The Art and Science of Sustainable Resource Management Planning Science Forum Proceedings*

September 27–28, 2006

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Introduction

What can be more challenging and rewarding than contributing knowledge or developing plans for the management of British Columbia's natural resources? How can you consider and manage for achieving objectives at various scales and for different values? How can managers combine what they learn from the latest science and indigenous knowledge with the tools and knowledge acquired through years of experience? Why is it important to consider both art and science in developing sustainable resource management plans? How can scientists best contribute their knowledge to sustainability solutions?

FORREX, in partnership with the Forest Investment Account–Forest Science Program (FIA–FSP), hosted this Science Forum to support exploration of the art and science of sustainable forest management planning. The Forum aimed to:

- increase awareness of the challenges, the art, and the science of sustainable forest management planning;
- increase awareness of current projects and initiatives that are contributing knowledge to improve science and knowledge-based resource management planning; and
- stimulate dialogue between resource professionals engaged in science and resource management planning.

FORREX and FIA–FSP appreciate the contributions of presenters and registrants, of session Chairs, and of the Forum organizing committee. We are pleased to present the following package of Popular Summaries from some of the presentations and posters as an enduring record of the Forum's dialogue. Due to certain constraints, not all summaries are presented here. We encourage readers to contact authors of those presentations for more information.

Forum Program

INTRODUCTION TO THE SCIENCE FORUM:
SUSTAINABLE RESOURCE MANAGEMENT PLANNING PRINCIPLES AND PRACTICES

Chair: John Innes, University of British Columbia

First Nations Stewardship Principles
Terry Teegee, Natural Resource Analyst, Carrier Sekani Tribal Council. Email: terryteegee@hotmail.com

National sustainability objectives and strategies: How does British Columbia contribute?
David Marshall, Executive Director, Fraser Basin Council. Email: dmarshall@fraserbasin.bc.ca

Integrated Land Management Bureau: Building synergies across spatial scales and organizational structures
Brenda Hartley: See Popular Summary page 55

The conundrum between results-based versus regulation: Lessons learned from a review of Forest Stewardship Plans
Bruce Fraser, Chair, Forest Practices Board. Email: bruce.fraser@gov.bc.ca

SCIENCE, STEWARDSHIP, AND BRITISH COLUMBIA'S NATURAL RESOURCES

Chair: Chris Hollstedt, FORREX

Science, stewardship, and timber resource management planning
Doug Williams, Partner, Cortex Consultants Inc. Email: dwilliams@cortex.ca

Science, stewardship, and non-timber forest products
Wendy Cocksedge, Brian Titus, and Will MacKenzie: See Popular Summary page 57

Science, stewardship, and managing for intangibles
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SCIENCE AND SUSTAINABLE FOREST MANAGEMENT PLANS FOR CERTIFICATION

Chair: Kathie Swift, FORREX

Science and Forest Stewardship Council certification standards for British Columbia
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SCIENCE AND SUSTAINABLE FOREST MANAGEMENT PLANS FOR CERTIFICATION (*continued*)

Experiences in science, innovation, and sustainable forest management planning in central British Columbia: Development and testing of Canfor's initiative
Clive Welham, Nicole Robinson, and Steven Day: See Popular Summary page 69

Science and planning for Sustainable Forestry Initiative certification
Gerry Fraser, Manager of Sustainable Forestry, Interfor. Email: Gerry_Fraser@interfor.com

SCIENCE AND INFORMING LAND USE PLANS

Chair: Steve Carr

Central coast land and coastal resource management planning
Shannon Janzen, EBM Manager, Coast Forest Conservation Initiative. Email: sjanzen@westernforest.com

Managing for science: Creating conditions for success
Melissa J. Hadley: See Popular Summary page 71

POSTER SESSION

Integrating science and knowledge into natural resource management solutions: Progress and results from British Columbia's innovation community

Popular Summary

Integrated Land Management Bureau: Building synergies across spatial scales and organizational structures

Brenda Hartley[1]

Presentation Abstract

This paper provides an overview of the structure, the core business areas, and the services provided by the Integrated Land Management Bureau (ILMB) to foster integration and create synergies to enhance land and resource management in British Columbia.

In British Columbia, government re-organization, streamlining of mandates, and the application of "the hard nose of business" has improved the overall effectiveness of government by improving the efficiency and focus of individual ministries. The Province of British Columbia is now striving to further enhance operations through strengthening the inter-agency workings of government. Clear benefits will be achieved from improving the flow of information and knowledge between ministries and from improving the ease of access to government for internal and external clients. The application of commonsense measures is important and includes: improving and simplifying access to land and resource information for users within and outside of government; increasing inter-agency collaboration to make government more accessible; and enhancing communication and the sharing of knowledge to foster more effective decision making. The ILMB, established in 2005, is a primary vehicle for horizontal integration on land and resource management issues.

KEYWORDS: *citizen-centred delivery of services, cross-ministry initiatives, horizontal integration, integrated land and resource information, inter-agency communication and co-ordination, land and resource management.*

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Hartley, B. 2007. Integrated Land Management Bureau: Building synergies across spatial scales and organizational structures. Popular Summary. *In* The Art and Science of Sustainable Resource Management Planning: Science Forum Proceedings, September 27–28, 2006. *BC Journal of Ecosystems and Management* 7(3):55–56. URL: *http://www.forrex.org/publications/jem/ISS38/vol7_no3_scienceforum.pdf*

What is the Integrated Land Management Bureau?

Mission and Vision

Goals

Core Business Areas

Organizational Context

Building Synergies Through Integrating Land and Resource Information Management

Chief Resource Information Office

Land and Resource Data Warehouse (LRDW)

Integrated Land and Resource Registry (ILRR)

Digital Atlas

Applications

Avian Flu

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Wildlife Habitat Area Modelling

Building Synergies Through Horizontal Integration

Inter-Agency Management Committees (IAMC)

Integrated Land and Resource Management

Integrated Engagement with First Nations

Resource Information Management

Front Counter BC (FCBC)

Species at Risk Co-ordination Office (SaRCO)

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Integrated Land Management Bureau Service Plan Summary, 2006/07–2008/09. URL: *http://ilmbwww.gov.bc.ca/ilmb/pdfs/ilmb_service_plan_sum.pdf*

http://ilmbwww.gov.bc.ca

http://www.bcbudget.gov.bc.ca/2006/sp/al

Popular Summary

Science, stewardship and non-timber forest products

Wendy Cocksedge[1], Brian Titus[2], and Will MacKenzie[3]

Presentation Abstract

Non-timber forest products (NTFPs) are all of the botanical and mycological resources of the forest other than conventional timber products. Both the recognition and use of these species is growing quickly in British Columbia. To ensure sustainability for personal, cultural, and commercial use of these species, NTFPs must be incorporated into forest resource management. At this stage, in order to be incorporated into management, NTFP stewardship tools must be simple, clear, and easily integrated with other forest management goals. As long as resource managers are willing to look outside the box, opportunities—just like mushrooms—are popping up everywhere.

KEYWORDS: *compatible management, inventory, non-timber forest products, resource management, traditional ecological knowledge.*

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Cocksedge, W., B. Titus, and W. MacKenzie. 2007. Science, stewardship and non-timber forest products. Popular Summary. *In* The Art and Science of Sustainable Resource Management Planning: Science Forum Proceedings, September 27–28, 2006. *BC Journal of Ecosystems and Management* 7(3):57–60. URL: ***http://www.forrex.org/publications/jem/ISS38/vol7_no3_scienceforum.pdf***

Introduction

Non-timber forest products (NTFPs), although a somewhat awkward term, include all of the botanical and mycological resources of the forest other than conventional timber products. Quite simply, they are things such as wild edibles, medicinals, art products, and floral greens. With some exceptions (see Mitchell *et al*., page 89), there is virtually no legislation or monitoring of these species. With an estimated 30 000 people commercially harvesting NTFPs in British Columbia each year, and tens if not hundreds of thousands more harvesting them for personal or cultural use, there is good reason to ponder whether lack of management may now, or in the near future, lead to yet another case of inefficient resource use and possible depletion. The NTFP sector is in a paradoxical situation in that lack of management is contributing to both over-harvesting in high population areas and under-valuing in the more remote communities.

It could be said that non-timber forest products are finally getting to sit down at the forest management table even if, figuratively speaking, there is not a lot of food to share yet. But with increased recognition comes increased responsibility and, if NTFPs are to be managed, we must ensure that we have at least a basic set of tools with which to manage.

To manage effectively, more information is required on the autecology of each NTFP species, on the levels, methods, and effects of NTFP harvesting on sustainability of the resource, and on the impacts of forest management on the NTFP resource. Of course, with large research investments, these ecological knowledge gaps can be quickly filled. In the meantime, however, there are innovative research methods and applications that can greatly contribute to stewardship of this resource.

Sources of Information

Because of a lack of short- and long-term NTFP research trials, it is important to think outside the box, and to view all available information with new eyes. The best opportunity for this is to increase the value of anecdotal information about NTFPs that resides in both local and traditional knowledge amassed by NTFP harvesters over decades and even centuries. Good NTFP harvesters are observant and have a great awareness of the effects of harvest and the location and stand conditions of the harvest sites on productivity, and have credible theories about what leads to increased or decreased production levels. By simply giving more credit to the people in the sector, and providing realistic opportunities for communication, some initial tools for improved NTFP stewardship can easily be created.

Many species which also happen to be important NTFP species are already considered in other areas of forest management. Information from managing for wildlife habitat, biodiversity, and riparian areas, for example, can be used to manage for species in these areas which are also NTFPs. And, ironically, information on how to eradicate some species, such as salal (*Gaultheria shallon*), can be used to determine potential effects of harvest (Haeussler and Coates 1986).

Inventory

There are many reasons for inventorying and monitoring NTFPs. The most obvious reasons are to ensure that commercial activities within the NTFP sector neither impede cultural or personal use nor degrade the environment. Inventory will also identify habitats that are sufficient to support the NTFP species, and to locate high value NTFP areas for integration into forest management plans. It has been stated by many forest managers that if they had a concept of the economic values of NTFPs on a per hectare basis, they could then better incorporate some NTFP species into forest management plans in some areas (Centre for Non-Timber Resources 2006); this kind of stewardship cannot be done effectively without inventory.

A number of options for NTFP inventory have been explored (Cocksedge 2006). Community-based NTFP inventories have benefits, particularly low costs and greater community involvement in managing the resource. The downside, however, is that the data quality and metadata requirements for inclusion into a larger framework are not usually met, and therefore the data cannot be used on a larger scale and is often not useful for other purposes such as wildlife studies.

Inventories of NTFPs are simply focussed vegetation inventories. The opportunities for and limitations of NTFP inventories are similar to vegetation resource inventories (VRI), or those created through biogeoclimatic ecosystem mapping such as Terrestrial Ecosystem Mapping (TEM) or Predictive Ecosystem Mapping (PEM). The main limitation is simply that the presence and cover of a species does not necessarily reflect the potential for use of that species as an NTFP; to be effective, the inventory must also include the quality of the species. For example, a conventional vegetation inventory in a forest with a relatively closed canopy may show extensive *Vaccinium* cover, but it is likely that the amount of *Vaccinium* actually producing an NTFP (i.e., berries) would be small to nil because of lack of light.

It s not necessarily complicated or difficult to include quality traits of NTFP species into inventories, and this simple information can quickly enhance our understanding of the locations and stand conditions in which good quality NTFP traits are found for different species. The first step in development of criteria for quality is talking with the best source of information and knowledge—the harvesters. Once these simple and specific quality criteria are developed, they can then be used by those with little or no knowledge of the NTFP sector, and if these criteria are consistently used across the province, NTFP value scales can be incorporated into conventional inventories and into larger databases.

Earlier this year, in partnership with the B.C. Ministry of Forests and Range, trials to include NTFPs in vegetation inventories for ecosystem plots were held in both Smithers and Haida Gwaii. Initial quality criteria guidelines were developed for a number of individual species, as well as for specific categories of species, such as wild berries and floral greenery. Quality ratings were developed on a scale of 0 (moribund or inaccessible) to 4 (excellent), and quantified or qualified for each species. Other information, such as part of plant harvested and general use, was provided to assist with assessment.

This is a relatively simple tool; some work is still required to address practical issues, such as:

- how to create room for inclusion of quality values on conventional plot cards and in available databases;
- how to deal with multiple uses—and therefore multiple values—for single species from which different parts are used for different purposes; and
- how to class seasonally dependent products (e.g., berries) if inventories are carried out when the plant parts of interest are not developed or visible.

Furthermore, although general information for developing quality criteria is easily obtainable, plant uses and methods of harvest can vary, particularly for species used for cultural purposes, so local knowledge will be needed to refine the inventory method. Here, it will be particularly important to ensure that enough information is compiled to adequately inventory NTFP species for stewardship purposes, and simultaneously respect the privacy of traditional use information.

