FIA-FSP

Forest Science Board

Sustainability Program

Research Strategy 2006–2016

September 2006

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Sustainability Program Research Strategy 2006–2016

1.0 Context

Forest Science is one of seven programs in British Columbia's Forest Investment Account (FIA) to promote sustainable forest management. The FIA Forest Science Program (FIA-FSP) focuses on applied research and the extension of forest science results to meet the information needs and priorities of those who plan and manage British Columbia's public forest lands.

The program seeks to improve sustainable forest management by:

1. developing knowledge that addresses key short- and long-term forest management challenges
2. delivering existing and new information to practitioners, managers, and policy-makers.

The FIA-FSP funds three programs: Sustainability, Timber Growth and Value, and Forest Extension. A 14-member Forest Science Board (FSB) advises the Deputy Minister of Forests and Range (MoFR) on FIA-FSP strategies and priorities. The FSB relies on Program Advisory Committees (PACs) to assess issues and information needs within their program areas; evaluate available knowledge; identify knowledge gaps and strategies to address them; and make recommendations on priority issues, themes, and topics for annual funding support. The PACs also recommend mechanisms for delivering their programs.

This document is the strategy for the FIA-FSP Sustainability Program. It is updated periodically to reflect changing priorities and expectations of the overall program. Section 2 outlines the Sustainability PAC (SPAC) mandate and structure. Section 3 describes the program's strategic framework. Section 4 outlines the priority-setting process. Section 5 discusses program delivery. Section 6 presents the research implementation timeline. Appendix 1 presents the scores for research topic priorities that were used to determine the eligible research topics in 2007/08.

2.0 SPAC Mandate and Structure

2.1 SPAC Mandate

The SPAC mandate has two components:

- developing and periodically updating a 10-year strategy for addressing short- and long-term research priorities related to sustainability within the scope of the FIA-FSP
- developing and implementing an efficient and effective process for determining annual research priorities that meet defined business needs.

In fulfilling this mandate, the SPAC:

- advises the Forest Science Board on critical issues, knowledge gaps, and information needs relevant to the Sustainability Program
- annually recommends research priorities for the FIA–FSP Research Call for Proposals
- reviews and comments to the Board on the annual recommendations for maintenance of long-term research installations.

2.2 SPAC Membership

The SPAC consists of approximately 14 members, with 12 appointed by the Board from across the forest sector, and two representatives of the provincial extension provider who designs and implements the provincial forest extension program. Membership should reflect a geographically balanced complement of people from government agencies, First Nations, forest companies, the consulting community, academia, and research institutes. At least one Board member sits as an *ex-officio*, non-voting member of the SPAC, thus serving as a liaison between the two bodies.

The SPAC meets several times each year to discuss research priorities, set out a strategy for delivery, and address other issues at the request of the Forest Science Board. PAC members are encouraged to consult with providers and users of forest science within their area of expertise or geographic region, including groups that collect and maintain resource information.

3.0 Strategic Framework

Investments made through the FIA-FSP are expected to contribute to the government's goal of having a leading edge forest industry that is globally recognized for its productivity, environmental stewardship, and sustainable forest management practices. The Board and its PACs work to focus investments on high priority research and extension that address user needs, avoid duplication, and leverage funds by attracting money from other sources.

3.1 Program Strategies

The *FIA-FSP Strategic Plan 2004–2008* sets out the vision and strategic goals of the FIA-FSP, and identifies priority themes in each program area. Within the parameters of the Strategic Plan, each PAC evaluates available knowledge, identifies gaps, examines opportunities for cooperative research and leveraging funding, and makes recommendations to the Board pertinent to its program area. Component strategies for the Sustainability, Timber Growth and Value, and Forest Extension programs outline the priorities and methods to achieve each program's mandate.

The **Sustainability Program** focuses on research to improve:

- understanding and modeling of the relationships between ecosystem structure, biodiversity, and habitat values; and the effects of natural disturbance and human activities on ecosystems
- identification and monitoring of sustainable forest management indicators, functional targets, and thresholds

- effectiveness of mandated policies and practices.

Its four themes, and associated topics and priorities, address knowledge gaps affecting management issues, decision-support tools, monitoring, and scientific information to inform policy (Table 1). In developing the strategy, SPAC members considered comments from a selection of domain experts and forestry professionals province-wide who reviewed the draft list of identified topics.

Table 1 Sustainability Program themes, topics, and priorities

#	Theme/Topic	Priorities
1.0	**Ecosystem structure and processes, and biodiversity related to forest management**	
1.1	Riparian ecology and stream management	a Sensitivity of small-stream ecosystems to alternative riparian management strategies including livestock use (e.g., water quality, channel morphology, biological effects) b Biodiversity value of the riparian zones of small streams c Significance of small streams as sources of material and energy to downstream reaches. d Consequences of MPB salvage and management on riparian character and function of small streams and wetlands, and other aquatic habitats (e.g., channel morphology, stream temperature, organic matter dynamics) e Sensitivity of wetland ecosystems to alternative riparian management strategies including livestock use f Biodiversity value of wetland riparian zones, especially in dry Interior ecosystems
1.2	Soil biology, ecology, and productivity	a Evaluating changes in nutrient cycling and availability resulting from widespread mortality caused by MPB attack b Evaluating the relationships between soil biology/ecology and soil productivity c Evaluating the effects of forest management (e.g., coarse woody debris, green tree retention, soil disturbance) on soil biology/ecology, site hydrology, and productivity d Improving the scientific basis for defining sensitive soils e Evaluating effects of changes in site hydrology on soil biology, ecology, and productivity
1.3	Coarse filter approaches to maintaining biodiversity at the landscape scale	a How do various landscape-level attributes contribute to achieving coarse-filter biodiversity conservation goals (e.g., seral stage distribution, patch size distribution, ecosystem representation in reserves, riparian networks)? b Can current management practices such as MPB salvage operations and variable-retention harvesting, create or maintain structures and processes that are effective in maintaining key elements of biodiversity at landscape scales? c How do different landscape-level management approaches affect different species? d Are there species or groups of species that can be used to infer habitat condition for a variety of other species — if so, which ones?

