

Forest Ecosystem - Based Management In Northwestern BC:

A Status Report

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Executive Summary

Ecosystem-based management (EBM) has arisen from a melding of ecological science with social values to refocus resource planning and management on maintaining ecosystem integrity. This paper presents an overview of EBM concepts, and their relevance to forest management, and also provides a status report and recommendations on the implementation of EBM in northwestern BC.

The key components of EBM largely address the planning requirements, scientific principles and institutional considerations for natural resources management. The ecosystems themselves are the key frames for EBM planning, with special attention paid to achieving hierarchies of temporal and spatial scales and using ecologically relevant boundaries. Science plays a strong role informing planning decisions using systems theory, the best scientific information, and adaptive management to address knowledge limitations. Social values, economics and political processes form an inextricable context for EBM, requiring collaboration, cooperation and egalitarian relationships among organizations and stakeholders.

Many aspects of EBM are not new to BC forestry. Sustainable forest management, certification standards, and the Forest Practices Code all contain elements consistent with EBM. The survey of resource managers in northwestern BC that was conducted for this status report found examples of EBM throughout the region. The findings, summarized by forest districts within the Prince Rupert Forest Region, include:

North Coast harvesting has moved substantially to variable retention in the last few years. This district is also the site of a pilot project applying EBM to the harvesting of a watershed.

Kalum hosts another forest industry-led EBM pilot project. The Kalum LRMP has spurred movement in the direction of EBM particularly with grizzly bear habitat management and distribution of cutblocks to mimic natural disturbance patterns.

Kispiox small business program is an excellent example of EBM put fully into practice. The McCully Creek portion of the program is an adaptive management pilot project.

Bulkley-Cassiar has implemented EBM through Landscape Unit Planning which covers the Bulkley portion of the district. By providing direction to achieve biodiversity objectives, these plans have created stability and resolved contention.

Morice EBM activities, including ecological research and development of monitoring indicators, are being woven into the Innovative Forest Practices Agreement, which will result in a district-wide sustainable forest management plan. To meet certification commitments, stand and landscape level targets and operating procedures are being developed for maintaining forest structure and biodiversity elements.

Lakes is also involved in the Innovative Forest Practices Agreement. Biodiversity requirements are being addressed through the Lakes LRMP and Landscape Unit Planning, with special biodiversity retention measures being applied in conjunction with bark beetle management.

This report also examines the extent and variation with which each component of EBM is put into practice across northwestern BC. Notable is the variation among definitions of EBM across the region, particularly concerning the incorporation of economic and social values. Also significant is how extensively the Biodiversity Guidebook is being used for implementing EBM.

Several barriers to implementing EBM were identified repeatedly by survey respondents and are widespread throughout the region. These are: higher costs with implementing EBM, disincentives to applying EBM contained in forestry legislation and policy, and insufficient science to support EBM locally. Still, there are opportunities for resource managers to better achieve EBM using the tools already in place. These include more thorough implementation of LRMPs and using scientifically-based ecological criteria in the selection of patches for retention from harvesting.

The results of this survey and analysis lead to three recommendations for enhancing the regional context for implementing EBM. The recommendations involve 1) revising legislation and policy, 2) updating the Biodiversity Guidebook, and 3) encouraging research into EBM priorities. EBM is currently being explored in a wide variety of forestry contexts throughout northwestern BC, while the knowledge of how best to apply it here is still emerging.

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Forest Ecosystem – Based Management in Northwestern BC

Introduction

Ecosystem-based management (EBM) has arisen, over the last fifteen years, from a melding of ecological science with social values. It constitutes the latest thinking in the evolution of approaches to land use planning and management (Yaffee 1999). The following section provides an overview of EBM concepts and their relevance to forest management, and forms the basis for the survey, reported on later in this paper, into the current application of EBM principles to forestry in northwestern BC.

Overview of Ecosystem - Based Management

EBM Defined

While most academics and practitioners agree on the general principles of EBM, there is a range of perspectives and debate over nuances, emphasis, application and details (Holt, 2001; Rauscher, 1999; Yaffee, 1999). Nevertheless, a definition offered by Grumbine (1994) has become a widely adapted EBM cornerstone.

Ecosystem management integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term.

While EBM does allow for sustainable use such as forest harvesting, the primary goal is maintaining ecological integrity (Christensen et al, 1996; Rauscher, 1999; Yaffee, 1999). Ecosystem integrity involves maintaining and where necessary, restoring, long-term ecosystem health (Haynes et al 1996; Holt, 2001). Healthy ecosystems have intact processes including nutrient cycling, energy flows, disturbance regimes and succession, that are functioning within the natural range of variability (Noss, 1999). Significantly, the EBM perspective represents a move from conserving individual species to maintaining ecosystem functions (Thomas, 1997), thereby sustaining species about which little is yet known. What EBM means for BC forestry is a shift in focus from the trees taken to what remains after harvesting (Clayoquot Sound Scientific Panel, 1995; Drever, 2000; CFCI/ENGO Initiative, 2000).

The extent to which human social and economic agendas drive EBM goals is a subject of much debate and interpretation among academics and practitioners (Noss, 1999; Yaffee, 1999). Many view humans as part of ecosystems (Christensen et al, 1996), while most agree that ecosystems and humans are at least interrelated (Yaffee, 1999). It is also generally accepted that EBM allows for sustainable use within an ecosystem's capabilities (Haynes et al, 1996; Yaffee, 1999).

Overall, it is recognized that social values, economics and political processes form an inextricable context for ecosystem-based management.

EBM Criteria

Over the last ten years, agreement has solidified on the overarching features of ecosystem-based management. Although numerous listings exist, each somewhat different, (Christensen et al, 1996; Yaffee, 1999; Grumbine, 1994) the themes presented here are adapted from Holt's (2001) amalgamation of the recurring emphases these, and many others, have provided. The key components of EBM largely address the planning scope, scientific principles and institutional considerations for natural resources management.

Planning Scope

The ecosystems themselves are the key frames for EBM planning with special attention paid to scales and boundaries.

1. **SCALES** Hierarchies of ecologically relevant temporal and spatial scales are considered for planning, assessment and decision-making (Haynes et al, 1996). Various scales are needed to accommodate the range of areas and timeframes over which different ecosystem processes operate. A hierarchical approach to planning enables the appropriate integration of scales and ecological processes (Bunnell, 1998; Haynes et al, 1996). This entails setting broad objectives regionally to provide context for more detailed landscape and site-level plans (Drever, 2000; Haynes et al 1996). Planning and commitment for EBM, while accommodating the need for short-term decisions, must also transcend human lifetimes to be ecologically relevant.
2. **BOUNDARIES** Plans use ecologically based boundaries within which management units encompass coherent ecosystems. (Yaffee, 1999). Landforms, such as watersheds, serve this function well since these provide an ecological anchor that is easily mapped (Clayoquot Sound Scientific Panel, 1995; Hartig et al, 1998; Rowe, 1998; Slocombe, 1993).

