Large-Scale Natural Disturbance Demonstration Area

Final Report To:
The Forest Resource Improvement Association of Alberta

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By:
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On behalf of
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BACKGROUND
The Foothills Model Forest (FMF) Natural Disturbance (ND) Program has been studying natural disturbance patterns in the foothills of Alberta since 1996. While we are far from finished with our research efforts, we have gained considerable insight into how natural disturbances shape our landscapes. We have also found that natural patterns are present at virtually all scales, and are tremendously variable in both breadth and depth. The challenge is shifting now to more practical questions of implementation guidelines, operational realities, ecological impacts, and social and economic limitations. Exactly how, to what degree, and when will natural pattern knowledge be used to plan, manage, and monitor?

Towards that, there have been several isolated integration efforts across Alberta and elsewhere. Some forest management companies are now leaving residual stems and islands, disturbance sizes are increasing, and shapes are becoming more irregular – all of which represent more “natural” patterns. In addition, natural range of variation (NRV) targets for metrics such as residual material, block size, and seral-stage distributions are now being included in planning guidelines and monitoring systems.

These efforts are commendable, and clearly represent the progressive integration of a selection of NRV metrics into the existing policy, planning and monitoring frameworks. In other words, coarse-filter objectives based on natural patterns are being added to the list of values we manage for, depicted as value inputs from below, as in the figure on the left on the next page.

This gradual type of integration is certainly logical, but not infallible. For example, there is a risk of high-grading the most obvious or economically viable natural patterns (regardless of whether it is deliberate or inadvertent). The list of natural disturbance patterns extends far beyond seral-stage representation, patch sizes, island remnants, and coarse-woody debris, yet these are commonly the only metrics used in so-called natural pattern guidelines. Based on our research at the FMF, Hinton Wood Products has already compiled a list of 78 natural patterns to consider during planning, and the list continues to grow.

Adopting a few natural patterns as practical guides for individual (coarse-filter) plan attributes is not the same thing as adopting a natural pattern strategy. Natural disturbance patterns may also be used as a conceptual framework, as well as a practical guide. The idea is to accept and apply NRV metrics as a complete package on a given landscape as a sort of neutral (and ecologically viable) starting point for planning activities. Other values such as caribou habitat, outfitting or aesthetics are now filtered through the NRV baseline or template (as in the diagram on the next page). If and when a decision is made to deviate beyond NRV (to satisfy the need for roads, safety, cultural preferences, or specific ecological issues, for example), it can be done so with full awareness of the potential risks. In this way, natural disturbance patterns have the potential to provide a broad ecologically defendable foundation for planning and management that encompasses many other values within it.

What advantages could this proposed alternative planning system offer? What little we have seen so far suggests that many other ecological, social, and economic values are consistent with an NRV strategy. In fact, the more substantial experiments have had considerable success in dovetailing NRV patterns with other values. In other words, we
are finding a substantial number of win-win scenarios. This should not necessarily be surprising – often word or logic models are sufficient to demonstrate that the natural disturbance model is consistent with the habitat requirements of many species, access issues, aesthetics, and even dealing with the threat of natural disturbance. At the very least, it is safe to say that the breadth and depth of natural patterns have been much more complicated and informative than anyone anticipated, and potentially affects virtually every level of planning, as well as many policies.

The use of an NRV foundation is also theoretically attractive. Consider that it offers the potential to 1) integrate (and potentially simplify) management and monitoring systems, 2) ensure that management decisions have a scientific and ecological foundation (consistent with “ecosystem management”), 3) integrate the planning needs of several institutions, and 4) streamline the planning process. The potential to provide these advantages has gone untested to this point. Thus the goal of the Hwy40 Demo project is to **demonstrate the effectiveness of using natural disturbance pattern knowledge as the foundation for effective operational-scale forest management planning**. The right side of Figure 1 shows a conceptual model of how operational planning might occur using natural patterns as the foundation. Note that this hypothesis tests the potential of promoting NRV from being a decision-making *filter* (as depicted on the left of Figure 1), to a decision-making *foundation*.

