Southern Interior

Strategic Regional Restoration Plan

Prepared for the Ministry of Environment,

Ecosystems Branch, Victoria, BC

August 2006

ENAR ESDE Inc.

Consultants in **N**atural **R**esources **S**ustainable **D**evelopment

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Acknowledgements

The Ministry of Environment (MOE) contracted ENAR ESDE Inc. and their associates to develop three Strategic Regional Restoration Plans to guide further planning in forest management units (i.e., Timber Supply Areas and Tree Farm Licenses) affected by mountain pine beetle and wildfire.

The project team included Janet Gagné, Rachel Holt, Mike Fenger, Tanis Douglas, Sheldon Gagné, Michele Baker, and Keith Jones. Themed management unit maps were produced by Wildlife Infometrics Inc.

We sincerely thank the over 80 participants of the engagement process (the Challenge Dialogue™ and/or regional workshops) for their valuable knowledge, insights, and time[1]. This Strategic Regional Restoration Plan was available for general input during July-August of 2006. As no further comments were received, the Plan reflects the input received from the Challenge Dialogue ™ process, and the Regional Workshops.

The MOE project sponsors are gratefully acknowledged and include Colene Wood, Judy Millar, Chris Ritchie, Sue Crowley, Patrick Daigle and Lyle Gawalko. The contract was administered by Glenn Theim of Forsite Consulting Ltd.

This project was funded through the Forests for Tomorrow Program, of the Ministry of Forest and Range. This program focuses on silviculture planning, reforestation and brushing in management units severely impacted by MPB and recent wildfires.

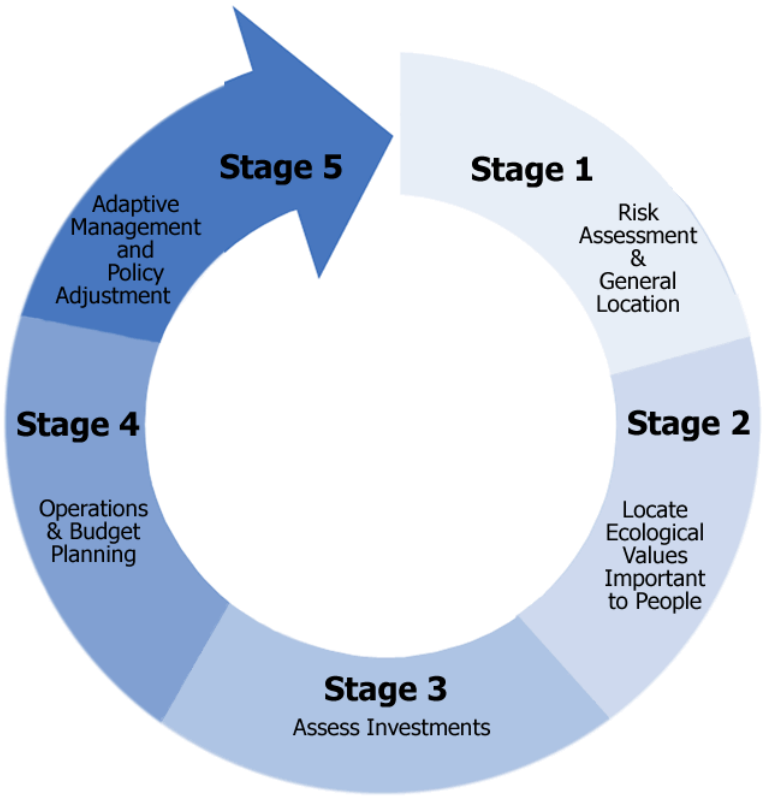
Thank you.

[1] Workshop participants for this regional plan are found in Appendix 2.

Executive Summary

A Five Stage Framework was developed to guide ecological restoration from strategic through to operational planning. The framework takes a “science-first and people”, holistic landscape/watershed approach that starts with the potential values to restore, and includes ecological and investment risk assessments. The five stages are:

1. **Risk Assessment and General Location**—to determine the high priority ecological values and landscapes/watersheds to focus attention to.
2. **Locate Ecological Values Important to People**—to maximize the overlap of the high ecological values and general locations identified in Stage 1 with the values and specific locations of importance to people.
3. **Assess Investments**—to determine the costs and benefits, investment risks (e.g., known techniques, security of investments) and alternatives to achieve the desired outcomes.
4. **Operations and Budget Planning**—to align, co-ordinate, link with and develop and capitalize on synergies with other partners, programs, budgets and activities.
5. **Adaptive Management and Policy Adjustment**—to ensure explicit continuous improvement adaptations and performance indicators are documented and incorporated within a pre-determined planning cycle.



Ecological issues are best addressed with preventative approaches. Restoration is a relatively new and integrative science, with not fully tested or known techniques; hence a science-first continuous improvement framework that incorporates adaptive management is key.

Mountain pine beetle (MPB) infestations are extensively altering landscapes and watersheds in the BC interior, bringing significant uncertainties and implications for a variety of ecological values, and the people that they benefit. MPB impacts are cumulative to other human impacts (forest harvesting and other activities) and climate-change effects.

In the **Southern Interior Region**, MPB-related impacts to ecological values were identified where restoration activities may be warranted:

- Invasive plants—a continuing issue that negatively affects a wide range of values. Invasive plants may be further spread with the response to MPB, restoration treatments, response to wildfires, and increased cattle access. Best management practices and a strategy are required. Availability of native grass seeds is an issue.
- Domestic water (watershed hydrology)—related to pine mortality and salvage. Concerns about effects of potential wildfires on domestic water. Potential restoration includes planting pine stands that will not be salvage harvested, as well as preventative approaches related to salvage harvesting and fuel management.
- Fish habitat and aquatic values (watershed hydrology) —potential impacts related to increased peak flows, temperature increases, and large woody debris pulses and deficits over time. Planting unsalvaged pine stands is the primary response, in addition to preventative approaches related to salvage harvesting, and potential water storage.
- Maintaining natural tree species diversity and distribution—concern over species conversion from Douglas-fir to lodgepole pine as part of forestry practices related to stocking standards. Approaches include policy changes and selection of a greater diversity of ecologically appropriate species for planting (e.g., for ungulate winter ranges, community watersheds, important fisheries watersheds).
- Species at risk—in particular fish affected by increases in stream temperature (listed coho, bull trout). Restoration approaches include re-establishing riparian shade where it is lost, but more scoping of the problem is required.
- NDT 4 Ecosystems with frequent stand-maintaining fires. The restoration issues and approaches for these ecosystems are well known and high priority.
- Education around general restoration issues.
- Access management related to wildlife species and hydrologic issues is considered a very high priority. The ideal approach is access management planning. Requires buy-in from many agencies. Other approaches include inventory and restoration of non-status road impacts.

This list provides a recommended Regional Science and Strategic Planning Committee with a starting point for the annual development of five-year Regional Strategic Restoration Plans, using the Five Stage Framework.

The Strategic Planning Context

Introduction

The Ministry of Environment (MOE) is developing a new Ecosystem Restoration Program (ERP) for Crown forest and range lands, to identify high priority restoration needs, irrespective of the cause or funding source. For the purposes of this plan, restoration is defined as the "process of assisting the recovery of an ecosystem that has been degraded, damaged or "destroyed[2]".

In support of the ERP, the purpose of this project was:

- To develop a strategic framework and a process to set ecological restoration priorities for forested landscapes and watersheds;
- To involve those with interests in ecological restoration to identify where further restoration planning and project implementation will occur, initially for BC's interior forests affected by mountain pine beetle (MPB) and recent wildfires; and,
- To produce three Strategic Regional Restoration Plans to guide more detailed planning in *management units* – Timber Supply Areas (TSAs), Tree Farm Licences (TFLs) or other associated tenures.

The three Strategic Regional Restoration Plans are for the Northern Interior (MOE Skeena and Omineca regions), Southern Interior (MOE Thompson, Okanagan and Kootenay regions) and the Cariboo Region. Landscape units are the recommended organisational framework for the management unit plans and for performance measures.

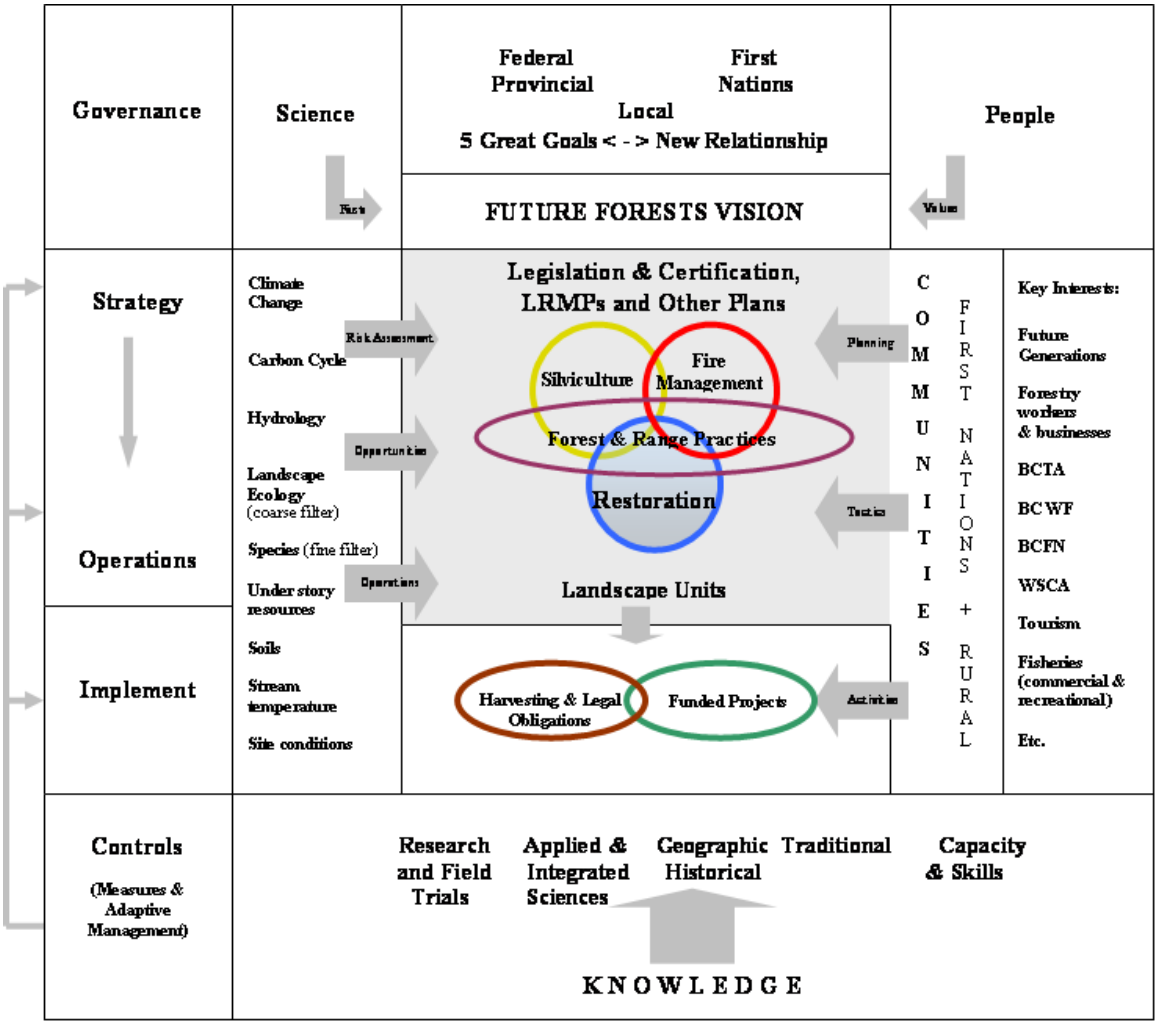
A "science-first and people" approach to strategic restoration planning is proposed, that incorporates a future forest vision, knowledge, and a strong governance framework (i.e., measures and controls), including adaptive management. Science, people, knowledge and a collective future forests ecosystems vision are essential for restoration success.

For further details on the ERP refer to **Appendix 1: The Ecosystem Restoration Program.**

The context for regional restoration plans are shown in **Figure 1: Strategic Planning Context for Restoration.**

[2] Society for Ecological Restoration. See http://www.ser.org/

Figure 1: Strategic Planning Context for Restoration



The Engagement Process

The engagement process was designed to reflect the strategic restoration planning context (Figure 1) with two goals—to collectively explore aspects of Science, People, Knowledge and Governance in the development of a strategic planning framework, and to identify initial restoration priorities related to the impacts of MPB and wildfire.

The Challenge Dialogue System (CDS)™ [3] was used, starting with an invitation to respond to two web-based Challenge Dialogue (CD) papers developed by the team— "The Scientific Foundation for an Ecological Restoration Program" and "Engaging First Nations and Key Interests in Developing an Ecosystem Restoration Program". These papers provided background, tested assumptions and posed questions about the science and the social-cultural aspects of restoration, in particular for MPB-related ecological impacts. In addition, satellite image digital map files of MPB-impacted management units, themed to indicate recent logging and MPB-susceptible pine types[4], and other background materials were developed and posted to the website.

In March, 2006, three regional workshops that were in certain respects additive and which built upon the CD responses were held. At workshops, key findings of the two challenge dialogues were presented, and potential ecological values and preliminary MOE priorities to restore were vetted. Initial framework concepts evolved through facilitated collective discussion to determine preliminary regional restoration priorities. The themed MPB satellite image maps along with other materials as brought by regional planners supported geographic overview of candidate landscape units.

This engagement process involved over 80 people—ecologists and other scientists, government planners and program staff, First Nations, and key interests. Invitations to participate were sent by email to over 150 individuals and organizations. Responses included 45 CD feedback forms, 12 emails (some with briefs), and phone calls. CD responses were compiled in a progress report, and posted on the website, with notification to participants. Workshops to build from this process were organized and held in March 2006. Collectively there were over 60 participants at the workshops, primarily drawn from the web-based stage of the process.

The three strategic regional restoration plans were then developed with input from project sponsors, and substantially shaped by the breadth and depth of this entire engagement process.

For further details including the workshop agenda and participants, refer to **Appendix 2: The Engagement Process and Participants.**

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[3] See Innovation Expedition for further details on the CDS at http://www.innovationexpedition.com/CDS.html

[4] These two papers and "Maps, Plans and Geographic Priorities"; CD feedback forms and background materials are found at http://www.nrsd.ca, by clicking on "MOE Restoration Project" and using the password "innovate".

Restoration and Future Forests Ecosystems

The Future Forests Ecosystems Initiative[5] and vision provides direct context for Strategic Regional Restoration Plans. The Chief Forester proposed a future forest vision and consultative process in light of the change agents impacting the forests in BC, at a symposium in December, 2005, consistent with the provincial government's Goal #4," to "lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management." During the spring of 2006 further consultation regarding this initiative was held with resource agencies, academics, First Nations, forest and range industries, environmental groups, professional organisations, and other interested parties.