#	Theme/Topic	Priorities
1.4	Effectiveness of stand-level structures in maintaining biodiversity and rangeland habitats typified by grass and shrub cover	a What stand-level attributes are required to meet wildlife habitat needs and maintain biodiversity? b What are appropriate stand-level targets and configurations of stand-level structures in cutblocks needed to maintain biodiversity (e.g., in MPB-attacked areas)? c What are appropriate targets and configurations of stand-level structures in dry forest and open range (grassland, shrubland) needed to maintain biodiversity? d How effective are management strategies in creating stand-level structures and how effective are these in maintaining stand-level biodiversity, non-timber forest values, and rangeland habitat? e How do riparian buffers and their design contribute to maintenance of stand-level wildlife habitat and biodiversity (aquatic, upland, and riparian)?
1.5	Natural disturbance ecology	a What is the dominant type, intensity, frequency, pattern, and scale at which historic natural disturbance (e.g., fires, wind, insect, and disease infestations) occur in different areas of the province? What are the rates of tree mortality, tree fall down, and tree decomposition for those dominant disturbances? b To what degree can large areas of dead trees (e.g., killed by insects, disease, or windthrow) meet resource management objectives? c Measuring the effectiveness of various approaches for managing for biodiversity, including emulation of natural disturbance patterns? d How must windthrow be considered in the design of stand-level biodiversity retention? e How do natural disturbance processes including gap creation affect forest regeneration, succession, and wildlife habitat at landscape and site scales? f How do natural successional processes, including forest in-growth and encroachment on rangelands, affect forage for livestock and wildlife habitat at landscape and site scales? g How has management (e.g., fire suppression, road construction, harvesting) affected the structure and composition of forests (stands and landscape patterns) compared to natural systems (particularly Douglas-fir, lodgepole pine, and ponderosa pine forests in the interior, and drier ecosystems on the coast (e.g., CDF))? h How do insects and disease affect structural and spatial diversity (including forest regeneration), wildlife habitat, and the occurrence of wildfire?
1.6	Watershed function	a Connectivity and linkages between up-slope disturbances and stream channel response b Effects of road construction and layout on streamflow and watershed processes c Developing methods for landslide risk assessment and landslide avoidance d The implications of different patterns, levels, and methods of tree removal (e.g., variable-retention harvesting, cable logging vs. helicopter-grapple logging) on slope stability e Evaluating the physical, biological, and cumulative effects of forest management (incl. salvage harvesting), natural disturbance (e.g., fire, mass wasting, MPB), and range practices on watershed processes (e.g., streamflow quantity and timing, water quality, water table response), channel morphology, and aquatic habitat (e.g., salmon spawning grounds) f How large woody debris recruitment relates to stream channel type and state
1.7	Invasive species (plants, animals, pathogens)	a Impacts of exotic (alien invasive) plants on diversity, productivity, and resilience of grassland and forest ecosystems b Characterizing population growth and range expansion of potentially harmful pests and pathogens, with an emphasis on early detection, prediction, and control

#	Theme/Topic	Priorities
		c Problem analysis of the impacts of invading species on species at risk
1.8	Ecological restoration	a Evaluating the effectiveness of restoration techniques on mitigating forest encroachment and in-growth in NDT4 ecosystems b Evaluating the effectiveness of diversity enhancing techniques, such as introducing snags and gaps, as a means of restoring biodiversity in stands or landscapes dominated by homogeneous second-growth forests c Evaluating the effectiveness of methods for controlling the populations or impacts of invasive and colonizing species d Evaluating the effectiveness of in-stream aquatic habitat restoration techniques e Evaluating the effectiveness of soil rehabilitation techniques f Evaluating the effectiveness of riparian habitat restoration techniques
2.0	**Decision support tools for sustainable forest management**	
2.1	Habitat supply modeling	a Developing, calibrating and validating habitat models related to priorities identified in theme 1.0 (Ecosystem structure, function, and processes…), topic 3.2 (Thresholds...) and for decision support related to priorities in topic 4.1 (Species-at-risk…). NTFPs may also be treated in this manner. b Evaluating the effectiveness of fish habitat capability models in identifying high value fish habitat c Developing tools to explore the spatial and temporal dynamics of habitat values in both natural and managed stands, both among and within stands. Tools focused within stands should include multi-species irregular stand structures and (or) where variable-retention harvesting is practiced? Priority will be given to developing or adapting approaches that use or improve the utility of existing inventory and other readily available data.
2.2	Population viability and spatially explicit population models	a Developing spatially explicit habitat supply models for population viability analysis (PVA) applied to species at risk as outlined in topic 4.1 (Species-at-risk recovery)
2.3	Watershed response	a Developing, refining, and validating spatially explicit watershed models that address the effects of forest development and natural disturbances on: peak flow, timing of flow, volume of flow, effect on critical aquatic habitat, effect on ground water, and water quality
2.4	Refine ecological classification system	a Updating, reconciling, and refining BEC or its components to better identify site series to improve management at the stand and landscape levels b Developing methods for identifying rare ecosystems c Developing, refining, and validating classification systems for aquatic ecosystems d Defining seral stages in all ecological sites grazed by cattle and wild ungulates
2.5	Watershed stewardship tools	a Predicting stream temperature regimes to support designation of temperature-sensitive streams
2.6	Ecological risk assessment frameworks	a Developing frameworks and (or) models for evaluating the resilience and sensitivity of ecosystems to change and disturbances, with emphasis on the hydrological, geophysical, and aquatic resources at the watershed and landscape scales b Developing integrated risk assessment frameworks for evaluating trade-offs between multiple outcomes