**Figure 1. Conceptual Models of How Forest Management Planning Occurs Today (left), Compared to How it Might Occur Within a NRV Strategy (right).**

**OBJECTIVES**

The FMF Natural Disturbance Program partners felt that the time had come to take that next step and test the potential for NRV to be used as a planning foundation, by developing a plan based on NRV knowledge across a substantial area. To be clear, we do not intend on developing a plan only using NRV knowledge. Rather, we will use what we know about local natural patterns at various scales as the foundation for planning. Thus, the three main objectives of the project are as follows:
1) Evaluate the robustness of an NRV strategy as a foundation for operational planning. The success or failure of individual elements of NRV (such as retention as islands) has little to do with the ability of a holistic NRV strategy to advance sustainable forest management.

2) Identify and explore potential convergences and conflicts of adopting an holistic NRV strategy with existing policies, practices, objectives, and other economic, social, and ecological values. The best way to learn about these issues is from an adaptive, practical application.

3) Build a common understanding of the concept and practice of adopting a natural disturbance based plan. A myriad of opinions exist today on how, to what degree, and where NRV information should be integrated into forest management planning, and to what degree it is possible or advisable. Regardless of the outcome, a large demonstration area will be a powerful communication tool on which to help develop and focus debates, and ultimately informed opinions, strategies, and policies.

LOCATION
Consistent with our objectives, our criteria for the choice of the location and size of the demonstration project were as follows:

- Operational plans are pending – the plan must be a real one.
- Includes multiple jurisdictions.
- At least moderately “natural” from a vegetation pattern perspective.
- An area with multiple values that poses a planning challenge.
- Consideration of the full range of known NRV patterns.
- Inclusive of other sustainable forest management values.
- Include opportunities for public viewing in the forest.
- Provide scientific opportunities towards the ecological impacts of using NRV.
- Use, but critically evaluate, the existing planning system.

After considerable deliberation, the site chosen for this demonstration project is an area approximately 70,000 hectares in size spanning approximately equal parts of the Hinton Wood Products and Alberta Newsprint Company (ANC) Forest Management Areas (FMA) and the Foothills Forest Products quote area, as well as a portion of the Willmore Wilderness Area. The area is bisected by Highway 40, and runs from approximately the Berland River in the south to Pierre Greys Lakes in the north and roughly corresponds to the main foothills winter range of the A l a Peche caribou herd. (Figure 2). This location and size were chosen deliberately for several reasons:

- It is highly visible and accessible. Part of the reason for doing this is to raise awareness about NRV and forest management issues. The Hwy 40 corridor offers excellent access for the public, scientists, and professionals.
- There are unique and high values and risks in the area already. Caribou, old growth, and bull trout are of particular concern, and it is also the most likely entry point for Mountain Pine Beetle (currently present in the Willmore Wilderness Area). The proximity to, and vegetation of, the Willmore also poses a significant forest fire risk.
- Despite these unique biological values and risks, the management of the area falls under many jurisdictions, including three forest management areas, a protected area under the auspices of Alberta Community Development, oil and gas companies, trappers, and many different types of public. We intend
to test whether we can define a more efficient, cross-jurisdictional “one window” planning approach to dealing with these and other values.

- The three forest management areas have plans and approvals for harvesting in the vicinity due within the next 5-10 years. In other words, if we did not choose this area for the project, plan development and approvals would occur anyways.
- Its proximity to protected areas offers the potential for some alternative management solutions perhaps not as readily available elsewhere – prescribed burning in particular.

