Project Proposal

To The Foothills Research Institute
Mountain Pine Beetle Ecology Program

Project Title
Simulating historical and future MPB threat in Alberta’s eastern slopes.

Proposed By
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Collaborators
Confirmed:
Chris Stockdale, FRI, Program Coordinator, Natural Disturbance Program.
Allan Carroll, UBC Forest Sciences. Climate change specialist.
Marie-Pierre Rogeau, Consultant. Fire regime specialist for the eastern slopes.
Bill Riel, CFS, Pacific Forestry Centre. MPB modeller.
Brad Hawkes, CFS, Pacific Forestry Centre. Fire behaviour specialist.

Potentially (have contacted, but have not yet confirmed involvement from):
Daniel Lux / Erica Lee, ASRD. MPB expert

Background
Knowledge of historic disturbance regimes and landscape conditions is a powerful decision-support tool. The natural range of variation (or NRV) for the condition of a given landscape (in terms of structure, composition, age-class distributions, etc) provides some simple but meaningful biological thresholds. Knowing whether, in what way, and to what degree a given landscape is beyond NRV can provide valuable insights. NRV knowledge also provides some possible explanations of how current landscape conditions were created with respect to the likely historical disturbance regime patterns. One can use this knowledge to help design both mitigation strategies and desired future landscape conditions by directing the location, type, sizes, and severity of disturbance activities.

Case in point, the severity and extent of the current Mountain Pine Beetle (MPB) infestation in Alberta has come as a surprise to most because there is no precedent for it in recent history. Over the last century or so, only a handful of isolated outbreaks were recorded in the southern foothills, and little or no obvious historical evidence of MPB has been found north of Banff. In other words, the prevailing assumption is that this outbreak is both unprecedented and unnatural. To some, this suggests that an NRV approach is inappropriate.
On the contrary, there remain several unanswered questions about the disturbance history of the eastern slopes that could provide significant new value to future management planning. For example, it is entirely possible that current landscape condition of the eastern slopes is well within the natural range (just not within the last century perhaps). Furthermore, we know that such extreme natural behaviour tends to have a disproportionately high influence on the future landscape ecosystem. One could argue that rare and extreme floods, storms, and wildfires periodically “reset” critical landscape functions that some species rely on. In other words, although wildfires, storms, and floods often have devastating cultural consequences, they are not necessarily natural “disasters” as often depicted. The value of such knowledge is that it provides confirmation that although extreme, this is an event to which the ecosystem is resilient (although not in a form we are particularly familiar or comfortable with).

Of perhaps greater significance is connecting the historical disturbance regime with the natural range of the landscape condition. What sorts of (known or likely) past disturbance regimes create landscapes with what we consider to be acceptably low threat levels of MPB? For example, several eastern slopes fire history studies suggest that the historical disturbance rate was much higher than it is today in many areas. If this were true, the proportion of the eastern slopes susceptible to MPB historically would be far lower on average than it is today. Similarly, recent and ongoing dendrochronological studies on the eastern slopes suggest that “mixed” fire regimes (e.g., some combination of stand-replacing and stand-maintaining fires) were far more common than we presume. Furthermore, the spatial distribution of the evidence so far suggests that some landscapes may have toggled from one regime type to the other in response to subtle changes in climate over the last several hundred years. If this is true, this dynamic would have created a far more heterogeneous landscape structurally and compositionally than we see today, which also translates into lower MPB threat levels.

The real power of these types of NRV “what if” exercises is that, regardless of whether the current landscape condition is within NRV, we have now linked potential disturbance treatments with likely landscape conditions and MPB threat levels. This allows us to identify some specifics in terms of disturbance management options over the short term such as where, by what means, over what period, and to what level of severity we should be designing disturbances to maximize MPB threat mitigation over the next few years. This can also be linked over the long term to some landscape scale (socially derived) risk thresholds as part of regional planning strategies – a new decision-support tool.

This same information also allows us to project the likely impacts of climate change on future MPB threat scenarios. If we have already made the link between a) climate and fire regime shifts, and b) disturbance regimes and landscape conditions (including MPB threat), then we can provide some information on the likely future direction and magnitude of MPB threat by linking future climate change model scenarios with probable changes to fire regimes. In other words, this could give us a good idea of in what direction future MPB risk is travelling, how fast, and why.