#	Theme/Topic	Priorities
3.0	**Indicators, thresholds, and monitoring systems**	
3.1	Development of indicators and monitoring systems	a Indicators and monitoring systems are needed for each of the 11 FRPA values (i.e., soils, visual quality, timber, forage and associated plant communities, water, fish, wildlife, biodiversity, recreation resources, resource features, cultural heritage values). The following is a non-restrictive list of examples: riparian function, watershed function, ecological representation, habitat quality, and range health (upland and riparian). b What aquatic species (benthic invertebrates, algae, fish, etc.) can be used as indicators of watershed health? c Developing and evaluating uses of remote sensing, information systems, and innovative technology to assess landscape- and stand-level characteristics
3.2	Indicator thresholds of sustainability	a Defining the response curves for biodiversity indicators to assist in identifying thresholds for maintaining ecological resilience b Determining the likely range of natural variability (biological and biophysical) of coarse- through fine-filter indicators to aid in the determination of management thresholds c Defining criteria suitable for assessing the ecological representation, landscape, and site attributes needed to maintain wildlife and biodiversity, and how best to allocate them across the landscape? d Assessing potential indicator targets and management thresholds for sensitive species and ecological communities, especially those species and communities designated under the *Forest and Range Practices Act* and regulations as: "at risk", "regionally significant", or "specified ungulates". (Also see 2.2 - Population viability and spatially explicit population models, and 4.1 – Species-at-risk recovery research.) e Clarifying and (or) refining thresholds for indicators of change in watershed functioning (e.g., road density, equivalent clear-cut area)
3.3	Indicators for economic and social sustainability	a Devising appropriate methods for valuing non-timber economic values (consumptive and non-consumptive) for effective inclusion in forest and land management plans. b Identifying patterns of values and perceptions of various stakeholder/public groups about the relative importance of social, economic, and ecological factors. c Mechanisms for aggregating social and economic data for use in land-use planning processes d Quantifying impacts on affected parties, and identifying socially acceptable mechanisms for compensation e Evaluating conflicts between municipal/regional district planning (e.g., regional growth strategies) and forest management and land-use planning in B.C. and exploring ways to better coordinate them
3.4	Methods for balancing social, economic, and environmental indicators of sustainability	a Process and criteria for setting thresholds, establishing targets, and examining trade-offs between ecological and socio-economic indicators, especially in multi-stakeholder planning processes b Implications and management of changing access patterns on non-timber resource use (e.g., fish, wildlife, recreation)

#	Theme/Topic	Priorities
4.0	**Scientific information to inform policy, regulations, standards development, and (or) refinement**	
4.1	Species-at-risk recovery research	a Determining critical habitat requirements for species at risk, defined at the appropriate scale b Clarifying and (or) assessing threats to species or ecosystems at risk, particularly those with cumulative effects or where evidence is conflicting c Understanding the effects of management practices (particularly forest roads, harvesting, livestock use, exclusion/re-introduction of fire, large-scale salvage) on the ecology of species at risk d Determining how specific threats may be mitigated or recovery mechanisms developed to assist recovery
4.2	Evaluation and management of impact of potential AAC changes over time on community resiliency	a Mechanisms for enhancing community resilience b What are effects of established policies and regulations on community resilience (e.g., how do communities adapt to AAC changes)? c Knowledge to improve determination of AAC in ways that minimize impacts on communities? d What are consequences of policies, regulations and science on community resilience? e Evaluation of effectiveness of implemented policy in achieving socio-economic objectives
4.3	Ecosystem-based management	a Comparing the effectiveness of EBM with current planning and management approaches

3.2 Annual Priorities

Research themes and topics are reviewed and updated annually in consideration of feedback from research users and researchers. The Sustainability and Timber PACs identify research priorities that shape the September Research Call for Proposals. Expert review committees evaluate all proposals that are submitted in response to the Call for Proposals. Based on their recommendations and PAC priorities, the Board recommends the allocation of available funds to research projects.

When approved by the Deputy Minister of Forests and Range, the Board's recommendations for research, extension, program development, and administration constitute the annual FIA-FSP Business Plan.

3.3 Monitoring

Progress monitoring and feedback to the Board and PACs occur through several mechanisms, including:

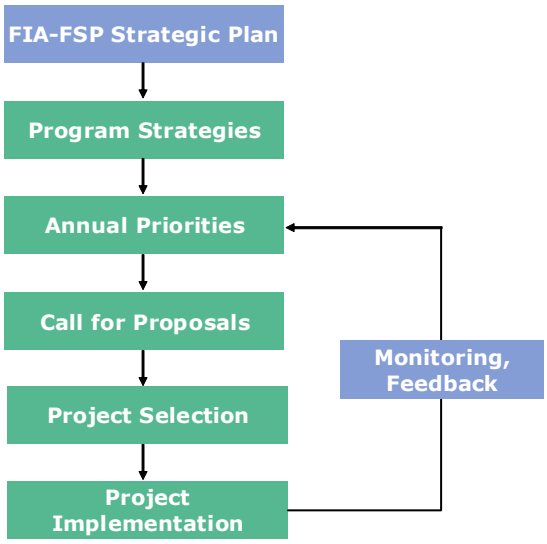
- feedback from the administrators of the Call for Proposals process (PricewaterhouseCoopers)
- forestry community communication with individual PAC members
- response to broadcast invitations for comments on this strategy

- reviewing proposals and project deliverables
- feedback from the provincial forest extension provider (FORREX).