> *"Our forests are facing significant change in light of factors such as climate change, fire, drought conditions in the south, increased outbreak of forest insects such as MPB and forest diseases so I have decided to focus on the ecological factors that influence our forest practices. …I anticipate that there will be a strong connection between the Future Forest Ecosystems initiative and Strategic Ecological Restoration Plans."*
>
> Jim Snetsinger, Chief Forester
> Prince George Workshop
> March 3, 2006

The initiative's focus on ecosystem resiliency in BC's forests mirrors the ERP scientific foundation. Both initiatives propose ***that forest ecosystems be managed to maintain the resiliency required to withstand perturbations, and that forest management policies and results should be checked through a 'resiliency lens'.*** This is synergistic to and aligns with ecological restoration programs that purport that ecological adaptation is necessary to effectively manage the effects of climate change, wildfire events, pathogens, insect infestations, and other rapidly changing conditions in B.C.'s forest ecosystems.

Values to restore are also values of importance for the management of ecosystems through sound forest practices and policies in that prevention is the best investment of results based ecosystem management. Biodiversity, ecosystem resilience and ecosystems within their range of natural variability (RONV) are key restoration concepts – regional ecologists and other scientists are needed to inform both initiatives.

Restoration and Mountain Pine Beetle

B.C.'s interior forest ecosystems are experiencing levels of environmental change that are unprecedented in recent history. The immediate impetus to develop this strategic restoration plan was to address ecological values in areas heavily affected by MPB. This plan identifies these values and preliminary steps to address or restore them, or to further scope the need for restoration.

[5] Future Forests Ecosystems Initiative aims to maintain and enhance the resilience of B.C.'s forest ecosystems - see url: http://www.for.gov.bc.ca/hts/Future_Forests/

Fire suppression and forest management have resulted in an over abundance of mature pine compared to historically, and these extensive areas of mature pine are highly susceptible to MPB. Climate change is an exacerbating factor, if not a root cause, and creates uncertainty for the future state of forest ecosystems and species populations.

With warming climate trends since 1998, cold temperatures have been insufficient to kill over-wintering MPB, allowing the populations to increase exponentially. Extensive and continuing pine mortality, as a result of MPB infestations and on a smaller scale, the wildfires of 2003 and 2004, are resetting vast areas of mature and older seral stage forest to young forest.

Such large-scale and rapid changes to the forested landscape affect aquatic and terrestrial ecosystems in a myriad of ways. MPB and fires result in many direct changes to ecosystems, including changing water quality and quantity, timing of flows, water temperatures, sediment delivery to streams, and reduction in mature and old forest habitat and the connectivity of older forest structures across landscapes.

Increased fire risk is also discussed as a potential issue in MPB-affected forests, due to surface accumulation of fuels once trees fall—though this level of risk has not been quantified in this report. Similarly, while fire suppression has increased the amount of area covered by mature pine, it has also caused fuel build-ups in lower-elevation Douglas-fir forests, and increased the likelihood for catastrophic fire. Restoration and urban-forest interface hazard reduction will apply similar practices to achieve complementary goals—these naturally aligned initiatives need to be strongly linked to achieve stand-level ecological restoration at the same time that fuel loadings are reduced.

> *"Ecological Restoration is the 'right thing to do' with collateral benefits to the environment, society and the economy. If effective it may help to further BC's sustainability "brand" which has value in global markets and contributes to the economic well-being of province."*
>
> Ray Schultz,
> Assistant Deputy Minister,
> MPB Response
> Kamloops Workshop
> March 6, 2005

In addition to the direct impacts of pine mortality, there are indirect impacts associated with increasing the rate of harvest to salvage dead and dying pine, including increased rates of disturbance, reduction of stand level attributes, impacts to understory regeneration and mixed species stands, and higher road densities.

The MPB Action Plan has seven objectives, of which objective #4 states: "Conserve the long-term forest values identified in land use plans", and takes into account established resource objectives and mitigation for wildlife habitat and biological diversity. Objective #6 states: "Restore the forest resources in areas affected by the epidemic." MPB initiatives are expected to be synergistic and to collectively reduce negative short-term impacts on forest values, communities and the provincial economy and to support sustainable development.

First Nations and Key Interests

First Nations have a special interest in ecological restoration including a longstanding history of practices applied to maintain healthy ecosystems. Healthy ecosystems are integral to aboriginal traditional use, knowledge and rights to use plants, fish and wildlife for food, shelter, and cultural and medicinal purposes.

First Nations bring local and traditional use knowledge to restoration planning, and can provide crews to carry out the work. First Nations are essential to include in any restoration program, for their linkages to and knowledge of the land base. Traditional First Nations knowledge (and local historical information) should inform restoration practices together with the scientific understanding of the range of natural variability of ecosystems.

The provincial government is currently developing a “New Relationship” with First Nations, to enable them to become more directly involved in forest resource planning, management, and program delivery.

For further details refer to **Appendix 3: First Nations and Restoration.**

Key Interests includes any group or individual with an interest or stake in restoring ecological values. The number, breadth and the depth of key interests that chose to contribute to the initial strategy discussions—through the Challenge Dialogue System™ and by attending workshops—is a clear indication of the high level of interest in restoration.

The relevancy, types, results and the amount of restoration and prevention work that is ultimately possible will depend on successful identification, engagement and alignment of diverse and multiple restoration interests. These groups have talents, skills, knowledge – scientific, technical, planning, and techniques - and organizational structures and networks that are germane to this effort.

For further details refer to **Appendix 4: Key Interests and Restoration.**

A Science-First Foundation

A solid ecological foundation for strategic restoration planning is critical to achieving the desired outcome of maintaining healthy ecosystems, able to provide the diversity of goods and services to benefit people.

In the context of the CD, a participant defined “*ecological foundation*” as “*understanding the fundamentals of the field of ecology, such as, ecosystem processes, biological diversity, and genetic resources, that enables the maintenance and, in some cases, restoration of the integrity, diversity, and resilience of existing and future BC forests and grasslands”.* (Brad Hawkes, Fire Research Officer, NRCAN).

It is essential to put science first as the basis for making restoration investments, and in understanding how to take preventative actions. A “science first and people” approach is

recommended because restoration success requires inter-disciplinary scientific understanding, and because limited resources means prioritizing the values (and locations) of most strategic importance to people. The development of an ecological foundation for restoration is a complex problem that will continue to evolve as more knowledge is gained.

Other key CD findings include:

- The current MPB outbreak may or may not be a "natural" phenomenon. Irrespective, it will have some negative impacts on certain ecological values including values such as hydrology and species' habitat. Restoration activities have the potential to reduce the impacts for some values.

- It is recognized that salvage activities result in significant incremental risks over and above the direct impacts of MPB or fires to many ecological values.

- The primary and most effective approach to restoration is to ensure that damaging activities do not occur. This is because restoration activities are costly and ecologically uncertain. Efficient investment combined with stewardship responsibilities therefore requires improved planning to ensure ecological damage is minimized during salvage operations.

- Outside of the need for improved planning and management practices, it is recognized that active restoration has the potential to mitigate some of the impacts associated with MPB and fires.

- There is a concern that large fires may result from a combination of MPB impacts and climate change, though the level of risk is not well quantified. There is a recognized high level of risk in adjacent lower elevation Douglas-fir forests, due to fuel accumulations caused by fire suppression. Restoration activities have the potential to reduce the impacts for some values.

For further information on the key findings refer to **Appendix 5: Ecological Foundation**

A successful strategy also includes understanding the current state of restoration knowledge, and that not all impacts can be addressed. What tools and knowledge are available, or will need to be developed to successfully restore the ecological values at risk?

> *"People get excited about 'fixing things'. While there may be some obvious things such as deactivating failing roads and opening drainage structures that block fish passage, we need calm heads and wisdom as we head into a restoration program. There aren't many examples I know of where people really improved on Nature…."*
>
> Dave Wilford, Regional Hydrologist, MOFR,
> (Challenge Dialogue™ Participant)

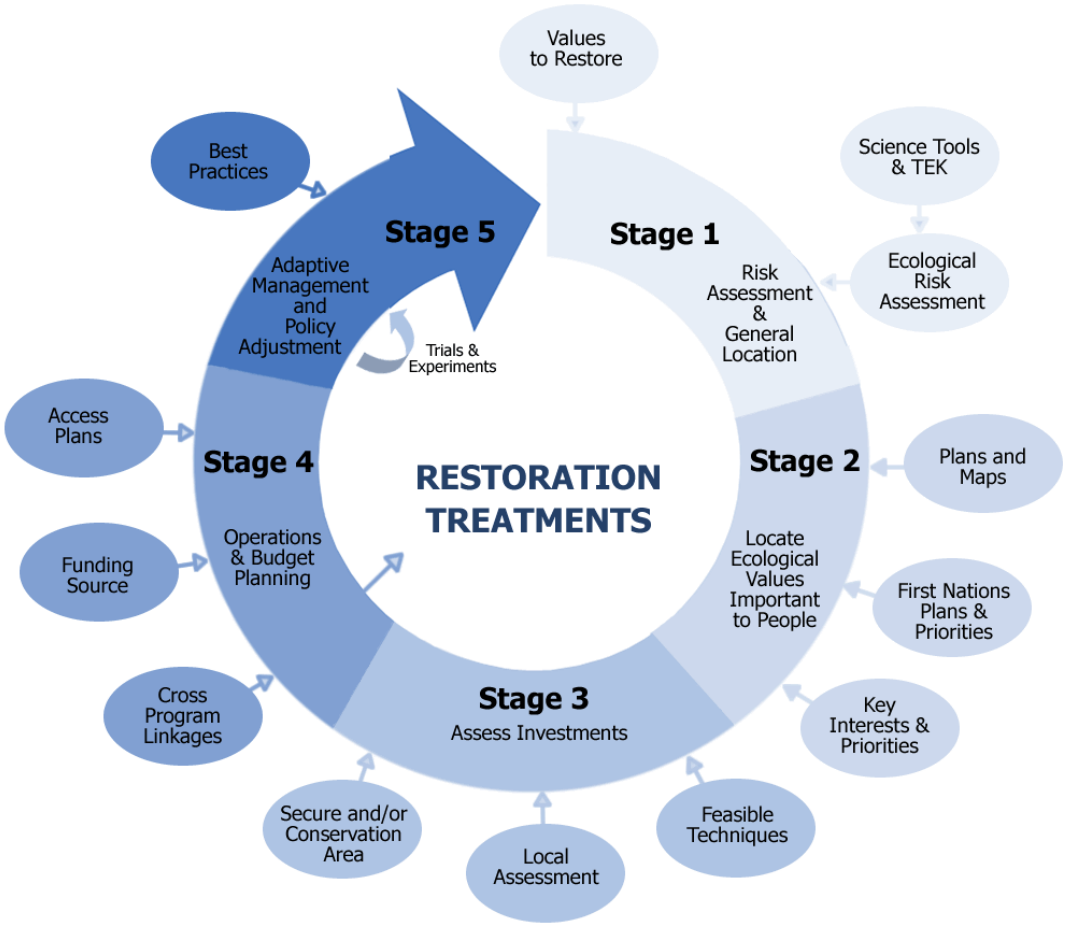
The Five Stage Planning Framework

At the landscape and watershed planning levels, ecological values are affected cumulatively, thus strategic selection of landscapes and watersheds for restoration includes knowing risks and mitigation measures for ecological stress agents such as MPB, accelerated salvage harvest of stands with dead pine, access development and use, and other on-the-ground activities within landscape units.

A framework was developed to guide investments for environmental values at high risk, outside of industry obligation, within the landscapes and large watershed of strategic importance.

This Five Stage Framework and key inputs are shown in Figure 2 below:

Figure 2: Five Stage Framework



This Five Stage framework and the steps to guide each stage are detailed in this section.

Potential Values to Restore

The first input to the framework, is the identification of the values to restore. The values to restore of most interest in regions may vary in emphasis, depending on the regional and local ecological conditions and interests.

The list shown in Figure 3 was developed through prior work (Fenger, et al), then vetted through all aspects of the engagement process:

Figure 3: Potential Values to Restore

Aquatic:

- Community watersheds (drinking and domestic water)
- Maintain habitat in high-value fish streams; temperature sensitive streams; (e.g., stability issue); blockage of fish habitat
- Loss of riparian stand structures for shade, nutrients, and stream bank stability
- Flooding and related effects on drinking water intakes and infrastructure
- Widespread increase of human and livestock access

Terrestrial:

- Older forest structures, stands, and connectivity at the landscape level
- Lodgepole pine-dominated winter ranges for terrestrial lichen-adapted caribou herds
- Winter ranges for other regionally important species'
- Historic decline in deciduous species
- Spread of invasive plants
- Widespread increase of human and livestock access
- Natural Disturbance Type 4 (NDTF) issues (i.e., over-dense conifer forests)

Cultural Ecological Values:

- Many aquatic and terrestrial ecological values are important to First Nations (i.e., water, fish, and species of trees and plants)
- First Nations spiritual and traditional use – e.g., areas with culturally modified trees and grease trails
- Fur-bearing animals are a socio-economic/cultural ecological value for trappers

Stage 1: Risk Assessment and General Location

The purpose of Stage 1 is to assess and determine the ecological priority for proposed values to restore. This involves defining the general Potential Values to Restore (Figure 3) in “real terms” for the region. A strategic, science-first approach to restoration requires us to first identify the **types of ecological values** to restore, then the **places on landscape** that are the most critical and have the most benefit for the cost to restore.

For this plan, the initial priorities are found in the next chapter, in the section, “Regional Priorities, Geographic Areas, and Sites for Restoration”, and are summarized in this report's Executive Summary.

A Regional Science and Strategic Planning Committee is recommended to implement the strategic restoration planning process. Its first role is to lead the assessment of the values to restore. The scientific members take the lead and the strategic planners offer their knowledge of the landbase and key contacts (i.e. local experts) and process support.

For further ideas for this committee, see **Appendix 6: Regional Science and Strategic Planning Committee.**

There are two types of inputs of values to restore to Stage 1 of the framework:

1. The first is through the regional themes. For example, regional MPB themes identified for preliminary assessment are found in the section Regional Restoration Priorities. The overall restoration opportunity is assessed, and if “screened” through, more specific locations are identified in subsequent stages.

2. The second type of starting point is the landscapes and watersheds known to be of high value and ecologically degraded, in which case a holistic assessment is undertaken to narrow down restoration opportunities within those areas.

Once the specific values/general locations are decided upon, a science based ecological risk assessment is overseen by a regional science team, drawing on key experts and regional knowledge, using the concept of the range of natural variability (RONV). Risk is determined by comparing the current or predicted future state of an ecological value with that under natural disturbance conditions.