This project proposes a regional-scale disturbance simulation exercise using the LANDMINE spatially explicit computer model, and empirical research from the FRI Natural Disturbance Program and others to explore the relationship(s) between disturbance regime NRV, the associated landscape condition NRV, and MPB threat levels. This exploration will be broad enough to provide critical new information regarding the current MPB situation relative to past and future scenarios, and some strategic-level recommendations in terms of MPB threat mitigation.

1 Note: By MPB threat, I refer here only to the physical conditions under which MPB invasion is possible. More specifically, this refers to the proportion of lodgepole, whitebark, and jack pine trees in a stand, stand age, stand density, and physical arrangement of the pine-dominated stand types on a landscape.
Qualifications

We propose running this project through the FRI Natural Disturbance Program. This allows us access to significant data and information resources, access to a proven communications and extension network, low overhead costs, and the expertise of, and input from, the current partnership base of the ND program. The project is well within the mandate of the ND Program as per our long-term plan (Andison 2009).

As the scientific lead on this proposal, Dr. Andison’s expertise lies mainly in the areas of natural disturbance patterns, biodiversity monitoring, and disturbance simulation modelling throughout western Canada. He has published several relevant articles in peer-reviewed journals and books, but is perhaps better recognized locally as the lead for the FRI Natural Disturbance Program.

The ND program activity team to which Dr. Andison and Mr. Stockdale are responsible has successfully provided consistent leadership over the last 14 years on a broad variety of natural pattern research, education, and decision-support priorities. The ND activity team currently includes two members of forest industry, two members of the Alberta government, one from national parks, and one from the FRI. All sitting members represent agencies that work in the eastern slopes.

Ms. Rogeau and Dr. Hawkes will assist Dr. Andison in filling in the knowledge gaps of fire history on the eastern slopes. Dr. Carroll will provide and interpret both past patterns of, and future climate change predictions for, the eastern slopes. Dr. Carroll, in collaboration with Hawkes, Andison, Rogeau, and Stockdale, will translate possible climate change futures into fire regime characteristics. Mr. Riel and Lux / Lee will provide the link between stand conditions and MPB threat. The entire team will participate in the interpretation of the results, and Lux / Lee, Stockdale and Andison will work together on disseminating the results.

Project Goals and Objectives

The goal this project is to provide some biologically relevant, historically based strategic-level management assistance to the short and long-term management of current MPB situation in Alberta’s eastern slopes.

The objectives of this project are to:

- Compile what is currently known of the fire regime characteristics of the eastern slopes of Alberta.
- Develop, through simulation, the most likely scenario(s) of pre-industrial natural range of variation (NRV) for landscape condition and MPB threat (as relates to physical conditions only) for the eastern slopes of Alberta.
- Where possible, establish a relationship between historical natural disturbance regime behaviour with historical climatic shifts.
- Develop, through simulation, likely future range of variation (FRV) for landscape condition and MPB threat (as relates to physical conditions only) for the eastern slopes using climate change projection models.
- Provide biologically based strategic direction on the most efficient disturbance scenarios of how to mitigate MPB threat (as relates to physical conditions only) over the short term.
- Provide the ecological foundation for developing a socially acceptable threshold of future MPB threat (as relates to physical conditions only).
• Provide a baseline dataset, methodology, and model framework for future investigations of regional MPB threat scenarios through simulation. (i.e., once the data has been compiled and the model calibrated, it can be used in the future for any number of purposes).

• To make research results available in a variety of forms to maximize exposure of the largest possible audience to the results, and their potential implications to forest management within Alberta.

• To provide some decision-support tools that will help partners integrate this new information into operational reality.

Study Area
The east slopes of Alberta is not a specific landscape but rather a general expression used to describe the area to the east of the Rocky Mountains. We interpret this to mean the area influenced by the Rocky Mountains in terms of topography, ecology, climate, water, and disturbance regime.

An approximation of the eastern slopes of Alberta is shown in green in Figure 1. Areas within National Parks are shown in green stripes, while the solid green areas are provincial Forest Management Units (FMU’s).

Potential Application of Results
This project will provide practical answers on several different levels.

Over the short term, this project will provide some direction for mitigating the MPB threat. In accepting the current situation for what it is, we need to focus on maximizing the return on the available future options. One of the best ways of doing that is through understanding the context of a) historical threat levels, and b) the associated disturbance regime characteristics. Since our impact on forests is largely as a disturbance agent, this is our best chance to link disturbance activities with desired outcomes in terms of MPB threat mitigation.