To monitor research progress on priority topic areas, successful research projects are correlated with priority topics to determine whether key issues are being addressed and additional work is needed.

Figure 1 illustrates the FIA-FSP research strategic framework.

Figure 1 Strategic Framework for FIA-FSP research.

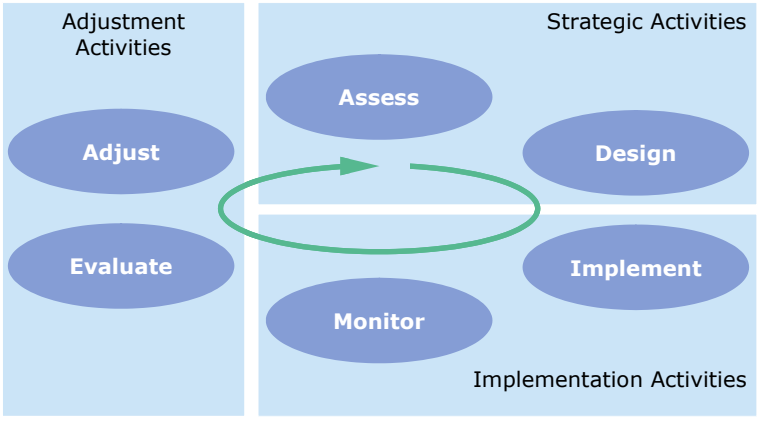


4.0 Overview of Sustainability Program Research Strategy

4.1 Themes

Research themes in the Sustainability Program area can be broadly categorized as biophysical, decision support, monitoring systems/indicator development, and policy support. Together, these themes outline the information needed to support the adaptive management cycle (Figure 2). Biophysical information provides fundamental information for managing and developing decision support tools. Monitoring, including the development of meaningful indicators, enables assessments about whether adjustments to management practices are meeting objectives. Ultimately, biophysical information, decision support tools, and monitoring results are used to inform policy. Policy adjustments affect management activity, and the cycle continues.

Figure 2 **Adaptive management cycle.**



4.2 Determining Focus

Given the inter-relatedness of the thematic components in this program area, it is logical to consider encouraging work in all four areas simultaneously — especially where topics are related. Doing so should improve the chances of effectively identifying research needs and successfully applying research results. At the same time, because of limited funds, it is important to maintain focus and avoid spreading research efforts too thinly. However, this means that some important issues will not be addressed — at least in the short term. Because the Sustainability Program is so broad in scope, decisions regarding focus are difficult to make systematically. For example, it is difficult to imagine any criteria that would categorically identify watershed-related research as a higher priority than biodiversity-related research, or vice versa, because elements in each are equally high priorities for different reasons.

From time to time, specific issues arise that dictate priorities for the Program (e.g., the mountain pine beetle [MPB] epidemic). Related research is needed across a broad spectrum of disciplines, spanning the four thematic areas in the Sustainability Program. Owing to the magnitude of MPB epidemic, a sense of urgency and importance must be reflected in this Sustainability Program strategy.

4.3 Adjusting Priorities

In 2004/05 the SPAC developed its first draft of research topics for the Sustainability Program. At the Forest Science Board's request to focus the relatively scarce available funding, SPAC members also identified the six highest priority topics, which were those considered "eligible for funding" in the 2004 Call for Proposals. These priorities continued to guide the topics eligible for funding in 2005/06. In principle, the Sustainability Program strategy will maintain those six topics as the highest priority for the next few years, adjusting if necessary, based on annual review by the SPAC, taking into account new issues, state of knowledge, and availability of funding.

Under normal circumstances, it is unlikely that significant program/strategic changes will be made in less than three years. However, as the state of knowledge in any particular area

improves, emphasis might move from one theme (e.g., biophysical data collection), to another (e.g., development or refinement of decision-support tools).

4.4 Long-term Research Installations

Long-term research installations are another important strategic consideration. While short-term outputs are expected and preferred, in a long-term endeavour like forest ecosystem management, long-term installations are the "window to the future." Long-term results frequently contradict short-term results, so revisiting well-designed projects already in the ground can often provide critical and cost-effective information. Key installations must be identified and their viability over time must be ensured. Minimally, this means maintaining the physical infrastructure, which is done under the FIA-FSP Long-term Research Installation (LTRI) program, but optimally it means supporting short- and long-term research activities at those installations. Whether any single installation generates short-term results might not be the only determinant of eligibility for funding if the experiment in question is otherwise likely to yield valuable long-term results.

4.5 Research Implementation Timeline

Research on priority topics must be delivered over a long time due to limitations of funds, skilled researchers, and biological requirements associated with long-term research. Research of the sort addressed by the Sustainability Program is inherently broad in scope, complex, and the projects are frequently inter-related and multidisciplinary.

Determining how long any priority topic area should be funded is difficult for several reasons:

- without knowing which projects will be selected through the competitive process, it is impossible to know how many years of funding will be required for any specific topic
- biophysical research often requires five to ten years before meaningful results are achieved
- research at the topic level does not lend itself to an on/off funding approach, with an expectation that at some defined point in the future, the research in that topic area will be complete or finished.

The Sustainability Program spans biophysical, decision support, monitoring, and policy-related themes. The breadth of scope, complexity, and interrelatedness of topics within these themes make it difficult to establish a concise process for identifying funding priorities. Furthermore, the temporal scope of "sustainability" is at least one forest rotation in length, making it difficult to prove or disprove aspects of SFM within the window of a 10-year strategic plan. Since FIA FSP funding is only allocated annually, it is difficult to schedule research investments reliably over the longer term."

