implemented in the same way. The process of clarifying HWB strategies is already underway, and many collaborative and independent strategies for economic development (e.g. shellfish aquaculture) are taking shape at the local and regional level. These kinds of strategies can be described and added to the Knowledge Summary based upon the decisions of First Nations, local government agencies and economic or social development organizations. Note that in order to add strategies to the emerging HWB Knowledge Summary, they should be designed to specify indicators and targets in a fashion analogous to the EI strategies.

Building up a Knowledge Summary for HWB will probably take several years, because of the need to clarify objectives and strategies, as well as to describe key concepts, cause-effect relations and key uncertainties (or barriers and constraints). This is a process that should involve First Nations communities extensively. They will be key users of this decision-support tool, and they are key knowledge holders. Processes of consultation, engagement and documentation will be important to build awareness of the Knowledge Summary and to develop its content. This will be one of the tasks of an AMSU.

In the meantime, an interim prioritization process should be used for HWB, and for EI issues not covered by existing Knowledge Summary content (e.g. marine ecosystems). This process will be based on the same principles as for EI. It will use similar criteria, and be driven by questions of how to produce the most valuable knowledge for management. Instead of basing prioritization on independent analysis of the existing knowledge base, we suggest a proposal-driven prioritization process that provides the same kind of information as the Knowledge Summary. This allows the same logic to be applied in selecting priorities.

While there are many parallels between adaptively managing for ecological integrity and adaptively managing for human well being, there are also differences. Relative to ecological integrity, objectives and strategies for human well being are less well articulated and the scientific evidence to support strategies is often contradictory. Human well-being studies at the outset will focus on completing conceptual models and articulating objectives and strategies clearly enough to be able to apply this framework. This is a strategic planning process that must engage decision makers at the relevant scales (community, region). Where the assessment of risk (failure to achieve objective) associated with indicator values is uncertain, one of the additional questions on the human well-being side is whether there are factual or cause-effect relations that could realistically be resolved through research. In human well-being, many of the uncertainties may have to do with intervening or external

factors mitigating the effects of indicators on the objective. These may be difficult to resolve simply by additional knowledge.

Human well being management initiatives will normally take the form of economic or social development projects. These must reflect local leadership and priorities. Therefore it is reasonable to expect that for HWB aspects of EBM, many of the priority research and monitoring activities will be proposed by communities themselves in response to the strategies and uncertainties that are of most direct concern to them.

Proposals from communities can be structured, and reviewed, using the same kinds of criteria as listed above for EI. These proposals should refer to regional level policy objectives and explain how proposed strategies relate to these, as well as how they relate to other strategies. The purpose and mechanism of the management intervention (strategy) should be explained, with reference to cause-effect relationships, the extent of existing knowledge, and any important factors that are beyond the control of managers (this is analogous to a concept map).

Strategies (with indicators and targets, for example) are typically defined as part of the planning process. Many community planning efforts are already underway or completed, and can serve as a source of information to help develop HWB concept maps and knowledge base.

Proposals for HWB monitoring or research should be able to demonstrate ways in which changes in the proposed indicator level will achieve management objectives. The likelihood of success can be estimated in relationship to different levels of indicator achievement, along with the degree of confidence in these estimates. What level of the indicator would be acceptable to achieve the desired objective? What would be the risk that even at this level, the result would not be achieved? These risk values can be ordinal (high / medium / low), but should be accompanied by explanation to demonstrate the knowledge and experience that forms the basis for these conclusions.

Proposals for data collection should refer to this kind of rationale for selection of indicators, and then compare the kinds of data that are available now, and the cost-effectiveness of alternatives. Once again, these comparisons do not need to be detailed – an ordinal ranking with justification should be sufficient.

Research proposals will be high priority when information is available about objectives, strategies, and indicators, but where uncertainties related to risk levels associated with the indicators are large. This sort of proposal would help address the situation when managers are not certain what will happen to the key indicator “B” if they undertake activity “A”. To be able to express the connections between objectives, strategies and indicators requires considerable knowledge, which may be the result of past experience or of expert advice.

Proposals that present this kind of information can then be assessed using an analogous process to that described above for EI. The information in the proposals themselves will help to construct the knowledge base in HWB, and over time major gaps and issues can be more readily identified.

Additional prioritization criteria may be applied to HWB proposals if there is a need to further select from among those rated as high priority. These issues are particularly relevant at the community level, and in support of the overall regional objectives of HWB.