From a communications perspective, the proposed project is one of the very few to date that steps back to consider the MPB situation from a regional, long-term perspective. We tend to judge the impact of the more extreme natural events negatively, superficially, and over the short term. While this perspective is certainly valid from a cultural and economic perspective, it is not necessarily true from a biological perspective. Understanding the critical role of extreme natural events to the long-term health of ecosystem may be the ultimate lesson we should be learning and sharing with professionals, managers, regulators, and the public.

Figure 1. Proposed Study Area: The Eastern Slopes of Alberta.
Perhaps the ultimate value of this project is to put bounds on inevitable social debates about responsibility. The current MPB situation is less a biological threat than it is a social dilemma that requires making some difficult decisions.

The FRI Natural Disturbance Program

It is important to understand that this is by no means a stand-alone project. This proposal fits within a deliberate package of leading-edge research, experimentation and decision-support tool development. As described above, the FRI Natural Disturbance Program has been functioning for 14 years. As described in the FRI ND long-term plan (Andison 2009), this project links directly with a number of existing research, communications, and integration projects, as well as the FRI Communications and Extension Program, the potentially the FRI Fish and Watershed Program, and the FRI Grizzly Bear Program. More specifically, this project fits under the existing “Disturbance Regimes of East Slopes of Alberta” project approved by the FRI ND activity team this year (see attached Appendix A).

Methods

The methods for this project involve several phases;

1. **Partnership Consultation.** Consistent with the mandate of the FRI, our first step is to solicit input to the proposal as written for improvements and additions by partners. Although we are clear on the goals and objectives of this project, there remains some room for interpretation. We consider this the classic definition of “extension”, and will require one or two small, focused, professionally facilitated, workshops.

2. **Compile Data.** The raw data for the eastern slopes is available in a number of forms, some already complied, and others not. The scale and resolution of the simulation exercise will determine the best raw data layer(s).

3. **Summarize Existing Historical Disturbance Regime Knowledge.** The FRI ND Program already has an existing, approved project to deliver on this output; the “Eastern slopes disturbance regime project” led by Chris Stockdale. In addition, the FRI ND Program has an existing pilot study that is exploring the possibility of historical evidence of a true mixed fire regime in the Berland area of the FRI land base. Lastly, MP Rogeau is currently working on fire regime research in the R11 management unit, which will provide new information. Results from these studies will provide invaluable evidence concerning the prevalence of so-called mixed fire regimes in the northern half of the eastern slopes.

4. **Calibrate the LANDMINE model to NRV of the Disturbance Regimes (as per item 3).** A disturbance simulation model is ideally a very simple thing. Calibration includes the frequency, sizes, shapes, and severity of fires. The LANDMINE model has already been used four times on the east slopes on smaller areas, and has been calibrated for severity and shapes. Calibrating LANDMINE to frequencies and sizes for the entire region will require some additional effort.

5. **Adopt and Interpret the most appropriate MPB Threat Model.** In collaboration with Alberta Sustainable Resource Development Forest Health experts and CFS modellers, identify and adopt to the modelling exercise the most robust version of a MPB (physical environment) threat model.

6. **Generate Landscape Condition NRV, and MPB NRV.** Once calibrated to historical conditions, run LANDMINE to generate the natural range of variation for basic landscape condition metrics, including MPB threat as defined by #5 above. Several disturbance regime scenarios will be tested here (as per input from #1 and #3 above).
7. Summarize the Relationship Between NRV and the Current Landscape Condition. This functions as a reality check in terms of where we are relative to historic conditions.

8. Identify and Summarize Disturbance Regime Characteristics that Reduce or Mitigate MPB Threat Levels. There will be some iterative testing of disturbance regime combinations that involve returning to step #6 here.

9. Identify Likely Possible Futures wrt Natural Fire Regimes From Future Climate Change Estimates. Run the calibrated LANDMINE model using future projections and probable impacts on the natural fire regime.

10. Create a Series of Spatial MPB Options. Although the output is stochastic, we tend to need spatial cues as output to aide in decision-making and communicating.

11. Communication. As an FRI project, substantial and sustained effort will be applied to communicate these results and their implications to the partners. Research reports and journal articles are the most obvious hard deliverable, but the results will also become an integral part of the ND Quicknote series, presentations and workshops, and more elaborate focused workshops with the partners.