Scientific Principles

Science plays a strong role informing decisions made under EBM, but it is tempered with an explicit respect for current limits to knowledge regarding the complexity of ecosystems. The concepts integral to EBM involve systems theory, using scientific information and using adaptive management to address knowledge limitations.

3. **SYSTEMS THEORY** Systems principles, using an interdisciplinary and holistic perspective, apply to the biophysical interactions and dynamic structure of ecosystems as well as the socioeconomic considerations of planning processes and resource values (Slocombe, 1993).

4. **SCIENTIFIC INFORMATION** Planning and management decisions for EBM are based on the best available scientific information concerning the complex and dynamic nature of ecosystems including composition, functions and inter-relationships (Noss, 1999).
5. **ADAPTIVE MANAGEMENT** The multitude of variables and complexity inherent in systems considerations raises the levels of scientific uncertainty. In response, adaptive management is a fundamental requirement of EBM whereby hypotheses are tested operationally and responses systematically monitored, leading to subsequent re-evaluation of decisions (Merriam 1998; Noss, 1999). Consistent with implementing adaptive management, is the need to manage the uncertainty of outcomes by keeping options open to change directions based upon new knowledge or unexpected events. Many advocate using the precautionary principle of acting conservatively when faced with incomplete knowledge and potentially irreversible consequences (Drever, 2000; Maini, 1998; Merriam, 1998; Noss, 1999).

Institutional Considerations

The EBM concept emphasizes cooperation among people and organizations in an egalitarian manner. This likely involves changes to institutional structures and policies, and to public involvement processes.

6. **ORGANIZATIONAL CHANGE** EBM involves partnerships among organizations rather than competitive or authoritarian relationships (Hartig et al, 1998; Slocombe, 1993). Institutions also need to be adaptable by seeking new ideas, and experimenting with alternative management strategies.
7. **STAKEHOLDER INVOLVEMENT** Collaboration and cooperation among all stakeholders in problem-solving and decision-making is necessitated by the diverse knowledge required by EBM (Hartig et al, 1998). To effectively involve the public, power imbalances need to be addressed.

Adoption of EBM

EBM acquired public prominence in 1993 when US agencies quickly adopted it as a land management approach, prompted by wide-spread dissatisfaction with the results of multiple use and other approaches (Thomas, 1997). Since then, it has been embraced by other land management agencies. For instance, the US and Canada have jointly required an ecosystem-based management approach for remediation of the Great Lakes watersheds (Hartig et al, 1998). Canada's National Parks Act was amended to set maintaining ecological integrity as a first priority and was followed by policy revisions in 1994 to require an EBM approach for parks management (Zorn, 2001). Advisory committees to the BC provincial government have recommended adopting EBM, including BC's Park Legacy Panel (1998) and the Clayoquot Sound Scientific Panel (1995). An array of forest management stakeholders have also advocated

EBM in BC, such as the David Suzuki Foundation (Drever, 2000) and a group of five coastal forestry companies (Coast Forest Conservation Initiative, 2002).

Many elements of EBM are not new to BC forestry. The concept of sustainable development, introduced by the Bruntland Commission (World Commission on Environment and Development, 1987), has led to sustainable forest management (SFM) in BC and is recognized as a significant precursor to EBM (Slocombe, 1993). Sustainable forest management, as defined by the Canadian Council of Forest Ministers (CCFM), includes many features common to EBM such as maintaining ecosystem condition and conserving biological diversity (CCFM, 1995). The Alberta Forest Management Science Council has taken the CCFM definition several steps closer to EBM by embracing EBM features such as maintaining ecological integrity, using a hierarchy of temporal and spatial scales, and adaptive management (James et al, 1997). The CCFM definition of SFM forms the basis of Canadian National Sustainable Forest Management Standard (CSA) certification, for which forestry companies have modified their operations on 4.65 million ha in BC, including 720,000 ha in the Prince Rupert Forest Region (Abusow, 2002). CSA standards also incorporate other principles of EBM such as adaptive management and multi-stakeholder participation in planning decisions (Ridley-Thomas and Bebb, 2000).

While sustainability is a fundamental goal of EBM, (Christensen et al, 1996; Noss, 1999), it is interpreted somewhat differently from the application of sustainable development arising out of the Bruntland Commission. Sustainable development emphasizes that natural resources be sustained to provide for future generations. Definitions of SFM include providing “economic, social and cultural opportunities for the benefit of present and future generations” (CCFM, 1995; James et al, 1997). EBM is not limited to meeting the needs of future human generations, but involves sustaining all aspects of ecosystems, regardless of their usefulness to humans (Noss, 1999).

The *Forest Practices Code of British Columbia Act*, (the Code) enacted in 1996 to govern forestry planning and practices, also arose out of the philosophy of sustainable development, as highlighted in the Act’s preamble. Consequently, elements of EBM are evident in the Code. For instance, it established a multi-level planning hierarchy, though not all levels are based on ecological boundaries, nor have all levels been widely implemented. Accompanying the Code are biodiversity guidelines (BC Ministry of Forests and BC Environment, 1995) providing strategies for mimicking natural disturbance patterns in managed forests. While the guidebook is considered to have provided a good start, experience and research since the guidebook’s publication indicate a need for refinements to better achieve natural disturbance patterns (Bunnell, 1998; DeLong, 2000).

At the same time as the Code came into effect, the BC Ministry of Forests began exploring the use of adaptive management to improve forest practices. Since documented experience in applying adaptive management to forestry was scarce (Nyberg and Taylor, 1995), pilot projects were established throughout the province, including at McCully Creek in the Kispiox Forest District (Bilodeau and Turney, 1999). Nevertheless, the prescriptive approach to forest management required under the Code has limited the application of adaptive management (Hebert, 2000). This and other concerns regarding the tightly structured regulatory regime are partially responsible for driving the Code’s evolution to results-based.

Managing Forests With EBM

EBM is a planning-oriented management system and its implementation begins with defining measurable goals for sustainable management (Christensen et al, 1996; Haynes et al, 1996). Setting goals involves describing the desired future condition and ecosystem dynamics of the landscape over various spatial and temporal ecological scales (Holt, 2001; Marcot, 1997). For forestry management, Bunnell (1998) recommends that the broadest level of planning involve an area of at least 200,000 ha and have a minimum time horizon of one rotation, recognizing that detailed planning beyond 20 years is unreliable.