Compatible Management

Non-timber forest products can be managed along a continuum, from wild-harvest through to agroforestry. With no monitoring, it has been difficult to estimate what proportions of harvesters are doing what kind of management, or the effects of the management (or lack thereof) on the NTFP species. The health and availability of NTFP species, however, is likely affected much more by habitat availability than by commercial harvest levels.

Compatible management is the practice of managing forests in a manner that is compatible for both timber and non-timber values, including NTFPs. As with NTFP inventories, much information is available that can be immediately applied to the stewardship of NTFPs (Titus *et al.* 2004), though gathering sources of information for compatible management often requires more effort than reading the scientific literature. A survey completed last year to assess the degree of awareness and the extent of the practice of compatible management showed that many land managers are already conducting compatible management to some degree (Centre for Non-Timber Resources 2006). Without regulation, it is not possible for land managers or harvesters to enforce rights to the NTFPs, which limits incentives for management. However, even given this limitation, activities ranged from relatively inactive forms of management (such as providing roads for access) to more active forms of management (such as specific silvicultural practices, and issuing permits for NTFP harvest on both private and public lands).

As a first step, incorporating NTFPs into forest management simply requires creative thought and communication. Enhancing NTFPs can be done as part of sustainable forest management, ecosystem-based management, management for biodiversity and wildlife, Aboriginal cultural studies, and restoration activities. An understanding of the harvesters' requirements is required so that these can be incorporated into forest management. It is also important to accept anecdotal information, from a variety of sources, on species' autecology and synecology where more formal information is not available—which is much of the time. Many harvesters and foresters are familiar with compatible management activities (and their biological and socio-economic effects), such as integrating conifer foliage collection with pruning and juvenile spacing, using longer rotations for certain mushrooms, using controlled burning for specific species regeneration, and using species with economic or cultural values for riparian area restoration.

Conclusions and Recommendations

The NTFP sector knows that it has to bring its own cutlery to the resource management table, which is certainly possible already if sterling silver is not demanded by the other guests. Inviting this old-yet-new character is not only the polite thing to do—it may ensure some rather tasty contributions to the meal.

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Popular Summary

Science, stewardship, and managing for intangibles

Wolfgang Haider[1]

Presentation Abstract

Including intangibles in resource management processes constitutes a serious challenge. This presentation summarized the types of values, talked about their measurement, and identified some trends and challenges when it comes to including relevant social science research in resource management. Among the many barriers that prevent the explicit consideration of these values in decision processes of particular importance appear to be the insurmountable time lag between issue identification and the completion of relevant research, and the frequent lack of awareness among decision makers of the kind of information social sciences actually could provide.

KEYWORDS: *existence value, intangibles, resource management, social sciences, trade-offs, valuation.*

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Introduction

Managing for intangibles is one of the big challenges of sustainable resource management. Intangibles are all those phenomena associated with forestry, and with resource exploitation in general, that cannot be observed or measured directly, yet have value to at least some interest groups or to society at large. In this summary, I will present a framework for categorizing the various social and or economic values, then articulate briefly the main challenges they pose to research; finally, I will discuss some trends and challenges related to including them in decision processes of sustainable resource management.

Resource economists frequently use the "total economic values framework" to categorize and more accurately measure the diversity of values that are typically under consideration (Table 1). "Direct-use values" can be observed via market transactions or user counts. Subsistence hunting and fishing would also fall into this category. Obviously, the concept of intangibles does not apply to direct-use values, with which we are all familiar and which are considered in any management debate. The concept of "intangibles" refers to the two other types of values. "Indirect-use values" are called this because they do not represent a value in their own right, but provide indirect benefits (= values) to individuals and (or) society at large. They range in scale from local benefits (e.g., watershed protection) to global life support functions (e.g., carbon sink). Finally, the category of "non-use values" represents the most challenging intangibles, such as biodiversity, culture and heritage values, and undisturbed ecosystems. Occasionally these values are also referred to as "existence values." Needless to say, these values do not accrue separately, but occur in complex webs among each other, as most management (= use) decisions affect the other values positively or negatively.

Measurement and Research Methods

Although indirect-use values and non-use values are not as readily observable and measurable as the direct-use values, various social science disciplines have developed an array of methods to identify and measure these "softer" values. The main methods in economics are the travel cost approach, hedonic pricing, contingent valuation and contingent choice, and shadow pricing, among others. Other social sciences use a wide array of qualitative (e.g., focus groups, grounded theory, participatory observation) and quantitative methods (e.g., inferential modelling on observational data, perception and attitude research, opinion surveys, stated preference methods) to investigate these values.

It should be emphasized that different methods are applicable for identifying and measuring different types of values. Many studies focus on one particular value in its own right. Occasionally, the entire suite of values relevant to a management issue or a specific geographic area may be investigated within a "total economic values" or a "cost–benefit" framework. Actually, such a framework in itself may provide important guidance for data gathering, monitoring, and research as it assists in identifying the knowledge gaps.

The resource management community must recognize that the social sciences are much more diverse in method, and also in their conceptualization and underlying philosophy of science, than the natural sciences are. This diversity might lead to apparently conflicting results in different reports, caused by different assumptions and different researcher backgrounds and biases, which should be considered a healthy contribution to

TABLE 1. Classification of "total economic value" for forests (Barbier *et al.* 1997)

Use Values		Non-use Values
Direct-use values	**Indirect-use values**	**Existence value**
timber products	nutrient cycling	biodiversity
fruits, vegetables, fungi	hydrological regulation	culture, heritage
game animals, fish	control of soil erosion	undisturbed forest ecosystems
flowers, fodder	amelioration of climate	
medicinal plants	weather damage protection	
recreation and tourism	groundwater recharge	
education and research	greenhouse gas sink	
human habitat	ecosystem stability	

the process of knowledge generation. Therefore, "triangulation" is crucial in the social sciences, referring to a purposely diverse research design in which an issue is investigated from different perspectives. The researcher bias should be apparent; when writing this article, my personal bias, which inevitably influences the arguments in this presentation, is one of a quantitative social science researcher who specializes in stated preference and choice modelling and trade-off modelling.

I presented several examples of relevant quantitative studies and discussed their relevance to resource management, which can be read in the following papers: Hunt *et al*. (2005a, 2005b) used a hedonic pricing method to measure a suite of values around fishing lodges in northern Ontario in relationship to forest management; and Moore (2002) used a stated preference method to measure the values of intangibles defined within a criteria and indicators framework from a community perspective in northern Ontario.

Trends and Challenges in the Use of Social Sciences in Decision Making

Currently, two rather disparate trends seem to characterize social science activities in resource management. (One good overview of these trends can be obtained on the Web site of the most recent International Symposium on Society and Resource Management (ISSRM) in Vancouver, which contains over 500 abstracts documenting all facets of social science contributions; see *http://www.issrm2006.rem.sfu.ca*). One line of work is inherently process-oriented in the sense that its main purpose is to design and drive decision processes, which are consultative or participatory in design. Social sciences or social science-trained persons function as facilitators. Once processes have been established or decisions have been made, a need for evaluation of these processes emerges.

The other line of work is data-based analysis and modelling. First of all, there is increasing demand for monitoring and the setting of standards. Some applied research fields, such as outdoor-recreation research, have a long-standing tradition in this area. Second, decision processes, regardless of type and form, also have (or should have) a need for quantitative information and modelling.

I consider this distinction between "the two lines of work" important as it assists in identifying a gap—or at least a discrepancy—in the application of research and information in resource management between the natural and social sciences. When it comes to providing information for decision makers and (or) decision processes, it is expected by all involved that any natural science information is presented to the decision makers in the form of data, analysis, models, or indicators. Modern technology, such as GIS, has revolutionized the analysis and presentation of this knowledge. Social information, however, is frequently treated rather differently: it largely remains an integral part of the process, and many facets of the social sciences may not play the part they could. Although basic social information, such as employment or income statistics (i.e., basic community indicators), will be presented in analogous fashion, any information that might get at the "intangibles" is not presented in any scientific manner, but instead enters the discourse around the negotiating tables as anecdotal evidence, which is formulated by a "stakeholder" representative. An occasional survey might be used, or maybe even an economic impact model. However, more sophisticated social science techniques, such as economic valuation or trade-off analysis, as well as qualitative approaches, are usually conspicuously absent. I would consider the lack of modern social science contributions as potentially serious, because it might amount to a systematic disregard of the silent majority, whose perspectives are especially important when it comes to considering the "intangibles" in decision processes.

There is no room here to speculate on the many barriers leading to this discrepancy, and both managers and researchers must take part of that blame. One important element is the time lag between issue identification and deadlines, which prevents an appropriate research process to unfold, as well as a frequent lack of fiscal resources for the design and execution of an adequate study. Proponents of the social sciences need to improve the level of understanding of the potential of the social sciences among managers and decision makers. In the spirit of adaptive management and ecosystem management, major improvements are in order around the anticipation, design, and execution of relevant social science research as a joint endeavour between managers and researchers.

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Popular Summary

Science and Forest Stewardship Council certification standards for British Columbia

Greg Utzig[1]

Presentation Abstract

The Forest Stewardship Council of British Columbia (FSC-BC) incorporates scientific knowledge into forest certification in various ways. During the standards development process, FSC-BC utilized a technical writing team with scientific expertise assisted by outside specialists through technical briefings, workshops, and issue reports. The certification standards themselves require forest managers to base their management on applicable scientific knowledge. Although science can provide answers to many questions, there are also issues that science cannot resolve, such as those associated with value choices and levels of acceptable risk.

KEYWORDS: *certification, forest planning, scientific knowledge.*

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Introduction

Forest certification is a voluntary means to guarantee that wood, paper, and other forest products originate from sustainably managed forests. Certified forests are generally audited against a set of standards by an independent third party and then identified by a certification label. This allows discerning consumers to show a preference for certified products over others (like certified organic food). Not only does this allow the customer to choose wisely, but also provides a potential market advantage to the certified producer.

The Forest Stewardship Council (FSC) is an international membership organization with members organized into three chambers: economic, social, and environmental. The FSC certification standards are intended to support forest management that is environmentally appropriate, socially beneficial, and economically viable. The FSC accredits certification bodies that audit forest managers against FSC standards, as well as auditing manufacturing and distribution enterprises for chain of custody of FSC-certified forest products (see: *http://www.fsc.org/en/* or *http://www.fsccanada.org/default.htm*). The FSC is the only forest certification system supported by conservation organizations.

At the international level, the FSC standards consist of 10 Principles and 56 Criteria (P&Cs) that are employed to assess forest management throughout the world. Within the context of the international P&Cs, regional indicators and verifiers can be developed to ensure the P&Cs are applied in a manner consistent with local conditions. In Canada, there are regional standards for British Columbia, the Great Lakes/St. Lawrence, the Maritimes, and the Boreal. This paper focusses on the FSC–BC Regional Standards (Forest Stewardship Council–Canada 2005).

In this discussion, "science" has been defined as: the body of knowledge that has been obtained and tested through application of the scientific method. The FSC Standards also place emphasis on the utilization of "traditional knowledge," but that is not discussed here.

Science is incorporated at various stages of the FSC certification process, including:

- development of certification standards,
- planning and implementation on the management unit, and
- monitoring and adaptive management.

Science in the Standards Development Process

The FSC–BC standards have been developed over the last 10 years. A technical writing group, called the Standards Team, worked on successive drafts of the standards between 1998 and 2005. The team has included resource management specialists and professionals from various fields, including: forestry, biology, forest ecology, terrain assessment, economics, forest labour, environmental law, and the application of First Nations traditional knowledge. The standards development process was iterative, including a series of drafts, public and technical reviews, field testing, revisions based on input received, and finally review and accreditation by FSC International in 2005. The FSC standards are also periodically revised based on new scientific information and experience gained from their application.

During this process FSC–BC used various means to ensure the standards are consistent with current scientific information. In addition to the scientific knowledge brought by the Standards Team itself, other specialists were utilized through technical briefings or workshops on specific issues. The following examples highlight specific situations where scientific knowledge was used during the development of the FSC–BC standards.

Conceptual Framework for Forest Conservation and Management

To provide a common basis for discussion and the drafting of indicators for Principle 6 (maintenance of ecological integrity), the Standards Team requested a literature review on forestry planning and conservation design. The principles of sound planning identified in the literature were then used in the development of an assessment framework under Principle 6. Indicators for Principle 6 were chosen to assess key ecological components within that framework based on priorities taken from the ecological literature. Guidance materials were also prepared for use by forest managers and auditors when addressing Principle 6 (Forest Stewardship Council–Canada 2005). These cover ecosystem-based management and conservation design, inventory, environmental risk assessment, and the application of the range of natural variability (RONV) to forest management.

Riparian Function

To ensure that decisions regarding riparian management were made on a sound scientific basis, it was decided to seek outside expertise. Three consultants were hired (forester, biologist, and hydrologist) to review the scientific literature regarding riparian functions and to assess the efficacy of alternative riparian management strategies.