**Figure 2. Map Showing the Outline of the Hwy40 North Demonstration Area (in Red).**

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**A CHANGE IN PARTNERSHIP**

The original partnership of the Hwy40 Demo Project included Weyerhaeuser Company in the north. Early in 2004, the Weyerhaeuser Grande Cache sawmill was closed, and the responsibility for managing the forest in that FMA ceded to the Alberta government. Over the short term, representatives from the Alberta Sustainable Resource Development (ASRD) acted on behalf of that part of the Hwy40 area until early Foothills Forest Products (FFP) took over responsibility for the area late in the year. FFP became a member of the Hwy40 planning team soon thereafter.
METHODS
There was no roadmap, no precedent, and no sage wisdom available from others who have ventured down this path. This project is as much about providing the benefit of experience to others as anything else. However, going first means that a certain amount of flexibility is required with respect to the number, order, and nature of the steps involved. The following list includes elements that were part of the original project vision, and others that were created and/or developed as we went.

Develop an Organizational Structure
Highway 40 North is a FMF project, but it is also an operational plan. Considerable thought went into designing teams and assigning responsibilities at the outset such that the project objectives for the model forest could be met with minimal interference to the standard planning requirements for the partners. The figure on the next page depicts the organization of the Hwy40 Demo Project. This structure was more or less part of the original vision of the project, with some minor changes.

Structurally, the project is part of the Natural Disturbance (ND) Program - one of eleven program areas at the Foothills Model Forest. The project is part of the ND work plan for 2003/04, 2004/05 and 2005/06 approved by both the FMF Board of Directors and the ND Activity Team.

To initiate the project, the ND Activity Team formed a Project Team, who established the location and size of the study area, the partner base, the overall project guidelines, and the composition of, and “rules” for, the core Planning Team. The Hwy40 Project Team includes most of the ND Activity Team, the Alberta Sustainable Resource Development (SRD) Area Manager for Foothills (responsible for approving the operational plans), and representatives from Weyerhaeuser / Foothills, Alberta Community Development (for the Willmore Wilderness Area), and Alberta Energy. Thus, representatives on the Project Team also serve as direct links back to their respective organizations in terms of planning.

The Planning Team’s responsibilities are to develop and deliver an operational-scale disturbance plan for the area. The core Planning Team thus includes planners from each of the four land management agencies involved, a representative from the Hinton Area, a specialist in prescribed fire planning, and a specialist in natural patterns. This group quickly expanded to include individuals that could provide input on key local issues such as caribou and energy sector development. The planning team has also begun the process of contacting other experts and agencies through the “referral” process as input to the final plan.

The most recent addition to the organizational chart of the Hwy40 project is a group involved in adaptive monitoring and research opportunities that the project will create. This work has been slowly ramping up to the point where we have hired a coordinator, Matthew Wheatley.

There has been some movement of people and agencies within the project, the most notable being the transition of forest management responsibilities in the northwest corner of the study area known as “E8”.

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Figure 3. Conceptual Models of How Forest Management Planning Occurs Today (left), Compared to How it Might Occur Within a NRV Strategy (right).

- **FMF Board of Directors**

- **FMF Natural Disturbance Program**
  - Activity Team:
    - Don Podlubny, FMF
    - Rick Bonar, HWP
    - Greg Branton, ANC
    - Herman Stegehuis / John Stadt, ASRD
    - Bob Anderson, ASRD
    - David Anderson, Bandaloop
    - (Luigi Morgantini / Wendy Crosina, Weyco)
    - Mark Storie, ASRD Area Manager
    - Kyle Clifford, Comm. Devel. (Willmore)
    - Jennifer Steber / ?, Alberta Energy

- **Hwy40 North Project Team**:
  - Don Podlubny, FMF
  - Rick Bonar, HWP
  - Greg Branton, ANC
  - Herman Stegehuis / John Stadt, ASRD
  - Bob Anderson, ASRD
  - David Anderson, Bandaloop
  - (Luigi Morgantini / Wendy Crosina, Weyco)
  - Mark Storie, ASRD Area Manager
  - Kyle Clifford, Comm. Devel. (Willmore)
  - Jennifer Steber / ?, Alberta Energy