Whether at the stand or landscape level, planning involves the analysis of ecological and resource information and the design and evaluation of treatment options (Daigle, 2000; Holt 2001). Information collected includes resource inventories, natural variability characteristics and threats to ecological integrity (Holt, 2001). Plans use the best available scientific information from a wide array of disciplines.

Analysis of this information develops ecological baselines and identifies critical species and knowledge gaps (Holt, 2001). Baseline information is essential to monitoring and adaptive management, which are designed in response to knowledge limitations. These EBM planning principles have been applied in numerous variations at the landscape level throughout BC and northwestern US, with no one methodology emerging as superior (Daigle, 2000).

Management decisions are formed from this information analysis. Decisions include identifying reserves that are located to protect critical ecosystems. This is considered an important component of EBM in landscape and regional contexts (Holt 2001; Franklin et al 2000). Plans also recognize that some species are of particular concern and include prescriptions to benefit these species (Bunnell, 1998; Franklin et al, 2000; Holt, 2001). Site-level treatments aim at maintaining ecosystem complexity by using a variety of silvicultural systems. These may result in multiple canopy layers and stand densities, varied rotations, and retention of non-woody material and woody debris (Franklin et al, 2000; Kohm and Franklin, 1997; Rummer, 1997). EBM plans consider as well the ecological impacts of road construction and maintenance and the role of roadless areas in maintaining ecological integrity (Drever and Hughes, 2001; Franklin et al, 2000).

Status of EBM in Northwestern BC

Methodology

To determine the extent and nature of EBM being implemented in the Prince Rupert Forest Region, a review of planning documents and twenty interviews with forest managers were conducted during August and September 2002. In each of the six forest districts, staff from the Ministry of Forests and major licensees were contacted. As well, staff from regional offices of provincial agencies, woodlot licensees and First Nations were interviewed. The collection of information focussed on aspects of forest planning and operations which contain elements of EBM, even where these have not been labelled as such. Besides providing a snapshot of EBM application within each forest district, the survey looked for general patterns across the forest region, and addressed perspectives on, including difficulties with, applying EBM.

The presentation of the results here begins with a summary of EBM application within each forest district. The forest district was chosen as the framework for discussion since this is the administrative unit through which broad strategic land use planning and landscape levels of planning are conducted. The extent to which this planning has been completed varies from district to district. The district results are then rolled up to address each component of EBM, noting the extent to which it is implemented and the range of variation across northwestern BC.

Summarized separately are prevalent observations on barriers to implementing EBM and opportunities for expanding EBM application. Following from the conclusions of this analysis, recommendations are provided on changes that can be made to facilitate EBM implementation.

District Summaries

For each district, a brief description highlights where EBM concepts are being partially or entirely applied. This summary is not meant to be comprehensive, nor a critical assessment of the nature and extent with which EBM is being applied, but merely an indication of the key ways in which aspects of EBM are being implemented at this time.

North Coast

Strategic planning at the district and landscape levels for the North Coast is not yet in place. A small portion of the district falls under the Central Coast LRMP (Land and Resource Management Plan), to be completed in the spring of 2003. The North Coast LRMP planning table convened in February 2002 and is scheduled to conclude by the end of 2003. The Central Coast table has evolved to embrace EBM as a planning and management framework for forestry. The North Coast process, building on the Central Coast experience, is using a revised strategic planning process, adopting the same EBM definition and principles as the Central Coast, and explicitly incorporating EBM elements such as adaptive management, risk assessment, and sustainable forest management indicators (Prince Rupert Inter-Agency Management Committee, 2001).

The lack of strategic planning direction has been ameliorated somewhat on the north coast in that forest harvesting occurs over a relatively small portion of the district. Major access to harvesting areas is primarily by water and only six percent of the land base is operable. Nevertheless, there are limited ecologically-derived constraints on the temporal and spatial distribution of operations. It has not been assessed whether any ecosystems have been disproportionately or critically affected by timber harvesting.

Several industry initiatives have created a shift in forest practices to those more compatible with EBM although not always driven by EBM criteria. Corporate commitment made by Interfor in 1998 to conduct variable retention on half of its operations, and also by Triumph Timber in 2000, has resulted in harvesting with smaller openings and more retention of the full forest profile and is thus closer to natural disturbance regimes than conventional clearcutting. By definition, variable retention, more than other silviculture systems, lends itself to maintaining structural complexity and biological legacies over a full rotation (Mitchell and Beese, 2002). Heli-logging is extensively used by Interfor for variable retention, reducing the amount of roads built to access timber. Although application of these approaches is largely driven by visual quality requirements, steepness of hillsides and cultural values, they do result in retaining more ecosystem diversity.

Ecological considerations do drive some aspects of stand level design, particularly for riparian management, a dominant ecological feature on the north coast. Retention around S4 streams (fish bearing streams less than 1.5 metres wide), for example, is based upon the stability of the stream substrate, recognizing that stream banks of bedrock are less prone to erosion after harvesting than soil substrates. Provisions for coarse woody debris, wildlife tree patches (WTPs) and connectivity are also incorporated into operational planning, based upon the Code's Biodiversity Guidebook (BC Ministry of Forests and BC Environment, 1995).

EBM is explicitly being used as a framework for one harvesting operation conducted by Triumph Timber in cooperation with the Gitga'at First Nation above Fraser Reach on Princess Royal Island. Using an EBM planning framework developed for this project, a 5,000 ha hanging valley was chosen for harvesting because of its relatively benign mix of values, low ecological complexity and to take advantage of the Terrestrial Ecosystem Mapping (TEM) information already in place. This operation has since been adopted as a Pilot Project by the Coast Information Team which is developing an EBM framework for the BC's mid and north coast (Ministry of Sustainable Resource Management, 2002a). Road building began during the summer of 2002 with logging expected to occur over the next two years. Harvesting will occur with retention located where it makes the most sense ecologically, including increasing riparian reserves around streams in excess of the Forest Practices Code's minimum requirements.