Their first report was a summary of the scientific literature (over 100 articles and reports) dealing with management of riparian vegetation for the protection of aquatic values (Carver 2001). A second report examined six approaches to riparian management that have been implemented in various jurisdictions in the Pacific Northwest and British Columbia, and briefly highlighted aspects of four other approaches (Zielke and Bancroft 2001a). A third report qualitatively assessed the level of scientific input and the level of caution used to develop various riparian management systems (Zielke and Bancroft 2001b). A final report discussed key themes that had to be considered when designing a riparian management strategy, including level of certainty or scientific knowledge about riparian functions, and risk tolerance with regard to conserving riparian values (Carver and Zielke 2001).

The Standards Team then designed preliminary indicators for assessing a forest manager's strategy for maintaining the integrity of riparian ecosystems. This proposal, along with copies of the background reports, were sent to a series of peer reviewers with direct experience in riparian management (federal and provincial government staff, industry managers, and university staff), who provided comments on the efficacy of the proposed approach. The proposal was then revised based on comments received.

Pesticides

The FSC International maintains a list of pesticides specifically prohibited from use on FSC-certified management units. This list is periodically reviewed to ensure that it is based on the latest scientific information related to persistence, toxicity, tendency for biomagnification, and the presence of specific compounds, such as heavy metals, dioxins, carcinogens, mutagens, and endocrine disruptors (Forest Stewardship Council 2002).

High Conservation Value Forests

In 2000, FSC International established an Advisory Panel of scientists to address the identification of High Conservation Value Forests (HCVFs), including specialists in conservation biology, tropical forestry, ethnobotany, and ecological anthropology (Forest Stewardship Council 2001). These scientists produced recommendations on the application of Principle 9, on the identification of HCVFs, and on development of management strategies that would constitute a precautionary approach to maintaining HCVFs at the global level. Later in 2000, FSC–BC held a symposium to explore the application of the HCVF concept in the British Columbia context. The symposium included regional specialists in conservation biology, forest monitoring, forest management, ecology, wildlife biology, ecological risk assessment, and First Nations studies. A summary of the results from discussions at this symposium (Stewart 2000) was used as a basis for drafting the final version of Principle 9 in the FSC–BC standards.

Field-Testing and Review

Three successive drafts of the FSC–BC standards were circulated for public comment during the standards development process. The second draft of the standards was field-tested on three forest management units that included both coastal and interior ecosystems and three distinct tenures (Forest License, Tree Farm License, and Woodlot). All of these review processes garnered comments from a range of stakeholders, including auditors, forest managers, scientists, and the general public. Refinements to subsequent drafts of the standards in response to these comments often included further review of scientific information to ensure that the standards were consistent with the best information available.

Science in Ongoing Management of FSC-certified Forests

Indicators under Principles 6, 7, 8, and 9 require that a forest manager make use of the "best available information" when collating and collecting inventory information, planning for forest management, and when developing strategies to implement forest management activities on the ground. The inventory and assessment requirements under Principles 6 and 9 require the input of trained scientists and collection of information to specific standards. Where it was felt critical that specialized scientific expertise was required for key assessments or guidance in design of management strategies, the indicators require the use of "qualified specialists," or that management is consistent with recommendations by such individuals. This also ensures that management is relevant to the local situation.

The FSC standards place significant emphasis on monitoring and the incorporation of monitoring results, as well as new scientific information, into ongoing revisions of management plans and implementation strategies. Principle 8 requires the establishment of a formal monitoring program to ensure that the forest manager is meeting the objectives defined in the management plan. Indicators under Criterion 9.4 require effectiveness monitoring of conservation attributes identified for HCVFs, and immediate feedback to management strategies when increasing risks are detected. Criterion 7.2 specifically requires that: "The management plan shall be periodically revised to incorporate the results of monitoring or *new scientific and technical information*, as well as to respond to changing environmental, social and economic circumstances" [emphasis added].

Discussion and Conclusions

Although science can provide answers to many questions associated with forest management, there are also issues that science cannot resolve. Many of the most difficult decisions regarding forest management and setting thresholds for certification involve making value choices. These often come down to balancing benefits, costs, and risks to various values. Science can help to inform these choices, but it cannot make the choice itself (e.g., How much protected area is enough?). The FSC–BC standards have attempted to use science, but also to be transparent about risks associated with any management choices that are made (e.g., see Swanston *et al.* 1996). They have also emphasized that benefits of forest management should accrue to local communities, that ecological integrity must be maintained, and that the precautionary principle has to be employed when the sensitivity of non-timber values is high and (or) scientific knowledge is incomplete.

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Popular Summary

Experiences in science, innovation, and sustainable forest management planning in central British Columbia: Development and testing of Canfor's initiative

Clive Welham[1], Nicole Robinson[2], and Steven Day[3]

Presentation Abstract

Current forest policy in British Columbia places considerable emphasis on managing forest resources responsibly. To demonstrate its commitment to sustainable practices, Canadian Forest Products Ltd. (Canfor) has developed a comprehensive planning framework to guide forest management strategies and achieve the goals and objectives of forest certification and sustainable forest management (SFM). Canfor's SFM framework uses a hierarchical planning process to achieve management objectives at various spatial and temporal scales. A suite of decision support tools and processes, including scenario planning and analysis, simulation modelling, public multicriteria analysis, and trade-off analysis, aid in the development of local, performance-based SFM plans.

KEYWORDS: *criteria and indicators, ecosystem productivity, ecosystem simulation modelling, monitoring, soil organic matter, sustainable forest management.*

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Introduction

Current forest policy in British Columbia places considerable emphasis on managing forest resources responsibly. To demonstrate its commitment to sustainable practices, Canadian Forest Products Ltd. (Canfor) has developed a comprehensive planning framework to guide forest management strategies and achieve the goals and objectives of forest certification and sustainable forest management (SFM). Canfor's SFM framework uses a hierarchical planning process to achieve management objectives at various spatial and temporal scales. A suite of decision support tools and processes, including scenario planning and analysis, simulation modelling, public multicriteria analysis, and trade-off analysis, aid in the development of local, performance-based SFM plans.

From the planning through to the monitoring and adaptive management phases, the framework is driven by criteria and indicators (C&I) as a means of developing and implementing forest management strategies with clear goals and measurable objectives. Criteria are broad management objectives that are validated through the repeated, long-term measurement of associated indicators. Indicators are quantified by measures, a set of variables that when measured or monitored over time, provide information about the status and trend of an indicator to be compared to some sustainability target or desired future condition.

The C&I developed under the SFM framework are intended to be quantitative measures of progress towards sustaining economic, ecological, and social values in Canfor's operating areas. This performance-based approach is being tested in Canfor's Quesnel Timber Supply Area (TSA) to evaluate the effectiveness of a suite of indicators in measuring and monitoring significant temporal and spatial changes in ecosystem productivity, one criterion under the SFM framework.

Total soil organic matter (SOM; or SOM carbon) has been developed for use as a measure of one of the ecosystem productivity indicators (Indicator 2-1: Biological function of the soil resource will be sustained) in Canfor's framework. A joint field and modelling analysis conducted in the Fort Nelson TSA found that ecosystem productivity was strongly related to changes (declines) in SOM C. However, questions remain about whether changes in SOM C can be effectively employed as part of a SFM monitoring program. Specifically, information regarding the development of thresholds for different ecosystem types is required as well as information regarding the sampling intensity necessary to detect meaningful declines in SOM C.

These questions were addressed in a follow-up modelling and field study conducted in unharvested, lodgepole pine-dominated stands in the timber harvesting land base of Canfor's Quesnel Division. Simulation results suggested that rotation lengths shorter than 75 years will likely be problematic for maintaining SOM C. A power analysis was then conducted on each of six sites to determine the number of samples required to detect a "significant" decline in SOM C (and SOM N). Results indicate that trying to detect change in specific layers (e.g., LFH, 0–30 cm mineral, or 30–60 mineral) is likely prohibitive because of the large number of samples required; however, when the quantities of SOM C were summed for all layers, the results were more promising in terms of the capability to detect change in the field. Linking the output from an ecosystem model with a field sampling protocol and an associated power analysis represents a practical method for developing an effective SFM monitoring program.

Managing for science: Creating conditions for success

Melissa J. Hadley[1]

Presentation Abstract

Relevant, credible science is a critical input to sustainable resource management planning in British Columbia. Several models to develop and incorporate science in decision-making processes have been tried and have achieved varying degrees of success. This paper reviews what we have learned from the Clayoquot Scientific Panel and Coast Information Team models; it also reflects on what is needed to create conditions for success in managing processes to develop relevant, credible science to support sustainable resource management planning.

KEYWORDS: *Clayoquot Scientific Panel, Coast Information Team, land and resource planning, project management, science-based decision making, scientific knowledge, sustainable forest management.*

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Introduction

The focus of this Annual General Meeting is the art and science of sustainable resource management planning. My assignment is to present what I've learned about creating the conditions for successful development of science products by working with initiatives such as the Clayoquot Scientific Panel and Coast Information Team.

To do this, I will discuss:

- what we are seeking from science to further sustainable resource management planning;
- what we've learned from some of the models we've used to develop that science; and
- what structures and processes we need to manage for science that supports sustainable resource management planning.

What We Are Seeking

Science can be defined as "a body of knowledge that is constructed via observation, hypothesis, experimentation, and logic for the purpose of explaining and predicting events or behaviour." Developing a body of knowledge is a lengthy process that involves incremental acceptance of findings through a peer review process and development of a "scientific consensus." In practical terms, this means that the process of developing science can be complicated, its costs are difficult to estimate, and it is hard to schedule.

By comparison, the resource planning processes that we want science to support are characterized by tightly constrained schedules and budgets, and cover a broad array of scientific disciplines. Science is often only one factor in decision making, along with considerations such as socio-economic conditions, stakeholder values, and political concerns.

To use science effectively in supporting these processes, I believe that we must aggressively manage for it.

The first step in managing for science is to clarify the type of scientific product we want. Is it:

- new knowledge, such as that generated by research on topics where we have little information;
- expert opinion;
- the application of existing knowledge to a new or specific location;
- the integration of information from several scientific disciplines;
- the integration of Western science with Indigenous and local knowledge; or
- a synthesis of what is known on a particular topic at a given level of confidence?

We must also clarify the reasons we want "the science," and how we intend to use it. Are we looking for a scientifically based answer to a particular problem? Is the scientific information one of several inputs that will be considered in making or negotiating a decision? Is it to develop new policies (e.g., thresholds for ecosystem-based management)? To improve our practices (operational trials)? Or is it to justify an unpopular decision?

The type of science desired, and how we plan to use it, greatly influence the timeline and budget, and, ultimately, the structures and processes we put in place to develop the science.

What We Have Learned

We can learn much about the components of successful structures and processes by reviewing some of the models that have been used to deliver science in support of land and resource planning in British Columbia. Two of these deserve particular mention.

Scientific Panel for Sustainable Forest Practices in Clayoquot Sound

The Scientific Panel for Sustainable Forest Practices in Clayoquot Sound introduced the notion of "independent science" to issues of land use and resource management planning in British Columbia.

This international panel was initiated in 1993 by then Premier Mike Harcourt to seek an end to the blockades that characterized resource development in the area. The Panel's mandate was "to develop world-class sustainable forest practices for Clayoquot Sound's unique characteristics, based on the best scientific knowledge available."

The Panel of 19 included 15 scientists representing a range of disciplines, and four First Nations elders from Clayoquot Sound. Panel members were independent of government, industry, and environmental non-government organizations (ENGOs).

The Clayoquot Scientific Panel model was fairly straightforward—the provincial government invited scientists who were acknowledged authorities in their fields, and First Nations elders whose families had lived in Clayoquot Sound for millennia. The Panel was given clear terms of reference, few constraints, and set loose under the guidance of co-chairs Dr. Fred Bunnell, of the Centre for Applied Conservation Biology at the University of British Columbia, and hereditary chief Dr. Richard Atleo.

The first activity of the Panel was to develop a protocol by which it would reach decisions that reflected the Nuu-Chah-Nulth approach to group processes. The protocol was characterized by respect for one another, for different values, and for data founded both in science and "lived experience." The Panel next defined nine principles to guide its work. These were based on a commitment to the management of forest ecosystems for their long-term health and for a mix of resource values and products.

In May 1995, 18 months after its inception, the Panel submitted its three-volume final report. Government accepted the more than 120 recommendations on forest practices and First Nations issues.

Key learnings from our experience with the Clayoquot Scientific Panel model included:

- The importance of *vision and clear terms of reference*.
- The effectiveness of *strong scientific leadership* from co-chairs representing Western science and Indigenous knowledge.
- The utility of a Panel-developed *protocol and guiding principles* that members could fall back on when struggling with specific issues or situations.
- It is possible to *integrate broad scientific expertise* (conservation biology, ecology, engineering, ethnobotany, forestry, hydrology, geomorphology, soils and terrain stability, etc.) *with deep traditional knowledge* based on occupancy (four First Nations elders).
- *Independence* from the political stakeholder environment enabled the science to be free from the influence of social values—that is, the science was integrated by the experts, rather than negotiated by stakeholders.
- It was possible to deliver a solid scientific product within a reasonable timeframe by *applying and integrating expert knowledge* of the history and ecosystems of Clayoquot Sound—that is, the Panel undertook no new research.