For information on risk assessment based on the Range of Natural Variability (RONV), refer to **Figure 4: The Natural Disturbance Paradigm in a Risk Context.**

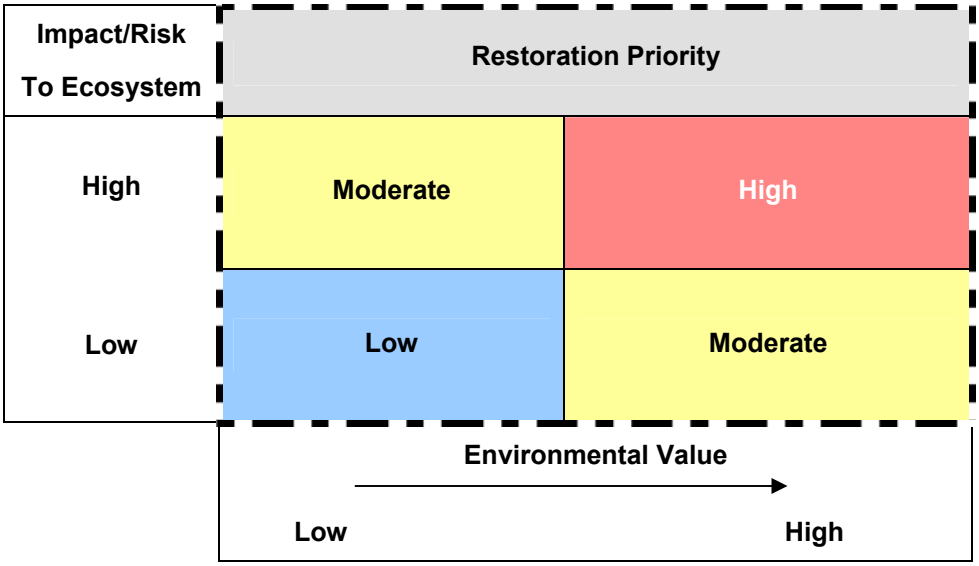
Figure 4: The Natural Disturbance Paradigm in a Risk Context

The Natural Disturbance Paradigm in a Risk Context
(See Framework Stage 1 Step 2)

The strategic framework uses the idea that risk to an ecosystem or ecosystem element can be determined using a comparison against historic natural conditions (i.e., the range of natural variability—RONV). Variables that are furthest from RONV are potentially at highest risk.

Historic natural conditions do not necessarily provide the template against which restoration goals should be set or success should be measured, given the current forest conditions, harvesting practices etc. and future uncertainties such as climate change. To develop restoration goals for an element, start with historic conditions then temper that with reality, climate change considerations, and a host of other factors to project the future desired condition.

Risk Assessment Framework



This Risk Assessment Framework figure shows a starting point for determining areas for highest priority restoration action: where the environmental value is highest and where risk is highest – restoration priority is, at least theoretically, the highest. Pragmatism however may result in a different set of initial priorities for action. The largest problems may be difficult to solve, known tools may be relatively limited, and funding restrictions may limit restoration potential.

This initial identification of the largest problems is a useful exercise because it opens up the creative thinking that may lead to other approaches being developed, increased pressure for improved planning, or alternative funding sources to be sought.

Table 1: Stage 1 Steps

Approximate scale 1:250,000 to 1:500,000	
Step 1 - Identify highest ecological values on the landscape.	Values may be significant for a wide range of reasons, for example, if they represent a coarse filter (e.g., old-growth or wildlife trees), provide key processes such as water transportation, are a critical habitat element for a species (e.g., terrestrial lichen for caribou), represent rare or unique habitats or habitat elements, habitat for a listed species etc. See Appendix 9 for a checklist of planning resources.
Step 2 – Identify level of risk today and predicted in future.	Identify ecosystems or elements that are outside of range of natural variability (RONV) today, OR That are predicted to be outside RONV in the future based on current knowledge. (*see Figure 4 – Natural Disturbance Paradigm in a Risk and Restoration Context*)
Step 3 – Prioritise in terms of both ecological value and risk level.	Prioritise the highest values and those considered at highest risk. Step 1 and Step 2 are iterative. Note that NOT only the highest values or those at highest risk may receive treatment. Maintain a full list of options to apply additional stages.
Step 4 – Consider restoration potential.	Can restoration techniques be applied to reduce the risk/impact to the value? Are the techniques reasonably likely to achieve the desired scientific/ecological outcome, with a reasonable benefit per cost? This step may result in lower level values or lower levels of risk being prioritised. Consider the following: ▪ Best value may be doing what we know how to do (e.g., road/ stream related restoration). Success may be highest in landscapes / areas that need action the least ▪ Consider "low value" areas that surround high values such as fish streams e.g., actions to reduce future sedimentation. This reduces the risk of action. ▪ Small successful activities may be most pragmatic. The most broken (or highest priority) ecological values – may require further information or may not be "fixable". ▪ Dendrochronological information may point to ecosystems that have evolved with the MPB, thus the restoration may be most needed in ecosystems "new" to the MPB. ▪ Lodgepole pine stands that provided highest ecological values, prior to MPB should be assessed for opportunities in these (e.g., caribou habitat, fish streams).
Step 5 – Identify preliminary (general) location of values with highest risk and most potential to restore i.e., could be description of type of locations, and/or geographic areas with ecological risk i.e., MPB infested, traditional use areas, or large drainage area	▪ Note: This stage should involve minimal planning. In most cases sufficient information should be available to identify key areas of interest from existing plans & mapping e.g., winter range, fisheries values, large wildfires, MPB or other disease/infested areas, over dense forest types, restoration-type specific plans, and First Nations Traditional Ecological Knowledge (TEK).
Stage 1 – the Regional Science Committee Undertakes this Review **The stage 1 process should take two approaches when using this framework:** **a) Focus budget on a few categories of 'do-able' treatments to locate across large areas such as culvert replacement, riparian planting, spacing, and/or native grass seeding; and** **b) Focus treatments into highest value and most at risk areas (e.g., Mt. Caribou, critical temperature sensitive streams, domestic water etc).** **Both types of priorities should factor in a final plan.**	

Stage 2: Locate Ecological Values Important to People

In Stage 2 ecological values assessed for the degree of ecological risk in Stage 1 are compared with the interests and potential benefits for people, in order to maximize overlap with socio-economic and cultural benefits. Existing planning committees, plans and processes are built by engaging First Nations and key interests as appropriate.

Planning resources already in existence are built into the framework at this stage, such as LRMPs and implementation committees, public advisory groups (e.g., certification), interested publics by geographic location (e.g., community watersheds) or by type of activity to locate (i.e., specific wildlife interests).

The following checklist for use in Stages 1 and 2 in locating general and then specific areas to restore - there are undoubtedly more resources within each region/management unit suited to different planning stages and scales.

Figure 5: Checklist of Planning Resources

Checklist of Planning Resources

- ❑ Management unit map(s) identifying pine-leading stands. Assume lodgepole pine 40 years or older will be affected by the year 2013 in some regions? Ponderosa and other pine may be similarly affected.
- ❑ Map of MPB spread (grey and red attack) to determine current status, and potential future status.
- ❑ Land and Resource Use Plans showing Resource Management Zones that are sensitive to forest condition, and text from plan explaining zones, resource values and resource objectives
- ❑ First Nations Land Use Plans or Maps identifying areas of strategic interest or importance
- ❑ Current and planned roading and harvesting (can use Landsat satellite images as backdrop for current harvesting)
- ❑ Maps of identified values, such as drinking watersheds, temperature-sensitive streams, high value fish streams, parks, pine-dominated caribou winter ranges
- ❑ First Nations traditional territories and other areas of interest
- ❑ MOE Regional priorities – (and other ranking criteria)
- ❑ Former areas of Watershed Restoration or other Restoration work – maps, reports, costs, etc.
- ❑ Spatial mapping of fires in BC – new mapping that relates to probability of fires

Table 2: Stage 2 Steps

Approximate Scale – 1:100,000 – 1:500,000 **Identify areas according to Landscape Units (LUs) or Resource Management Zones (RMZs)**	
Step 1: Start with the general location of values with highest ecological risk and most potential to restore as identified by the Science Committee. There will be two types: a) Categories of "doable" treatments b) Specific high ecological value areas For each type, assess the values and areas to mitigate/restore based on socio-economic and cultural values. Use a multiple accounts approach to identify the benefits.	Consider the following - Areas identified through LRMP processes and resource objectives, or other LUP for restoration. Reconfirm based on LRMP/LUP table review First Nations – Land Use Plans or strategic identification of conservation areas with ecological values of interest to restore. Areas adjacent to local communities with high values at risk, or with options to showcase restoration activities. See the Checklist of Resources in Appendix 9. Note: The underlying assumption of stage 2 is that there will be more to treat than is economically feasible to do. Therefore, add to the ecological rationale with socio-economic- cultural benefits to narrow down the most important areas within a category. It is entirely feasible that a high ecological risk (or low risk but more certain/economical) treatment may proceed because of the ecological consequences of not treating the site, e.g., to prevent loss of soil, stabilize a slope, or because the purpose is to keep the options open for future generations (i.e., not as important right now but may be 30+ years down the road – e.g., hedging bets in light of climate change or future uncertainties by increasing overall landscape level resiliency).
Step 2: Identify cross-program linkages	Is the area underway or planned for treatment with a cross-linking program – e.g., Forests For Tomorrow large fire reforestation? (urgent) (see section on Program Cross-linkages)
Step 3: Identify Partners	Assess potential to partner with others with complementary programs, objectives, and goals Work with First Nations, special interest groups or sub-committees of interest (e.g., NDT 4 groups), Trench Plan, Grasslands Strategy, etc. Align the priority restoration work with FN capacity building programs (federal)

Stage 3: Assess Investments

The purpose of Stage 3 is to determine the potential return on investment and associated risks. This includes investment security (land use – see Section 5.1 "Certainty in Investment / Integrated Planning), the costs and benefits of treatment, and the status of science/knowledge issues.

Highest ecological values at highest risk are the first choice for investment, however, lesser ecological priority values should also be assessed in Stage 1 for further review in Stage 3 because a value for money assessment may indicate a better choice for immediate investment, for example if probability of success is higher (e.g., known tools and techniques are available), or other factors such as the biological or logistical timing window to act is limited.

Table 3: Stage 3 Steps

Approximate Scale: 1:20,000 to 1:100,000 and/or not applicable Identify and assess the specific treatment areas within Landscape Units (LUs) or Resource Management Zones (RMZs)	
Step 1 – Assess the value in the investment (or bundle of investments in a LU), and likely effectiveness of available techniques	There is relative certainty about success, i.e., the treatment is feasible The approach and cost is a reasonable way to mitigate the value(s), or Does the necessary effectiveness monitoring exist for this technique? A scientific assessment been done that recommends actions to address locations within the landscape or watershed– e.g., species at risk plans, watershed assessments, other? We've done this before and can predict the outcome ***Potential actions with a scientific and practical basis exist*** (Techniques are doable)
Step 2 - The ecological value and / or the risk is so high that an experimental treatment is appropriate.	The window of opportunity is short so need to act in some areas with incomplete knowledge; Document the scope of the overall potential work (ecological importance and how much there might be overall to do). Proceed to establish experimental areas &/or research trials where restoration opportunity fits within the broader adaptive management framework, and treatments are expected to provide significant learning (feeds back into Stage 5)
Step 3–Assess the potential security of the investment. .	Are the areas of interest on crown land? If area of most importance to restore is in a licensee operating area, secure agreement of licensees in the management unit (TSA or TFL) that the area will be reserved from activities that would threaten the investments (e.g., logging, road building and access control measures) before proceeding with restoration. This could take the form of a memo of understanding (MOU) signed by relevant authorities, and/or by designation in a formal signed-off plan i.e., Forest Stewardship Plan. Are they in recognized conservation areas where salvage will not occur? Note within Parks alternative MPB funding is available. For Examples see text box "Conservation Areas with Higher Security of Investment". Note: An MOU/agreement or map reserve or notation in these areas may still be prudent depending on type of investments and risks to them.
Step 4 – Identification and analysis of policy or practices intervention	Would it be more effective to adjust management practices or other activities for this area than to restore? Does this require some level of scoping or analysis that could be completed for low cost (e.g., $10K or less?).

Stage 4: Operations and Budget Planning

The purpose of Stage 4 is to undertake operations planning, and to consolidate strategic linkages to other programs, partners, funds, key interests and activities.

Understanding restoration linkages is imperative to the full realization of the synergy of other funding, resources, capacity, partnerships, decision tools, and tactics. The need for restoration results often from the cumulative impacts of forest management policy and practices. Funding sources are often more narrow in scope therefore must be applied in awareness of the broader context and with an understanding of the root causes of the problems and current and predicted future landscape forest conditions, as well as knowing what management practices and local planning (i.e. access) might be adjusted to support the overall restoration goals.

Figure 6 shows important program ecological and management cross linkages to account for in operations and budget planning.

Figure 6: Restoration Cross Linkages

The rationale for a proactive strategy that identifies ways to link with overlapping initiatives includes:

- To make best use of limited restoration dollars, expertise and capacity to plan and implement;
- Different initiatives may well target the same ecological values, strategies, techniques, locations and stands (i.e., NDT4 restoration);
- To ensure that one initiative doesn't negatively impact another i.e., road access created, management prescriptions;
- To be able to tender long term, diverse, area based stewardship contracts (supports the development of a multi-skilled and stable workforce);

- To showcase a number of restoration techniques aimed at multiple values;
- First Nations traditional uses are impacted by silviculture, fire management and restoration programs; and,
- Forest and range policy, practices and operational plans impact positively or negatively the ecological values to restore.

Strategic linkages need to be consolidated into the program strategy.

For further background see **Appendix 8: Strategic Program Linkages.**

Stage 4 also provides due diligence to ensure that the goals of the work can be achieved. Related to this is the operational issue of worker safety—see the section “Standing Dead Trees and Worker Safety.”

Table 4: Stage 4 Steps

Approximate Scale: up to 1:50,000 Identify and assess the "on the ground" areas to treat within watersheds, BEC Zones, Large Wildfires, etc.	
Step 1 – Assess budget sources from various restoration and complementary programs	I.e., agency base, MPB Action Plan, FNs, FIA, federal, NGOs, other programs with complementary goals and objectives.
Step 2 – Assess Urgency of acting on opportunities or barriers.	Do a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) Is there and *ecological rationale* to move on this work quickly, such as a short biological window of opportunity, or because the value is a Species at Risk? Conversely, are there reasons to delay work pending resolving of other knowledge or information issues? If so, what kind of delay is likely? (These considerations would decrease the immediate priority of the work, and require an action plan to resolve, monitor) Assign a priority for future years.
Step 3 Tactical plan for access, equipment, season, and overall project timing	Is the work doable? Is the timeframe reasonable—when will it be done? What are existing operating plans of licensees? Is there needed equipment, crews or access to the area? Are there snags or other WCB or regulatory issues/permits/permissions to resolve? For the work, are seedlings, seeds or other supplies available?
Step 2: Identify group(s) for implementation of contracts.	Who can do the work? Consider existing capacity and capacity-building objectives in light of future amount of similar work. Are there implementation consultants and skilled workers to do this work? ▪ by category of work ▪ by grouping of projects ▪ within a "large project area" (FFT), the watershed, drainage or BEC zone of interest ▪ across a large geographic area (i.e., region or province)
Step 4 – Determine overall costs and document benefits, "cradle to grave"	Estimate the TOTAL cost to completion. If budgets are annual, the decision to proceed must still consider total anticipated costs to completion of the project, "cradle to grave". Are there cost comparisons for similar work, and or cost analysis of alternative approaches? Provide cost/output or estimate range ($/ha, $/km). How much area should we treat? How long will it take? How much will it cost? What do we need to do now? What do we need to do later? When will we know we are done? Review general benefits, stage 1. can you be more specific and are there additional benefits through the stage 3 analysis – i.e., capacity building or synergies with other programs. .Now – figure out your budget "ask" and document the rationale: We need $X over $Y years!!! (and this is why)

Stage 5: Adaptive Management and Policy Adjustment

The purpose of this stage is to ensure that strategic-level planning (at the regional or provincial level) seeks and incorporates learning in order to improve restoration outcomes and efficiencies. At the provincial or regional level, this includes measuring and evaluating progress against performance measures, and evaluating the strategic process used to determine restoration investments.