- Is there strong local leadership and support for the proposal?
- Does the proposed activity build local capacity in management and learning?
- Does the proposed activity have a broad regional application, or is it only of interest in a particular case?

In the discussion of prioritization for EI issues above, we suggest a scientific advisory body to review high priority monitoring activities and assess feasibility, cost and appropriateness by comparison with best available knowledge. A similar review body could be contemplated for HWB proposals. It could be composed of social science experts as well as community representatives who would provide a solid grounding in experience and practical community concerns. Their role, as in the EI process, would not be to approve funding, but rather to provide AMSU with additional information and to provide additional evidence where priorities were not clearly justified.

## **10.7 Prioritization issues not addressed in the Prioritization Procedure**

These prioritization mechanisms produce recommended high priority activities under each of five categories, whether a Knowledge Summary covers the topic or not. Priority issues within each of the five research and monitoring lists are ranked for research or monitoring, but no method exists for ranking between the lists themselves. There may be a tendency to collect information in the order suggested in Table 3, finishing objectives and strategies and then checking implementation before studying uncertainties and effectiveness. This is not necessarily the best option. Preparing objectives and strategies and monitoring implementation can be time-consuming tasks and need not be completed for all objectives before undertaking other studies. Considering all study options may increase flexibility and help facilitate opportunities for collaboration in implementing monitoring or research studies.

Land Use Objectives are inconsistent in geographic coverage. Some cover the entire North and Central Coast; others cover specific areas such as a First Nation Territory, or the North Coast only. Some objectives must be considered at multiple spatial scales, because targets vary by scale. Some objectives address a single scale. For HWB, objectives and strategies also vary. Many strategies are implemented at a community scale, rather than a regional scale, but may be similar across multiple communities. If all else is equal, objectives and strategies that have broader geographic applicability should have higher priority for research and monitoring. Similarly, HWB objectives and strategies that apply to more communities should have higher priority.

## 10.8 Alternative approaches to prioritization

The FREP program has an existing and logical approach for determining monitoring priorities. Topic experts consider issues and identify key questions (uncertainties) of management relevance within their field. The questions from different fields are combined and distributed to forest managers for comment. Comments are considered by topic experts and a list of research priorities for the year is prepared. In other words, this approach uses expert judgment to assess priorities directly. In the procedure we recommend here, the main element of judgment is in assessing risk, and that is conditioned by explicit assessments of uncertainty.

In principle, the prioritization procedure we recommend, as described above, has benefits over the FREP approach. The conceptual models used to inform the procedure bring together objectives from many parties and information from many knowledgeable people. The models broaden the scope of topics that individual experts might consider since people tend to focus on their own areas of interest and perspective, whether academics, managers or other stakeholders. Ultimately, both approaches will reflect the time and effort put into either building and analyzing the Knowledge Summary or developing analogous questions.

## 10.9 From priorities to research projects

It should be clarified that research projects may be initiated from a variety of different sources. The AMSU can develop specific research or project proposals based on high priorities and then prepare these for contracting or as calls for research proposals. Communities may propose research activities for funding by AMSU, in which case the AMSU will refer to these priorities to determine the topic areas for funding. Provincial agencies may fund and implement high priority topics within their own budgets. Academic researchers with their own funding support may use the priority lists to fine-tune proposals to make their research more relevant to managers on the coast. And there are a wide variety of possible collaborative arrangements: First Nations may receive funding from AMSU to implement research in collaboration with relevant technical support as required; industry may collaborate with academic researchers to study particular dimensions of a high priority issue with AMSU funding; etc. etc.

The priorities arising from the procedures described above should apply to funding provided through a regional AMF process, which we expect to be administered by the AMSU. But other sources of funding are available, so there would continue to be scope for independent research projects on the coast. However, AMF priorities could also be used as a guide by other parties (such as FN governments, provincial agencies, research funding bodies), who could link their approvals or collaboration decisions, to the list of topics identified through the AMF as high priority.

The AMF does require that, whoever undertakes the research, results must be shared for review and interpretation (both from scientific and management perspectives); they must be summarized and added to the Knowledge Base; and they must be widely shared throughout the region. This will help all resource and economic managers to improve decision-making.