Coast Information Team

Seven years after Clayoquot, the Coast Information Team (CIT) was established in January 2002 to bring together the best available scientific, traditional, and local knowledge to develop independent information and analyses in support of ecosystem-based management (EBM) in the north and central coasts and Haida Gwaii.[1]

This information was to be provided to the Central and North Coast subregional Land and Resource Management Plan (LRMP) tables and the several First Nations Land Use Planning tables to assist them in developing practical recommendations to resolve land use and natural resource management issues.

The CIT governance model consisted of a management committee, executive director, secretariat, and project leaders for 10 distinct scientific studies and an arms-length peer review process. The management committee included representatives from: local First Nations; local communities; the forest industry partners in the Coast Forest Conservation Initiative (CFCI)[2]; the provincial government (primarily the then Ministry of Forests and Ministry of Sustainable Resource Management); and partnering ENGOs in the Rainforest Solutions Project.[3]

The management committee approved terms of reference, schedules, and budgets for 16 contract project teams that undertook analyses and developed recommendations related to: ecosystem-based management; ecosystem, cultural, and economic gain scenarios; and community well-being. Analyses were peer reviewed and delivered to the management committee and the land use planning tables as they were completed.

The CIT was a complex and ambitious undertaking. Several of the analyses had not been done previously in British Columbia, and some represented the application of relatively new methodologies. Not all components were delivered when the CIT concluded in October 2004.

We learned a great deal about managing for science in our experience with the CIT—so much, that I wrote a report with recommendations on processes and structures for creating conditions for success in similar projects. I will highlight only a few examples by major category here, and refer you to the report for more (Hadley 2004).

[1] The CIT analysis area was approximately 118 km^2 or 11 million ha—for reference, a bit larger than Newfoundland.
[2] Canadian Forest Products, International Forest Products Limited, NorskeCanada, Western Forest Products, Weyerhaeuser.
[3] ForestEthics, Greenpeace, Rainforest Action Network, Sierra Club of Canada BC Chapter.

Program Planning, Initiation

At the outset, ensure consensus (signed by clients and stakeholders) on project scope, inputs, and deliverables. Focus analysis at the appropriate spatial scale to meet client needs. Limit complexity and the amount of innovation in consideration of budget, timetable, availability of data, and expertise. Assess and manage risk—in particular, establish data acquisition and distribution as an independent component of the program with clear milestones and adequate resources. Define integration requirements (common land base categories, input data specifications, output product standards) for component projects before deciding on methodologies. Implement a change control process.

Finances

Complete fundraising before projects begin. Create one fund for program disbursements. Do not allow funders to target specific projects.

Governance

Ensure that Steering Committee members have skills and expertise suited to the program and commit to actively participate for its duration. Where "independent science" is an objective, separate the political (multi-stakeholder, funding partner) aspects from the scientific and technical aspects of the program. Retain a scientific leader with exceptional qualifications to advise the Steering Committee on scientific content and guide the work of project teams. Where subject matter is extensive, establish a standing scientific advisory committee to guide the Steering Committee and scientific leader. Follow established project management principles and processes.

Include local and First Nations expertise on project teams to "ground truth" projects, build understanding and capacity, and assist in interpretation of project outputs to stakeholders. Allocate resources to build, launch, and support teams and project integration.

Incorporate two types of peer review: internal program review by a scientific advisory committee to advise on issues such as appropriate scale, planning unit boundaries, and project integration; and external review of project outputs by reviewers selected by an independent peer review chair.

Communications

Develop a communications plan at the outset and communicate continuously and appropriately with all parties.

What We Need

We can gain three "big picture" lessons from our experiences in managing for science:

1. Good science isn't good enough—the success of "science" in land use and resource management is often not about the quality of the science, but the appropriateness of the science to the task at hand.
2. We must specify the type of science required consistent with our needs, timetable, budget, and available data.
3. We must rigorously manage the process by which we develop and deliver the science so that it is timely and appropriate for its intended use.

How do we accomplish this?

How To Manage For Science

First, we need clear agreement on: who the science is for and how we will use it; the kind of "science" or other information we need; working constraints (time, budget, data, resources); and the roles and responsibilities of parties involved in developing the scientific products, including data holders, managers, and contractors.

Second, we need to design and implement appropriate structures and processes to develop the science, including: governance; change control; funding; and data acquisition, use, and storage. This includes explicitly addressing the scientific independence of contractors and peer reviewers, and the integration of data sets, scientific methodologies, and analyses.

Third, we need rigorous project management that includes: managing expectations and changes in scope; assessing and managing risk; procuring appropriate resources; assessing progress (against workplans, timelines, budgets); implementing quality assurance; and maintaining project documentation (project plan, estimates, actuals, lessons learned).

Last, but certainly not least, we need relentless communication from project conception through initiation, execution, and closure. To be effective, our communications must be in a form, at a level, and with a frequency appropriate to the roles and relationships (internally) or interests and needs (externally) of each audience.

In summary, to use science effectively in supporting sustainable resource management planning, we must be clear about the type of science we need, the way we intend to use it, and the resources we have to develop it. In so doing, we can create an effective framework to manage for science.

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Rapid transformation of pine-dominated sub-boreal forests of British Columbia mediated by insects and pathogens*

Philip J. Burton[1] and Andreas Hamann[2]

Poster Abstract

The lodgepole pine (*Pinus contorta* var. *latifolia*) forests of British Columbia are experiencing an unprecedented outbreak of mountain pine beetle (*Dendroctonus ponderosae*), now affecting more than 9 million ha. After control and containment efforts failed in the core outbreak area, forest management has emphasized accelerated salvage harvesting before the timber loses commercial value, to be followed by reforestation, typically with more lodgepole pine. It is widely believed that "the forest is dying" and "must be restored." But forest inventory data reveal that only 26% of the affected area consists of pure (> 80%) lodgepole pine. Field surveys and forest company pre-harvest stand inspections further indicate that 41–48% of pure pine stands are adequately stocked (> 600 stems per hectare) with advance regeneration of other conifer species. Mountain pine beetle populations are now so high that they are attacking plantations only 20–30 years old, while pathogens such as *Dothistroma* needle blight (*Dothistroma septosporum*) also are becoming more prevalent in young sub-boreal pine plantations. Despite concerns about the greater flammability of dead pine forests and slight increases in mean annual temperature, summers in north-central British Columbia appear to be cooler and moister, and fires are less prevalent than in previous decades. Collectively, these trends indicate that the region is becoming more suitable for interior spruce (natural hybrids of *Picea engelmannii* and *P. glauca*) and subalpine fir (*Abies lasiocarpa*) than for lodgepole pine. Contrary to expectations of gradual change and inertia associated with long-lived trees, results are consistent with the rapid "release" and "reorganization" of ecological systems as described by the panarchy theory of Gunderson and Holling (2002). Such rapid and unanticipated transformations pose serious challenges to sustainable forest management.

KEYWORDS: *advance regeneration,* Dothistroma*, lodgepole pine, mountain pine beetle, panarchy theory.*

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URL: *http://www.forrex.org/publications/jem/ISS38/vol7_no3_scienceforum.pdf*

Poster

The complementary nature of experience and evidence: Informing resource management decisions

Dave Clark[1]

Poster Abstract

Sound science encompasses: expert (or experiential) knowledge, built up over decades of learning, study and observation; and scientific (or evidentiary) knowledge, generated from rigorous research and monitoring initiatives. Through Structured Decision Making, decision alternatives can be developed, and consequences can be estimated qualitatively and quantitatively, depending on the nature of the decision, the resources, and the time available for information development and analysis. Uncertainty and decision risk define information gaps that can be addressed through some combination of experiential and evidentiary knowledge. Characterizing and comparing alternative approaches exposes trade-offs and helps determine the best balance for a given decision. Continuous improvement of our understanding of natural and managed ecosystems depends on effective data and information management, and effective outreach to build our collective experience.

KEYWORDS: *decision analysis, information development, knowledge management, organizational knowledge.*

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Objectives

The objectives of this poster are to: (1) define and characterize expert knowledge and scientific knowledge (Table 1; Figure 1); (2) present a simple framework that can be used to refine a question and develop an efficient and effective approach that will inform the question(Figure 2); and (3) improve and increase both experiential and evidentiary knowledge.

Principles

Sound Science – Decision alternatives and their consequences will be based on information collected through best practices in science, including natural sciences, health sciences, engineering, economics, and social sciences.

Clear Values – Decisions will be based on a clear statement of objectives, explicit value judgements, and transparent trade-offs.

Results-based Environmental Management – A flexible process requires professional accountability for results.

Adaptive Management – Documentation of objectives and procedures, followed by monitoring and reporting, and evaluation and reporting of results.

Business-focussed Information – Mandate comes from legislation and strategic plans.

TABLE 1. Characteristics of experiential and evidentiary knowledge can be expressed as opposing endpoints of certain continua

Experience	Evidence
holistic	reductionist
synthetic	analytic
deductive	inductive
inexpensive	expensive
unreliable	reliable
inconsistent	consistent
best guess	definitive
subjective	objective
top-down	bottom-up
purposive	random
biased	unbiased
predict	verify
estimate	measure
model	monitor
what we believe to be true	what we prove to be true

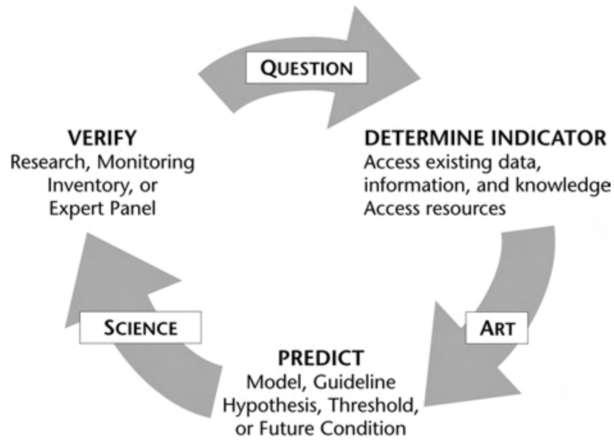

FIGURE 1. Every information project should have an element of art, followed by an element of science.

Risk Management – Risks and uncertainties will be addressed explicitly and their implications for management noted.

Continual Improvement – Decisions will be based on the best available information with a commitment to monitor and review over time.

Flexibility and Iteration – Decision process and analysis will be iterative and commensurate with the nature of the decision.

Conclusions

Every information project should have an element of art, followed by an element of science.

One key to successful learning is to ask the appropriate question, and phrase it in terms of a S.M.A.R.T. indicator (i.e., Specific, Measurable, Achievable, Realistic, and Timely).

No modelling initiative should be undertaken without considering and incorporating an appropriate means of verification and reporting.

Conversely, no monitoring or research initiative should be undertaken without accessing, synthesizing, and focussing relevant expert knowledge into a testable prediction.

Effective communication of the results to the decision maker should include an assessment of the contribution of that information to the decision.

Learning, on both a personal and an organizational level, requires an open mind and a willingness to change, enabled by trust in a rigorous process.