In some cases continuous improvement also means directing the development of projects that address information gaps and answer key adaptive management questions. Given the uncertainty regarding restoration techniques for MPB, this stage will identify a small number of central science and implementation questions for critical investigation using adaptive management. Strategic planning (i.e., investment guidelines) should also foster adaptive management at the project scale, in order to further restoration knowledge.

Table 5: Stage 5 Steps

Approximate Scale: Depends on what's being assessed Identify strategies for continuous knowledge improvement for program areas and projects within.	
Step 1 – Establish Strategic-Level Performance Measures	Once the preceding 4 stages identify a strategic-level focus and priorities, identify goals and performance measures. Create a plan and a management structure (e.g., regional science committee) to measure and report on progress.
Step 2 – Identify information and knowledge gaps and a plan to address them	Identify 2-3 key knowledge questions where uncertainties remain for the values and risks that are thought the highest in the plan areas Develop a plan to answer these most critical questions/gaps directly related to achieving a value-centered results based approach to the strategically prioritized program issues.
Step 3 – Encourage Project-Level Adaptive Management and Monitoring	In addition to projects to address critical strategic (program level) questions, foster adaptive management at the project level. Questions to ask include: Can the likely effectiveness of the techniques/approach being used be assessed? For projects can an endpoint be defined at which success or failure can be assessed? Does the necessary effectiveness monitoring exist for this technique? Has a scientific assessment been done that recommends actions to address locations within the landscape or watershed– e.g., species at risk plans, watershed assessments, other? Can this work be carried out within an adaptive management framework, or can it benefit from AM being done for similar projects elsewhere?
Step 4 – Implement the Continuous Improvement Feedback loop	Document all learning and make recommendations for the science committee/management Document all learning and develop extension/communications plan Update the Regional Strategic Plan and operational plans in full consideration of new knowledge and its implications. Make ERP Management and Policy Adjustments and communicate them.

Southern Interior Priorities

Regional Overview

The Southern Interior Strategic Ecological Restoration Plan covers the area within the Kamloops, Merritt, Okanagan and Cranbrook TSAs, and TFL 18 (Canadian Forest Products Ltd). This initial selection of areas was based on TSA and TFL units chosen by MOFR based on highest predicted MPB impacts. However, this strategic plan could easily be extrapolated to other areas in the Southern Interior.

There are three major aquatic units in the plan area: (1) Upper Kootenay, (2) Thompson, and (3) Okanagan (Nature Conservancy 2005). The dominant forested Biogeoclimatic zones are the Montana Spruce (MS), Interior Douglas Fir (IDF), Ponderosa Pine (PP), Interior Cedar Hemlock (ICH) and the Engelmann Spruce - Subalpine Fir (ESSF) zones.

The plan area is situated in Southern Interior and Southern Interior Mountain Ecoprovinces. Wells Gray Park is located west of the plan area, Manning Park is to the south, and Okanagan Mountain and Top of the World parks are also within the plan area. The Kamloops and Okanagan-Shuswap Land and Resource Management Plans, and the Kootenay Boundary Land Use Plan provide social direction through Resource Management Zones and resource objectives within their respective plan areas. No Land Use Plan exists for the Merritt TSA. The Kootenay-Boundary Land Use Plan is the only plan in the province to provide specific direction for restoration activities. This is done for defined areas to restore open forests and open grasslands in areas affected by fire suppression (i.e. NDT 4 ecosystems). All Land Use Plans for the province can be found online at: http://ilmbwww.gov.bc.ca/ilmb/lup/lrmp/index.html

Regional maps were produced at a 1:250,000 scale for this planning exercise, and digital versions are available for viewing online, at www.nrsd.ca (once into the site, click on MOE Restoration Project, then enter the site with password 'innovate'), or the Ministry's ftp site at: ftp.elp.gov.bc.ca/pub/outgoing/Restoration_Maps. The maps use 2005 satellite images as base information to show the landscape and current harvesting pattern.

On top of this base, the following information layers are provided: major roads, towns and settlements, major waterways, susceptible lodgepole pine distribution, cumulative MPB attack severity (2001-2004), TSA and TFL boundaries, biogeoclimatic zones, approved ungulate winter ranges, parks and protected areas, and community watersheds. These details provide a visual sense of where ecosystems have been or might be impacted by MPB (and potentially fires) and so may require restoration. Smaller-scale priorities like riparian and old-growth management areas would require a different mapping scale to reveal their extent and condition.

An overview map was also produced at a 1:500,000 scale, to assist program delivery. This map is also based on satellite imagery, and communicates regional boundaries and landscape unit planning boundaries and names, as well as (TSA and TFL boundaries.

Salvage harvesting is expected to bring additional levels of impact beyond the effect of MPB itself. Increases in harvest levels in the plan area are as follows in Table 6[6].

Table 6*:* Management Units with Allowable Annual Cut (AAC) uplifts

Management Unit	AAC (million cubic metres)	Salvage AAC (million cubic metres)	% increase
Okanagan TSA	2655	3,375	27
Kamloops	2,683	4,353	62
TFL 49	441	580	25

In addition to addressing the effects of MPB, the Kamloops AAC uplift is to recover fire-damaged timber from the McClure, McGillivray, Venables, Vermillion Creek and Strawberry Hill wildfires.

To address future timber supply shortfalls, the MOFR is currently completing Type 1 Silviculture Strategies in Kamloops, Okanagan, Merritt, and Cranbrook TSAs. These strategies are supported through Forests for Tomorrow program funding, and clarify opportunities to speed the recovery of both timber and habitat post epidemic. Activities and budget forecasts are contained in these strategies, that if adopted for habitat will be complementary to other activities under the ERP.

Regional Priorities, Geographic Areas and Sites for Restoration

Restoration priorities were previously identified for the plan area by Holt (2001). These priorities were used as a starting point for a project in which Fenger and Associates worked with the MOE to describe priorities in forested areas, particularly forests affected by MPB (Fenger et al. 2006). A preliminary set of general priorities was determined in that process, which were used as the basis for listing the potential ecological values that might require restoration effort.

These preliminary priorities were vetted and expanded on through the web-based CD process and at the regional workshop in Kamloops on March 6, 2006.

Based on this input, the following table identifies a preliminary list of highest values to restore, the risk (or level of impact), and potential restoration actions for these values. This list reflects participants' understanding of the local impacts of the MPB and fire on environmental values, and the likely focus on MPB-related issues. However, participants noted that NDT 4 issues (areas of dry forest and grasslands affected by fire suppression), were the highest terrestrial restoration priority for the region, regardless of funding source.

[6] Information on the elevated harvest levels is found at: http://www2.news.gov.bc.ca/nrm_news_releases/2004FOR0040-000707.htm
Rationales for expedited salvage are found at: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/aac.htm

Table 7: Southern Interior Restoration Priorities – Preliminary List.

Priority /Value	Risk (Impact)	Do-able? Probability of success? Relevant considerations (climate change / invasive species / social license / available tools etc)	Projects recommended
Invasive species negatively impact a wide range of values, including grassland areas, and forested ecosystems throughout the region.	High risk (impact) and related to a variety of practices and agencies. Need to consider invasive plants from three perspectives: – as a problem in itself that requires restoration, secondly as a potential by-product from other restoration work (e.g. evidence that thinning / under-burning / wildfire – results in larger invasive species problems); and use of non-native species for seeding throughout the landscape, by a variety of agencies. Requires risk avoidance through development and implementation of policy Best Management Practices (BMPs).	Yes actions are feasible: – it is possible to deal with each of the three areas of concern, though there are limitations in terms of supply of native seeds. Cannot buy quantities of native seed on short notice. New policy/ regulation are likely required to create the investment climate to produce commercial quantities of native seed. Need to ensure native grass seeding availability. Would the program collect / grow native seeds? Need to supply tools to protection branch (and other agencies) to guide their practices, to reduce problems with invasives (e.g. develop Best Management Practices around grass seeding).	A problem analysis could help focus the scope and need for native seed. The analysis would look at suppliers, and the current situation (how do highways, parks etc. buy seed now?). Soil stability practices post fire, seed sources and purchasing criteria, policy and implementation. Follow-up on this analysis could provide coherence across a range of agencies. Concern that invasives is only partly a MPB/fire issue – really is more centred on NDT4. A retrospective study of seeding on fires may help understand the impacts of current policy. Could also assess natural succession in areas not salvaged and seeded. Restoration program needs to develop a set of its own BMPs to reduce the spread of invasive species while doing other restoration work. There must be lessons available from work that has already occurred (e.g. in EK trench). Can information be compiled from existing work and provided by the Program to guide restoration projects and inform other programs? Could fund a prioritization strategy for removal / treatment of existing invasive species problems. Work with invasive species committees?

Priority /Value	Risk (Impact)	Do-able? Probability of success? Relevant considerations (climate change / invasive species / social license / available tools etc)	Projects recommended
Water: for people. **Community watersheds** very high values (e.g. Kimberley/ Okanagan). Also concern about watersheds that are not officially Community Watersheds (CWS) but which support domestic water intakes.	High risk from extensive loss of lodgepole pine, which will have hydrologic impacts[7]. All community/drinking watersheds very high priority in Southern Interior. In particular, areas considered at greatest risk are where pine mortality increased equivalent clearcut area (ECA) to greater than 30 %. What to do for those areas? Concern that impacts increase when a watershed has high ECA and then burns if fire risk is increased by MPB. Very different in the southern plan area than in the north as pine is not homogeneous and evenly distributed so it is not expected that all the lodgepole pine is going to be impacted.	Not clear how effective restoration actions may be (particularly in this dry climate, and in light of climate change). However, potential to plant can speed hydrologic green-up and increase rate of watershed recovery once a new forest is established and has reached a good height. Look at increasing the diversity of the riparian zones that have high pine content. Plant late successional species into the understory so when pine dies there is a start on hydrologic green up. What is the ability to space MPB killed lodgepole pine to reduce susceptibility and change fire behaviour? Are there tools that we are confident could reduce CWS risks? Science board is a potential group (contact Art Tautz, MOE) to which we can indicate there is a lack of information about conditions and solutions. Can do some background and look at obvious information on mitigation related to roads / access / fire risk etc. Additional concerns that Best Management Practices and coordinated salvage planning are the most effective way to deal with this problem (and not restoration projects) – i.e. avoid salvage and road building which may exacerbate the problems in some areas.	Need to identify the highest risk areas. Consider high density lodgepole pine, overly dense Douglas-fir areas, high value watersheds etc. To help with prioritization: a) use a coarse level analysis[8] on natural fire regimes and current condition classes already done for southern BC. Use this analysis to help describe how far the watershed is from natural conditions. B) Use the Canadian Forest Service spatial fire database developed for looking at probability of fire spatially (which watersheds have a higher probability of fire locally). C) Use available mapping of red/ grey (dead) trees, and time since last outbreak (on the ground). These three areas highlight which community watersheds are highest priority. Refer to examples from National Parks – they are taking a leadership role in use of fire as a management tool and increasing the diversity and resilience of Park ecosystems to MPB. Look at in-stream structures that may not be able to deal with peak flow. Review roads / culverts / bridges/ ditching etc that may fail when increased overland flow occurs. MoFR Protection branch projects. Remove some beetle killed trees and thin others, to create stands that are less susceptible to MPB and fire. Identifying areas that this may work may be useful. Could consider as Demonstration / Adaptive Management projects. NDT 4 ecosystems: Riparian areas may be densely grown and buffer zones may susceptible to intense burns. Manage to lower stocking to reduce fire intensity. Treat the riparian areas by thinning pile and burn and plant deciduous trees where appropriate. Need education and communications to inform communities about their options and risks to help them understand what may happen.

[7] Scherer and Pike 2003.
[8] Blackwell et al. 2003. Contact is Brad Hawkes at Canadian Forest Service. Also refer to a recent strategic restoration prioritization done using this methodology for the Okanagan MOE Region.

Priority /Value	Risk (Impact)	Do-able? Probability of success? Relevant considerations (climate change / invasive species / social license / available tools etc)	Projects recommended
High value fish streams.	Similar risk and changes in hydrology as for community watersheds. High risk (impact) will be proportional to past harvest, current pine density and expected roads and salvage. Provincial data to describe and map high value fish streams and high sensitivity watersheds is being developed and mapped provincially (Art Tautz, MOE), so it is possible to identify higher value and higher impacted systems. Includes watershed uniqueness.	Similar treatments and projects to mitigate impacts as for community watersheds. To manage peak flows, and temperature, may need to build new dams for water storage. Might keep water at higher elevations to keep it cooler longer. Can create an engineered mitigation solution. Unclear how effective this may be, and whether new problems would be caused as a result. Understory vegetation is important for recovery (for hydrology and the next rotation). Need to consider maintaining advanced understory regeneration when salvage harvesting. Understory is not mapped and not in the forest inventory, and so is difficult to manage effectively. However it, obviously benefits hydrologic green-up where it exists. Investigate the hydrology effects of having lodgepole pine on the ground vs. standing. Suggested that it holds water longer once it has started to rot. Unsure how this will vary temporally.	See discussion above about community watershed projects. Expected higher peak flows and concerns for channel stability. Ensuring some pine is perpendicular to the flow can slow the velocity of the stream. Particularly in relation to the riffle / pool component. May help retain bank stability (Phil Epp, MOE). Could review some treated watersheds (e.g. FRBC) information. Could review restoration related to salvaged burns as well. What happened and what did we learn from the treatments in these areas? Can overlay provincial high value stream mapping with lodgepole pine cover, as a first cut planning exercise.
Maintaining natural tree species diversity and distribution.	High risk to a series of values (winter range, general habitat etc). Concern about species conversion through current forest practices raised particularly in relation to ungulate winter ranges and the conversion from Douglas-fir to lodgepole pine.	Restoration would be to plant other ecologically appropriate trees species. Priority areas could be Ungulate winter ranges, Community watersheds, important fisheries watersheds To change current planting practices and the species conversion problem requires addressing silviculture policy – i.e. stocking standards under FRPA. Can address the decline in deciduous species through time and improve ecosystem resilience. To identify areas with advanced regeneration need different standards for forest inventory and increased ground verification.	Planting requires an assessment of the selected area to determine if planting is required, then a more detailed assessment of specific selected areas. With an understanding of what's there (e.g. understory / advanced regeneration etc) can select appropriate species.