## 11 Appendix 3 – Data Management Requirements

In general terms, adaptive management requires more types of data, more frequently than does regular management. During the planning phase of resource management (prior to taking decisions and implementing them), adaptive management sets up explicit predictive models that will require data from previous research or monitoring. When monitoring the implementation of management practices, adaptive management mostly extracts appropriate information from existing inventories. Data required for most of the implementation indicators addressing EI under the Central and North Coast land use decisions exist already in provincial and forest industry databases, but will require GIS expertise to access and use. Other relevant data may come from monitoring programs (e.g., FREP, industry certification). An AM process also creates new kinds of data that must be managed: it combines existing inventory information in new ways to create relevant indicators; it generates research results; it creates a synthesized, referenced knowledge summary focused on relevant management issues.

A prioritization process identifies whether new data needs to be collected or synthesized to meet EI monitoring requirements. The process asks whether there is sufficient information about current and target implementation levels to determine the likelihood of achieving land use objectives. If there are no implementation indicator data, its collection becomes a priority task for adaptive management. While prioritization will identify indicator data gaps, that process would be streamlined by ensuring indicator data is assembled and updated in an easily accessible format / location.

*There is no expectation that adaptive management will impose new reporting requirements on industry, but it will build expectations for greater sharing of corporate forest data when that contributes to reducing uncertainty about ecological risk.*

HWB indicators (as proposed in Sheltair Group 2008) are mostly derived from Statistics Canada data. They are also tied to GIS databases, so will similarly require GIS analytical capacity. A drawback of the HWB indicators is that the base census data is only updated every 5 years. To obtain additional monitoring data to guide HWB management decisions, it might be possible to develop additional “interim” indicators obtained from other government agencies (e.g. regional districts, health or education bodies). There are many challenges here, because the scale of data reporting for these agencies typically does not permit disaggregation to the relevant community level, and the data are not necessarily consistent over time or from one community to another. Some data are not available at all and will require periodic surveys.

Adaptive management is a collaborative process that aims to build and retain stakeholder trust. From this perspective it is important that the AM program provide free public access to information that it creates. Part of this challenge is to organize information in a manner that makes it easily accessible and digestible, and part of the challenge is keeping public data sets up to date. The principle will be to handle data the minimum number of times, and to have it processed, stored and used in the same formats that are publicly accessible to reduce the need for additional treatment.

In the Central and North Coast, the AMF faces three data-related challenges. First, it must obtain data from a variety of sources: gathering data will be a significant task. Second, it needs data held exclusively by the forest industry and First Nations, which may not be made available. Third, forest cover information from different sources is recorded in different formats and must be made compatible. This may not be technically difficult, but is time-consuming. Aligning maps to create a “seamless” coverage is not a trivial task. These challenges must all be addressed before community technical staff, researchers or consultants can analyse such data. If data assembly, consistency, coverage and maintenance issues are not addressed, this leaves the task to be repeated each time an analytical study is undertaken. That creates redundancy and additional cost, but it also means that only fairly sophisticated and experienced consultants or well-resourced researchers can engage in these studies and complete a satisfactory product. It also means that for each study, reviewers and critics will be left wondering about the origin and consistency of the data. It would be far preferable to have common data prepared in standard shareable and original formats, in order to increase transparency and accessibility so that a broader range of participants can engage more fully in AM studies.

The above arguments lead to the following recommendations.

### **11.1 Management of information generated**

Information created by the Adaptive Management Framework should be freely available, easy to retrieve and appropriate for a range of audiences. AMF implementation will require ongoing technical capacity and communication design support necessary to do this (e.g. by commissioning short term or maintenance tasks through consultants or partners). This is a task that might occupy a professional staff person full-time for several months at start-up, but would then decline to much less time for maintenance.

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

### **11.2 Management of information needed for analyses**

In order to make the calculation of indicators efficient and consistent, a standard methodology should be developed for calculating indicators (and then tested); the process of gathering and preparing GIS data should be separated from the analysis process; and indicators requiring similar data should be grouped for analysis. Preparing data for analysis may include the following steps. For each indicator, prepare a list of data required, including sources and reliability (in many cases, this will be a short list). From these lists, aggregate sets of 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 the relevant data. These steps require periodic GIS and data management expertise on the part of staff, consultants or partners. Appropriate data storage and maintenance capacity will be needed as part of AM implementation.

### **11.3 Proprietary data**

The Vegetation Resources Inventory is currently being conducted by MFR for coastal BC. Air photos have been taken and classification, mapping and field verification are underway. This new inventory should reduce the need to seek proprietary data held by industry.