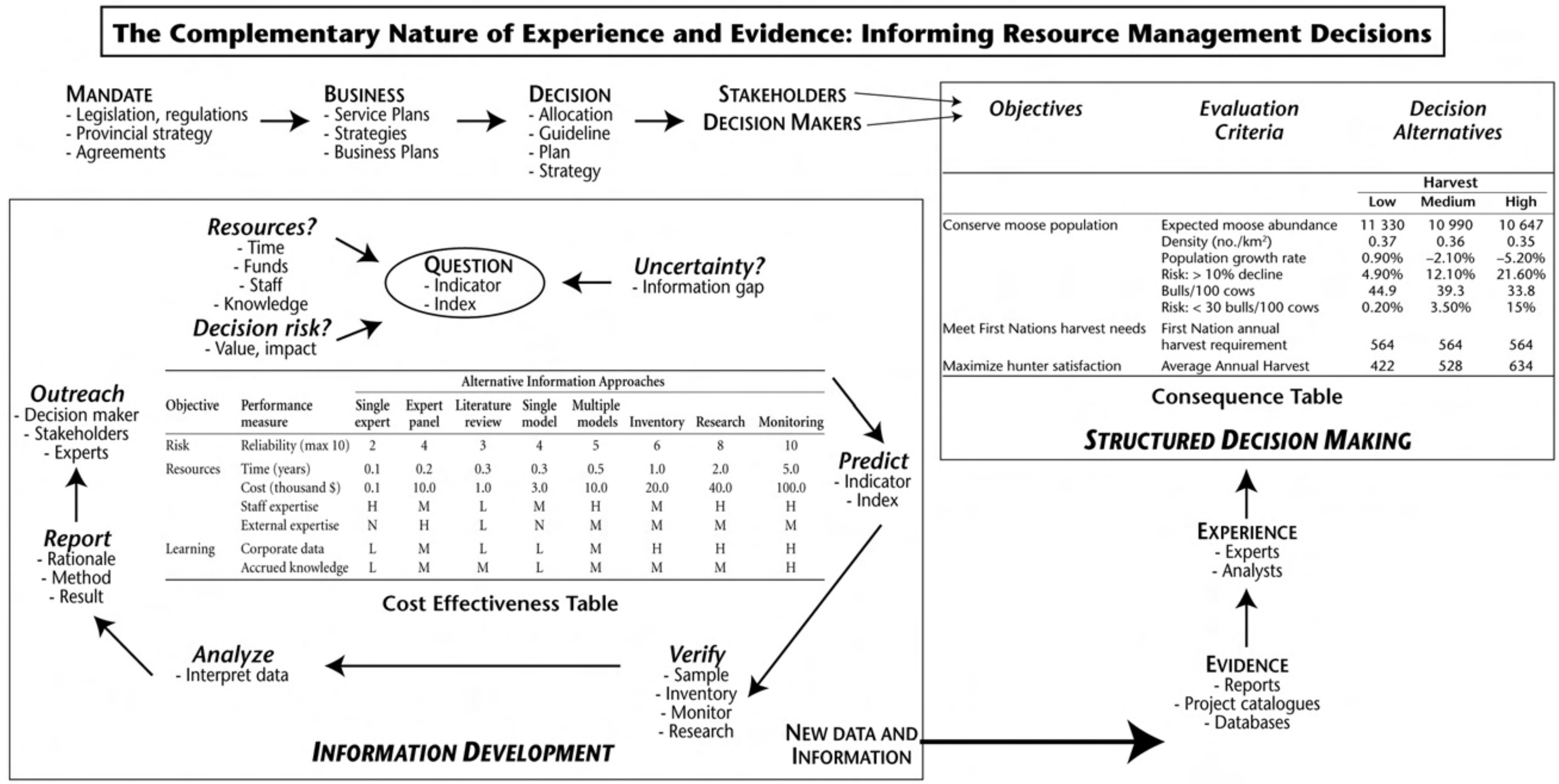

FIGURE 2. Through Struct ,
depending on the nature of the decision, the resources, and the time available for information development and analysis.

Acknowledgements

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Poster

Ensuring sustainable forest management by understanding objectives at the stand level: Management and Working Plan No. 3 for the UBC Alex Fraser Research Forest

Ken Day[1], Cathy Koot[2], and Mircea Rau[3]

Poster Abstract

Since 1993, management and working plans have been prepared for the University of British Columbia's Alex Fraser Research Forest near Williams Lake, B.C. The Research Forest is subjected to multiple management objectives through the University's own corporate goals and the Cariboo-Chilcotin Land Use Plan. Management planning has proven to be a good opportunity to find novel solutions to potentially conflicting objectives. This planning has allowed us to propose an area-based allowable annual cut, and to manage our way through the present outbreak of mountain pine bark beetle.

KEYWORDS: *area-based allowable annual cut, land use objectives, management and working plans, mountain pine bark beetle, strategic planning, working circles.*

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Introduction

The University of British Columbia's (UBC) Alex Fraser Research Forest was created in 1987 by the people of the Cariboo, who saw education in forestry as an opportunity for economic development. The express purpose set out for the new Research Forest was to manage an area of forest land to provide for education, research, and demonstration in integrated forest resource management.

The Research Forest is an area of 9841 ha of Crown land in two blocks near Williams Lake, B.C.:

- Gavin Lake Block (121°45'W, 52°27'N) is 6355 ha in the Sub-Boreal Spruce dry warm (SBSdw1) and Interior Cedar–Hemlock moist cool (ICHmk3) subzones; and
- Knife Creek Block (121°50'W, 52°2'N) is 3486 ha in the Interior Douglas-fir dry cool and xeric mild (IDFdk3, IDFxm) subzones.

Management plans have been prepared since 1993 and we are presently preparing Management and Working Plan No. 3. We find that preparing these plans helps us to look at our management intent and make sure that we are on target with our own objectives, with the objectives of the Crown, and with the existing or emerging risks that threaten our ability to achieve the multiple objectives.

Potentially conflicting objectives are applied to the forest land base; careful thought allows us to find ways to meet all the objectives through use of appropriate silvicultural systems. In this way, forest management becomes a tool to achieve diverse objectives, and the completed Management and Working Plan No. 3 will provide us a very clear rationale for the preparation of our Forest Stewardship Plan.

University of British Columbia Management Goals

We manage the Alex Fraser Research Forest to create opportunities for education, research, and demonstration of sustainable forest management. We will steward the Research Forest to produce a sustainable flow of values in a financially self-sufficient manner.

We will:

1. Operate a viable forestry enterprise, to pursue the mission of the Faculty of Forestry and UBC. By managing our forest lands for education, research, and demonstration, we will positively affect natural resource science, management, and stewardship.
2. Create a wide range of conditions to maintain a field laboratory that supports teaching, research, and demonstration in resource management and conservation.
3. Protect investments in research and teaching from our management activities, and from other research activities.
4. Thoughtfully carry out and document our activities, to actively support teaching and research for students, faculty, and professionals. We will make our experience available to those who seek it.
5. Promote the use of the Research Forest, and ensure that the Research Forest remains relevant to UBC, the Faculty of Forestry, and the citizens of British Columbia and the world.

Land Use Objectives

The Cariboo-Chilcotin Land Use Plan (CCLUP) (British Columbia Ministry of Sustainable Resource Management 1995) "presents the overall framework for land use, conservation and economic development." The land use plan divides the Cariboo-Chilcotin into three Resource Development Zones depending on intensity of use—Enhanced, Special, and Integrated. Both blocks of the Research Forest fall into Enhanced Development Zones, defined as follows:

> *The Enhanced Resource Development Zone includes areas where economic benefits and jobs will be increased through intensive resource management and development . . . In particular, forest productivity will be maintained and enhanced through intensive reforestation, spacing, pruning, thinning, and new harvest practices.* (B.C. Ministry of Sustainable Resource Management 1995)

The land use plan direction from the CCLUP has been spatially resolved by a series of seven sustainable resource management plans (SRMPs), which present objectives to guide operational planners, and strategies to support proposed objectives (Anonymous 2005a, 2005b).

Spatial Resolution

The SRMPs are drafted to cover areas of 1 million ha, and so spatial resolution has relied heavily on mapping with little ground truthing for many objectives. Inaccuracy of forest cover inventory (due to mountain pine beetle harvest activities) has undoubtedly created errors in the SRMPs, which need to be addressed in subsequent planning stages.

TABLE 1. Summary of area (hectares) for Management Units and Working Circles of the UBC Alex Fraser Research Forest

Management Unit	Working Circle	Gross area (ha)	Gross area (%)	General silvicultural system
Knife Creek Block	Knife Creek MDWR	3333	34	Single tree selection
	Reserves and deferrals	152	1	N/A
Knife Creek Block Total		***3486***	***35***	
Gavin Lake Block				
	Beaver Valley MDWR	2846	29	Group selection
	Gavin Lake demo area	706	7	Shelterwood
	Reserves and deferrals	270	3	N/A
	Timber production area	2532	26	Clearcut
Gavin Lake Block Total		***6355***	***65***	
TOTAL		***9840***	***100***	

Implications to Management

The SRMPs delineate areas for various objectives with attendant strategies (Anonymous 2005a, 2005b), including mule deer winter range, visual quality, and old-growth retention. Lakeshore management objectives are declared for each lake depending on its recreational value.

The impact of the SRMPs on the Research Forest is to delineate areas with unique management objectives, where we are required to create or maintain particular attributes. The objectives and strategies are sufficiently detailed to allow us to describe a target stand structure, and therefore select a silvicultural system to achieve the objectives.

Our response to SRMP direction has been to subdivide the Research Forest into Working Circles. Working Circles are described by Matthews (1991) as areas with unique management objectives and silvicultural systems. Table 1 provides a summary of the Working Circles and their area. We have created generalized silvicultural approaches to each working circle to allow us to contemplate how the silvicultural system will be applied, in terms of timing and intensity of cut phases. Each Working Circle is further divided into Compartments, which are geographically identifiable groups of stands with approximately equal site productivity.

Benefits of Forest Management Planning

Example 1 – Area-based Allowable Cut Calculation

Volume-based allowable annual cut (AAC) calculation assumes that the analyst knows the stand volume accurately, and can predict the volume per hectare to be cut at harvest time; in our case, these assumptions are false. Area-based AAC calculation allows for more uncertainty in volume production, while creating more certainty in the extent of the area to be treated. This is a more realistic way to deal with the intricacies of silvicultural systems other than clearcutting, and is a transparent way to describe our intentions to interested reviewers. Area-based AAC also allows more direct linkage between our requirements for even flow of revenues and the variation of selling price through time.

Subject to approval by the Forest District Manager, the Research Forest will be guided by area regulation with a volume check. Such hybrid approaches are supported by Davis and Johnson (1987) as being a framework for considering the complexities of setting allowable harvest rates in order to make decisions. Table 2 shows the proposed allowable cut (hectares per year) for the Research Forest.

Example 2 – Explicit Harvesting Priorities: Dealing With Mountain Pine Beetle

Preparing a Management Plan allows us to consider the best allocation of our harvesting power. Management and Working Plan No. 1 (Day 1993) included a statement of how we would select stands for harvesting,

TABLE 2. Area-based allowable annual cut for the UBC Alex Fraser Research Forest

Harvest type	Annual harvest area (ha)
Salvage	25.5
Roads	2.4
Preparatory cut	26.2
Final harvest	26.8
Single tree selection	82.0
Commercial thinning	4.7

based upon the risk of loss. This analysis was extended in Management and Working Plan No. 2 (Day 1997) with the availability of GIS analyses. Acting on these analyses, we began harvesting timber at risk of infestation by mountain pine beetle in 1993, and were able to substantially complete the harvest of our lodgepole pine growing stock while the selling prices for logs averaged 40% higher than present selling prices. The same analyses help us to focus on other problems as they arise (e.g., Douglas-fir bark beetle, spruce bark beetle, or windthrown timber).

Conclusions

Forest management planning allows us to resolve management objectives from higher level plans to the stand level in an efficient way, because we know the area and can find solutions for conflicting objectives. Management planning causes a planner to think strategically about the forest estate, the Crown's expectations, and their corporate objectives. This provides an opportunity for creative solutions to emerge that satisfy multiple objectives in a fixed land base. A management plan also creates a transparent statement of intent to manage values extant, which is a requirement in the preparation of a Forest Stewardship Plan under the *Forest and Range Practices Act*.

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Poster

Fostering stewardship behaviour: An outreach strategy for the Environmental Stewardship Division of the Ministry of Environment

Jenny L. Feick[1]

Poster Abstract

To contribute to the British Columbia Government's goal of sustainable environmental management, the Ministry of Environment's Environmental Stewardship Division (ESD) developed a strategy to promote stewardship through outreach. By engaging partners, clients, and stakeholders, the ESD hopes to encourage voluntary compliance with Ministry laws and regulations and to foster stewardship in British Columbia. This poster summary provides a description of the development and content of the ESD Outreach Strategy as well as a discussion on the future of the Stewardship Outreach Project.

KEYWORDS: *community-based social marketing, Ministry of Environment outreach, stewardship.*

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Introduction

Stewardship involves the diligent protection of and care for something which one does not own. Shared stewardship implies co-operation, collaboration, and joint responsibility in environmental management. Fostering a culture of shared environmental stewardship in British Columbia is an important goal in the Ministry of Environment Service Plan, and contributes to the government's goal of sustainable environmental management. The Stewardship Outreach Project aims to equip Ministry staff with the knowledge and tools required to cultivate a stewardship ethic among partners, clients, and stakeholders.

Background

Assistant Deputy Minister Nancy Wilkin, and the Division Management Committee, initiated the Stewardship Outreach Project in June 2005 to develop a strategic approach to outreach within the ESD. The project aims to increase shared stewardship and promote voluntary compliance among ESD clients, stakeholders, and park users. This project came about because of the B.C. Ministry of Water, Land and Air Protection Compliance Review and the resulting Ministry Compliance and Enforcement Directive issued in November 2004 by former Deputy Minister Gordon Macatee. This directive mandated staff to undertake approximately 30 hours of outreach activities per year.

The mandate for this project also stemmed from the 2005/06 ESD Business Plan, which identified the need to develop a strategic plan for the establishment of a divisional outreach program, and to develop outreach materials for the Division suitable for delivery by ESD staff in headquarters and the regions.

The Ministry of Environment's 2006/07–2008/09 Service Plan contained a new Ministry goal that provided additional impetus for this project. Goal 3 states that "British Columbians understand that they share responsibility for the environment." It encompasses the following objectives that support staff engaging in outreach:

- British Columbians understand the benefits of healthy living and the effect of their actions on the environment.
- Shared stewardship.
- Industry and client groups are knowledgeable and implement best environmental management practices.