Table 2 represents the SPAC recommendations for profiling available funding between 2006 and 2016. It is expected that this table will be revisited by the SPAC regularly and adjusted to reflect current events, changing operational priorities, and new knowledge gained through research. For these reasons, the reliability and commitment to the schedule depicted in this table decrease with

time. The first few years may be considered relatively stable, but beyond that, significant change is likely to occur based on regular SPAC review.

In 2004, the SPAC narrowed the focus of the Sustainability Program to six research topics. Table 3 reflects the SPAC opinion that priorities identified in 2004/05 should continue for the next few years, contingent on annual reviews. It also reflects the view that some support should be provided for research in decision support (habitat supply), and for work on indicators for economic and social sustainability under the topic "SFM indicators, targets, and monitoring systems."

Note that Table 2 simplistically shows funding abruptly starting and stopping in discrete years for most topics. In reality, funding for topics will likely, and should logically, scale down over time. Likewise, new topic areas would be expected to scale up concurrently; for example, mountain pine beetle research has been added to specific topics. The research timeline for some research topics has yet to be determined. Table 2 should be interpreted as an indicator of strategic research timelines to 2016, based on the Forest Science Board desire to focus research efforts. As noted elsewhere, the SPAC annually identifies research funding priorities that consider, but are not rigidly bound, to this timeline. As well, all topic areas are open for proponent-driven proposals each year.

Table 2 Research emphasis 2006 to 2016, FIA-FSP Sustainability Program

	Theme / Topic	Plan Fiscal Year									
		05/ 06	06/ 07	07/ 08	08/ 09	09/ 10	10/ 11	11/ 12	12/ 13	13/ 14	14/ 15
1.0	**Ecosystem structure and processes, and biodiversity related to forest management**										
1.1	Riparian ecology and stream management	---	---	---	---	---	---				
1.2	Soil biology, ecology, and productivity							---	---	---	---
1.3	Coarse filter approaches to maintaining biodiversity at the landscape scale	---	---	---	---	---	---				
1.4	Effectiveness of stand-level structures and habitat in maintaining biodiversity, including rangeland habitats typified by grass and shrub cover	---	---	---	---	---	---				
1.5	Natural disturbance ecology (MPB focus 2007/08 to 2010/11)			---	---	---	---	---	---	---	---
1.6	Watershed function (MPB focus 2007/08)			---	---	---	---				
1.7	Invasive species (plants, animals, pathogens)										
1.8	Ecological restoration										
2.0	**Decision support tools for sustainable forest management**										
2.1	Habitat supply modeling	---	---	---	---	---	---				
2.2	Population viability and spatially explicit population models										
2.3	Watershed response (MPB focus 2007/08 to 2010/11			---	---	---	---	---	---	---	---
2.4	Refine ecological classification system							---	---	---	---
2.5	Watershed stewardship tools										
2.6	Ecological risk assessment frameworks (MPB focus 2006/07 to 2010/11)		---	---	---	---	---				
3.0	**SFM indicators, targets, and monitoring systems**										
3.1	Development of indicators and monitoring systems (the following is a non-restrictive lists of examples)	---	---	---	---	---	---				
3.2	Indicator targets and functional thresholds of sustainability (the following is a non-restrictive list)	---	---	---	---	---	---				
3.3	Indicators for economic and social sustainability	---	---	---	---	---	---				
3.4	Methods for balancing social, economic and environmental indicators of sustainability		---	---	---	---	---	---			
4.0	**Scientific information to inform policy/ regulations/ standards development and (or) refinement**										
4.1	Species-at-risk recovery research	---	---	---	---	---	---				
4.2	Evaluation and management of impact of potential AAC changes over time on community resiliency										
4.3	Ecosystem-based management							---	---	---	---

5.0 Program Priority-Setting

Early in each fiscal year, the Sustainability and Timber Growth and Value PACs begin a priority-setting process to define the eligible topics for the September Research Call for Proposals. This process includes reviewing the program strategy; considering the program's relevance to key interests and initiatives; reviewing the funding of program themes, topics, and priorities to date; considering research being carried out by other agencies and opportunities for collaboration; identifying new issues and (or) priorities since the previous year; and scoring the program topic priorities.

5.1 General Approach

The SPAC follows six general principles in establishing annual priorities for research:

- Continue with strategic priorities as outlined, keeping focused on identified needs. Some topics will not be addressed by FIA-FSP.
- Maintain long-term research installations (LTRI), and fund their maintenance under the FIA-FSP LTRI program. Support for collecting data is also important and needed, but is currently outside the scope of this strategy.
- Fund research in each of the four themes.
- Add a regional focus to establishing priorities.
- Consider funding available from other sources that might address sustainability priorities.
- Account for emerging issues and urgent priorities (e.g., mountain pine beetle).

5.2 Scoring Process

The scoring process has five steps:

- amending and (or) confirming the topics and priorities under each Program theme
- assigning preliminary scores to each priority, and distributing to PAC members
- canvassing of members by constituents, assigning a score to each priority, and identifying any theme, topic, or priority issues (including the need to add new topics or priorities)
- compiling a group scoresheet and distributing to PAC members as background for a group discussion
- confirming the PAC's final scores.

Using the scores, the PAC recommends eligible topics and priorities for the Call for Proposals to the Forest Science Board (see Appendix 1).

5.3 Limitations to the Setting of Research Priorities

Priority development and research delivery have the following limitations:

- information on research needs is incomplete
- understanding of research needs is imperfect
- the scoring system has a relatively coarse resolution and small number of criteria
- funding constraints limit the scope of the themes considered and topics recommended
- resolution of geographic strata is not optimal for the evaluation of many research topics
- the relative importance of the evaluation criteria varies by individual, agency and company.

6.0 Program Delivery

6.1 FIA-FSP Call for Proposals

The FIA-FSP currently uses a call for proposals process to solicit research projects, and a program delivery approach to implement the Provincial Forest Extension Program (PFEP).