Budget and Timelines

The funds requested from the FRI MPBE Program are $125,000 commencing April 1, 2010. The total project cost is $170,000 and will run for just over two years. Below is a detailed budget estimate for the project over that time.

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3-YEAR TOTAL BUDGET $170,000 (125k from MPBE Program)
Project Management
The project will be managed through the Foothills Research Institute Natural Disturbance Program and Dr. Andison will be the Principle Investigator.

Literature Cited
Appendix A

Alberta East Slopes Disturbance Regimes Project

Foothills Research Institute (FRI) Natural Disturbance (ND) Program

By: Dr. David Andison and Chris Stockdale

1. Introduction
Disturbance is one of the primary mechanisms by which ecosystems exist as we experience them. For example, the diversity and number of terrestrial and aquatic species, or the risk of MPB outbreak, are in part a function of the available amount and distribution of suitable habitat (represented as the blue biological consequences box in Figure 1). This in turn is dependent on the more generic landscape condition elements (in green in Figure 1), which are in turn determined by the attributes of the disturbance patterns, or disturbance regime (in red in Figure 1). In other words, to understand the processes and thresholds that might exist within any landscape, it is necessary to identify the disturbance agents and their associated patterns. Furthermore, without a full understanding of the components of a disturbance regime, management actions focused on single elements may either conflict with other management activities, or fail entirely to achieve the original objectives.

Figure 1. The Process Hierarchy of Forest Landscapes.

An understanding of the historical disturbance patterns, or the “disturbance regime” of a landscape serves many needs. Forest management agencies have been using so-called coarse filter biodiversity indicators for many years to complement species specific, or fine filter, biological indicators. FireSmart-ForestWise programs have been using pre-industrial disturbance pattern knowledge to help guide disturbance design objectives for future forest structure and composition. Forest health professionals are similarly interested in how pre-industrial disturbance patterns and conditions compare to current patterns and conditions. On a much broader scale, natural pattern knowledge has the potential to provide overarching biological context for regional land use planning exercises (sensu Andison et al. 2009).

Nowhere in Alberta is there a greater need to understand historic disturbance regimes than the east slopes of the Rockies. The area is under high to extreme wildfire and mountain pine beetle (MPB) risk, includes the home range of several threatened species, contains the headwaters of several major watersheds, includes the tenured areas of several large forest management companies, is subject to extensive oil and gas development, and is home to tens of thousands of people and a major tourism and recreation destination for many times that. Understanding how such a landscape behaved and was structured prior to industrialization provides a robust and relevant benchmark with which to compare cultural disturbance choices. It also allows us to assess how and to what degree we have already deviated from the natural range of variation (NRV).

This proposal outlines a five-year research strategy for quantifying natural patterns for Alberta’s east slopes. However, the methods, indicators, and data standards established in this project are relevant provincially. This project is part of a larger ND Program initiative to coordinate natural disturbance pattern research for the entire forested area of Alberta.

1.2 Disturbance Regimes of the East Slopes

Along the east slopes of the Rocky Mountains and into the foothills, the main ecological disturbance agents are wildfire, insect outbreaks and disease. In terms of numbers of hectares affected and biomass consumed, the most consistent and obvious destructive disturbance agent over the last several hundred years is wildfire. However, the current mountain pine beetle (MPB) epidemic demonstrates the potential for less frequent disturbance agents to dramatically alter the landscape at any given point in time.

From a wildfire perspective, evidence from a variety of sources suggests that the landscape condition of the east slopes may be beyond its historical, natural range. While much of the foothills has what appears to be a stand-replacing fire regime today (infrequent, high intensity fires), there is growing evidence of the presence of a mixed fire regime that includes both infrequent high-intensity fires and frequent low-intensity fires. The extent and frequency of a mixed fire regime is unknown, and fire control may be masking the most obvious evidence.

The disturbance history of MPB for the east slopes is less apparent. The Canadian Forest Service’s Forest Insect Disease Survey (FIDS) reveals that MPB has been present on at least two known occasions over the last 70 years; in the Bow Valley during the 1930’s and 1980’s and Crowsnest Pass in the 1980’s. There are no records of MPB since the
1930s, and no known historical MPB outbreaks north of Banff. Today, however, MPB is present in Alberta in numerous locations along the east slopes and well beyond.