Outreach

Within the Ministry, outreach includes the following broad range of activities:

- creating Web sites, accessible databases such as the Species and Ecosystems Explorer, and print and audio-visual materials;
- giving presentations or field tours or demonstrations to groups;
- training and coaching stakeholders in best management practices;
- establishing stewardship agreements, conservation covenants, and partnerships to promote stewardship; and
- providing advice, information, and skills to stewardship groups and other third-party partners involved in delivery of stewardship and (or) outreach services.

The purpose of outreach is to inform and engage individuals and groups to foster stewardship behaviour among our partners, clients, and stakeholders. Adoption of stewardship practices will reduce costs associated with enforcement, allowing for a more efficient use of Ministry resources.

Project Description

The project is carried out by a Project Manager, a project team with representation from every region and headquarters branch, and every business area of the division, with assistance from co-op students, staff on short-term temporary assignments or in auxiliary positions, and administrative staff. Phase One of the Stewardship Outreach Project resulted in four different deliverables: an assessment of outreach activities in the ESD; a pilot project; interim direction for staff; and the development of a strategic plan.

Planning and Pilot Testing – First Year

The first step in planning the ESD Stewardship Outreach Strategy was to assess the current situation to gain an understanding of how ESD staff perceived outreach, what types of outreach activities staff were already involved in, and what types of tools and resources staff required for effective outreach. Therefore, in October of 2005, a division-wide on-line survey was conducted. The information from this survey proved invaluable during the strategic planning stage.

In addition, a pilot project was conducted to test the theoretical framework of community-based social marketing (CBSM)—a fundamental philosophy behind the new outreach approach in the ESD. Gaining an accurate understanding of target audiences allows for a more strategic approach to outreach, and ultimately a greater chance of success. This pilot project demonstrated the effectiveness of CBSM techniques and solidified it as the foundation for the Stewardship Outreach Project.

Interim Direction

The 2004 Compliance Directive advised staff to identify individual contributions to voluntary compliance and shared stewardship through outreach in their personal Employee Performance and Development Plans (EPDPs). Staff survey results showed that ESD employees were far more likely to conduct outreach activities if they had a goal related to outreach in their EPDP.

Stewardship outreach became an operating principle of the ESD in the winter of 2005/06, and was promoted by the ESD Management Committee members. To facilitate outreach activities during the development phase, interim direction was developed to guide staff until the strategy was developed. The guidelines advised staff of the Division Management Committee's support for outreach initiatives, and that outreach was a key strategic initiative of the ESD. It provided staff with a Web site where they could access additional information and a checklist to guide development of outreach initiatives.

Outreach Strategy

The final ESD Outreach Strategy was developed based on the staff survey results, workshops, and pilot projects. This strategy was designed to guide the efforts of staff over the next 3–5 years. It includes some background, a logic model, vision, mission, and principles, as well as goals, objectives, and strategies. The document reflects a community-based social marketing approach. It also refers to a companion piece—an outreach toolkit—developed to provide staff with valuable checklists and guidelines for more specific, practical aspects of outreach project development and implementation.

The strategy's vision and logic model articulates the environmental and social outcomes the ESD wants to achieve through the use of outreach. The vision statement reads:

> *Through outreach activities that demonstrate the benefits of shared stewardship, British Columbians become engaged and motivated to adopt a stewardship ethic and act accordingly, resulting in sustainable environmental management.*

To accomplish this, the ESD chose as a mission for its outreach function, to be co-ordinated, pro-active, and strategic. To support this vision and mission, the strategy contains four main goals:

1. Encourage and enable ESD partners, clients, and stakeholders to practice shared stewardship and responsible outdoor recreational behaviours and to voluntarily comply with Ministry of Environment regulatory requirements.
2. Empower ESD staff and partners to provide and participate in outreach activities.
3. Integrate outreach project planning, development, and delivery with the Ministry of Environment's regular business processes.
4. Continuously improve outreach delivery to achieve ESD goals.

Each goal was supported by more specific objectives. Under each objective, a series of strategies identified specific actions needed to accomplish the objective. The project team also developed principles to guide ESD outreach implementation at all scales from routine daily interactions to large-scale division-wide projects. They are the values that will guide implementation of the stewardship outreach program and ensure consistency in its delivery (see Figure 1).

Implementation – Second Year

With the release of the strategy in 2006, the Stewardship Outreach Project entered its implementation stage. An on-line outreach toolkit was launched in September 2006 to provide staff with more detailed information about outreach as well as useful guidelines and templates to assist them. In addition, materials are currently being developed, including a PowerPoint presentation, to help train new recruits to the B.C. Conservation Corps, and educate people in British Columbia about Ministry priorities and stewardship. A number of valuable partnerships are also in the works, including a collaborative Web site with the Stewardship Centre of British Columbia (*http://stewardshipworks.bc.ca*), an agreement to promote a stewardship code of ethics with the B.C. Wilderness Tourism Association, a Memorandum of Understanding with FORREX to help implement the strategy, and a Memorandum of Understanding with the BC Snowmobile Federation to develop outreach materials and training.

Where possible, we have also been assisting the Ministry and partners with stewardship outreach

Environmental Stewardship Division Stewardship Outreach Principles

In the Environmental Stewardship Division, we:

- believe we can improve environmental outcomes through fostering stewardship behaviour among individuals, industry, communities, First Nations, and all levels of government. This involves a conscious, deliberate, and collaborative application of scientific knowledge, education, and outreach methods and practice.
- apply outreach to achieve the Ministry of Environment's legal and policy objectives by promoting sustainable environmental practices, the benefits of responsible outdoor recreation and environmental stewardship behaviour, and science-informed decision-making processes that can be clearly understood by our stakeholders.
- provide outreach in a manner that responds to the needs and concerns of our partners, clients, and stakeholders; and empowers them to adopt a shared stewardship approach. We use research, engagement, and consultation to identify their needs, motives, barriers, and preferences.
- develop outreach methods and materials that encourage and support shared stewardship and voluntary compliance. We will seek to reduce the barriers to and emphasize the benefits of responsible and sustainable behaviours.
- operate in a spirit of partnership and collaboration in outreach efforts, seeking opportunities to work with others to provide outreach services and materials that meet mutually agreed-upon goals.
- respond to changing environmental, economic, technological, demographic, and other societal trends in the development and implementation of outreach projects and programs.
- integrate and use information and perspectives from many disciplines in the development and implementation of outreach projects and programs.
- improve and adapt our approach to outreach by listening for feedback, setting measurable targets, gauging effectiveness, learning from our experiences, and sharing lessons learned with our co-workers and partners.

FIGURE 1. Environmental Stewardship Division Stewardship Outreach Principles.

components of other priority initiatives, including the provincial Biodiversity Strategy, the Oceans Education Strategy, extension for the mountain caribou recovery program, and a survey of local governments to determine how to improve service to support urban and rural habitat planning and management.

Professional Development

To re-engage in outreach, it is first necessary to provide staff with the necessary skills and information. We are currently organizing and conducting staff workshops promoting principles and techniques of effective outreach, including CBSM. Pilot workshops were already conducted in Penticton in February 2006 and in Nanaimo in May 2006. These were highly successful workshops since they helped staff apply the theory to practical situations, and provided information that could be used for regional work planning. A "Train-the-Trainer" workshop was planned for November to help develop more outreach capacity within the division. We hope to conduct similar workshops in all regions of the province over the next couple of years. FORREX will be instrumental in providing the expertise and peer support required to rebuild capacity within the Ministry of Environment for effective stewardship outreach.

Conclusion and Feedback

The first year of the Stewardship Outreach Project proved successful. Through the hard work of ESD staff, outreach once again is becoming a central part of regular business processes. If you have any questions, comments, or suggestions, please feel free to contact the Project Manager at: *stewardship.outreach@gov.bc.ca*

Poster

Non-timber forest resources in British Columbia: History and state of the art

Darcy Mitchell[1], Evelyn Hamilton[2], Sinclair Tedder[3], Tim Brigham[4], Wendy Cocksedge[5], Tom Hobby[6], and Shannon Berch[7]

Poster Abstract

The importance of non-timber forest products (NTFPs) to community development and to First Nations is becoming increasingly clear. The current focus in British Columbia is on developing partnerships to try new approaches for NTFP management—approaches that ensure equitable sharing of benefits with First Nations and help address the need for economic diversification in mountain-pine-beetle-affected areas, while ensuring sustainable management of the resources. A collaborative stewardship pilot project, postponed in 2003, is generally agreed to be the best approach to move forward in this regard. Work to initiate this project is now under way.

KEYWORDS: *First Nations, land use planning, non-timber forest products, regulation, resource management, stewardship.*

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Overview of Products, Users, Volumes, and Values

In British Columbia, non-timber forest products (NTFPs) are generally considered to fall into the following categories: floral greenery, wild edibles, medicinals, and nutraceuticals (also known as functional foods), landscaping and restoration products, crafts and art, miscellaneous products (essential oils, smoke woods, soaps, etc.), and forest-based cultural or eco-tourism with an NTFP component.

Over 200 products have been commercially harvested in the province (de Geus 1995). Wills and Lipsey (1999) estimated direct corporate revenues to the sector were approximately $280 million (including ecotourism-related activities). The commercial trade in NTFPs in British Columbia is dominated by wild mushrooms and floral greenery. The Centre for Non-Timber Resources (2006b) estimates the average value of annual wild mushroom trade at $29 million (ranging from $10–42 million over the past decade) and the export value of the floral greens sector at $40 million yearly (ranging from $27–65 million over the past 5 years). Pine mushrooms, chanterelles, and morels are the most commonly marketed wild mushrooms, while salal accounts for approximately 90% of the floral greenery bought and sold in the province.

Tens of thousands of people are believed to engage in NTFP harvesting on an occasional, part-time, or—less commonly—a full-time basis (Wills and Lipsey 1999). Most collecting and harvesting is undertaken by individuals working alone or in small groups and many are involved only part-time or at specific times of the year. Harvesting is an important source of income for many rural community members, particularly in areas that have few options. It is very labour-intensive, and harvests can fluctuate significantly depending on the year. Buyers and distributors or wholesalers of some products (floral greens and mushrooms) are well-established throughout the province.

Given the widespread use of these products for cultural and subsistence purposes, their commercial value, and their vital importance in livelihood strategies, it seems clear that NTFPs *are* important. But how and why are they important? As Brian Belcher (2003) argues, views on their importance tend to depend heavily on the specific interests of the NTFP "stakeholder" involved. Community economic development workers may see NTFPs as income-generating opportunities for residents of rural communities. Conservationists may perceive NTFP harvesting as a more "benign" land-use activity than commercial timber harvesting. Governments may see NTFPs as a potentially untapped source of revenue, or as a potential complication in land use planning processes. First Nations may value non-timber resources for their cultural importance, as a means of demonstrating land use and occupancy, as well as for their potential to generate income for community members.

Non-timber forest products can be considered as "important" for all these reasons. These resources have clearly provided opportunities for people in rural communities to generate income, often under circumstances where few other opportunities are available. For people firmly rooted in their community, whatever the reason, NTFPs can provide important additional income. They may also lend themselves to the development of small businesses that contribute to the vitality, and perhaps viability, of rural communities.

History of Legislation and Regulation, Property Rights, and Land Use Planning

Legislation and Regulation

Since the mid-1980s, policy specifically focussed on regulation of the NTFP resource has begun to figure on the provincial agenda. The initial policy efforts towards NTFPs in British Columbia reflected more of a single-species response to immediate utilization pressures than any formal strategic approach to resource management (i.e., cascara and western yew bark harvesting regulations and cedar and pine bough harvesting permits). The regulations have generally been repealed and efforts to manage by permits abandoned.

Property Rights

Property and management rights for NTFPs have been assigned to a very limited extent through fee simple ownership, license, and treaties with First Nations.

Only about 5% of the land in British Columbia is private land. Private forest land owners, ranging from single individuals to large forest companies, control all forest resources on their holdings. Most large private forest land holdings are located on southern Vancouver Island. Some owners have taken steps to manage, or to benefit from, the use of NTFPs by providing permits.

In 1998, the provincial government introduced legislation resulting in the establishment of Community Forest Agreement (CFA) tenures in British Columbia. The 11 existing CFAs are the only forest tenures in the province to specifically include NTFPs (referred to as botanical forest products in the *Forest Act*) within an agreement. A further 29 communities have been invited to apply for CFAs. A recent review has indicated that many of these tenure holders would like to manage NTFPs on these lands.

Although the rights to manage NTFPs are not explicitly provided through their tenure agreements, some woodlot and other licence holders (e.g., Tree Farm Licence holders) manage NTFPs on their lands by issuing permits to harvesters, undertaking management activities to enhance NTFPs, and (or) harvesting products themselves (Centre for Non-Timber Resources 2006a).