- **Hwy40 Core Planning Team**:
  - Morris Archibald, Weldwood (planner)
  - Peter Winther, ANC (planner)
  - (Phil Temple, Weyco) (planner)
  - Erik Kok (FFP)
  - Laura Graham (planner - Willmore)
  - Rob Mueller / Bill Tinge, ASRD (regulator)
  - David Andison, Bandaloop (NRV expertise)
  - Sherra Quintilio, Kevin Quintilio, Chad Morrison ASRD (fire)

- **Hwy40 Extended Planning Team**:
  - Kate Lindsay, ASRD (representing E8)
  - Kirby Smith, ASRD Fish & Wildlife
  - Brad Herald / ?, CAPP
  - Brad Lloyd, Alberta Energy

- **Plan Referrals**
  - Erica Lee, ASRD (mountain pine beetle)
  - Caribou Land Management Assoc.
  - 8 companies holding local gas leases
  - Local outfitters
  - Trappers
  - Other users

- **Hwy40 Adaptive Monitoring Group**
  - Matthew Wheatley (coordinator)
  - Gord Stenhouse, FMF (Grizzly Bear)
  - Rich McClIeary, FMF (Riparian)
  - Alberta Research Council (Caribou)
  - Kirby Smith (Caribou)
  - Jasper National park (Caribou).
  - Ken Van Reese, U of S (Soils)
  - Keith Hobson, CWS (Birds)
Establish Project Planning Rules
The project team developed and agreed on several important “rules”:
1) Local knowledge of natural patterns is used to inform starting points for disturbance designs. The first question for any planning decision is, “What would Mother Nature do?” From that point forward, the needs of all other values are brought forward and considered within the context of the NRV guidelines.
2) This is an operational plan – which respects all higher-level plan goals and objectives. The group will accept and work within the decisions that were made at higher levels of planning.
3) The plan will take into account the management of the total land base.
4) Disturbance activities will be designed in detail for 10 years, although disturbance scenarios identified generally for 40 years.
5) A single disturbance plan will be developed, but each land management agency will submit their individual portion of the plan for approval through the normal channels.
6) Where possible, all forms of cultural disturbance activities will be planned, including harvesting, road building, oil and gas exploration and development, and prescribed burning.
7) The major outputs are:
   a. A single, holistic disturbance plan in space, and over time.
   b. A report on the process.
8) The existing respective planning process and approvals will be respected.
9) Disturbance designs can and will adapt to facilitate adaptive management learning opportunities where possible.

Compile and Present Relevant Background Data, Materials, and Knowledge
Considerable effort was necessary to identify, summarize, and disseminate to the planning team all relevant data, information, and specific knowledge of the study area, as well as the relevant planning processes and policies from each partner involved. This built a common understanding of the issues, limitations, state of knowledge, and available data. Although this was originally envisioned as a distinctive stage of the planning process, in fact, the process of sharing knowledge, data, and information was ongoing.

The relevant spatial datasets, including roads, harvesting history and plans, inventories, stand-origin maps, historical fire locations, DEM’s, existing and proposed access layers, and any ecological data, such as collar locations for animals, were gathered from the four different sources and merged into seamless layers by a GIS consultant. The single exception to this was the Weyerhaeuser portion of inventory, updates, and access data, which could not be shared with the team after the announcement of the mill closure. The completed set of edge-matched data for the study area was one of the key deliverables that the OPEN FRIP funds supported. These data now resides with the FMF GIS group.

Since the plan will be based on natural patterns, a full account of what is known about the disturbance history, patterns, and legacy of the area (both natural and cultural) was complied, presented, and distributed to the planning team. Many parts of the natural pattern research were presented multiple times as the planning process progressed.

The concept and the decision support tools used for “fire-smarting” landscapes to reduce the risk of wildfire were summarized, and a full assessment of fire threat for the Hwy40
area presented to the planning team. Provincial policy and strategies with respect to prescribed fire were also outlined. This was facilitated by the fire behaviour expert on the planning team.