We know that natural disturbance agents often interact with each other in a feedback loop, so it is likely that the current MPB and wildfire situation are linked. For example, MPB activity can create higher landscape fire risk by increasing dead and downed biomass, whereas lack of fire can lead to increased MPB activity due to increases in availability and connectivity of mature lodgepole pine forest.

2. **Study Area**

The east slopes of Alberta is not a specific landscape but rather a general expression used to describe the area to the east of the Rocky Mountains. We interpret this to mean the area influenced by the Rocky Mountains in terms of topography, ecology, climate, water, and disturbance regime.

A first approximation of the Forest Management Units (FMU’s) in the east slopes is shown in solid green in Figure 2. Areas within National Parks are shown in green stripes.

3. **Goals and Objectives**

The goal of this project is to: **Quantify the natural disturbance patterns, and key historical landscape condition and biological response patterns for Alberta’s east slopes.** This objective is part of a larger initiative by the FRIND Program to coordinate the understanding of natural disturbance patterns for the entire forested area of Alberta.

This is an ambitious project, which includes both short and long term objectives:

Short-term objectives (by April 1, 2010).

1. Conduct a gap analysis of quality, quantity, and extent of existing fire regime and landscape condition knowledge & data.
2. Develop from point 1 a first approximation of a Matrix of Needs and Knowledge.
3. Create from point 2 a long-term research proposal to fill in the knowledge and data gaps.
4. Identify the most immediate priorities from the partnership from point 3.
5. Develop and submit an annual research plan for this fiscal year as per point 4.
6. Establish a library of available data and research (from points 1, 2) for partners to access.

Long-term objectives (over the next five years):

1. Provide knowledge of historical disturbance patterns or regimes (the attributes shown in red in Figure 1)
2. Describe key historical stand and landscape condition patterns (the attributes shown in green in Figure 1) as per the direction of the Project Activity Team (see below).
3. Describe key historical biological condition patterns (the attributes shown in green in Figure 1) as per the direction of the Project Activity Team. At the very least, this will include past, current and future fire and MPB susceptibility of the landscape
4. Compile and continually update a spatial database of east slopes disturbance history.

4. Methods
This is not a classic research proposal, but rather a *research plan* proposal. In other words, we are proposing a coordinated strategy for developing understanding of natural patterns for the east slopes. The research plan involves three elements;

1) Research activities (which are developed into annual work plans),
2) A matrix of knowledge and needs, and
3) Communication and extension.

Figure 3. Project Strategy Overview (NRV Research Activities Shaded in Grey).
4.1 Research Activities

The methods used to acquire knowledge of the various NRV metrics fall into two broad categories; 1) empirical, and 2) simulation. Empirical research refers to that knowledge gained by physical measurements; disturbance sizes, percent mortality, ignition locations, charcoal dates from lake cores, and so on. Ideally, one would want to use empirical measurements exclusively since physical evidence is the most defendable. Unfortunately, physical measurements of some NRV metrics are often impossible to obtain, limited in scope, of poor quality, or biased.

Simulation models allow us to develop estimates of knowledge gaps unable to be filled by empirical research. Simulation models are also ideal tools to project the impact of future disturbance scenarios on key landscape condition or biological consequences attributes. For example, one could use it to identify likely disturbance designs that reduce MPB threat by X%.

Simulation models require inputs in the form of data and assumptions. For example, a model that generates old forest levels for a landscape requires knowledge of fire size, fire frequency, and fire location over space and time. Thus, if any one of these parameters is wrong, the simulation output will be wrong. Furthermore, the choice of model is less important than how it is applied. The best simulation modelling exercises share two ingredients; 1) simplicity, and 2) a sensitivity analysis (which tests how output changes in response to changes in inputs).

NRV research uses both empirical and simulation methods, and ideally, transitions from empirical to modelling as one progresses down in Figure 1. For example, while there are many ways of defining the parameters of a disturbance regime, the most defendable involve field sampling. In contrast, the only way to determine both landscape condition and biological response NRV parameters is via spatial simulation modelling (Figure 3). Furthermore, the former functions as input to the latter two within simulation modelling exercises (note the flow in Figure 3). For example, landscape condition patterns are only as good as the disturbance regime parameters used to generate them.