Management and harvesting rights are currently granted by the Province to First Nations in lands settled by treaty. In British Columbia, the Nisga'a is the only nation that has signed a treaty, although a number of nations are negotiating these agreements. All the Agreements in Principle with First Nations specify that they own the forest resources including the NTFPs on their treaty lands. Some Nations are currently managing NTFPs on their non-replaceable tenures through Forest and Range Agreements.

Land Use Planning

Some land-use plans (e.g., Cariboo-Chilcotin Land Use Plan [CCLUP] and Kispiox Land and Resource Management Plan [LRMP]) consider NTFPs explicitly. The CCLUP table dealt with the issue of ensuring access to forested areas (Powell 2005). The Kispiox LRMP led to the incorporation of a specific management regime for pine mushrooms in the timber supply review and subsequently influenced the setting of the allowable annual cut (Forest Practices Board 2004). Government is currently reviewing the resource planning processes with the aim of developing a new government-to-government process with First Nations.

Examples of provincial efforts that have influenced timber management include modifying small business timber sales in several coastal forest districts to account for the presence of high-value pine mushroom habitat (Tedder *et al.* 2000).

The Current Policy Environment

The current NTFP policy environment reflects a rising concern for a number of issues, including the government's commitment to a New Relationship with First Nations, the need to respond to the mountain pine beetle outbreak in central British Columbia, and public concern about the management of NTFPs. Proposed research activities include a community needs assessment in mountain-pine-beetle-affected areas.

New Relationship with First Nations

In April 2005, in recognition of the imperative implicit in recent court decisions regarding government's obligation to consult with First Nations when decisions could affect Aboriginal rights and title, the Province announced its intent to build a New Relationship with First Nations to ensure that Aboriginal people share in the economic and social development of British Columbia. In September 2005, a $100 million New Relationship Trust was announced to support achievement of these goals.

Mountain Pine Beetle

A large scale mountain pine beetle outbreak is currently occurring in the central interior of British Columbia. By 2013, about 80% of the lodgepole pine volume in "pine units" is expected to be dead. There will be significant economic implications for provincial communities due to resulting shortfalls in wood supply (Eng *et al.* 2006). The Province is investigating alternative economic options for these communities, including those associated with NTFP enterprises.

Public Concern

In response to the public concern about NTFP management, a Special Report on non-timber forest products was commissioned by the Forest Practices Board in 2004. It recommended research, further investigation of regulation options, establishment of management objectives, and raising awareness about NTFPs.

Regulation

Provisions in the existing *Land Act* allow legally binding objectives for NTFPs to be set. The *Forest and Range Practices Act* (*FRPA*) and regulations have provisions for establishing legally binding resource management objectives, which do not currently include NTFPs explicitly, but could. Where an objective is in effect under *FRPA*, agreement-holders must identify measurable and verifiable results and prepare strategies that are consistent with these government objectives in their Forest Stewardship Plans (FSPs). Some NTFP concerns have been addressed by using provisions in *FRPA* (e.g., mushroom habitat has been protected by establishing Old Growth Management Areas).

The provincial government has recently investigated further options for regulating the NTFP industry and has concluded that it should focus on having a prescriptive rather than operational role in terms of NTFP management (Tedder *et al*. 2002). The most efficacious approach is thought to be one that combines elements of state, common property, and private property rights. Government is exploring a range of options, including new and expanded forms of property rights and tenures and a buyer licensing and reporting system, as part of the revived collaborative stewardship pilot projects (Tedder *et al*. 2002).

Summary

The importance of NTFPs to community development and to First Nations is becoming increasingly clear. The focus of current efforts in British Columbia is on developing partnerships to try new approaches for NTFP management that ensure equitable sharing of benefits with First Nations and help address the need for economic diversification in mountain-pine-beetle-affected areas, while ensuring sustainable management of the resources. The collaborative stewardship pilot project, postponed in 2003, is generally agreed to be the best approach to use to move forward in this regard. Work to initiate this project is now under way.

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Forest ecosystem carbon accounting in support of sustainability and climate change mitigation

Radostina (Tina) Schivatcheva[1]

Poster Abstract

Forest ecosystem carbon accounting facilitates the systematic evaluation of forest ecosystem carbon budgets and helps identify the carbon status of the forest landscapes as carbon sinks or carbon emitters. It also defines the relative and actual importance of various ecosystem stressors on the state of ecosystem carbon. The scientific basis of this new management paradigm is interdisciplinary, based on the epistemic advances of carbon science, forest science, and environmental modelling. The perspective of forest ecosystem carbon accounting increases forest managers' awareness of new opportunities for climate change mitigation in their professional activities, facilitating novel considerations of sustainable forest management practices. To achieve this goal, forest managers now need to consider utilizing new, carbon-friendly decision-making tools aimed at minimizing and eliminating forest ecosystem carbon losses, enhancing carbon sinks, and maintaining and enhancing the existing carbon reservoirs. Within the holistic framework of the "sustainable forest," forest ecosystem carbon accounting facilitates the sustainable management of forest carbon as an essential component of long-term, strategic decision making.

KEYWORDS: *carbon accounting, carbon pool, carbon reservoir, carbon saturation, carbon sink, climate change mitigation.*

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The Carbon Status of the Forest Landscapes

Forest ecosystem carbon accounting is a decision-making tool that facilitates the evaluation of the carbon status of the forest landscapes. By evaluating the actual and relative impact of various forest management activities and natural disturbances on the forest ecosystem, it helps determine whether a forest landscape, or a particular forest stand, is gaining or losing carbon. For example, activities such as deforestation, natural disturbances, or harvesting result in carbon losses, while activities such as planting and afforestation result in carbon gains (Figure 1).

Opportunities for Climate Change Mitigation

Carbon accounting helps identify the practices that would generate carbon sinks or carbon sources, as well as the relative and actual importance of various ecosystem stressors on the state of ecosystem carbon. Thus, it is a useful tool for identifying opportunities for climate change mitigation in the management of forest stands and landscapes.

Acknowledgements

Funding was provided in part by the B.C. Ministry of Forests and Range through the Forest Investment Account–Forest Science Program.

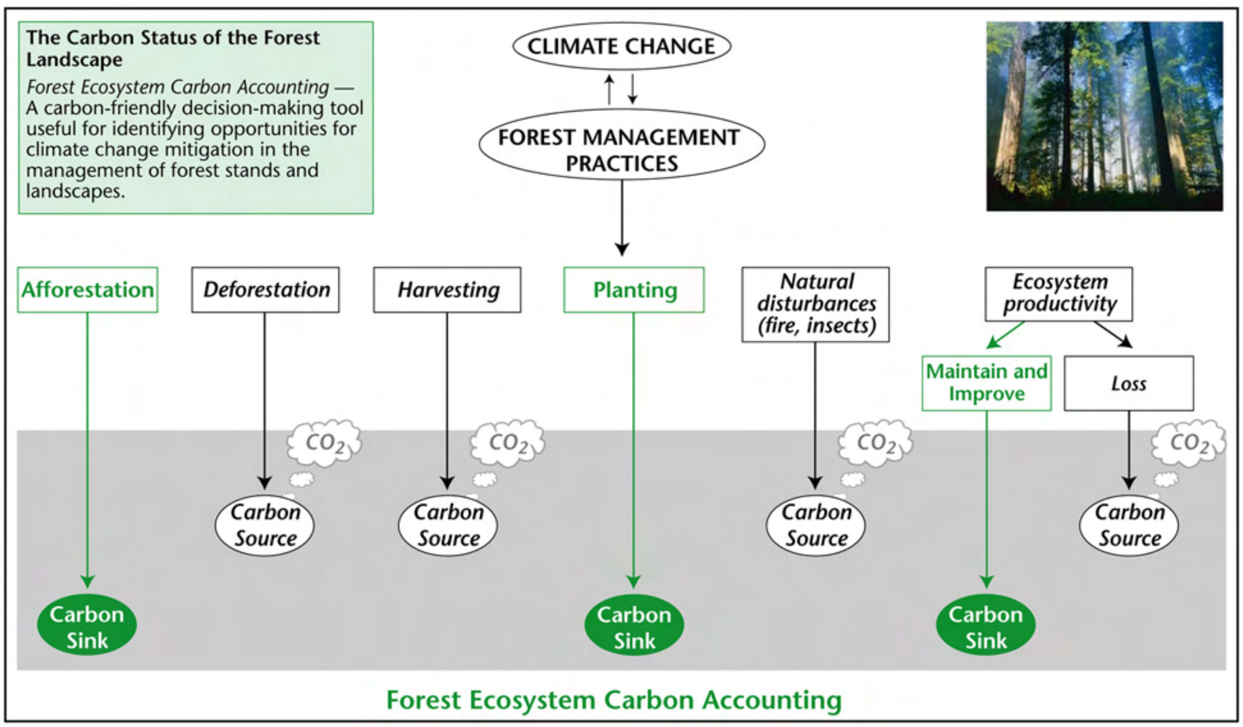

FIGURE 1. Forest ecosystem carbon accounting framework.

Poster

FORREX information products and services support knowledge exchange and innovation

Julie Schooling[1]

Poster Abstract

The Information Products and Services cluster plays a key supporting role to FORREX's extension clusters and to the Provincial Forest Extension Program (PFEP), providing a range of vehicles for high-quality, science-based information as the foundation for sustainable natural resource management and sound policy, planning, and operational decisions. Access to high-quality information contributes to achievement of learning outcomes defined by extension clusters in response to identified client needs.

The vision of this cluster is to ensure that science-based information flows readily from those who generate it to those who need to apply it. The cluster's goals are accomplished through working with our clients, contributors, and partners to maximize quality and efficiency and to minimize barriers at all stages of the information-sharing continuum, from submission and publication, to distribution and access, and finally through dialogue and refinement of the information. The intent of this cluster is to work closely with the FORREX extension teams and partner agencies to ensure that collaborative approaches are developed. This poster summarizes ways in which FORREX information products and services make a difference to our clients and the natural resource management community as a whole.

KEYWORDS: *extension, information management, knowledge exchange, technology transfer.*

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The Context for Information Products and Services

For adaptation to occur in policy or practice, "actors" in the natural resource management sector need opportunities to engage in informed debate, challenging norms and presenting new findings for peer review. —Sabatier and Jenkins-Smith 1993, 1999 (as cited in Wellstead *et al.* [2006])

Many of our woodlands staff at Canfor's Houston Division rely on JEM, Streamline, *and* LINK *to stay current on issues related to their fields of practice.* —Carl vanderMark, Planning Superintendant

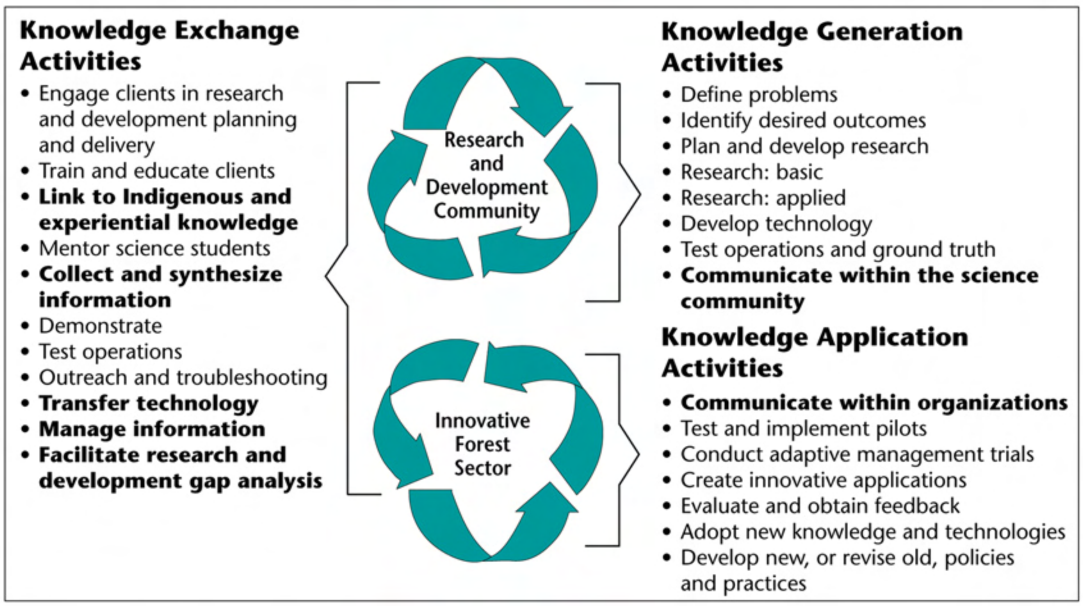

FIGURE 1. Contribution of information products and services to elements (emphasized in bold typeface) of the knowledge exchange system (from Deyoe and Hollstedt [2004]).