Kalum

Industry began incorporating leave areas into harvesting plans based on ecological considerations, such as retaining unusual ecosystems, on an ad hoc basis in the early 1990s. Approval of the Kalum LRMP, (Ministry of Sustainable Resource Management, 2002b) by government in 2001, provided more focussed direction consistent with EBM. Most notable is the LRMP's direction for patch size distribution. Based on criteria in the Biodiversity Guidebook, patch size distribution is now assessed with numerical justification in forest development plans

(FDPs) to meet the Code's Operational Planning Regulation requirements for rationalizing clearcuts over 60 hectares in size. The patch size requirements have also led to a longer-term outlook for planning future forest conditions. The LRMP notes that natural disturbance favours smaller patch sizes throughout the district. In practice, however, for economic reasons, these tend to be located within 50 kilometers of mills. Smaller openings are also placed where green-up adjacency constraints under the Code preclude clearcutting, rather than being determined by broader ecological criteria.

Another area where the LRMP has had influence is in specific direction for grizzly bear management, a species whose population decline in the district is linked to habitat loss. In effect, it serves as an indicator species and the LRMP goes into detail on the science behind grizzly bear management in the area. For forestry this has largely impacted stocking standards for certain ecosystems in specified watersheds. These now have lower stocking standards for reforestation to provide bear habitat needs, particularly benefiting growth of berry producing plants. Elsewhere, the district has moved to more widespread restocking of sites with the species that were logged, rather than pine monocultures.

As part of the LRMP, West Fraser Mills made a commitment to using ecosystem-based planning in undeveloped watersheds along the coast. This move was prompted by "international concerns regarding forestry operations in coastal temperate rainforests." (Land Use Coordination Office, 2001). The first of these watersheds, the Kowesas near Kemano, is about halfway through a planning process. Since the Kowesas is a highly significant valley for the Haisla, containing an eulachon run and an historic village site, the plan is being developed in consultation with the First Nation. Whether or not West Fraser will even attempt to log the 2,500 operable ha in the 40,000 ha watershed will be decided once options developed in the planning process are assessed.

Kispiox

Ecosystem-based management in the Kispiox forest district is the stated resource management framework for the McCully Creek adaptive management pilot project and for the small business program, particularly at the forest development planning level. Total Resource Planning has been used in many areas to provide a level of resource value analysis fitting between LRMP and FDP scales. The LRMP itself (Land Use Coordination Office, 1996) provides general objectives for biodiversity which are consistent with EBM premises of maintaining ecosystems and the structural diversity of forests. Some of these objectives became legally enforceable in 1996 as higher level plans (HLPs) under the Code. Many of the Kispiox LRMP objectives and strategies for values such as wildlife are intended to be implemented at the landscape planning level, but have not yet been completed.

The latest small business FDP (Kispiox Forest District, 2002) is exceptional in the depth of resource information provided, demonstrating explicitly how decisions are anchored in science. The plan provides summaries of the scientific literature and other data upon which its management strategies are based, and identifies where limitations to this knowledge exist. For the most part, the small business chart areas correspond to watersheds, enabling planning at the FDP level for a geographically coherent area. The plan includes temporal and spatial analyses of disturbances, identifying disturbance patterns at a variety of timeframes and spatial scales.

Alternative silvicultural systems are being used to mimic a range of disturbances, from pathogens and insects covering less than one hectare, to mid-sized windthrow patches and fire events which could result in aggregated openings of over 400 ha. Overall, nearly two-thirds (64 %) of the cutblocks are partial retention, leaving 40 to 70 % of original basal area. Up to 40 % retention is included in another 17 % of the blocks. Management strategies are measurable and go beyond timber harvesting to providing a range of habitats. For instance, cottonwood trees are omitted from utilization specifications due to their value as wildlife denning sites.

Adaptive management is focussed on the McCully Creek area, where the results of silvicultural research trials begun in 1990 at Date Creek are being tested operationally in the context of ecosystem management. The adaptive management plan was developed out of several workshops with resource managers and stakeholders where issues, indicators and management objectives were defined. The study is assessing the impacts of timber harvesting, that has been designed to mimic natural forest disturbances, on such things as timber quality and production, water temperature in small streams, water quality and terrain stability. Measurable indicators exist for some of these values, while others are being developed as part of the project.

Bulkley-Cassiar

The most significant feature in the Bulkley portion of this district, and unique to the province, is the completion in 1999 of landscape unit planning for a full range of resource values. Based on the Bulkley LRMP (Land Use Coordination Office, 1998), these provide key direction for forest ecosystem management and have been a major driver in changing logging practices, particularly to partial cut silvicultural systems. Biodiversity elements of both levels of planning are also legally established under the Code as higher level plans.

Many principles relevant to EBM are incorporated into the LUPs such as maintaining a representative cross-sections of ecosystems, and maintaining natural age class distributions and natural disturbance patterns across the landscape. The planning approach was based upon recommendations in the Biodiversity Guidebook. The plans identify on maps ecosystem networks comprised of Core Ecosystems and Landscape Corridors, that are managed to allow for natural ecological processes. Core Ecosystems contain representative samples of the range of ecosystems where old growth and interior forest conditions are to be maintained. Landscape Corridors enable plant and animal dispersal by reducing habitat fragmentation and maintaining mature tree cover. Harvesting and road building in these areas occur only under certain circumstances. Measurable targets for seral stage, patch size and WTPs are also provided within the plans. As well, the LUPs address timber, recreation, wildlife, fish habitat, access management and visual quality.

Monitoring is an integral part of the plans and the first monitoring results have been reported for the biodiversity indicators at the landscape level (Cuell, 2001). This analysis has identified where targets are and are not being achieved, and provides recommendations specific to landscape units and biogeoclimatic subzones for future harvesting in order to meet the LUP targets. Pacific Inland Resources is also working on more detailed indicators. They are building on experience elsewhere to develop for their Bulkley operations a benthic invertebrate index as an index of biological integrity to monitor water quality.

From the perspectives of the district, licensees and public, having LUPs in place has created stability and resolved contention. The working forest is now defined providing the timber industry with clear direction. While FDPs now need to contain analyses of patch sizes and seral stages, rationalizations for large cutblocks are not required, because these are contained in the LUP. As well, licensees are now able to prepare FDPs spanning tens years, and have considerably more comfort with planning decisions.

Morice

District level strategic planning has started, but is not yet completed to the point of guiding forest operations in the Morice district. Stakeholder planning meetings for the Morice LRMP will commence in October 2002. Further along is the Morice and Lakes Innovative Forest Practices Agreement (ML-IFPA), a government and industry initiative begun in 1999 to develop a district-wide sustainable forest management plan based upon forecasting through computer modelling of alternative scenarios for forest management. Ecosystem-Based Management is one timber harvesting scenario planned, where timber harvesting practices are guided by localized targets for patch size and seral stage. Other scenarios will focus on landscape and stand level biodiversity and on specific wildlife species. Data gathering for the models is currently underway and once the computer modelling is completed, the results will be presented publicly for feedback on the preferred option for the Morice district.