Several questions remain to be resolved, but may be clarified through a parallel EBMWG data management study (underway). When is VRI likely to be complete? Will the VRI cover private and public land on TFLs? Will VRI on public and private TFL land be updated as harvesting and road construction occurs? Will VRI provide a better ability to estimate site series?

## 12 Appendix 4 - Climate Change

Climate change has not so far been considered in the determination of Land Use Objectives or in the articulation of EBM background information. Climate variability and change are a function of global scale processes. In the short term, over a period of several years, climate variability on the North Pacific Coast is driven partly by the El Nino Southern Oscillation, a global pattern measured by water surface temperatures in the equatorial Pacific Ocean. Over a period of decades, north Pacific coastal surface water temperatures also fluctuate in phases of 20 – 30 years (the Pacific Decadal Oscillation, or PDO). These factors combine to strongly influence “natural” variability in seasonal temperature and precipitation patterns in British Columbia (Rodenhuis et al. 2007). Of greater concern are the overriding long-term impacts of anthropogenic climate change due to increasing atmospheric concentrations of greenhouse gases. There is overwhelming scientific evidence to suggest that this secular climate change will accelerate for at least the next century, and there is as yet no indication that greenhouse gas concentrations will stabilize in the foreseeable future (IPCC 2007).

There is already evidence of shifts in long-term climate conditions in B.C., most notably in the northeast and southern interior of the province (Rodenhuis et al. 2007). Such changes are likely to accelerate in coming decades. Localized climate projections are highly uncertain due to modeling limitations and the effects of B.C.’s extreme topography. However, downscaling of global models suggests that the northern coastal areas of the province will generally see minor increases in average temperatures, especially in winter months, and increased winter precipitation. There is greater uncertainty about future precipitation than temperature.

The most significant climate impacts for the coast are expected to be declines in spring snowpack as a higher percentage of winter precipitation falls as rain at higher elevations; a marked retreat of glaciers; and a decline in late season streamflow in snow and glacier-fed streams. Results from a limited modeling exercise suggest average spring snowpack in the north Coastal range could decline by over 50% from typical 1960-1990 levels by 2050 (Rodenhuis et al. 2007). Another important climate factor will be the frequency and intensity of storm cells from the north Pacific as water temperatures increase there. There is no scientific consensus on the likelihood of storm intensity increasing, but this is a distinct possibility. While these factors have not been studied in detail for the Central and North Coast, they point to potential areas of ecological vulnerability that could be assessed in future by adaptive management.

These climate changes will have an impact on Central and North Coast ecosystems. The biggest effects will be due to cumulative exposure to climate extremes and other disturbances. Ecosystems that are already vulnerable due to other disturbances will be more vulnerable to climate impacts.

For any particular land use objective, the impact of climate change will therefore depend not only on other anthropogenic stresses, but also on the specific site conditions. For example, increased temperatures may result in productivity gains for coastal forests, except on poorly drained sites, which are likely to be further constrained due to increased precipitation. However, some areas are also likely to experience more frequent dry conditions in late summer as a result of lower streamflow and reduced soil moisture. The potential for more intense or frequent winter storm events may pose

increased risk for slope stability and soil retention, leading to modification of management practices and harvesting procedures on steeper slopes. It may also increase the risk of windthrow in exposed or remnant stands.

Aquatic ecosystems are likely to be more severely affected. Climate change will pose special problems for salmon, which will be negatively affected during all phases of its life cycle by the combination of temperature, water quality and quantity changes forecast in both freshwater and marine ecosystems. While southern and interior salmon runs are likely to face the greatest threats, even coastal areas are likely to be negatively affected (Walker and Sydneysmith 2008). These threats, especially combined with existing impacts from disturbance, could require more determined conservation and habitat protection measures. Monitoring of aquatic resource indicators will be a high near term priority in the face of this uncertainty, and may lead to the identification of needs for related research to test effectiveness of management strategies.

The potential effects of climate change on species at risk will depend on the autoecology of each particular species. Similarly, effects on keystone species are unpredictable, but could lead to restructuring of entire ecological communities. Aquatic systems are likely to face the greatest impacts, due to greater extremes of precipitation and of streamflow and because of the threat posed to salmon by increased water temperatures.