The FIA-FSP Research Call for Proposals follows a two-stage competitive process, based on the current research priorities set by the Forest Science Board on advice from the PACs. The first stage involves a letter of interest (LOI) that briefly describes the proposed project. Proponents whose LOIs pass the first review phase are invited to submit a detailed proposal (second stage). Expert review committees evaluate all proposals. Based on their recommendations and PAC priorities, the Board recommends the allocation of available funds to research and extension projects. When approved by the Deputy Minister of Forests and Range, these recommendations constitute the annual FIA-FSP Business Plan.

The Timber PAC is investigating the feasibility and benefits of taking a program delivery approach to growth and yield modeling. If successful, the Sustainability PAC may consider a program delivery approach for specific components of the Sustainability Program.

6.2 Research Problem Analysis, Synthesis, and Gap Analysis

Many research needs are effectively delivered through a call for proposals, as they are characterized by dispersed expertise, shorter-term projects, and limited knowledge and facility capital. However, some topics require other approaches; for example, the impacts of invading species on species at risk. So little is known about this topic that the SPAC commissioned a problem analysis in 2005/06 to assemble the information needed to define appropriate research topics and identify priorities. The problem analysis described the nature of the risk and recommended next steps leading to the identification of priorities. The report will be circulated for peer review in 2006/07 to identify research priorities in this topic area for the 2008/09 Call for Proposals. The SPAC will also commission research syntheses and gap analyses on topics 1.2, soil biology, ecology, and productivity; and 3.1, development of indicators and monitoring systems.

Appendix 1 – Scoring Research Priories

Scoring System

Research topic priorities are scored for each region[1] in consideration of the size of knowledge gap (the degree to which lack of knowledge is affecting management, cost, or value), the urgency of the priority, and the percentage of the region to which the priority applies. Table 3 shows how these criteria are combined to develop a score from 1 (highest) to 8 (lowest).

Table 3 Scoring system used to rank research topics

KNOWLEDGE GAP (large, medium, small)	URGENCY (great, moderate, low)	% of REGION (>50%, <50%)	Short-form assessment	SCORE
LARGE	Great	>50%	LG>	**1**
LARGE	Great	<50%	LG<	**2**
LARGE	Moderate	>50%	LM>	**3**
LARGE	Moderate	<50%	LM<	**4**
LARGE	Low	>50%	LL>	**5**
LARGE	Low	<50%	LL<	**6**
MEDIUM	Great	>50%	MG>	**2**
MEDIUM	Great	<50%	MG<	**4**
MEDIUM	Moderate	>50%	MM>	**4**
MEDIUM	Moderate	<50%	MM<	**6**
MEDIUM	Low	>50%	ML>	**5**
MEDIUM	Low	<50%	ML<	**7**
SMALL	Great	>50%	SG>	**3**
SMALL	Great	<50%	SG<	**5**
SMALL	Moderate	>50%	SM>	**5**
SMALL	Moderate	<50%	SM<	**6**
SMALL	Low	>50%	SL>	**7**
SMALL	Low	<50%	SL<	**8**

Research Priority Scores 2007/08

Table 4 lists the scores for research topic priorities for the 2007/08 fiscal year. The priorities with scores of 1, 2 were designated as eligible topics for the 2007/08 Call for Proposals. The *Sustainability Program Eligible Research Topics 2007/08* document includes context information for each of the eligible topics.

[1] Ministry of Forests and Range administrative regions were used (Coast, Southern Interior, and Northern Interior).

Table 4 **2007/08 scores for Sustainability Program topic priorities**
Columns 4 to 7 indicate relevance to the Future Forest Ecosystem Initiative (FFEI), identified First Nations issues (FN), Mountain Pine Beetle (MPB), and Range.

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
1.0	**Ecosystem structure and processes, and biodiversity related to forest management**								
1.1	Riparian ecology and stream management	Sensitivity of small-stream ecosystems to alternative riparian management strategies including livestock use (e.g., water quality, channel morphology, biological effects)		FN	MPB	Range	1	2	2
		Biodiversity value of the riparian zones of small streams					2	4	4
		Significance of small streams as sources of material and energy to downstream reaches		FN			5	7	6
		Consequences of MPB salvage and management on riparian character and function of small streams and wetlands, and other aquatic habitats (e.g., channel morphology, stream temperature, organic matter dynamics)	FFEI	FN	MPB		6	1	2
		Sensitivity of wetland ecosystems to alternative riparian management strategies including livestock use		FN		Range	6	4	2
		Biodiversity value of wetland riparian zones, especially in dry Interior ecosystems		FN		Range	6	4	2
1.2	Soil biology, ecology, and productivity	Evaluating changes in nutrient cycling and availability resulting from widespread mortality caused by MPB attack	FFEI	FN	MPB		6	4	4
		Evaluating the relationships between soil biology/ecology and soil productivity	FFEI				4	4	4
		Evaluating the effects of forest management (e.g., coarse woody debris, green tree retention, soil disturbance) on soil biology/ecology, site hydrology and productivity		FN	MPB		3	3	3
		Improving the scientific basis for defining sensitive soils					6	6	6
		Evaluating effects of changes in site hydrology on soil biology, ecology and productivity	FFEI	FN	MPB	Range	8	2	6