To provide data for the modelling, there have been several research initiatives relevant to EBM. These include modelling forest succession pathways, studying natural fire history to determine forest responses to natural disturbances, and modelling habitat supply for selected vertebrate species. A current emphasis is on developing relevant indicators for monitoring the implemented management plan. Research into biological integrity indicators has involved developing a benthic index and forest bird community index.

In the meantime, forest harvesting has generally moved towards greater implementation of partial cutting. For instance in the latest small business FDP, 40 % of cutblocks involve 30 % removal of trees in one to five hectare patches. Retention areas in this program and on some other licenses are sometimes planned to accommodate wildlife values, but are often determined by areas which are not harvestable, or based upon historic cutting patterns and implemented by operator selection of leave areas.

CSA certification, achieved by Houston Forest Products in December 2001, has entailed company commitments that have moved their practices to an EBM approach. These include developing targets, operational tools and operational practices to manage stand level indicators such as coarse woody debris (CWD), snags, and large live trees so that structure and ecological attributes remain after logging. Considerable effort has gone into field research to identify where and how to best conserve these elements. The aim is to develop standard operating procedures and decision matrices to guide choices of management strategies.

Wildlife tree patches comprise five to eleven percent of Houston Forest Product's cutblocks. Selection of wildlife tree patch sites meets ecological criteria such as location of key features and distance to cover, with objectives for each WTP specified in silviculture prescriptions. At the landscape level, aspects of ecosystem management that are considered when planning for

harvesting include patch size distribution, seral stage distribution, tree species composition for leave areas and reforestation, and key wildlife habitats for seven species of concern.

Lakes

Since early 1997, the Lakes forest district manager has expected licensees to meet biodiversity requirements for WTPs and other elements in operational plans. Since then, through district and landscape level planning, biodiversity requirements have been refined and formalized. The Lakes LRMP was completed in 1999 and a year later, seral stage targets and old growth management areas (OGMAs) for two resource management zones were established as Higher Level Plans, making these legally enforceable under the Code. Much of the LRMP is to be implemented through landscape unit planning, the first of these to be completed by the end of 2002.

The mountain pine beetle epidemic has drastically changed forest management in the last few years, including doubling the district's AAC to 3 million cubic meters. The most infested area, south of Francois Lake, is undergoing an accelerated LUP process in response to these forest management pressures. Planning is focussing on what will remain after harvesting, by mapping OGMAs and connectivity corridors. As a conservative measure because of the accelerated harvesting, WTP retention requirements are being doubled. Retention includes beetle killed stands, and mixed wood stands of spruce, pine and subalpine fir in the MS and ESSF zones. A panel of ecosystem experts, convened to provide direction in the context of the mountain pine beetle epidemic, recommended adding a new element to LUPs: retaining as much as one percent of the land base as unmanaged young forest.

Government agencies, public interest groups and forestry companies are compiling information in conjunction with and parallel to the IFPA process in Morice, leading to a separate sustainable forest management plan for the Lakes district. The ML-IFPA has fostered ecological research. Projects have included monitoring the Tweedsmuir caribou herd's response to bark beetles and forest harvesting, and describing habitat needs and population dynamics of Foxy Creek Canyon mountain goats.

Since 1997 the district has shifted to larger cutblocks which are more within the range of natural disturbance patterns as recommended in the Biodiversity Guidebook. Where visual quality is a concern, cutblocks have included patch or partial cutting approaches.

Babine Forest Products achieved CSA certification in March 2001 and is tracking interior forest conditions, seral stage distribution and WTPs to meet their certification commitments. The company's FDP contains volume targets for CWD, and policies for single tree retention. To control sediment from road crossings of fish streams, every culvert has been color coded based on the habitat sensitivity. This makes it easier for road crews to maintain culverts in ways which minimize sedimentation of fish habitat. Babine Forest Products is also involved in a large scale adaptive management study of Northern Goshawk habitat considerations for forest harvesting.

Indicators receive less attention, however, when plans are abruptly changed in response to mountain pine beetle outbreaks. The desire to develop access for controlling bark beetles has substantially increased the road network throughout the district. Now instead of following a

strategy of leaving areas such as the North Babine inaccessible by road, the entire district will likely be driveable within a few years.

Addressing EBM Criteria

The following section discusses the definition and criteria of EBM, highlighting the extent and variation with which these have been applied in northwestern BC.

EBM Definition

There is consistency as well as significant variation in the definition of EBM formally adopted by various forest planning and management initiatives around the region. (A listing of these definitions is on the following page.) The definitions are generally consistent with the scientific literature in that they recognize that EBM is about ensuring ecosystem integrity. Usually EBM definitions link this concept with maintaining ecosystem processes and characteristics. Where definitions diverge, however, is the extent to which social and economic values are incorporated. In some definitions, these are not mentioned (eg. Kispiox FDP, Kalum LRMP), while more often, providing social and economic benefits is presented as a strong component of EBM (eg. Lakes LRMP, Gitga'at Pilot Project).

Potentially the most influential EBM definition in BC has arisen out of a lengthy consultation process involving participants in the Central Coast LRMP with advice from a broad range of scientists. This resulted in formal agreement in April 2001 on an EBM definition along with 35 principles. The definition is broader than the conventional focus of EBM to maintain ecological integrity (Coast Information Team, 2002). In addition, the definition covers ensuring that healthy human communities exist and that human social, economic and cultural activities are sustained. This definition has subsequently been adopted by the North Coast LRMP (Ministry of Sustainable Resource Management, 2001) and by the Gitga'at Pilot Project (Gitga'at-Kitasoo/Xaixais Pilot Project, 2002). However, it has implications for pushing EBM into new ground regarding the social and economic dimensions. The practicalities of how this works operationally are being explored by the Coast Information Team as part of their mandate to develop an ecosystem-based management framework for BC's central and north coast and the Queen Charlotte Islands by June 2003.

It is notable that EBM cannot easily be separated from the overarching imperative to balance social, economic and environmental needs in BC resource planning and management. This brings the definition of EBM here closer to the preamble of the FPC and to what is typically considered sustainable forest management. The critical difference between SFM and EBM, which many forest managers in this survey identified, is that EBM is much more strongly anchored in and supported throughout by science than is found with SFM.

Despite all this, however, this survey found that many forest managers readily admit to not having a clear idea of what EBM really is. This may have arisen from the relative newness of the concept, the varying definitions used so far, and lack of formal application of EBM throughout most of the region.