Priority /Value	Risk (Impact)	Do-able? Probability of success? Relevant considerations (climate change / invasive species / social license / available tools etc)	Projects recommended
Species at risk, particularly fish species that are affected by stream temperature.	Coho now federally listed. Bull trout are temperature sensitive	Yes – actions are possible. But unsure which species are increasing and which are decreasing. Some understanding exists regarding lethal stream temperatures and species' tolerance. Attempt to mitigate stream temperatures through re-establishing riparian vegetation to improve shading. Unsure about the temporal aspects of the problem, and how well restoration actions will reduce the impacts associated with broader climate change as opposed to just loss of overstory lodgepole pine.	Identify key priority streams (data available through Art Tautz's projects), and overlay with lodgepole pine. Manage for riparian shade near affected temperature sensitive streams through planting.
NDT4 Ecosystems with frequent stand maintaining fires. High ecological values High social values High forage production Many rare and endangered species Grasslands issues. Very high priority	Very high risks (impacts) due to long-term habitat loss and changes. High fire risk. Risk has increased due to the long history of successful suppression. The ability to control fires now has diminished with excessive fuel loading over many decades.	This is a well worked through problem, with much learning available from the EK trench. Uncertain whether Kamloops area has social acceptance to under take extensive restoration. Open forest canopy and grassland encroachment may fit only if linked to other initiative such as interface fire management. Some previous under burning experience under FRBC.	There are projects addressing grassland encroachment and restoration guided by the NDT4 committee. Stratified the NDT4 into its components (closed forest / open forest etc). Finer resolution of natural disturbance classes has occurred in portions of NDT (Kamloops) Some priorities and projects identified: both Kamloops District and MoE both have projects developed. Could implement some on the ground projects. Recent strategy document has suggested next steps.[9]
Education – around the general restoration issues.	Need to connect benefits of management in natural areas to urban people.	Very do-able.	Educate on lots of different elements. Benefits of lowered risk needed to accept smoke resulting from NDT 4 restoration activities.

[9] Jones and Douglas 2006

Priority /Value	Risk (Impact)	Do-able? Probability of success? Relevant considerations (climate change / invasive species / social license / available tools etc)	Projects recommended
Access management in relation to wildlife species and hydrologic issues. Considered a very high priority issue for this region. Unsure how well it can be managed under ERP. Really requires access management planning in advance.	Under FRPA no regulation around access management. Lack of access management in land use plans.	This is a restoration priority for many ecosystems and species but is a daunting task, requiring buy-in from many agencies. May also be some restoration work related to access management. Closing trails/ mending quad trails into walk-in lakes etc. where access has happened – how do we deal with this?	Potential to identify areas sensitive to access before mountain pine beetle salvage is done and new roads constructed. Inventory of non status roads and restoration needs, where no one has a maintenance responsibility, to identify potential areas where road rehabilitation can take place. Some non-status roads areas can be treated but ideally integrated with access management planning.

Preliminary Geographic Priorities

At the workshop, the working maps were used to allow participants the opportunity to highlight key areas that they suspected would be appropriate for restoration actions, based on their professional and local knowledge. Landscape units were used as the basis for this scoping exercise because these administrative units are established province-wide and have legally defined boundaries. Landscape units are based largely on watershed boundaries composed of a number of smaller drainage systems.

The following Landscape Units were identified by workshop participants based on their local knowledge. Areas within each LU are considered to be at high risk and potential sites require a more detailed scoping to establish restoration potential.

1. Deadman Landscape Unit. Temperature sensitive creek / high fisheries values. High susceptibility to MPB.

2. Tranquille Landscape Unit. Temperature sensitive creek / high fisheries values. MPB high susceptibility.

3. Lewis Creek Landscape Unit—affected by the 2003 fires, and now affected by MPB. Values downstream are high. Community water use (though not a watershed). Fisheries values. This area might have potential areas for underplanting. The watershed is already at 30% equivalent clearcut area—and more salvage is happening in Lewis Creek. May be able to undertake restoration to contribute to riparian bank stability.

4. Salmon Arm Landscape Unit and Chase Creek. Contain old earthen dams which may not remain stable. Landslide prone area. Many downstream water users. Past damage has occurred to property in the lower reaches during peak flow periods. Watershed assessments have been completed and form a potential source for restoration project guidance.

5. Mission Landscape Unit. Mission Creek is a very high value watershed from fisheries perspective (supports Kokanee) and from a water values perspective (it is a community watershed). Upper portions of the watershed have pine components—unsure what restoration opportunities might exist related to MPB.

6. Okanagan West Side Landscape Unit, Trepannier Landscape Unit, Trout Landscape Unit, Penticton Landscape Unit. Regional hydrology concerns. Many watersheds begin in the ESSF, MS and upper IDF biogeoclimatic zones (that contain pine) and then feed into Okanagan Lake. In the Penticton Forest District—40% land area was community watershed. Changes in hydrology indicate that in time the valley may be forced to move to using Okanagan lake water. This is a costly solution but doesn't solve the problem of hundreds of little dams – earth filled dams built for irrigation that with changes in hydrology are at higher risk of failure. Safety standards are higher today and it is expensive to upgrade—dam upgrades unlikely. Risk of loss of infra structure high. Regional hydrology concerns—Whiteman creek (west side of OK lake). An area with high ECAs, plus high pine content. Also flows into the Okanagan Indian band reserve, with many people living on the fans at the bottom of the creek.

7. Upper Salmon Landscape Unit. Salmon river—similarly, a large watershed with large cumulative issues.

8. Wigwam River Landscape Unit, in Cranbrook TSA: Big horn sheep habitat. High value fish habitat. Much historic damage—plus effects of 1970s MPB attack, and flooded. Several projects on file to do.

9. Saint Mary's Prairie - Wasa Picture Valley Landscape Unit, in Cranbrook TSA. Nature park. Williamsons sapsucker habitat and fire interface. Bob Gray prescription on file.

10. Kimberly Watershed Landscape Unit, in Cranbrook TSA. Mark creek. Community watershed, plus Wildlife Habitat Area for coeur d'alene salamander, plus past mining damage. Needs prescriptions developed—not on file.

11. East Flathead Landscape Unit, in Cranbrook TSA. Flathead (general). Fish. 1970's MPB salvage. Lots of projects on file.

12. Redding Creek Landscape Unit in Cranbrook TSA. Reading creek—riparian / fish habitat. The watershed is unravelling from old logging. Projects ready to go.

13. Okanagan Westside Landscape Unit. Nashwaito—similar concerns as described in # 6 inside TFL 49. Also flows into OK Indian band reserve, with many people living on the fans at the bottom of the creek. Communication problem—licensees don't want to communicate the risk

14. Cranbrook Landscape Unit, in Cranbrook TSA. Joseph / Gold. Fish habitat and community watershed. Lots of lodgepole pine. Significant restoration required to repair logging damage and ranching issues. Mo projects identified.

15. Anarchist Landscape Unit, TFL 15 portion, in Okanagan TSA. NDT4 and community watersheds. Needs an analysis re: community watersheds (see comment #6).

16. Penticton Landscape Unit, in Okanagan TSA: NDT4 and community watersheds. Needs an analysis re: community watersheds (see comment #6).

17. Anarchist Landscape Unit, in Okanagan TSA (Penticton). NDT4 and community watersheds. Needs an analysis re community watersheds.

18. Coldwater Landscape Unit, in Merritt TSA. Temperature sensitive stream. Existing fish kills.

Restoration Themes for MPB Areas

The following is a synopsis of “themes” discussed at the workshops about values affected by MPB (and other stressors), and ways to address potential impacts.

Consistent and emphatic advice from the engagement process—including experienced participants from other restoration programs—is that the ***prevention of damage is without doubt the most effective way to spend restoration dollars***.

Co-ordination is recommended for the values and issues applicable to two or more regions, e.g., provincial expertise and/or nominate “lead” regions where an issue ranks higher in one than another.

Best Management Practices (BMPs)

BMPs - scientifically-based methods for restoration – and to prevent and mitigate negative effects of pine mortality associated treatment and/or harvest was strongly recommended by many participants.

For details of BMPs discussed, refer to: Table 6: Best Management Practices to Minimize MPB-Related Impacts.

Table 7: Best Management Practices to Minimize MPB-Related Impacts.

Best Management Practices to Minimize MPB-Related Impacts

Extensive Salvage Harvesting Planning (Landscape Level Impacts)
Co-ordinated salvage planning of harvest and retention areas to ensure that the highest value ecological and cultural sites are retained

Salvage Harvest Within-Block Retention (Site Level Impacts)
Within-block retention planning is a proactive approach to manage for non-timber values, to ensure that where advance regeneration is a feasible option that it is protected and/or that mixed-species stands regenerate.

Access Management in Salvaged Landscapes (Landscape Level Impacts)
Increased access (roads) affects many different ecosystem functions, including reductions in habitat quality, disturbance factors resulting from vehicles, and hydrologic impacts resulting from roads and culverts. Coordinated access management planning was strongly recommended in order to minimize road densities and impacts in salvage areas.

Cattle Access Management (Sensitive Ecosystems)
To ensure that cattle are kept away from newly accessible sensitive ecosystems and riparian areas as natural cattle barriers are altered via MPB-associated tree death and harvesting, preventative measures are required. Barriers may need to be re-established, and adaptive management could help to establish how this is best done. Options are fencing, moving herds, brush fencing, directional felling of dead stems and likely other techniques.

Invasive Plants (natural diversity and resiliency)
Road access and soil disturbance associated with extensive MPB salvage harvest and recent burns (from wildfire or restoration activities) increases the risk of invasive plants. Non-native seeding—a current restoration practice—was also identified as a problem. The spread of invasive plants can be achieved through best management practices, identifying (and correcting) barriers to extensive use of native seed and incorporating adaptive management.

Tree Species in MPB Blocks

Extensive harvesting/reforestation (and climate change) flags the need to re-examine species compositions (i.e., away from pine and towards more diversity including deciduous) and planting densities to diversify future forests and their resiliency to abiotic (i.e., climate change) and biotic (i.e., MPB) stresses. (Note Chief Forester policy formation is in progress – see section on Future Forest Ecosystems).

Watersheds at Risk

Changes to watershed hydrology and the resulting effects on water for people and habitat for fish were key concerns. A project is required for each region to scope out priority watersheds to address from both a drinking water and fish habitat/hydrology perspective. Community watersheds were highest priority in the Southern Interior plan area, while the other two plan areas have fewer community watersheds, but were concerned about other licensed water intakes.

Actions that could be taken include:

- Identifying and assessing those community watersheds most at risk, and developing a risk reduction/restoration strategy. Watersheds that will have changed hydrology and potential changes to water quality because of MPB need to be identified so that mitigative action can be taken. A scoping exercise could include overlaying mature pine distribution with community watersheds in the context of cumulative impacts to watershed hydrology (see Fenger *et al.* 2006a and 2006b for an example).

- In the Southern Interior, it is a priority to identify and treat community watersheds at high fire risk (NDT 4 ecosystems). Planning can be done to identify areas at highest risk of wildfire (i.e., identifying areas that have high fuel levels see Blackwell et al 2003) and that have higher probability of wildfire.[10]

- Identifying high value/high sensitivity fish streams that will likely be negatively affected by dying pine forests and associated salvage harvesting. This can be done by overlaying existing high value fish watershed maps (3rd order watersheds at a 1:50,000 scale), with the distribution of mature pine, as a 'first cut' planning tool. See also Fenger *et al.* 2006a and 2006b[8].

- Within the highest value/highest risk fisheries and drinking watersheds (including those not identified as community watersheds but that have domestic water licenses), identify areas where infrastructure (i.e., culverts, bridges, dams, roads) is inadequate to handle increases in peak flows. Address the condition of this infrastructure so that its failure will not further impact water resources.

- Within the highest value/highest risk fisheries and drinking watersheds, identify areas to plant to speed hydrologic recovery. (These areas must be 'secure', in that they will not be salvage harvested in future.) Assess riparian areas for provision of stream shade and other riparian functions, and plant or otherwise treat if necessary. These actions may be appropriate within an adaptive management framework as their effectiveness is unquantified.

- For important fish streams where low flows and stream temperature is an issue, a possible mitigative action is to build dams in order to store water for release at critical times.

[10] Brad Hawkes, Fire Research Officer, NRCAN, Victoria, is a contact for this information.

Revisit Watershed Restoration Program Priorities and Plans

A great deal of prioritization, planning and assessment was done under the former Forest Renewal BC Watershed Restoration Program (WRP). Much of this information is still accessible; however its relevance would need review given that the landscapes are changing dramatically with MPB-caused mortality and associated salvage harvesting. This information should be considered along with new information in the process of identifying locations of high drinking watersheds, high priority fish streams, and infrastructure that is at risk due to increased peak flows.

Specific work completed through the WRP could be retrospectively assessed or monitored to determine effective restoration techniques for use under the ERP.

Invasive Plants

Invasive plant species are a major ecological issue, with diverse causes and high levels of impact. Invasive plants affect a wide range of sensitive resources in all ecosystem types, and their extent continues to increase. There is concern that new road access and disturbance brought by MPB salvage may worsen the problem. Additionally, areas that have been burned by wildfire or as part of a restoration treatment are vulnerable to invasive plants influx. Grass seeding with non-native species in disturbed areas and areas burnt by wildfire may also be problematic.

Immediate actions that can be taken relative to invasive plants include:

- Develop a set of Best Management Practices for restoration that compiles knowledge regarding approaches to minimizing invasive plants in treated areas. This is to ensure that restoration work does not exacerbate the invasive plants problem.

- Undertake a scoping exercise to determine how native seeds could be sourced and used to replace agronomic species currently used on disturbed sites. This would require inter-agency collaboration to develop and incorporate new practices.

- Undertake a scoping exercise to determine what measures can be taken to reduce the rate of spread of invasive plants, in general and also in relation to the MPB epidemic.

- In the Prince George area, invasion of Marsh Plume thistle is a high priority issue that requires immediate restoration actions. Note: this is a local issue not directly related to the MPB epidemic.

Affected Wildlife

Caribou were the species most cited as a concern being a high value species already at high risk: a situation which is being exacerbated by MPB and salvage harvest. As a first priority, support can be given to on-going and proposed efforts to monitor and understand the effects of MPB on caribou range. Incorporating adaptive management into projects will be necessary to understand the effectiveness of potential restoration actions on caribou habitat quality—some initiatives are suggested by MOE staff (see Fenger et al. 2006).

Winter ranges for other ungulates are also potential areas for restoration action. Concern about species conversion from Douglas-fir leading stands to lodgepole pine-leading stands (as pine is planted to replace fir) was a concern, as was general loss of mixed stands during salvage. Improved planning, combined with under-planting of Douglas-fir could be used to improve this situation.

A scoping exercise could be undertaken to evaluate which wildlife species (e.g., pine marten, fisher) may need special management, in each of the three plan areas. Squires *et al.* (2004) have written a paper analyzing the effects of MPB on various vertebrate species, and this and other background materials could be used to provide an assessment for locally-at-risk species. Planning and restoration actions could then be identified.

Riparian Zones

Riparian zones were frequently cited as of high ecological importance for restoration. A scoping exercise to determine the riparian areas with high pine content within high value/high sensitivity watersheds should be completed, within a watershed context as described above. The extent of riparian areas containing dead pine, and the extent of impacts resulting from dead pine in riparian areas, is not currently understood. Adaptive management would be necessary. Activities within riparian areas could include planting where advance regeneration is insufficient (including planting appropriate deciduous and other non-pine species), and managing large woody debris and coarse woody debris if appropriate.

Roads and Access Management

Access management is a multi-faceted restoration issue, and is central to the theme that the *"prevention of damage is the most effective use of restoration resources".* Access management techniques include road network planning, deactivation, and access restrictions. Access management plans are best done in conjunction with planning for other values (i.e., land use plans, forest stewardship plans, and large project area multi-year plans).

The stress on non-timber values of the expedited MPB salvage rate of cut increases the need to implement access management. Potentially both site and watershed-level increased road density impacts are significant where there are anticipated sediment and hydrologic effects on streams, changed predator-prey relationships, increased invasive plants, increased hunting, fishing and poaching and general human disturbance.