Climate change can also impact human well being both directly and indirectly. For example, if storm intensity and/or frequency does increase, urban infrastructure may face greater risk of damage. Road construction and maintenance costs are likely to increase to handle more intense rainfall events. Low-lying coastal areas will be subject to higher sea levels and storm surges. If stream temperatures rise, salmon stocks used for commercial and/or subsistence purposes may collapse. Some benefits may arise from climate change, but in general, as the variability and dynamics of systems increases they become more difficult to manage.

In the near term, climate change itself poses no immediate risk to land use objectives. There is no need for special consideration of climate change as an unique factor in adaptive management. However, in the medium to long term climate change will increase the uncertainty of achieving objectives and consequently it is more important that ecological objectives be monitored, and management practices adjusted, to identify and account for the increased risks linked to climate change. It is also possible that climate change could increase the probability of achieving some objectives. For example, in well-drained, productive forests, climate change may lead to more rapid forest growth and recovery from disturbance. The uncertainties associated with climate change are high, and localized predictions are impossible. But, the ecologically precautionary approach that underlies EBM should promote resilient ecosystems that are better able to face climate change.

Over coming years, as evidence accumulates from scientific studies done by other researchers, the knowledge base for climate-sensitive EI objectives should be modified to reflect the increased uncertainty in predicted ecosystem responses due to climate change. This is a good example of how adaptive management provides an ongoing framework to respond to changing knowledge and uncertainty in ecosystem management.

## 13 Appendix 5 – Practical Example: Prioritization and AM Studies

### HYPOTHETICAL EXAMPLE: AM for grizzly bears

#### Existing information

- Objective is to maintain population at natural level.
- First strategy is to protect all critical habitat.
- Second strategy is to limit displacement by avoiding logging activity in key feeding periods.
- Knowledge Summary contains conceptual model (Fig 1), cause-effect relationships (e.g., Fig 2) and text description saying that human-induced mortality is the largest threat, followed by loss of habitat (availability) and then displacement from habitat, etc.

#### Year 1

Local bear biologist comes in seeking funding to assess bear population. Is it worthwhile?

No: Concept map shows that critical strategies related to bear mortality are not in place. Thus based on existing knowledge, strategies are not currently designed to achieve the objective.

- KS indicates that accessible road density is the biggest controllable factor affecting bear mortality. Hunting is a big factor, but not within jurisdiction.
- Managers hold workshop to develop road management strategy
- AMF undertakes a study to assess current road density (implementation monitoring)

#### Year 2.

- New strategy aims to keep open<sup>19</sup> road density less than 0.5 km/km<sup>2</sup>
- Last years study results show that open road density is 0.7 km/km<sup>2</sup>
- Managers develop new strategy to limit public access using gates.

#### Year 3.

- Public access restrictions aim to limit public road access to 0.1 km/m<sup>2</sup>.
- In the Knowledge Summary, text that describes uncertainty around the road-bear mortality relationship indicates that the effectiveness of access restrictions is uncertain.
- AMF undertakes study to monitor effectiveness of gates (study to clarify cause-effect relationship).