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
1.3	Coarse filter approaches to maintaining biodiversity at the landscape scale	How do various landscape-level attributes contribute to achieving coarse-filter biodiversity conservation goals (e.g., seral stage distribution, patch size distribution, ecosystem representation in reserves, riparian networks)?	FFEI		MPB		1	1	2
		Can current management practices such as MPB salvage operations and variable-retention harvesting, create or maintain structures and processes that are effective in maintaining key elements of biodiversity at landscape scales?	FFEI	FN	MPB		1	1	1
		How do different landscape-level management approaches affect different species?	FFEI	FN	MPB		1	1	1
		Are there species or groups of species that can be used to infer habitat condition for a variety of other species – if so, which ones?					2	2	2
1.4	Effectiveness of stand-level structures in maintaining biodiversity and rangeland habitats typified by grass and shrub cover	What stand-level attributes are required to meet wildlife habitat needs and maintain biodiversity?	FFEI	FN	MPB	Range	1	3	3
		What are appropriate stand-level targets and configurations of stand-level structures in cutblocks needed to maintain biodiversity (e.g., in MPB attacked areas)?	FFEI	FN	MPB		1	1	1
		What are appropriate targets and configurations of stand-level structures in dry forest and open range (grassland, shrubland) needed to maintain biodiversity?	FFEI	FN	MPB	Range	6	4	2
		How effective are management strategies in creating stand-level structures and how effective are these in maintaining stand-level biodiversity, non-timber forest values, and rangeland habitat?	FFEI	FN	MPB	Range	1	1	1
		How do riparian buffers and their design contribute to maintenance of stand-level wildlife habitat and biodiversity (aquatic, upland, and riparian)?		FN	MPB	Range	2	2	2

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
1.5	Natural disturbance ecology	What is the dominant type, intensity, frequency, pattern, and scale at which historic natural disturbance (e.g., fires, wind, insect and disease infestations) occur in different areas of the province? What are the rates of tree mortality, tree fall down, and tree decomposition for those dominant disturbances?	FFEI		MPB		3	2	1
		To what degree can large areas of dead trees (e.g., killed by insects, disease, or windthrow) meet resource management objectives?		FN	MPB		4	1	2
		Measuring the effectiveness of various approaches for managing for biodiversity, including emulation of natural disturbance patterns	FFEI		MPB		1	1	1
		How must windthrow be considered in the design of stand-level biodiversity retention?					2	4	4
		How do natural disturbance processes including gap creation affect forest regeneration, succession, and wildlife habitat at landscape and site scales?		FN	MPB		4	1	1
		How do natural successional processes, including forest in-growth and encroachment on rangelands, affect forage for livestock and wildlife habitat at landscape and site scales?				Range	6	4	2
		How has management (e.g., fire suppression, road construction, harvesting) affected the structure and composition of forests (stands and landscape patterns) compared to natural systems (particularly Douglas-fir, lodgepole pine, and ponderosa pine forests in the interior, and drier ecosystems on the coast (e.g., CDF))?	FFEI	FN	MPB		7	6	2
		How do insects and disease affect structural and spatial diversity (including forest regeneration), wildlife habitat, and the occurrence of wildfire?	FFEI	FN	MPB		6	1	1
1.6	Watershed function	Connectivity and linkages between up-slope disturbances and stream channel response		FN			1	4	2
		Effects of road construction and layout on streamflow and watershed processes	FFEI	FN	MPB		4	2	4
		Developing methods for landslide risk assessment and landslide avoidance					1	2	1

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
		The implications of different patterns, levels and methods of tree removal (e.g., variable-retention harvesting, cable logging vs. helicopter-grapple logging) on slope stability	FFEI				2	6	6
		Evaluating the physical, biological, and cumulative effects of forest management (incl. salvage harvesting), natural disturbance (e.g., fire, mass wasting, MPB), and range practices on watershed processes (e.g., streamflow quantity and timing, water quality, water table response), channel morphology, and aquatic habitat (e.g., salmon spawning grounds)	FFEI	FN	MPB	Range	1	1	1
		How large woody debris recruitment relates to stream channel type and state	FFEI				3	3	3
1.7	Invasive species (plants, animals, pathogens)	Impacts of exotic (alien invasive) plants on diversity, productivity, and resilience of grassland and forest ecosystems	FFEI			Range	6	4	2
		Characterizing population growth and range expansion of potentially harmful pests and pathogens, with an emphasis on early detection, prediction, and control			MPB	Range	6	4	3
		Problem analysis of the impacts of invading species on species at risk				Range	8	8	8
1.8	Ecological restoration	Evaluating the effectiveness of restoration techniques on mitigating forest encroachment and in-growth in NDT4 ecosystems		FN		Range	8	4	2
		Evaluating the effectiveness of diversity enhancing techniques, such as introducing snags and gaps, as a means of restoring biodiversity in stands or landscapes dominated by homogeneous second-growth forests		FN			2	2	1
		Evaluating the effectiveness of methods for controlling the populations or impacts of invasive and colonizing species		FN		Range	4	4	2
		Evaluating the effectiveness of in-stream aquatic habitat restoration techniques		FN			4	4	4
		Evaluating the effectiveness of soil rehabilitation techniques		FN			6	6	6
		Evaluating the effectiveness of riparian habitat restoration techniques		FN	MPB	Range	2	2	2