Definitions of EBM Used in Northwestern BC

“The long-term goal of ecosystem management is to ensure that the integrity of a natural ecosystem is maintained while providing for social and economic values as well.”

McCully Creek Adaptive Management Plan (Kispiox SBFEP, 1999)

“Ecosystem management is designed to maintain ecosystem health by ensuring that genetic, structural, landscape, spatial and temporal diversity of ecosystems are retained.”

Kispiox SBFEP 2002 - 2011 FDP

“Ecosystem based management is a strategic approach to managing human activities that seeks to ensure the coexistence of healthy, fully functioning ecosystems and human communities. The intent is to maintain those spatial and temporal characteristics and processes of whole ecosystems such that component species and human, social, economic and cultural activities can be sustained.”

North Coast LRMP, Central Coast LRMP, Gitga’at Pilot Project (2002)

“the application of ecological, social and economic information, options and constraints to achieve desired social benefits while maintaining ecosystem integrity within a defined geographic area and over a specified period.”

Canfor (Draft Implementation Plan-Forestry Principles 2002)

“An ecosystem approach to resource management recognizes the structural, functional and evolutionary characteristics of the ecosystems which produce the renewable natural resources on which humans depend.”

Lakes LRMP (2000)

“A strategy or plan to manage ecosystems to provide for all associated organisms, as opposed to a strategy or plan for managing individual species.”

Kalum LRMP (2002)

Planning Scope

SCALES AND BOUNDARIES

Forest planning in BC is largely defined by the Forest Practices Code which provides a hierarchy of district: LRMP; landscape: LUP; operating area: FDP; and stand: silviculture prescription (SP) planning. Of these, LUPs and some SPs are based upon ecologically relevant boundaries, while the other two normally use forest administration boundaries. LRMPs exist in four districts and are underway in the other two districts within the region. LUPs also do not exist throughout the region, and have only been fully implemented in the Bulkley district. In some other districts this gap has been filled by other planning vehicles on a landscape scale, such as Total Resource Plans or Total Chance Planning.

Another level in the hierarchy not set out in the Code, but occasionally used in practice, is for areas defined by a mid-sized watershed of 5,000 to 40,000 ha. For instance, chart areas for the Kispiox small business program have been consolidated where possible to encompass mid-sized drainages. As well, both the Kowesas and Gitga-at EBM Pilot Projects involve planning for an entire valley system. This mid-sized watershed scale forms an ecologically coherent area that seems particularly relevant and useful for EBM.

Long-term temporal scales are rarely explicit in forest management plans. However, LRMPs and LUPs, are considered long-term living documents to be revisited periodically. Some FDPs are moving to a ten-year planning time-frame. With direction from LUPs in the Bulkley district, FDPs are able to forecast seral stage distribution ten years into the future. Longer planning periods are being incorporated into some innovative planning initiatives. Planning for the Kowesas, for instance, will cover a 250 year period. The McCully Creek adaptive management project includes a short-term temporal scale for management and monitoring of 5 to 10 years at stand and aggregated harvesting area level, and a medium-term time frame of 20 to 120 years at the landscape level (Bilodeau and Turney, 1999).

Scientific Principles

SYSTEMS THEORY

Consistent with systems theory, forest management is in many ways routinely interdisciplinary under the Forest Practices Code. At the stand level, biogeoclimatic ecological classification is required and depending on the site, assessments of terrain, archaeology or visual quality may be done. At the forest district level, LRMPs address biodiversity and wildlife as well as the range of resource uses and the social, cultural and economic considerations associated with these.

SCIENTIFIC INFORMATION

There is a trend to include more information and more precision in forest planning. For instance, the Morice small business program's latest FDP has, for the first time, included site series for high value wildlife habitat. The level of detail provided in FDPs does vary, with some, such as the Kispiox small business 2002 FDP, providing scientific information explicitly laid out as reasoning for the selection of forest management approaches. Cases also exist, such as the

Kispiox small business FDP and the discussion of grizzly bear management in the Kalum LRMP, where the limits to scientific knowledge and the assumptions behind management strategies are described in detail, as is expected with EBM.

The scientific standard used throughout the region for biodiversity management is the Biodiversity Guidebook (BC Ministry of Forests and BC Environment, 1995), developed by provincial resource agencies to accompany the Forest Practices Code. Arguably, this guidebook has been the single biggest influence on ecosystem management in northwestern BC to date. Most of the foresters and planners surveyed said the guidebook is their main source of direction for ecological management. It is used in every district, at every level of planning and for every type of timber tenure. Although not legally required under the Code, the guidebook standards have also been adopted as strategies for biodiversity management in LRMPs such as Kalum and Lakes.

The guidebook provides recommendations for such things as seral stage distribution, patch size distribution, and landscape connectivity for five natural disturbance types found in BC. The reference is soundly based on ecological principles and is generally regarded by resource managers as a solid approach to ecosystem management. Nonetheless, the guidebook does not always reflect the latest scientific information. Much has been learned through research and application of the guidebook since it was published but the book has never been updated. For instance, an analysis of historic disturbance rates suggests that the guidebook overestimates stand replacing disturbances in the ESSF biogeoclimatic zone. (Steventon, 1997). Other recent research indicates that SBSmc2 stands attain old growth characteristics at 175 years, not 140 years as recommended in the Biodiversity Guidebook (Burton and Coates, 1996). The guidebook is also weak in differentiating smaller disturbance patterns, which are naturally prevalent in the western portion of the region. All disturbances of less than 40 ha are classified and treated the same. There is, however, a great range of variability among smaller disturbances including windthrow, disease and landslides that the guidebook does not capture.

Most visibly on the landscape, partial cutting is a move towards mimicking some natural disturbance patterns and retaining structural and species diversity in forest stands. Throughout the region, use of patch retention has increased over the last decade. However, the extent to which the practice has been adopted varies among licensees and districts. From an ecological standpoint, results of recent research support the move in northwestern BC forestry to partial retention (Steventon et al, 1998). As an example, partial retention results in a greater diversity and abundance of birds in the SBSmc biogeoclimatic subzone compared with clearcut or uncut stands (MacKenzie and Steventon, 1996).

New planning initiatives such as the ML-IFPA and EBM pilot projects have involved considerable gathering of inventories and other resource data at the initial planning stages. This is also standard process for LRMPs. The Code provides a legal limit regarding what information is required in FDPs. Unless resource information is made “known”; that is, included in a Higher Level Plan or made available by certain government officials for at least four months, operational plans are not required to contain the information. The Forest Practices Board, in their province-wide review of forest development planning, found cases where this regulation was

resulting in the exclusion of information from FDPs. (Forest Practices Board, 2000). This is counter to the EBM premise of using the best available scientific information.