<sup>19</sup> accessible to the general public

**Year 4.**

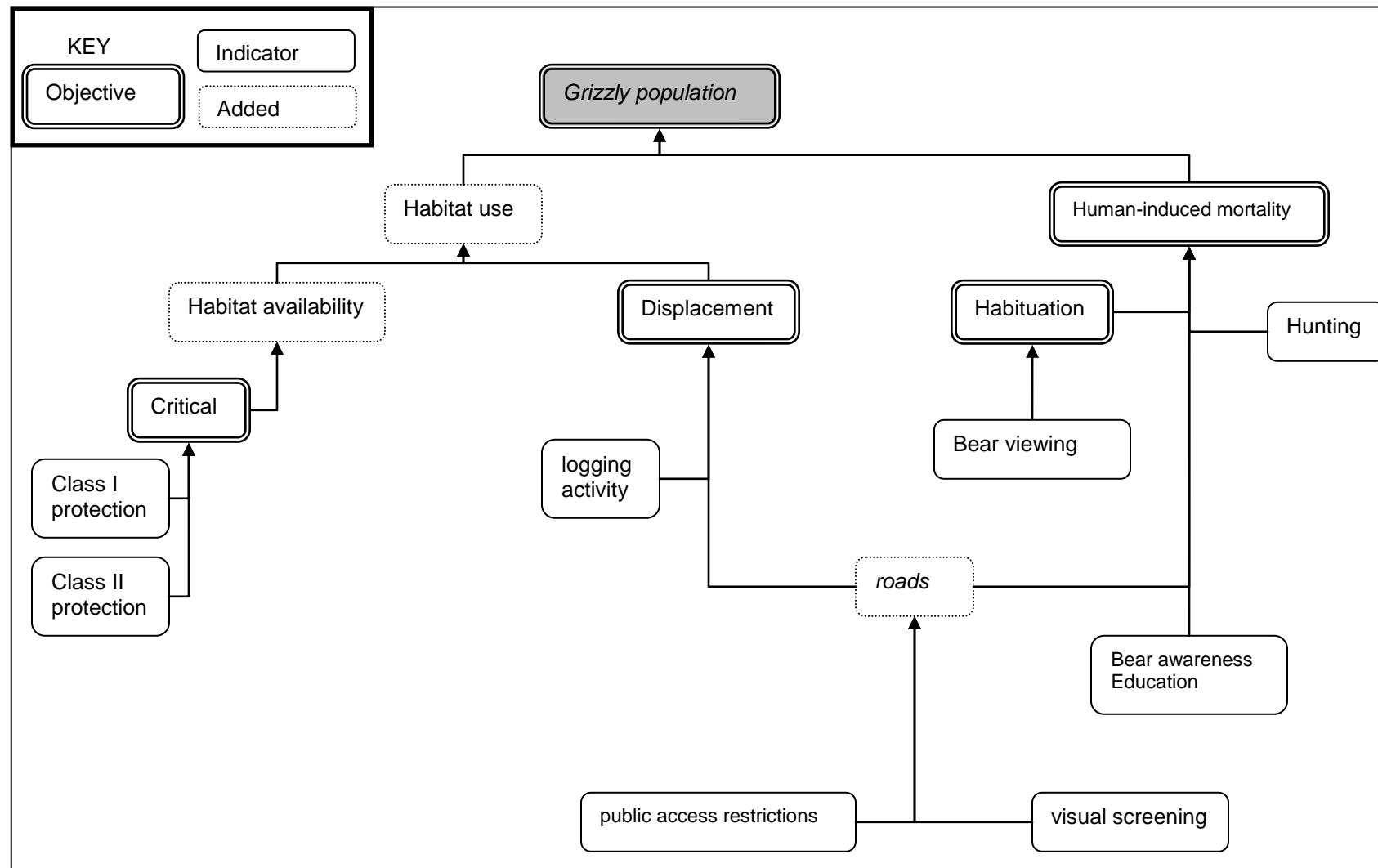
- Study results indicate that gates only lower traffic by 50%.
- Managers move some gates to better locations.
- Managers start a public awareness program to explain need for gating.
- Managers consider limiting roadside seeding (provides forage that attracts bears), but want to see if gating works first. KS indicates that roadside seeding is not a big factor if open road density is low.

**Year 5.**

- AMF monitors gate effectiveness and finds 95% reduction in traffic (study to improve cause-effect relationship).
- Managers consider this to be sufficient.

This example shows how AM can improve management by dealing with oversights (missing strategies), by determining the current condition (implementation monitoring) and by reducing uncertainty (in this case a cheap study).

Figure 1. Hypothetical conceptual model showing key factors affecting grizzly bears populations.



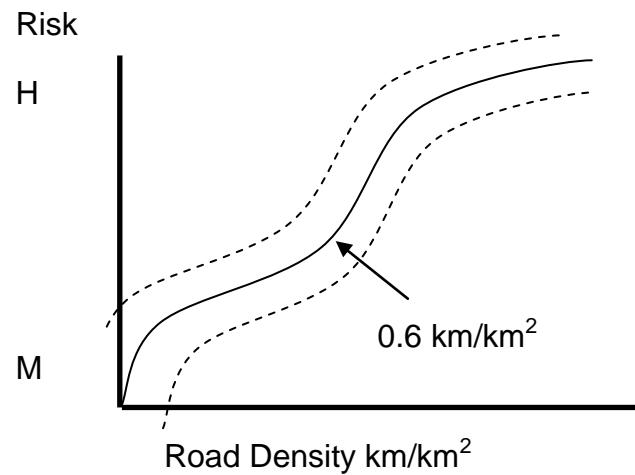


Figure 2. Risk to grizzly bear mortality versus open road density within watersheds.