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
2.0	**Decision support Tools for sustainable forest management**								
2.1	Habitat supply modeling	Developing, calibrating, and validating habitat models related to priorities identified in theme 1.0 (Ecosystem structure, function, and processes…), topic 3.2 (Thresholds...), and for decision support related to priorities in topic 4.1 (Species-at-risk…). NTFPs may also be treated in this manner.		FN	MPB		1	1	1
		Evaluating the effectiveness of fish habitat capability models in identifying high value fish habitat		FN			1	1	1
		Developing tools to explore the spatial and temporal dynamics of habitat values in both natural and managed stands, both among and within stands. Tools focused within stands should include multi-species irregular stand structures and (or) where variable-retention harvesting is practiced. Priority will be given to developing or adapting approaches that use or improve the utility of existing inventory and other readily available data.	FFEI				3	3	3
2.2	Population viability and spatially explicit population models	Developing spatially explicit habitat supply models for population viability analysis (PVA) applied to species at risk as outlined in topic 4.1 (Species-at-risk recovery)					3	3	3
2.3	Watershed response	Developing, refining, and validating spatially explicit watershed models that address the effects of forest development and natural disturbances on: peak flow, timing of flow, volume of flow, effect on critical aquatic habitat, effect on ground water, and water quality		FN	MPB		3	1	1
2.4	Refine ecological classification system	Updating, reconciling, and refining BEC or its components to better identify site series in order to improve management at the stand and landscape levels	FFEI	FN			1	6	4
		Developing methods for identifying rare ecosystems					2	4	4
		Developing, refining and validating classification systems for aquatic ecosystems					2	2	2
		Defining seral stages in all ecological sites grazed by cattle and wild ungulates				Range	6	4	2
2.5	Watershed stewardship tools	Predicting stream temperature regimes to support designation of temperature sensitive streams					6	4	4

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
2.6	Ecological Risk Assessment Frameworks	Developing frameworks and (or) models for evaluating the resilience and sensitivity of ecosystems to change and disturbances, with emphasis on the hydrological, geophysical, and aquatic resources at the watershed and landscape scales	FFEI	FN	MPB		3	1	1
		Developing integrated risk assessment frameworks for evaluating trade-offs between multiple outcomes	FFEI	FN	MPB		3	1	1
3.0	**Indicators, thresholds, and monitoring systems**								
3.1	Development of indicators and monitoring systems	Indicators and monitoring systems are needed for each of the 11 FRPA values (i.e., soils, visual quality, timber, forage and associated plant communities, water, fish, wildlife, biodiversity, recreation resources, resource features, cultural heritage values). The following is a non-restrictive list of examples: riparian function, watershed function, ecological representation, habitat quality, and range health (upland and riparian).	FFEI	FN		Range	2	2	2
		What aquatic species (benthic invertebrates, algae, fish, etc.) can be used as indicators of watershed health?					2	2	2
		Developing and evaluating uses of remote sensing, information systems, and innovative technology to assess landscape- and stand-level characteristics		FN	MPB		1	1	1
3.2	Indicator thresholds of sustainability	Defining the response curves for biodiversity indicators to assist in identifying thresholds for maintaining ecological resilience	FFEI	FN			1	1	1
		Determining the likely range of natural variability (biological and biophysical) of coarse- through fine-filter indicators to aid in the determination of management thresholds	FFEI				1	1	1
		Defining criteria suitable for assessing the ecological representation, landscape, and site attributes needed to maintain wildlife and biodiversity, and how best to allocate them across the landscape					1	1	1

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
		Assessing potential indicator targets and management thresholds for sensitive species and ecological communities, especially those species and communities designated under the *Forest and Range Practices Act* and regulations as "at risk", "regionally significant", or "specified ungulates." (Also see 2.2 - Population viability and spatially explicit population models, and 4.1 – Species-at-risk recovery research.)					2	2	2
		Clarifying and (or) refining thresholds for indicators of change in watershed functioning (e.g., road density, equivalent clear-cut area)					1	1	1
3.3	Indicators for economic and social sustainability	Devising appropriate methods for valuing non-timber economic values (consumptive and non-consumptive) for effective inclusion in forest and land management plans		FN			1	1	1
		Identifying patterns of values and perceptions of various stakeholder/public groups about the relative importance of social, economic, and ecological factors		FN			3	3	3
		Mechanisms for aggregating social and economic data for use in land-use planning processes					1	1	1
		Quantifying impacts on affected parties, and identifying socially acceptable mechanisms for compensation		FN			1	1	1
		Evaluating conflicts between municipal/regional district planning (e.g., regional growth strategies) and forest management and land-use planning in B.C. and exploring ways to better coordinate them					3	3	3
3.4	Methods for balancing social, economic, and environmental indicators of sustainability	Process and criteria for setting thresholds, establishing targets, and examining trade-offs between ecological and socio-economic indicators, especially in multi-stakeholder planning processes					1	1	1
		Implications and management of changing access patterns on non-timber resource use (e.g., fish, wildlife, recreation)		FN	MPB		2	1	2

#	Theme/Topic	Priorities	FFEI	FN	MPB	Range	Score		
							Coast	N. Int.	S. Int.
4.0	**Scientific information to inform policy, regulations, standards development, and (or) refinement**								
4.1	Species-at-risk recovery research	Determining critical habitat requirements for species at risk, defined at the appropriate scale			MPB		2	2	2
		Clarifying and/or assessing threats to species or ecosystems at risk, particularly those with cumulative effects or where evidence is conflicting		FN	MPB	Range	2	2	2
		Understanding the effects of management practices (particularly forest roads, harvesting, livestock use, exclusion/re-introduction of fire, large-scale salvage) on the ecology of species at risk	FFEI		MPB	Range	1	1	1
		Determining how specific threats may be mitigated or recovery mechanisms developed to assist recovery			MPB	Range	1	1	1
4.2	Evaluation and management of impact of potential AAC changes over time on community resiliency	Mechanisms for enhancing community resilience		FN	MPB		1	1	1
		What are effects of established policies and regulations on community resilience (e.g., how do communities adapt to AAC changes)?		FN	MPB		1	1	1
		Knowledge to improve determination of AAC in ways that minimize impacts on communities?		FN	MPB		1	1	1
		What are consequences of policies, regulations, and science on community resilience?		FN	MPB		1	1	1
		Evaluation of effectiveness of implemented policy in achieving socio-economic objectives		FN	MPB		1	1	1
4.3	Ecosystem-based management	Comparing the effectiveness of EBM with current planning and management approaches					1	3	3