Road access creation (or re-opening) is a decision required prior to undertaking restoration activities. For example, restoring hydrologic function in an unroaded community watershed begs the question of whether it is more damaging to put in a road to undertake restoration, or to leave the situation to recover naturally.

The rehabilitation of non-status (i.e., not a licensee obligation) roads is a "doable" treatment, in particular for those roads where sediment is being introduced to streams or roads that provide access to ecologically sensitive areas.

Fire-maintained (NDT4) Ecosystems

"NDT 4" refers to Natural Disturbance Type 4 ecosystems—which encompass Interior Douglas-fir and Ponderosa Pine forests as well as grasslands. These ecosystems are assumed to have evolved with frequent low severity fire, and addressing the current poor condition of these ecosystems is seen as a priority in the Southern Interior and Cariboo plan areas; Williams Lake workshop attendees rated this issue highest; in the Kamloops workshop it was acknowledged as a high priority but was less discussed due to considerations about funding eligibility. NDT 4 ecosystems are not present in any significant quantity in the Northern Interior (Omineca-Skeena) plan area.

NDT 4 ecosystems are seen as a priority to address because:

- Ponderosa pine is susceptible to MPB attack.
- Dense stagnant forests created by decades of fire suppression are seen to present forest health risks - the departure from their natural range of variability (RONV) suggests they may be the next forest health issue (e.g., Douglas-fir bark beetle).
- Risks to biodiversity, timber values, range values and infrastructure posed by the forest and grassland conditions today are high.
- Dense stands are prone to major wildfire that negatively affects a range of values, and exclude species that rely on open habitats (including cattle).
- Tree encroachment resulting from fire suppression affects many grassland areas that aren't already alienated by urbanization or agriculture.
- After the majority of the economic MPB areas have been harvested (in the next 10-15 years), NDT 4 forests could be a source of timber supply. This timeframe allows managers to address their condition and manage for multiple values including timber quality and forest health prior to logging pressures.
- Restoring Mule deer winter ranges was identified in all workshops, and such work could be done in conjunction with managing NDT4.

A recent project (Jones and Douglas 2006) describes the current management and potential steps for NDT 4 ecosystem management.

Implementation Challenges

This section adds other implementation considerations, relevant to stages 3 to 5 of the Five Stage Framework, and its overall implementation.

Information Needs for Restoration Opportunities

The following table shows the types of restoration activities that could be implemented. It is not exhaustive.

Table 8: Restoration Opportunities, Actions and Factors to Mitigate

Restoration opportunity	Factors that can be mitigated	Types of restoration Activities
AQUATIC ECOSYSTEMS**		
Upslope	▪ Erosion ▪ Runoff ▪ Hydrologic green-up	▪ Road, landing, unstable terrain rehabilitation ▪ Drainage control ▪ Under planting Seeding
In-stream	▪ Fish passage ▪ Nutrients	▪ Culvert replacement/ removal ▪ Excess LWD removal ▪ Stream fertilization ▪ LWD placement
Riparian forests	▪ Bank stability ▪ Stand structure shade and detritus	▪ Bank bioengineering ▪ Planting deciduous and other suitable non-pine species into riparian
Riparian forests	▪ Wildlife Passage across landscapes ▪ Distributed older forest (connectivity)	▪ Brushing ▪ Maintaining and creating natural barriers to cattle ▪ Creating microsites for trees ▪ Plant (i.e., spruce, deciduous) ▪ Directional Felling to prevent flood event blockages
TERRESTRIAL ECOSYSTEMS**		
Older forest Stand Structure Connectivity Natural Successional Diversity	▪ Old growth recruitment ▪ Ungulate winter ranges ▪ Understory recruitment ▪ Increase deciduous components	▪ Controlled Burning ▪ Planting deciduous and other suitable species ▪ Road rehabilitation / closure ▪ Invasive plants removal/control ▪ - Livestock and human disturbance reduction
Access	- Invasive plants - Access Management	- Road rehabilitation / closure - Invasive plants removal/control
Species or ecosystems at risk and regional important species can trigger restoration based on their specific habitat needs e.g., Mountain Caribou, salmon, and moose		

** Note that there is of course much overlap between these 'areas' – with riparian in particular linking different aspects of the landscape together.

Knowledge of techniques and other information regarding the potential to restore are implementation challenges.

For information needs regarding restoration opportunities and potential **see Appendix 6: Information Needs for Restoration.**

Other challenges are discussed below.

Certainty in Investment

The Five Step Framework takes the approach that any Crown land with ecological values at risk could be assessed for ecological risk (Stage 1). In stage 3, investment risk assessment includes the certainty of intended outcomes. For example, should restoration be limited to areas where there is absolute certainty that harvesting won't occur? In the short term, restoration preference could be areas not available for harvesting, although ultimately these areas may not present be the highest restoration opportunity.

Areas with a high likelihood of not being harvested that was developed through the engagement process are listed in **Table 10: Areas with High Conservation Protection.**

Table 9: Areas With High Conservation Protection

Areas with High Conservation Protection
1. Provincial Parks, Protected Areas, Ecological Reserves, Wildlife Management Areas and Nature Trust Lands managed by MoE.
2. Higher Level Plan conservation emphasis zones; areas designated in LRMPs that are zoned for specific ecological objectives.
3. Spatially established Old Growth Management Areas in Landscape Units/BEC subzones.
4. Seral stage distribution (mature component) affected in Landscape Units/BEC subzones.
5. Community Watersheds/Drinking water watersheds.
6. Important/Critical habitats identified by Species at Risk recovery teams – where these have been applied through legislation.
7. Fisheries Sensitive Watersheds (as per FRPA)
8. Wildlife Habitat Areas.
9. Ungulate Winter Ranges.
10. Habitat for regionally important species – identified through Land Use Planning or similar process.
11. Riparian Management Areas (Reserve and Management Zones).
12. Wildlife Tree Retention Areas (Wildlife Tree Patches).

Standing Dead Trees and Worker Safety

The Workers Compensation Board (WCB) requires the removal of potentially hazardous trees or snags from worksites in order to ensure worker safety. An objective to maintain ecological values (i.e., standing dead/danger trees) over the last few years has resulted in more flexibility in WCB regulations to allow wildlife tree experts to check the soundness of potential danger trees, allowing them to be maintained on site.

Maintaining dead trees on site while allowing workers to plant can be a significant challenge within an area post-MPB infestation or post-fire. Studies have shown that MPB-killed trees can be considered safe for a significant period of time (J. Betts, Western Silviculture Contractors' Association), and efforts are underway to create more flexibility in this system as a result. Regulations that allow restoration work to occur without cutting of standing dead trees need to be worked out or restoration efforts may have negligible results or conceivably further exacerbate the loss of ecological values.

Additionally, the window of opportunity before trees become unsafe to work beneath creates a need for quick planning to allow for restoration in dead pine stands that may become unsafe or be deemed unsafe. The MOFR are working on methods to determine the safe length of time to expect for pine, based on site and other factors, to help guide planning.

Next Steps

This plan emphasizes a strategic and holistic restoration approach, with a landscape and watershed focus, administratively organized by Landscape Units – as opposed to a proposal driven process.

This planning is best done or directed by regional scientific and strategic planning committee (RSSP) with management support/involvement (champion from the IAMC). This recommended committee was introduced in Stage 1 of the Five Stage Framework and further ideas generated from workshops are found in **Appendix 6: Regional Science and Strategic Planning Committee.**

Other implementation steps include:

1. Identify the Ecosystem Restoration Program lead staff member(s) from within the MOE (potential chair for the RSSP).

2. Create/ensure the Inter-agency Management Committee (IAMC) support (i.e. steering committee function) for the regional plans and committee.

3. Create mechanisms (and staff roles) to facilitate delivery of restoration projects.

4. Continue solicitation of input from interested parties and continue attempts to align ecological restoration activities with other government business (e.g., land use planning, forest harvest planning, and fire risk abatement).

5. Communicate restoration strategies, goals and actions to provincial government IAMCs, Land and Resource Management Plan tables, Species Planning Groups, First Nations Tribal Councils, Key Interest Associations meetings and other venues. A synopsis can be developed appropriate to the different audiences.

6. Engage broadly with First Nations in both strategic-level and operational planning, and for input to the design of the program.

7. Focus on Management Unit-level (e.g., TSAs and TFLs) planning to locate priority restoration projects within this strategic framework.

Extension and communication are valuable parts of any restoration program, as described in the next section.

Extension and Communications

Developing and implementing a strategy for extension and communications is integral to an effective restoration program on several counts:

1. Extension and communication opportunities can be used to promote that understanding that the prevention of impacts is considerably more effective than attempting to restore damage after the fact. For example, ATV trails through sensitive areas from increased access to the site results in site damage (and cumulative impacts). Collaborating with local ATV club is the preferred approach – reduce damage before it occurs.

2. Large-scale restoration projects may require public support that could be provided through communication. For example the NDT 4 burning and harvesting in areas close to communities, and thinning closed forests often requires significant effort to communicate the rationale for doing the work.

3. The public is aware of the economic loss of the MPB but few understand the risks to ecological values and other socio-cultural impacts, both now and in the future. A restoration program for MPB-related effects should be accompanied by public education regarding the need for restoration and the types of activities required, as well as the value of standing dead trees.

Plan Revisions and Performance Measures

Strategic Restoration Plans should have a five-year horizon and be updated annually. The annual update process includes identifying target Management Units and Landscape Units and will reflect further restoration planning done at that level.

Strategic planning should inform the development of performance measures, ideally 3-4 “flagship” performance measures should be developed. This results-based approach requires a clear definition of the values to restore, and a preliminary list of these values is found in Stage 1 of the Five Stage Restoration Framework.

Updates should also be made as soon as possible if new significant information is brought to bear (through adaptive management, effectiveness evaluations, scientific research, studies, new funding opportunities and partners, etc).

The Regional Science and Strategic Planning Committee should meet at least quarterly. A larger, open to all interested parties should be held at least annually for insights, direction and communication at Stage 5 of the Framework. First Nations and Key Interests should be engaged on an ongoing basis, as applicable to their specific interests.

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Appendix 1: The Ecosystem Restoration Program

The Ministry of Environment (MOE) is developing a new Ecological Restoration Program (ERP)[11], primarily in response to the MPB Action Plan Objective #6: "To restore the forest resources in areas affected by the epidemic". It also encompasses restoration related to catastrophic fire (Forests for Tomorrow funding) and owing to past harvesting practices (Forest Investment Account, Land Base Investment Program funding). The strategic planning in this document is limited to areas affected by catastrophic events, but can also help to prioritize restoration using other funding sources.

Information on the ERP can be viewed at http://www.for.gov.bc.ca/hfp/fft/index.htm.

The ERP includes:

- Problem detection (what is broken);
- Technique exploration (how to fix it);
- Restoration activities (doing the fix);
- Monitoring the short and long term effectiveness (learning);
- Extension of the results (information broadcast);
- Extension of techniques (skill building) and,
- Reporting and performance measurement (accountability).

The ERP embraces a strategic approach by focusing primarily on areas with high ecological values or sensitivity such as riparian forests, important habitat and community specific watersheds (i.e., landscapes) and places within where investment is secure. The scoping of restoration opportunities will include the Crown land base, including Parks and Protected areas (PPAs).

The ERP is expected to consider these scientific principles:

- Restoration should be addressed at multiple scales:
    - Ecological processes
    - Habitat or habitat components
    - Individual species, guilds or communities

[11] A backgrounder on the ERP was developed for the Challenge dialogue(TM) process. See at http://www.nrsd.ca/ (MOE Restoration Project, password "innovate", Background Papers)

- The level of ecological processes is assumed to be the most important functional scale for restoration due to cascading effects through to lower levels
- Advance (a priori) goal-setting is critical for individual restoration projects (i.e., it allows for measurements of project and program success)
- Ecosystems should be restored to within the range of natural variation at the landscape level (while accounting for expected long term trends like climate change)
- Restoration ‘benchmarks’ are critical in setting goals. Benchmarks should use less disturbed reference ecosystems, or in their absence, a desired future condition

Appendix 2: The Engagement Process

The Challenge Dialogue System™ (CDS)[12] allows diverse groups to work together to find innovate solutions address their "key challenges". In this case, agency staff, scientists, First Nations and key interests were invited to give feedback on information posted on the web, in advance of three regional workshops. Two papers were posted on the internet to solicit written reactions to test background information, assumptions, critical questions, proposed ecological priorities, and a proposed prioritization framework for the restoration planning. The first paper was called "An Ecological Foundation for three Strategic Regional Restoration Plans, while the second paper was "Engaging First Nations and Key Interests to Develop Three Strategic Regional Restoration Plans".

To build from the web-based process and to interactively discuss issues with agency staff, experts, First Nations, and key interests regarding the development of strategic regional restoration priorities, workshops were held in Williams Lake on March 1st, Prince George on March 3rd and Kamloops on March 6th. The workshops were additive in certain respects since the attendance and issues raised were different at each workshop.

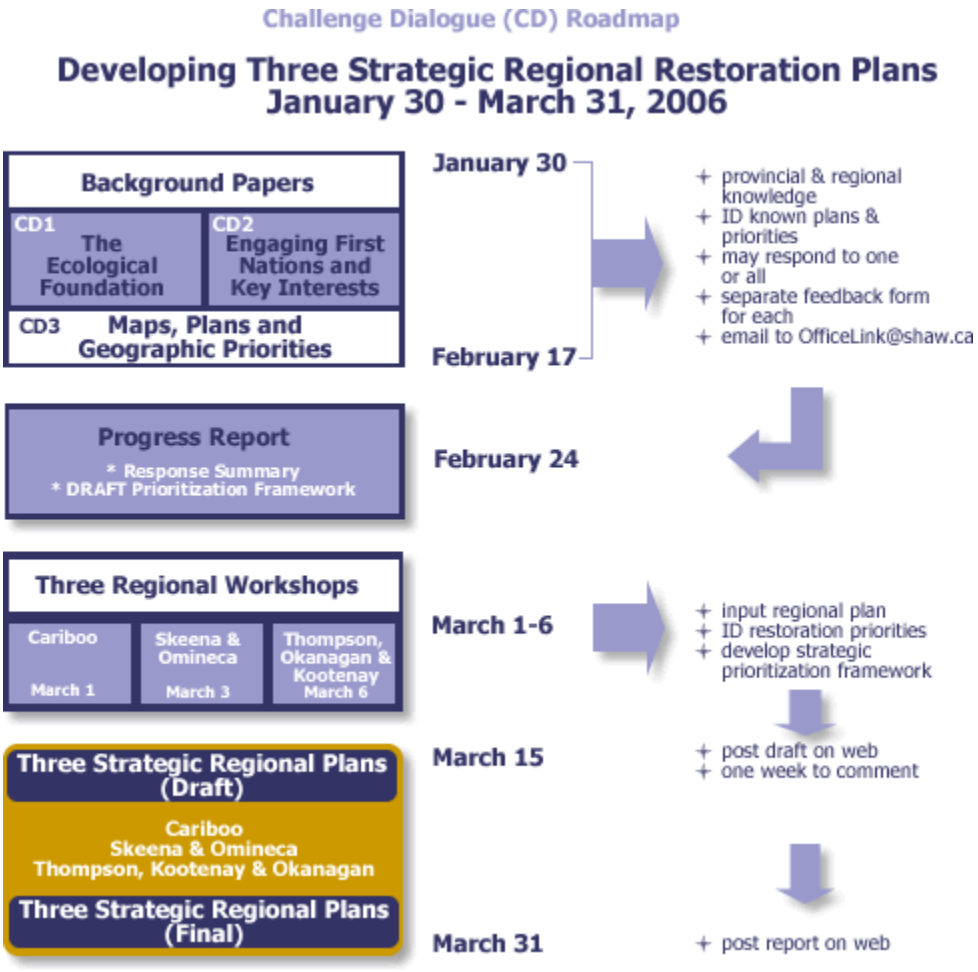
A progress report (compilation) and a synthesis of written responses were inputs to the workshops, where progress made to date was consolidated through discussions in order to progress to develop region-specific approaches and priorities. Ecosystem values with potential need for restoration, developed for the MOE by Fenger and associates were vetted through both the web-based and workshop processes to ensure a sound and well-tested starting point for the strategic ecological planning processes.