Use of the precautionary principle was not frequently mentioned by interviewees. Those who were explicitly applying the principle, had set out from the beginning to plan and manage forestry within the context of EBM. These include the Kispiox small business program, a Morice woodlot licensee, and the Gitga'at Pilot Project.

Monitoring at the LRMP level has proceeded in some districts such as Bulkley, but not yet in others such as Kalum. At the FDP level, numerical analysis for patch size distribution has recently begun where it is required to meet the Code's Operational Planning Regulation (section 11.3.b) requirements that cutblocks proposed larger than 60 hectares are consistent with the temporal and spatial distribution of natural openings. The Bulkley district has also recently assessed patch size and other biodiversity indicators at the landscape level. Work is proceeding on several fronts to develop other indicators for monitoring ecosystem health such as water quality and interior forest conditions. This is currently a focus of the ML-IFPA and several indicators have been established for McCully Creek. Since indicators are influenced by local ecosystem factors, they need to be calibrated or even redeveloped for different areas. This is true, for example, of the benthic invertebrate index that several forestry companies are currently developing, based on adapting experience gained elsewhere to local conditions.

ADAPTIVE MANAGEMENT

An excellent example of adaptive management in northwest BC is McCully Creek, which was established as an adaptive management pilot project under the Kispiox small business program. The need for continuing improvement is recognized by companies involved in CSA certification and by many resource managers. Although acknowledged as a necessary component, adaptive management has yet to be formally planned out for the ML-IFPA. The Kowesas and Gitga'at pilot projects will include evaluations of the costs of implementing EBM, but have not so far planned for other adaptive management studies. Canfor has committed to using adaptive management to build understanding of ecosystem processes in its operations, although implementation is in the early stages. A few operational trials are underway elsewhere in the region. For instance, Interfor is assessing whether ground disturbance from heli-logging is sufficient for forest regeneration.

Beyond these examples, the survey found that many resource managers had poor understanding about structured and scientifically rigorous approaches to adaptive management. Many resource managers consider their ongoing informal learning from experience, which they use to improve practices, as a form of adaptive management.

Institutional Considerations

ORGANIZATIONAL CHANGE

Organizational change has occurred throughout the region to better address resource management concerns. The most high profile example is the collaborative effort of several major forest companies, government agencies and interested public with the ML-IFPA. Influential in

prompting organizational change has been public values articulated through media and markets. This has spurred Houston Forest Products, Babine Forest Projects and Canfor to seek CSA certification. It has also led to commitments from the company executive of Canfor to practice ecosystem management (Canfor, 2002), by West Fraser to pilot EBM in Tree Farm License 41 (Kalum LRMP) and by Triumph Timber and Interfor to use variable retention harvesting methods.

STAKEHOLDER INVOLVEMENT

For LRMPs and the ML-IFPA, stakeholder involvement in planning has been a long and structured process. Public involvement for FDPs is required under the Code for a review and comment opportunity. Interestingly, several forest planners have found that once the parameters for ecosystem management are established with public acceptance, along with building of public trust, the public's interest in influencing FDP and LUP planning drops. This has occurred in the Kispiox and Bulkley districts.

In planning initiatives involving First Nations, there is movement to equalize the power among all participants in making decisions. The Gitga'at pilot project is being developed with full agreement of the Gitga'at First Nation. For the Kowesas, the Kalum LRMP dictates that planning be conducted through consensus of licensees, the provincial government and the Haisla.

Barriers to Implementing EBM

Several of the barriers to EBM were repeatedly mentioned during the survey and are prevalent concerns throughout northwestern BC. These widespread barriers: implementation costs, legislation and policy, and insufficient science, are each discussed below.

Implementation Costs

Throughout industry there is concern about how much EBM is going to cost. Partial cutting in particular was identified by many interviewees as being more expensive than conventional clearcutting. Over a given area, partial cutting incurs road costs comparable to those for clearcutting, but with lower returns since a smaller wood volume is harvested. This is a formidable barrier particularly for small operators working in difficult terrain, such as in the North Coast small business program and for woodlot licensees. Since it is only in the last ten years that northwestern BC has gained partial cutting experience, there is probably room for learning and refinements to improve costs. Experience in the Kispiox small business program indicates that partial cutting likely costs ten to fifteen percent more than clearcutting.

Many other resource management expenses can increase using EBM. These include the requirements for more detailed planning, better scientific information, and monitoring. The forest industry stresses that they need EBM to be cost neutral. If additional costs are incurred, these must result in better operations and ultimately lower expenditures elsewhere.

Legislation and Policy

Throughout the Forest Practices Code, and the provincial stumpage and appraisal systems, forest managers are encountering disincentives to practicing EBM. While many specific requirements may have a small impact, together these create a substantial barrier. For instance, the stumpage

appraisal system does not allow for the increased costs associated with leaving advanced subalpine fir regeneration on ESSF sites. A licensee incurs the extra costs of manoeuvring around the 500 poles and saplings left per hectare, to achieve ecological objectives and boost future timber yields. For an interior woodlot licensee, roads can be included as appraisal costs, but skidding cannot. This makes the access alternative that is least desirable ecologically to be the most attractive economically.

The Code's free-to-grow requirements are partially responsible for a graphic example of what can happen when EBM is not practiced. Lodgepole pine is a preferred species for planting because it achieves free-to-grow status more quickly than other species, ending licensee obligations. As a result, it has been planted extensively, even in the ICH zone, which is noted for its complexity of tree species, and on sites which are naturally dominated by hemlock and balsam. In the Kispiox district, 30,000 ha of pine monocultures have been planted over the last 35 years, with additional sites in the Kalum district. Now as saplings, these pine are succumbing to *Dothistroma foliar* disease. The severity and extent of the disease is unprecedented with over 80 % of blocks now infected, some suffering complete pine mortality. Several of these blocks are large clearcuts which were burned after logging and will now require considerable rehabilitation before other tree species can survive. Fortunately, there is now a trend in forestry here to replant with the same mixture of species that were harvested off the site.

Stocking standards are another source of difficulty for those attempting EBM. The Kalum LRMP cut stocking standards for certain BEC subzones which are berry-producing grizzly bear habitat. These sites are hummocky and water-logged, making them difficult to fully restock under normal standards with evenly spaced trees. Gaps in the forest canopy will provide better long-term forage production for bears. But planting in clumps is problematic because survey standards cannot properly assess the regeneration success of irregular stocking. The benefits of reforestation in clumps and gaps not only applies to grizzly habitat, but increases the diversity of many ecosystems, and can lead to better resilience to natural pathogens. Mimicking nature's patterns of reforestation, foresters have found, is not sufficiently encouraged under current silvicultural requirements.