Ideally, one would complete the disturbance regime research prior to simulation exercises. However, it is possible to use disturbance regime parameters from adjacent landscapes or based on anecdotal or other forms of imperfect information to develop first approximations of landscape condition or biological consequences patterns. Thus, it is possible for the three types of NRV knowledge to function in an iterative loop.

We propose that the specifics of research direction for this project are driven by a partnership (see section 4.3) with the assistance of a knowledge and needs matrix (see section 4.2).

4.1.1 Research Review and Gap Analysis

Over the last 15 years, a large amount of work has been done to define (mostly) the disturbance regime of various parts of the east slopes, and to a lesser degree landscape conditions. Thus, the first step is to evaluate the quality and quantity of existing fire regime knowledge, data, and coverage for the east slopes area. This will include, but will not necessarily be limited to:

- Published reports, articles and books.
- Unpublished, “grey literature” research.
- Related historical surveys, maps, and photos.
- Un-analysed related data.
- Anecdotal historical evidence.

We are already familiar with and/or possess much of the existing research and data through the FRI, Parks Canada, Alberta SRD, existing research partnerships, and forest management companies. This overview will provide the basis for a first approximation of the matrix of knowledge and needs (see section 4.2 ahead).
4.1.2 Empirical Research

The foundation of all NRV management applications hinges on the quality and geographic extent of the basic elements of a disturbance regime (see Figure 1). Gaining knowledge of the fundamental elements of disturbance patterns is time-consuming and expensive. All types of disturbance will be included, but our priority will be a) wildfires, and b) MPB.

Wildfire type, frequency, periodicity, and size (from Figure 1) are ideally captured by taking cross-dated field samples from live and dead trees to create some level and form of time-since-fire maps. It is also possible to make less precise, but more extensive (over time and space) estimates of wildfire frequency, periodicity, and to some degree, severity, using sediment cores in lakes and bogs, good quality historical records, maps and accounts, and traditional knowledge. Wildfire shape and severity are ideally captured through detailed mapping and spatial analysis of historical, natural wildfires.

Identifying regime parameters for MPB is more challenging, but a) the field sampling techniques are fairly similar to those used for wildfires, and b) we have the benefit of an informal partnership with the Pacific Forestry Centre of the Canadian Forest Service.

The importance of conducting high quality empirical research cannot be overstated. Subtle shifts in disturbance regime parameters can have dramatic effects on the resulting landscape conditions. For example, the extent and frequency with which lower intensity stand-maintaining fires occurred relative to the higher intensity stand-replacing fires is far from obvious in the east slopes. A cursory or ill-suited field sampling strategy is likely to miss important physical evidence since it will be masked by decades of fire control.

4.1.3 Spatial Simulation Modelling

The natural range of landscape condition patterns and biological consequences is unavailable to us from an empirical perspective because records and photos of historical landscapes date back only several decades, at best. This information can only be deduced by spatial simulation modelling. Simulation modelling can also be used to project the impact of future disturbance activities on both landscape condition and biological consequences indicators.

The inputs for landscape condition NRV simulation modelling exercise includes most of the information from the red box of Figure 1; fire type, frequency, size, shape, severity and tendencies. Model output includes NRV for several age X cover type seral-stages, as well as NRV for (old) forest patch sizes, MPB threat, wildfire threat, and species habitat levels. The following is an example of the types of questions that simulation modelling could address in the east slopes: Evaluate key current landscape condition indicators (such as old forest levels or patch sizes) in terms of its departure from NRV.

- Determine whether landscape structure has been the limiting factor in MPB spread in the past in Southern Alberta.
- Explore historical and likely future interactions of disturbance agents on the landscape
- Explore likely impacts of climate change on future natural disturbance patterns and landscape conditions.
- Evaluate scenarios of landscape level wildfire threat within NRV.
- Evaluate scenarios of landscape level MPB susceptibility reduction within NRV.
- Evaluate Harvest Plans Relative to NRV.

This project will use LANDMINE for this procedure (Andison 1996, 1998). LANDMINE has already been initially calibrated for three areas of the east slopes, and another three very large landscapes in northern Alberta.
4.2 Matrix of Knowledge and Needs

The initial synthesis of current knowledge (from 4.1.1 above) will provide the foundation for version 1 of knowledge and needs matrix (as per Figure 3). It will reveal that for some areas of the east slopes, we have broad and deep understanding of both disturbance patterns (in red) and landscape conditions (in green) (Table 1). For other areas, we have only pieces of one or the other. Our understanding of historical biological conditions (in blue) is almost non-existent. Note that the generic nature of the column headings in Table 1.