Maps were developed that showed the TSAs and TFLs in each region, impacted by MPB and showing pine distribution and some environmental values (see Appendix 10: Map Resources). These maps were at a 1:250,000 scale (plus 1:500,000 regional and a provincial scale map), and allowed a strategic view of potential MPB-related issues, as well as being used to locate potential on-the-ground projects thought of by the workshop attendees. These maps were available ahead of the workshops on the web, and in paper copy at the workshops.

It was acknowledged that while strategic priorities were being developed, that "project level" areas that might be considered a priority in the short term could be brought forward. These known site-level projects collected as part of this process are not comprehensive or complete and are described in the section "Preliminary Geographic Priorities". It was understood that the workshop was a starting point, and that more assessment work is required at a regional level to further develop strategic priorities and related operational plans.

The engagement process is shown in the following flow chart:

[12] See Innovation Expedition for further details on the CDS at http://www.innovationexpedition.com/CDS.html



This diagram, the two CD papers, themed maps and background reports were posted on the internet at: http://nrsd.ca/MOE/innovate.html, or by going to http://nrsd.ca , clicking on “MOE Restoration Project” and using the password ‘innovate’.

The workshop agenda and the participants for this plan’s regional workshop follow:

Workshop Agenda

March 1-6, 2006	Developing 3 Strategic Regional Restoration Plans	
Time	**Description**	**Who**
9:00	**Welcome and Introductions**	Project Sponsors (varies by region)
9:10	**Session 1: Setting the Stage for a Productive and Collaborative Workshop**	Janet Gagne
9:30	**Session 2: Getting on the Same Page – Setting the Context and Background**	Janet Gagne
9:45	**Session 3: Governance The MPB Action Plan, and/or the Future Forests Vision – context for restoration**	Sr. Management (varies by region)
10:00	**Refreshment Break**	
10:15	**Session 4: Challenge Dialogue 2 First Nations and Key Interests** **Summary, Synthesis and Discussion**	Tanis Douglas Group
10:45	**Session 5: Challenge Dialogue 1 Ecological Foundation** **Summary, Synthesis and Discussion**	Rachel Holt Group
11:45	**Session 6: MoE Restoration Priorities Rationale** **Discussion**	Mike Fenger Groups
12:00	**Lunch**	
12:45	**Session 7: Risk Assessment and Rank & Rank for Region – which are top priorities for actions?** **Report out**	Rachel Holt Groups
2:00	**Session 5: Top 2-4 Priorities for region** **SWOT Analysis** **Report Out**	Janet Gagne Groups
3:00	**Refreshment Break**	
3:15	**Session 6: CD 3 – Maps Plans and Geographic Priorities** **Locating Landscape Units & areas of interest**	Mike Fenger & Tanis Douglas Breakout Groups
3:45	**Next Steps**	Janet Gagne/MOE Sponsors All
4:00	**Adjourn**	

Workshop Participants

Kamloops, March 6, 2006

Attendees at the Kamloops workshop were:

Greg Anderson, MoFR
Michael Blackstock, MoFR
Phil Epp, MOE
Neil Findlay, BC Wildlife Federation
Tony Harrison, Western Silviculture Contractors Association
Brad Hawkes, NRCAN
Trevor Jeanes, Western Silviculture Contractors Association
Harry Jennings, MoFR
Harry Joules, NVIT & Simc'w First Nation
Katherine Ladyman, MoFR
Doug Lewis, MOE
Judy Millar, MOE
Francis Njenga, MoFR
Heather Pinnell, MOE
Harry Quesnel, MoFR
Ray Schultz, MoFR
Don Tretheway, BC Wildlife Federation
Rick Tucker, Range Agrologist, MOFR
Pete Wise, BC Trappers Association
Colene Wood, MOE
Janet Gagne, ENAR-ESDE Inc. & Associates
Mike Fenger, ENAR-ESDE Inc. & Associates
Tanis Douglas, ENAR-ESDE Inc. & Associates
Rachel Holt, ENAR-ESDE Inc. & Associates

Appendix 3: First Nations and Restoration

In 2005, the BC government announced a "*New Relationship*" agreement with First Nations, for a more direct government-to-government approach. The specifics of the New Relationship are evolving; however, First Nations will become more directly involved in forest resource planning, management and program delivery. To move First Nations governance, capacity, and technical expertise forward, in March 2006 the provincial government enacted a *New Relationship Trust Act* which is supported by a $100 M trust fund, and the establishment of a not-for-profit corporation. The New Relationship and Trust are components of the government's Five Great Goals for the province[13].

First Nations have a special interest in ecological restoration. Healthy ecosystems are very integral to aboriginal traditional use, knowledge and rights to use plants, fish and wildlife for food, shelter, and cultural and medicinal purposes. First Nations can bring local and traditional use knowledge to restoration planning, and can provide crews to carry out the work.

Recent provincial land use plans did not in most instances incorporate First Nations interests. Many First Nations chose not to participate, or did not have the capacity to take part in the land and resources management planning process. Therefore, the information in such plans needs to be acknowledged as limited when it is used for restoration planning.

Presently, there are several major initiatives and decision making teams in place to mitigate the environmental and community effects caused by the MPB as described previously. Some of these teams, such as the MPB Emergency Response Team have First Nations representatives. Strategic restoration planning must be aligned with the other initiatives and with respect to First Nations work with established representatives in regional - strategic planning. At the project level, connections should be made with specific First Nation community representatives. Tribal councils are also important and have formal structure and capacity. However, not all First Nations are affiliated with tribal councils, and additional effort may be required to reach out and involve those First Nations.

An "open door approach" to First Nations is an important program strategy. First Nations groups have substantial interests in the condition of BC's forests, and need to be involved at all levels of restoration – i.e., strategic planning, operational planning, and on-the-ground implementation. While First Nations may agree with many of the ecological restoration priorities described by other groups, some will have additional priorities. Restoring waterways and fish may be a high priority for many groups. Restoration of traditional use food, medicinal and ceremonial plants, game, and cultural features like trails may also be high priorities. First Nations will need to be involved in the decisions and planning of mitigation treatments and restoration of MPB damaged ecosystems.

[13] Five Great Goals have been set and written into every Ministry's Service Plan. The goals pertain to: sustainable environmental management (water, fisheries, and air), best-educated, healthy living, support for special needs, and job creation.

Appendix 4: Key Interests and Restoration

'Key Interests' is a term that includes any group or individual with an interest or stake in restoration of ecological values, including communities, associations, organizations, committees, agencies, tenure holders and individuals. Many that were invited to participate in the Challenge Dialogue were appreciative to be included up front. This process of engagement indicates that it will be important to strategically engage the diverse groups and individuals. They are all concerned with different values or geographic areas to restore, and their interests or expertise may extend to one of more of the scientific, technical, planning, extension, capacity building and economic aspects of ecosystem restoration.

The following groups were represented or had individual members contribute to the Challenge Dialogue and/or workshops. This list is indicative; however, by no means exhaustive of all the organizations, associations, agencies or others that might have interests in the program:

The BC Federation of Naturalists represents 49 clubs with a total of more than 5,300 members across the province. They have strengths in organizing education and conservation projects since the Federation was founded in 1979. They provide policy advice and local involvement in specific initiatives. The member attending described the need for public education and communications. See http://www.naturalists.bc.ca/ for more information.

BC Wildlife Federation (BCWF) is a province-wide voluntary conservation organization of hunters, anglers and recreational shooters, whose aims are to protect, enhance and promote the wise use of the environment for the benefit of present and future generations. The BCWF has 30,000 members, and 130 clubs, and membership includes many natural resource/conservation professionals. The forest policy committee of the BCWF submitted a brief to the Challenge Dialogue process, highlighting a major interest in NDT 4 restoration, in particular for ungulate winter ranges and riparian areas. The BCWF already get requests for involvement from MOE, and wish to maintain this liaison for future ecosystem restoration projects. The BCWF would provide information and would like to contribute in several ways: professional expertise, labour, working groups (e.g., access management), and networking with other groups (e.g., Ducks Unlimited, for wetlands restoration). Contact: Andy Pezderic, Forestry Committee Chair (and local members as applicable). See http://www.bcwf.bc.ca/ for more information.

Western Silviculture Contractors Association (WSCA) includes approximately 10,000 seasonal workers in tree planting, stand tending, wildfire fighting, site preparation and ecosystem restoration, and has interests in forest policy, industry regulation, and health and safety. The WSCA can help provincially with the operational side of restoration. For example, during the Challenge Dialogue process, the WSCA proposed creating training standards on prescribed burn/fire fighting. The WSCA active on the policy level as well, mostly to make point that a coherent overarching strategy is required to deal with MPB and other issues in forestry management. The WSCA already has a diversity of relationships with First Nations (e.g., for project implementation), and wishes to expand further on these relationships in order to work cooperatively on silviculture projects. http://www.wsca.ca/index.php

Forest Industry: Discussions were held with a representative of the Council of Forest Industries (COFI), and an industry representative involved with public advisory groups attended a workshop. The forest industry is challenged by the public to move beyond typical forestry considerations, and involvement in ecosystem restoration is one way to accomplish that. Companies engaged in certification processes have perhaps the most interest in restoration programs. Forest industry participation is important to plan, co-ordinate operations and the logistics of restoration, implement and monitor treatments, and to access restoration resources (i.e., the Forest Investment Account). COFI companies operate 120 production facilities in more that 60 forest dependant communities in the BC interior, and member company operations account for approximately 80 percent of all BC softwood lumber shipments. See http://www.cofi.org/

BC Cattlemen (Range Interests): Agency representatives that work on behalf of range interests were represented in the process. Working with range interests will be important, to monitor and address changes to natural range barriers caused by MPB, that may increase cattle access to sensitive ecosystems such as riparian areas. The BC Cattlemen were not in attendance, however, they express the following view via their website, that while "salvage operations in MPB infected stands will remove natural range barriers, damage range fencing, potentially spread invasive plants, and generally disrupt grazing practices, at the same time the harvesting does create opportunities for an increase in available grazing and access to lands suitable for intensive agriculture development."14 See www.cattlemen.bc.ca for more information.

BC Trappers Association: Trappers, the majority of whom (60%) are First Nations, are concerned about the long-term impact of changes to the forest on their livelihoods. They wish to develop ways to mitigate violent fluctuations in furbearer populations. Pine martin—a species that relies on mature forests—represents 60% of the value of the fur harvested. The BC Trappers Association is aware of restoration techniques to alleviate impacts on pine martens, as well as salvage harvest best practices to maintain habitat.

The BC Community Forest Association (BCCFA) is a network of community-based organizations either managing or striving to establish community forests, with over 40 communities and organizations that commit to cultural, ecological, and economical sustainable forestry. The BCCFA is very interested in strategic restoration planning, as restoration will need to be a key part of the long-term stewardship of most Community Forest Agreements. No community forest representative was able to participate in the Challenge Dialogue process, but there is interest in giving input to any future planning. The contact person is Jennifer Gunter, Coordinator. See www.bccfa.ca for more information.

[14] see: http://www.cattlemen.bc.ca/releases_2005.htm (viewed March 2006)

Appendix 5: Ecological Foundation

The following summarizes the results of the responses to the paper “An Ecological Foundation for Three Strategic Restoration Plans”. The full compendium of responses was posted on the web.

Program Scope

Strong agreement that prevention of damage is much more important than restoration (since it is known to be effective).

- Strong agreement that restoration following salvage harvesting will be needed. Restoration of the effects of the MPB would occur naturally. Developing and following BMPs in relation to salvage harvesting, stratified by site / value / site series would greatly reduce the expected need for restoration. Acknowledgement that this program may not directly address these issues due to limited scope and funding. Improved planning at stand and landscape level for salvage harvesting was advocated due to concern over environmental impacts resulting from current and planned future development.

The program needs:

- long-term commitment
- requires interdisciplinary teams doing the planning and work
- Need an integral process to keep the science foundation up to date with the science of the day. Need to establish a forum for ensuring science continues to be incorporated into the plans, including feedback loops from adaptive management

Natural disturbance paradigm:

- Agreed that natural disturbance paradigm provides a useful way of assessing risk to ecological values today and into the future. Agree that divergence from natural disturbances results in increased risk.
- Also generally agree that ‘restoring to a natural state’ is likely not possible, in the face of climate change and our historic and planned future land management activities.
- Therefore – use the natural disturbance paradigm to assess level of risk for prioritizing values of concern, but aim to restore key attributes and functions of the value of concern, rather than attempting to restore ecosystem ‘to a natural state’.

How to prioritize restoration action?

- Use a risk approach – which says identify the highest ecological values at highest risk and prioritize action in these locations.

- However, also acknowledge that lower level risks and values may be initial priorities because they provide activities that can be managed with current tools, knowledge and budget.

- Alternatively, prioritize if close to communities and / or first nations traditional use areas. Potentially use some restoration activities adjacent to communities to showcase the activities themselves and to educate about restoration and adaptive management.

Using the MoE Priorities:

A MOE preliminary list of priority ecological values to restore was vetted through the CD and at workshops. There was general agreement that this list of values were potential restoration priorities—see also Figure 3: Potential Values to Restore, Stage 1 of the Five Stage Framework.

Aquatic:

- Community watersheds (drinking and domestic water)

- Maintain habitat in high-value fish streams; temperature sensitive streams; (e.g., stability issue); blockage of fish habitat

- Loss of riparian stand structures for shade, nutrients, and stream bank stability

- Flooding and related effects on drinking water intakes and infrastructure

- Widespread increase of human and livestock access

Terrestrial:

- Older forest structures, stands, and connectivity at the landscape level;

- Lodgepole pine-dominated winter ranges for terrestrial lichen-adapted caribou herds;

- Winter ranges for other regionally important species;

- Historic decline in deciduous species;

- Spread of invasive plants;

- Widespread increase of human and livestock access;

- Natural Disturbance Type 4 (NDTF) issues i.e., over-dense conifer forests.