A Science-Based Suite of Products

TABLE 1. Examples of opportunities for science-based debate and extension of innovations

Knowledge exchange activity	Example of supporting information product
Link to Indigenous and experiential knowledge	FORREX Series includes full-length, peer-reviewed reports exploring specific issues in detail; Example: SIFERP Series 4, "Linking Indigenous peoples' knowledge and Western science in natural resource management: Conference proceedings"
Collect and synthesize information	The *BC Journal of Ecosystems and Management* (*JEM*) presents peer-reviewed Perspectives, Extension Notes, Research Reports, and Discussion Papers on diverse resource management topics
Transfer technology	*Streamline Watershed Management Bulletin* delivers scientifically sound technical information to the watershed management community
Manage information	The Natural Resources Information Network (NRIN) is a centrally searchable collection of collaborating organizations' information catalogues
Facilitate research and development gap analysis	File Reports serve a documentary purpose, ensuring current results are available for others to build upon; Example: File Report 05-02, "Mountain pine beetle: Linking recent and current projects to identified needs"
Communicate within the science community	*LINK*, a newsletter published three times a year, highlights current research, innovative applications, and recent events
Communicate within organizations	Organizations and communities of practice draw on commonly accessible Web-based information and communication through email lists; Example: *http://www.forrex.org*
Collaborate!	Co-publications and collaborative information management projects pool valuable resources; Example: Compendium of Forest Hydrology and Geomorphology in British Columbia: Ministry of Forests and Range Land Management Handbook being co-published with FORREX

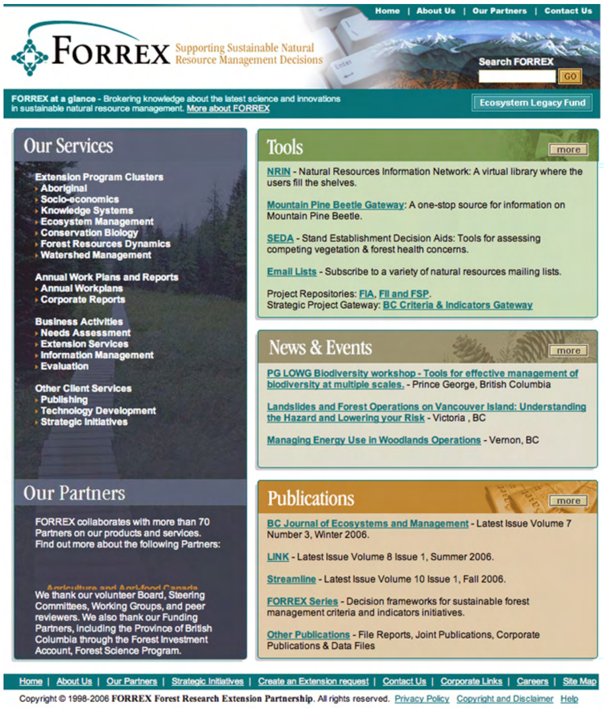

FIGURE 2. Our Web site, *http://www.forrex.org*, provides access to Partnership services and information products in keeping with the principle of Open Access: "free online availability of digital content . . . immediately upon publication." —Wikipedia

Who Are the "Actors," and How Does Information Flow?

TABLE 2. Information access and management roles upon which information quality and accessibility rely (adapted from Natural Resources Canada (2005):17 to apply to information access and management)

"Actor"	Information Access/Management Role
Creator	To collect, analyze, synthesize, add value, and suggest application
Custodian	To store and preserve
Owner	To control use, including management of copyrighted material and intellectual property
Manager	To guide access and implement policies
Provider	To organize for search and access; convert to desired formats; collect fees and restrict access if appropriate; and disseminate (there may be quality assurance role in producing or selecting information for dissemination)
User	To apply information to solve problems, answer questions, and make decisions

Acknowledgements

I appreciate the input of my colleagues in the Information Products and Services Cluster—Shelley Church, Jesse Piccin, and Satnam Brar—for their review and input. Funding for this program (including preparation of this poster) is provided, in part, by the British Columbia Ministry of Forests and Range through the Forest Investment Account–Forest Science Program.

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Poster

Southern Interior Forest Region Forest Science Program: From research to management

Ken Soneff[1]

Poster Abstract

Stewardship of the forest resource is a core business of the Ministry of Forests and Range. Ministry key strategies include managing the forest policy framework based on best available science and applying research and forest analysis to policy development and statutory decision making.

The Southern Interior Region Forest Science Section headquarters is Kamloops with staff also located in Williams Lake and Nelson. The section has 16 experienced scientists and professionals who undertake complementary job duties in consulting, research, and extension at a regional level in the core disciplines of soil science, plant ecology, hydrology, geomorphology, silviculture/silvicultural systems, and wildlife ecology. Our internal consulting role and applied research provides a close interrelationship between scientists, decision makers, and practising foresters. This unique perspective and the considerable experience of the Region's research staff enables development of an applied research program that enables science-informed management of forest and range resources.

The poster describes core research projects of the Forest Science Program as well as ongoing and new research projects related to the effects of mountain pine beetle. The program's interdisciplinary approach to beetle management issues is emphasized. Information on Forest Science Program projects, publications, and personnel can be obtained from the Southern Interior Region Web site at: ***http://www.for.gov.bc.ca/rsi/research/index.htm***

KEYWORDS: *consulting, extension, geomorphology, hydrology, plant ecology, research, silvicultural systems, silviculture, soil science, stewardship, wildlife ecology.*

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Poster

Forest resources dynamics: Ecosystems and Stand Management Mountain Pine Beetle Extension Program

Alan M. Wiensczyk[1] and Bruce Rogers[2]

Poster Abstract

The current mountain pine beetle (MPB) outbreak gripping British Columbia is the largest infestation in recorded history. As of 2005, over 8.5 million ha of lodgepole pine forests had been affected by MPB, and it is estimated that by the time the infestation runs its course in 2013 the beetle will have killed up to 80% of the mature lodgepole pine in British Columbia. The poster presented at the Science Forum highlights some of the extension activities being undertaken by FORREX to improve access to information on the MPB and to co-ordinate MPB-related research and extension activities. The poster provides information on the Web-based products, including the Mountain Pine Beetle Information Network, publications such as the MPB special issue of the *BC Journal of Ecosystems and Management*, as well as several MPB-related events that have been held recently.

KEYWORDS: *bibliography, events catalogue, extension, information management,* JEM *special issue,* LINK*, mountain pine beetle, publications, research,* Streamline*, workshops.*

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Introduction

The current mountain pine beetle (MPB) outbreak gripping British Columbia is the largest infestation in recorded history. As of 2005, over 8.5 million ha of lodgepole pine forests had been affected by MPB, and it is estimated that by the time the infestation runs its course in 2013 the beetle will have killed up to 80% of the mature lodgepole pine in British Columbia (British Columbia Ministry of Forests and Range 2006). Natural resource managers, policy-makers, socio-economists, and community leaders all need access to information, both current and historical, and to results of the latest research studies so that they can make informed management decisions around the MPB. To increase access to scientific, experiential, and Indigenous knowledge related to the MPB and to increase knowledge and awareness of MPB-related research projects and project results, FORREX has undertaken several extension activities, a selection of which are highlighted on this poster.

Web-based Products

The Mountain Pine Beetle Information Network (***http://nrin.forrex.org/servlet/mpb***) is designed to be a one-stop source of information on the MPB. The Network provides direct access to a searchable bibliographic warehouse of published literature on MPB. The warehouse currently contains over 1200 literature citations. Over 700 of those include the publication abstract. Work is continuing to add more references to this database and to locate and add abstract information to the existing records. In cases where the publication is available on-line, the Web address (URL) for the publication is included. The site also provides links to documents containing search and result-interpretation tips to assist users searching the database.

A second database that can be searched via the Network is the Mountain Pine Beetle Events Catalogue. This database contains information on MPB-related events (workshops, conferences, meetings, etc.) being planned throughout the province. This database is continually being updated as we become aware of new events. Contributions to this database are invited and can be made by contacting Al Wiensczyk (*Alan.Wiensczyk@forrex.org* or 250.614.4354).

Users of the Network can also search more than 25 other product catalogues contributed by various organizations and housed in the Natural Resources Information Network (NRIN). These catalogues contain metadata records of research projects, unpublished project reports (interim and final), and published papers.

In addition, a link is provided on the Network site to the McGregor Model Forest Association's Bark Beetle Links site (***http://www.barkbeetlelinks.ca***). This site is an information hub providing users with links to home pages of organizations involved in MPB issues, information, or research.

Publications

The *BC Journal of Ecosystems and Management* Special MPB Issue 7(2) (***http://www.forrex.org/jem***) contains 10 articles on topics related to MPB (Table 1). The guest editorial for this issue is supplied by Rod DeBoice, the Provincial Bark Beetle Co-ordinator. Efforts are continuing to gather articles on MPB-related projects for future issues of the journal.

In 2005, FORREX File Report 05-02, "Mountain Pine Beetle: Linking Recent and Current Projects to Identified Needs" (***http://www.forrex.org/publications/other/filereports/fr05-02.pdf***) was produced by Al Wiensczyk. This report provides a list of funded projects directly related to MPB conducted within the past 5 years, and classifies them according to a series of 23 topic areas corresponding to priority information needs identified by forestry practitioners. Several recommendations are made for activities to determine whether research gaps exist.

Other publications containing information on MPB include *LINK* and *Streamline Watershed Management Bulletin*. *LINK* publishes highlights of current research, innovative applications, and recent events. To view articles, see ***http://www.forrex.org/publications/link/link.asp***. *Streamline* delivers relevant, scientifically sound technical information to the watershed management community. To view articles in this publication, see ***http://www.forrex.org/publications/streamline/streamline.asp***.

Mountain Pine Beetle Events

FORREX and the FERIC members of the FORREX team have been involved in organizing several workshops within the past couple of years. These include:

- Water Under the Bridge: Mitigating the Effects of MPB Attack and Salvage Harvesting on Hydrologic Functioning. July 2006, Kamloops; URL: ***http://www.forrex.org/events/docs/MPB_Hydrology_Workshop.pdf***
- FORREX Ecosystem Restoration Workshops – Tools and Techniques: Restoration in Mountain Pine Beetle-Impacted Areas. March 2006, Prince George; URL: ***http://www.selkirk-management.com/page/page/2867131.htm***

TABLE 1. *BC Journal of Ecosystems and Management* Special MPB Issue 7(2)

Author(s)	Articles
Perspectives	
P. Burton	Restoration of forests attacked by mountain pine beetle: Misnomer, misdirected, or must do?
Discussion Papers	
K. Lewis and I. Hartley	Rate of deterioration, degrade, and fall of trees killed by mountain pine beetle
H. Griesbauer and S. Green	Examining the utility of advance regeneration for reforestation and timber production in unsalvaged stands killed by the mountain pine beetle: Controlling factors and management implications
J. Pousette and C. Hawkins	An assessment of critical assumptions supporting the timber supply modelling for mountain-pine-beetle-induced allowable annual cut uplift in the Prince George Timber Supply Area
A.C.A. Chan-McLeod	A review and synthesis of the effects of unsalvaged mountain-pine-beetle-attacked stands on wildlife and implications for forest management
Research Reports	
T. Nelson, B. Boots, K. J. White, and A.C. Smith	The impact of treatment on mountain pine beetle infestation rates
J.C. White, M.A. Wulder, and D. Grills	Detecting and mapping mountain pine beetle red-attack damage with SPOT-5 10-m multispectral imagery
Extension Notes	
J. Rex and S. Dubé	Predicting the risk of wet ground areas in the Vanderhoof Forest District: Project description and progress report
P. Rakochy and C. Hawkins	Wildlife/danger tree assessment in unharvested stands attacked by mountain pine beetle in the central interior of British Columbia
Extended Abstracts	
L. Uunila, B. Guy, and R. Pike	Hydrologic effects of mountain pine beetle in the interior pine forests of British Columbia: Key questions and current knowledge

- FORREX/FERIC: Addressing Operational Issues in Mountain Pine Beetle-Attacked Stands. March 2006, Kamloops; URL: *http://www.forrex.org/news/event.asp?status=Arch&pkey=129*
- UBC/UNBC: The Mountain Pine Beetle Epidemic and the Future of Communities and Ecosystems: Research Synthesis and Strategy Workshop Series, November 2005, Vancouver and Prince George; URL: *http://www.forrex.org/events/mountainpinebeetleforum/workshop_pdfs.html?AreaPkey=19*
- Innovative strategies for managing and harvesting forests affected by MPB. August, 2005; URL: *http://www.feric.ca/*

Current Research Questions

The poster also suggested some current research questions. Areas of concern include:

- the socio-economic impact of the MPB infestation;
- fire risks associated with beetle-killed forests;
- the shelf-life of beetle-killed trees;
- the impact of MPB on younger lodgepole pine plantations;
- natural regeneration in beetle-killed stands; and
- the amount and distribution of retention when salvaging stands impacted by the MPB.

FORREX is also involved in the development of a number of other extension activities related to MPB. Information on these activities will be available on the FORREX Web site (*http://www.forrex.org*).

Funding support for the Mountain Pine Beetle Extension Program has been provided, in part, by the British Columbia Ministry of Forests and Range through the Forest Investment Account–Forest Science Program and by the Mountain Pine Beetle Emergency Response: Canada–B.C. Implementation Strategy.

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