The matrix serves four purposes:

a) Provides the current status and past progress of NRV knowledge.
b) Provides the interface to an associated database that includes (to the greatest degree possible) the raw data, reports, summaries etc of each associated study.
c) Identifies the most likely source, and the relative risks, of borrowing information from adjacent landscapes to deal with gaps.
d) The primary tool with which to identify specific indicator needs (e.g., fire cycle vs fire return interval), and the highest priorities for investment.

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Matrix content will be managed by the principal investigators (Stockdale and Andison), but the decisions on the priorities of the gaps identified therein are the responsibility of the Project Activity Team (see ahead).

4.3 Communications and Extension

The research components of this project (section 4.1) will require considerable time and resources to complete, but the work itself is not complicated. The methods, expertise, models, partnerships, and even some of the data already exist. A dedicated communication and extension (C&E) strategy is necessary because this project requires substantial input from partners on at least three different levels:

1) Geographic priorities (i.e., where?)
2) NRV pattern priorities (i.e., what is important?), and
3) Pattern metric details (i.e., output format, spatial language, input assumptions, etc).

The first two are self-explanatory. The decision of where to focus research and on what patterns must align with partners’ priorities. However, as one progresses through the three stages of NRV (as per Figure 1), the choice and form of the pattern metric details becomes increasingly subjective. Disturbance patterns are the purest form of research, and the output is not open for debate or interpretation. While there is widespread agreement on many landscape condition patterns (such as seral-stage levels), there are a handful of subjective decisions that must be made.
that have a tremendous impact on the form of the outcome (e.g., age ranges for seral-stages, what defines an “edge”, etc). The number of possible manifestation of how to define biological consequences is even greater. The exact form of indicators such as wildfire risk, MPB risk, and suitable habitat for species are open to interpretation. In summary, as one proceeds through these three levels of NRV patterns, the focus shifts from the reliance on science to the need for constructive and consistent input from a team representing the partner needs.

There are at least four different, but overlapping needs for this project;

1) Coarse-filter biodiversity assessments and indicator development for forest management,
2) An evaluation of the historical MPB situation relative to that we see today, and various future landscape condition possibilities,
3) An evaluation of the historical forest structure, and composition in and around communities relative to today, and various future (Firesmart) landscape conditions,
4) Biological benchmarks and natural thresholds for land use planning exercises.

These needs translate into multiple possible interpretations of exactly how to proceed with the form and number of indicators for both landscape condition and biological consequences.

A proven strategy for providing effective partnership input to FRI programs is through “Activity Teams” representing all partners involved. In most cases, the Activity Team for the Natural Disturbance program is responsible for making all strategic decisions within the ND work plan (Figure 4). However, on occasion projects adopt their own Activity Teams. This project is sufficiently large and complex to warrant its own Activity Team (Figure 4).

**Figure 4. Proposed Organization of the East Slopes Disturbance Pattern Project.**
Fortunately, one of the responsibilities of the ASRD recently formed the “Wildfire Management Planning Task Group” (WMPTG) is to develop a strategy for generating, summarizing, and making available historical fire regime information for Alberta, starting with the east slopes (Figure 4). In March of 2009, the FRI and ASRD co-hosted a full day workshop to explore partnership opportunities. In agreeing that our objectives aligned well, the group decided to adopt part of the WMPTG as the activity team for this project. Other potential partners include Forest Management, Forest Health, the Land Use Secretariat, forest industry, the energy sector, Alberta Conservation Association, Alberta Tourisms Parks and Recreation, and Parks Canada.

5. Timelines and Budget

Present - March 2010 (fully funded through the FRI ND Program):
- Develop east slopes project proposal for discussion (this document).
- Identify the project Activity Team
- Complete the Matrix of Knowledge and Needs.
- First meeting of the proposed project Activity Team to discuss this proposal, budgets, and research priorities.
- Develop a long-term (five year) workplan based on partner priorities and several budget scenarios.
- Prepare and submit funding proposals for projects that are suitable for the annual workplan for 2010/11 and beyond.

April 2010 – March 2015
To be determined by the partnership needs, available funding, and proposal submission success.