Cultural Ecological Values:

- Many aquatic and terrestrial ecological values are important to First Nations i.e., water, fish, and species of trees and plants

- Spiritual and traditional use – e.g., areas with culturally modified trees and grease trails

Appendix 6: Regional Science and Strategic Planning Committee

This report recommends establishing Regional Science and Strategic Planning Committees. The committee will function best if divided into two sub-groups with some members spanning each:

1. A strategic restoration planning group.

2. A technical support team or subcommittee to support restoration activities.

Proposed Functions of the Strategic Restoration Planning Group include:

1. Oversight of strategic planning.

2. Determining the science foundation and direction, and what that means for strategically selecting types and locations of restoration work.

3. Determining which key interests should be involved and how.

4. Managing budget allocations, contracting, and integration with other regional initiatives.

5. Reporting accomplishments and achievement of performance measures.

6. Representing the program's interests in other committees and with key stakeholders and First Nations groups, link to other committees with related mandates.

7. Extension/communication of results and initiatives.

8. Renewing and revising the plan and ensuring it is relevant to the region and linked to provincial issues.

Proposed functions of the technical support team include:

1. Contributing to strategic selection of types and locations of restoration work, based on landscape-level issues.

2. Integrating locally appropriate technical understanding and direction.

3. Ensuring adequate short and long-term implementation and effectiveness monitoring, so that learning can result.

4. Exploring new restoration techniques and the effectiveness of known techniques.

5. Supporting extension of technical knowledge.

The technical support team may expand or contract on an as needed basis, depending on the agenda topics.

Committee members should be carefully selected for the right balance of practical science knowledge and committee cross linkages. The committee should be chaired by the Ministry of Environment and will likely include regional scientists, ILMB staff involved in land use planning, and the forest industry, First Nations, MOF Stewardship Forester and Range officers, the Department of Fisheries and Oceans, and potentially other key interests that are affected.

Appendix 7: Information Needs Related to MPB Restoration

Knowledge gaps and information requirements identified in the Challenge Dialogue and workshops highlight the need to know more about how to best address the effects of MPB, salvage harvesting and major fires at a landscape level.

The following are questions raised throughout the process where better information could influence the decisions about actions to be taken. These knowledge gaps need to be managed and/or monitored in order to advance from strategy to the operational phase.

1. **What geographic areas (e.g., watersheds) are most affected by MPB?** So far, strategic restoration planning has been done mainly on a theoretical basis, in the absence of knowledge of the final extent and impacts of the MPB epidemic. However, waiting to understand the final extent before taking action will not be productive since the complete picture will not be available until the epidemic has run its course. In the meantime the potential scope of the issue as it relates to specific geographic areas and values needs to be understood. This is a particular concern for community watersheds, and was raised in all three workshops. A scoping exercise is needed[15] to identify the highest risk community watersheds, and potential restoration solutions (e.g., whether planting or other activities are required.) The Southern Interior participants also identified community watersheds susceptible to fire (in NDT 4 ecosystems) as a similar high priority and requiring similar scoping.
2. **What are the potential effects of dead pine and associated salvage harvesting on watershed hydrology and fish streams?** Managing watershed hydrology is only in the purview of ERP if areas can be identified that will not be harvested yet require planting. Large areas meeting this description on the timber harvesting land base may be limited. However riparian areas are within the purview of the ERP and may be a restoration focus, particularly if temperature sensitive and high value fish streams are affected. Yet, it is not known how significant an issue MPB is in riparian areas – lodgepole pine is not a typical riparian species but is found in some riparian management areas. Therefore the following questions arise: Will a significant percentage of riparian management areas contain a significant proportion of dead pine? If so, where? What effects will loss of riparian trees have on stream temperature and fish habitat? What mitigation potential in riparian areas is possible when hydrologic impacts are primarily caused in upland areas? How much planting or other activities will be required in riparian zones? To begin scoping this issue, priority streams and riparian areas could be overlain with maps of pine distribution.

[15] Note, a scoping exercise has been done to identify specific watersheds that are or (based on mortality projections) will be negatively affected by MPB. This was done in a separate project for the Kamloops and Okanagan-Shuswap LRMP areas. See Fenger *et al.* 2006.

3. **How to limit and manage the increased cattle access to riparian and other sensitive areas?** Increased cattle access is anticipated to occur through removal of natural barriers and through increased road access. The extent of the problem needs to be scoped, and effective ways to mitigate it need to be developed. For instance, an inventory of natural range barriers should be developed. The logistics of creating effective natural barriers and using fencing should be explored.

4. **What's the impact of a loss of older forest characteristics, particularly in caribou winter range?** Loss of older forest attributes from the landscape is a significant issue resulting from MPB, fires and salvage harvesting. This is a problem in itself, for a large number of ecosystems and species. In the workshops, the issue focused on its potential implications for caribou. Work is required to determine what, if any, restoration strategies could be implemented at this time to restore older forest habitat particularly for this species. What are the opportunities using spacing, thinning, and planting to speed up the recovery of caribou habitat or older forest characteristics in general? Are these approaches effective and desirable activities? Is there anything that can be done to restore terrestrial lichen in caribou habitat affected by MPB?

5. **What is the effect of large pulses of wood to streams (large woody debris) and to the forest floor (coarse woody debris)?** Large amounts of wood in the stream could negatively affect stream hydrology, and large amounts of fallen trees on the landscape could affect ungulate movement. Movement of caribou in a landscape of dead pine is a particular concern. In the longer term, deficits of LWD and CWD could be an issue. This issue requires monitoring.

6. **What are the watershed hydrology effects of MPB with and without salvage harvesting?** This would entail a paired watershed research/monitoring project. Some qualitative information is known, however this is a key issue that requires further quantification.

7. **How does standing dead pine contribute to hydrologic functioning and shading of streams (particularly for temperature sensitive streams)?** Will the effect of standing dead pine on Equivalent Clear cut area be the same as if they were harvested? If significant areas of standing dead are found in riparian areas, or are left unharvested outside of riparian areas, monitoring will be required to understand and mitigate the effects.

8. **The effect of MPB on ponderosa pine and whitebark pine stands** is assumed to be similar to its effect on lodgepole pine stands. Yet little to no work has been done to understand and mitigate its effects. Some scoping of this issue is required given the relative rarity and importance of other pine forests.

9. **How effective were prior restoration projects and types of treatments? Can we learn from the work of recent past restoration programs?** Targeted follow-up from previous projects in the Watershed Restoration Program projects which aimed to improve fish passage, in stream habitat and riparian habitat could provide insight into how, or how not to tackle the issues being faced today. Similarly, a review of salvaged, grass seeded, and restocked areas within older burns may also provide insight into appropriate restoration actions today.

Appendix 8: Restoration Cross Linkage Details

Silviculture strategy workshops[16] were held in fiscal year 2005/2006 for a number of forestry management units affected by MPB, and more management units will be addressed in 2006/2007. Silviculture strategies are developed to address timber and habitat supply shortfalls, in this case to address shortfalls caused by MPB. Habitat supply considerations are a larger part of these strategies than historically. Silviculture investments in thinning, planting and in species selection can be done to benefit habitat, hence the co-ordination and integration of the programs in areas of overlapping objectives will lead to synergies, and considerable benefit for restoration which would not otherwise be possible. Development of this strategic approach and silviculture strategies are funded by the Forests for Tomorrow[17] program, which has a focus on replanting areas affected by MPB and large fires. This program may address restoration priorities where reforestation is required for ecological objectives.

Initial links have been made with staff involved in the Wildland Fire Management Strategy currently under development by the Ministry of Forests and Range. As part of the Strategy, the Ministry of Forests and Range wish to do proactive ecosystem management planning, in terms of deciding how and where to take action on wildfires, and for prescribed fire. Coordination will be necessary to realize the full ecosystem benefits of this developing Strategy. Linking strategic planning for wildland fire, prescribed fire, and ecosystem restoration makes good sense.

Agency staff in charge of range management are important to coordinate with. MPB and related harvesting is expected to increase forage resources. At the same time, natural range barriers will be altered, providing cattle access to riparian and other sensitive ecosystems. Proactive management is needed to identify and map natural range barriers, and identify when these barriers are breached. Agency staff are beginning to work on these issues.

Provincial and Federal parks carry out ecosystem management and restoration, and provincial parks have access to several funding sources to mitigate effects of the MPB. Parks staff can contribute their restoration expertise, and their activities can inform and coordinate with restoration activities outside parks. Federal parks staff have been undertaking density reduction and prescribed fire in the East Kootenays, for example, and are a source of expertise.

Forest policy, operational forestry and incremental silviculture initiatives are the most important links for a restoration program. As mentioned elsewhere in this report, salvage harvesting decisions are potentially the most important factor in determining the geographic focus for restoration projects, and good planning will lessen the need for restoration. Coordination is required to prevent the need for restoration, including coordination to determine areas that are to be left unharvested. Restoration investments should be made only in those areas that will not be harvested before the treatments have provided the maximum benefits – understanding where these areas are may be critical to restoration planning. Once priority areas have been selected for restoration, logistical considerations such as access, crews and equipment availability will require coordination and cooperation with forest industry staff.

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[16] See http://www.for.gov.bc.ca/hfp/silstrat/index.htm for the Silviculture Strategy home page
[17] See: http://www.for.gov.bc.ca/hfp/fft/index.htm for the Forests for Tomorrow website

Appendix 9: Planning Resources

The following strategic planning resources are in addition to reports cited in the References. It would be useful to keep this list current as other resources are identified.

Strategic Ecological Restoration Assessments were done in 2001 by Rachel Holt for the Terrestrial Ecosystem Restoration Program. Much of the strategic background information and priorities are still relevant today. One document was produced for each of the six former Ministry of Forests regions, as follows:

> Kamloops Forest Region Strategic Ecological Restoration Assessment
> http://wlapwww.gov.bc.ca/wld/documents/kamloops.pdf
>
> Nelson Forest Region Strategic Ecological Restoration Assessment
> http://wlapwww.gov.bc.ca/wld/documents/nelson.pdf
>
> Prince George Region Strategic Ecological Restoration Assessment
> http://wlapwww.gov.bc.ca/wld/documents/pgeorge.pdf
>
> Prince Rupert Region Strategic Ecological Restoration Assessment
> http://wlapwww.gov.bc.ca/wld/documents/prupert.pdf
>
> Cariboo Forest Region Strategic Ecological Restoration Assessment
> http://wlapwww.gov.bc.ca/wld/documents/cariboo.pdf

Funding for other related MPB-and wildfire related initiatives such as for range and community protection is described in the "MPB Emergency Response – Canada B.C. Implementation Strategy" found at: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm.

The Forests for Tomorrow Program is a Ministry of Forests program for silviculture planning, reforestation and brushing focused in catastrophic event-impacted management units. The main focus is to improve the long-term timber supply. Some silviculture for non-timber values may also occur. For more information see the following website: http://www.for.gov.bc.ca/hfp/fft/

The Cariboo-Chilcotin Land Use Plan has a Biodiversity Conservation Strategy and updates that is potentially relevant to strategic restoration planning:

http://srmwww.gov.bc.ca/car/planning/cclup/biodiv/index.html

An approach to managing environmental risk is given in the following document:

BC Ministry of Environment, Land and Parks, 2000. Environmental Risk Assessment (ERA): An approach for Assessing and Reporting on Environmental Conditions. Habitat Branch Technical Bulletin 1. http://wlapwww.gov.bc.ca/wld/documents/era.pdf

The BC First Nations Interim MPB Working Group is a resource for strategic planning. More information is on the web at: http://www.fnmpb.ca/

Relevant Action items and priorities are listed in the BC First Nations MPB action plan produced in September 2005: http://www.fnmpb.ca/downloads/FN_MPBActPlanSept27.pdf

Appendix 10: Map Resources

Watershed Mapping done by the Ministry of Environment identifies high value and high sensitivity fish 3rd order watersheds at a 1:50,000 scale. This is recently developed and available from Art Tautz, Ministry of Environment, Victoria.

Pine themed 2005 satellite imagery base maps were specifically produced to assist strategic geographic planning for this project, including the identification of forest harvesting and road development.

For each workshop a single large hard copy mosaic was produced.

The 1:250,000 map mosaic for the Northern Interior (Omineca and Skeena) are with Traci Leys-Schirok, ILMB, Prince George - Traci.LeysSchirok@gov.bc.ca.

The 1:250,000 map mosaic of the Southern Interior are Doug Lewis, MOE, Kamloops - Doug.W.Lewis@gov.bc.ca.

The 1:250,000 map mosaic of Cariboo Region with Colene Wood, MOE, Victoria - Colene.Wood@gov.bc.ca.

Digital versions of the maps are online in PDF form at http://nrsd.ca/ (using the password innovate) or at http://nrsd.ca/MOE/maps.htm, and at the Ministry FTP site: ftp://ftp.elp.gov.bc.ca/pub/outgoing/Restoration_Maps/.

The following maps are available:

1. Strategic overview of Management Units and Regional Groupings

Scale 1:1,750,000 Provincial boundaries

- shows entire province all TSAs and TFLs and pine distribution
- provide names for TSA and TFL numbers
- shows the 3 ERP plan areas.
- shows selected towns and settlements for orientation purposes

2. 1;250,000 sub-regional maps (19 maps)

1. Mackenzie TSA Northern Portion (1 of 3)
2. Mackenzie TSA Central Portion (2 of 3)
3. Mackenzie TSA Southern Portion (3 of 3)
4. Prince George TSA Northern Portion (1 of 4)
5. Prince George TSA Central Portion (2 of 4)
6. Prince George TSA Southwestern Portion (3 of 4)
7. Prince George TSA Southeastern Portion (4 of 4)

8. Quesnel TSA Eastern Portion (1 of 2)
9. Morice TSA (1 of 1)
10. Lakes TSA (1 of 1)
11. Quesnel TSA Western Portion (2 of 2)
12. Williams Lake TSA Western Portion (1 of 2)
13. Williams Lake TSA Eastern Portion (2 of 2)
14. 100 Mile House TSA (1 of 1)
15. Kamloops TSA Northern Portion (1 of 2)
16. Kamloops South TSA & Merritt TSA (2 of 2)
17. Okanagan Shuswap TSA Northern Portion (1 of 2)
18. Okanagan Shuswap TSA Southern Portion (2 of 2)
19. Cranbrook TSA (1 of 1)

These 1:250,000 maps are based on 2005 satellite imagery and show:

- cumulative MPB attack severity from 2000–2004 (derived from BC Forest Service annual aerial surveys)
- towns and settlements
- major roads (1:2,000,000) scale
- major rivers and names
- distribution of Pine susceptible to MPB attack developed by Eng et al. 2005
- TSA boundaries and names
- TFL boundaries and names
- community watersheds
- approved ungulate winter ranges
- parks and other protected areas
- biogeoclimatic zones

3. Regional Summary Maps at 1:500,000 scale (5 maps)

1. Cariboo Ecological Restoration Plan - LU Boundaries and Names (1 of 1)
2. Skeena - Omineca Ecological Restoration Plan - LU Boundaries and Names (1 of 2)
3. Skeena - Omineca Ecological Restoration Plan - LU Boundaries and Names (2 of 2)
4. Thompson - Kootenay Ecological Restoration Plan - LU Boundaries and Names (1 of 2)
5. Thompson - Kootenay Ecological Restoration Plan - LU Boundaries and Names (2 of 2)

These 1:500,000 maps are based on 2005 satellite imagery and show:

- towns and settlements
- landscape unit boundaries and names
- TSA boundaries and names
- TFL boundaries and names
- ERP plan area boundaries