One forests ministry policy in particular was identified in several interviews as an impediment to EBM. That is the directive to limit the impact on the timber supply, resulting from managing for biodiversity, to just over four percent (Pedersen et al, 1999) and from implementing Identified Wildlife measures to one percent (BC Ministry of Environment, Lands and Parks and BC Ministry of Forests, 1999). This policy does not take into account the various risk thresholds for ecosystems throughout the province. Related to this, other interviewees identified that too high a level of AAC and restrictive cut control requirements were hindering successful EBM implementation.

Insufficient Science

In most cases, resource managers find that the science does not yet exist to support adequately implementing EBM, particularly for the ecosystems encountered in this part of the province. Of particular concern is the scarcity of information on local thresholds for ensuring ecosystem integrity. These need to be established for items as diverse as the pattern, size and distribution of coarse woody debris to leave on a cutblock, to the amount of old growth forest an ecosystem

requires to be viable. In mountain pine beetle terrain, the question arises regarding the ecologically most desirable proportion of live versus dead trees to protect in old growth reserves.

Natural disturbance patterns is another item commonly mentioned in the surveys for which resource managers would like more scientific research. These are especially poorly understood in the western part of the region where small natural disturbance patterns dominate.

A third area in which there is a critical lack of science is identification of indicators for monitoring ecosystem health. There is a need for reliable, relevant, efficient and cost-effective measures to provide ongoing assessments of the extent to which forest activities are impacting ecosystems, particularly whether ecosystems are approaching viability thresholds. It is recognized that these indicators do not need to be precise scientific measures, but rather just sensitive enough to determine where a more in-depth assessment of conditions is required.

As one forester said, stubbing and partial cutting are “feel good” practices but we don’t know if we’re doing them in the right place and in the right way. But this lack of science doesn’t mean that foresters feel they should stop and wait until better information arrives. Instead, the strategy used for the Gitga’at project is to proceed with a precautionary approach when faced with the unknown.

Other Barriers

The lack of clarity among resource managers concerning what constitutes EBM and adaptive management certainly creates a hesitancy to practice these. There needs to be a consolidation of visions of EBM and a better understanding of adaptive management techniques. In its most ideal application, adaptive management with its scientific rigour is substantially out of reach both technically and financially for many resource practitioners. Adaptive management would become a more accessible tool if clear, easily applied and cost-effective techniques were developed and extended to resource professionals throughout the region.

Opportunities for Enhancing EBM

While the barriers mentioned above require some concerted action to overcome, there are opportunities for resource managers to better achieve an ecosystem approach, using the tools already in place.

Where LRMPs exist, they generally contain objectives and strategies for managing biodiversity and other resource values which are consistent with EBM principles. For instance, the Lakes LRMP “adopts the general management direction of maintaining ecosystem health based on an ecosystem approach to resource management.” (BC Ministry of Forests, 2000). The plan provides direction on maintaining and restoring ecosystem diversity with mechanisms such as landscape unit planning, designation of Wildlife Habitat Areas, improved inventories, access management and many others. Follow-through on implementing some components of LRMPs has been slow. No Wildlife Habitat Areas, for example, have been designated yet under the Forest Practices Code in the Prince Rupert Forest Region. More thorough implementation and monitoring of LRMPs will likely enhance the maintenance of ecosystem integrity.

One premise of EBM, as applied to forestry, is determining what needs to be left behind before deciding where to log. At the stand level, this means ensuring reserves areas such as OGMAs and WTPs are placed where these can do the most good ecologically. In practice, other factors such as convenience and lack of resource information sometimes dictate where patches are left in a cutblock. Criteria for reserve placement ought to be explicit and based upon ecological science. Coates and Steventon (1994) recommend criteria for selecting patches for retention such as the presence of a diversity of species and canopy layers, uncommon species or plant communities, large snags and evidence of wildlife use.

Some changes required to implement EBM are, in practice, easier to accomplish than others. Planning and setting landscape level targets for seral stage and patch size distribution tend to be relatively straight forward to implement. Challenges arise on the ground where it is tougher to change to logging practices which involve greater intricacy and possibly slower productivity.

Full-scale application of EBM, at this point in the discipline's development here, may be most successful on small areas. While acknowledging that EBM does involve the larger context, smaller management areas can involve fewer ecological and resource value variables. As well, sites where there is widespread acceptance of the need to manage for ecological values may be more amenable to EBM implementation. For areas where there is a concern with grizzly bear or caribou habitat, for example, there is more likely to be the institutional and individual willingness to plan and manage on an ecological basis. Although single species focus is not what EBM is about, concern for a keystone or focal species may be a catalyst for more comprehensively implementing EBM principles. These factors together will lead to EBM success by reducing its complexity while applying it in a context acceptable to a broad array of stakeholders.

Conclusion

There is interest in and awareness of ecosystem-based management across northwestern BC. Although full understanding of its application is still emerging, many resource managers are working with what is available to address forest management issues using ecological principles. As a result, case examples are cropping up in each district to explore the application of EBM criteria.

Concerns about cost effectiveness need to be resolved, however, before more widespread EBM implementation occurs. A stronger scientific base relevant to local ecosystems and revisions to legislation and policy will also facilitate the spread of EBM. Still, there are opportunities to work within current constraints to more effectively manage for ecosystem integrity, since guidance already exists in LRMPs and elsewhere.

Finally, events such as this conference will contribute to enhancing EBM in northwestern BC by building awareness and common understanding, and by providing opportunity for resource managers to jointly probe issues and applications.

Recommendations

In addition to the mechanisms described above that resource managers or licensees may individually adopt, the following recommendations are aimed at setting a regional context for enhancing EBM implementation and are based upon this overview of EBM in northwestern BC.

- 1) Forestry legislation should be amended and forest policy revised to remove disincentives to implementing EBM.
- 2) The Biodiversity Guidebook should be updated to reflect the best available scientific information and to provide more detailed distinctions amongst natural disturbance patterns of less than 40 hectares. Ideally the Guidebook would be treated as a living document which is continually improved as better information emerges.
- 3) Research ought to be encouraged into the characteristics of natural disturbance patterns, into thresholds for maintaining ecosystem integrity, into developing efficient and effective indicators, and into cost-effective harvesting patterns which support EBM.

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