The provincial policies, status, current state of understanding, and ongoing research efforts with respect to woodland caribou in Alberta was shared with the planning team, as were details of what is know of the dynamics of the resident A la Peche herd. This was facilitated by the wildfire expert on the planning team.

The location and age of gas wells, pipelines, and seismic lines, and a map of existing subsurface leases and leaseholders was presented to the group, along with an explanation of the tenure system for the energy sector.

We also ensured that we dealt with mountain pine beetle risk in the study area by inviting one of the provincial MPB experts to a planning team meeting to outline the current status of MPB in the area, as well as the output from the state-of-the-art prediction models of MPB spread into the Hwy40 study area at the time.

The planners and planning regulators on the team were responsible for explaining the process of developing, submitting, and approving operational plans for harvesting, prescribed fire, well-site development, roads, and seismic lines.

Finally, ASRD Community Development representatives outlined the policies, plans, and status of provincial parks, and the Willmore Wilderness Area in particular, to the planning team.

**Solicit Local Public Input**

The original vision of the Hwy40 Demo project was as an open planning process, in which any legitimate land use stakeholders were welcome to participate. In part, this perspective arose from the recognition that this particular operational plan was going to be fundamentally different than anything preceding it. The concept of inclusion with respect to decision-making is also consistent with the idea of the application of natural patterns as the foundation for better decision-making. In other words, if an NRV foundation is truly a superior strategy, then that opinion should ideally be a shared one.

A parallel FMF ND Program proposal provided an opportunity to integrate local public input into the planning process through the development of a “charrette”, in collaboration with University of British Columbia’s Sustainable Communities program, arguably one of the world leaders in such processes. A charrette is a process by which different stakeholders that share a common land base are brought together, educated, and given a formal, intensive procedural structure through which unanimous planning decisions are generated.

The application of a charrette initiative to the Hwy40 project was not fully supported by the original project team (see Figure 3). After considerable debate, the integration of the two distinct, innovative projects, regardless of their individual merits, was felt to be an unnecessary complexity in an already complicated project.

At this point, the land management agencies involved in the planning team were advised to initiate the conventional, mandated public involvement procedures through open houses, notices on the web, newspaper ads, and so on. In addition, the FMF proceeded
with formal presentations to town councils of Hinton, Grande Cache, and in the future, White Court.

Develop and Implement a Planning Process
This step represented the most challenging part of the project for the planning team simply because there were no templates available. It is accurate to say that the process that we used in the end was organic. In general, we tended to follow a sequence of questions as follows for each planning decision:

1. What is the natural range of variation (NRV)? (What did Mother Nature do?)
2. What is the current range of variation (CRV)?
3. Why is NRV different than CRV?
4. What management objectives would converge with moving towards NRV in this case?
5. What management objectives would conflict with moving towards NRV in this case?
6. (How) can we move towards NRV from CRV?
7. Are there policy or practice implications?
8. What are the new questions / issues?

We also relied heavily on both research results, and spatial simulation modelling output for the Hwy40 for each disturbance issue. To represent and help communicate to the team the natural range of patterns of disturbance and residual, we used a stochastic landscape disturbance simulation model (LANDMINE). LANDMINE was calibrated to the landscape based on the natural disturbance history. A series of stochastic runs was produced by LANDMINE under a range of disturbance regime assumptions, and the output provided to the planning team. This provided the necessary range of “natural” design possibilities as the decision-making starting point for attributes such as event size and configuration, patch size distribution and shape, and the size, shape, location and total amount of undisturbed residuals.

Planning Decision #1: How Much Disturbance?
The first planning decision relates to the total area to be disturbed in the study area. However, since the Hwy40 project is an operational plan, the area disturbed is dictated by the respective strategic plans of each partner. Thus, the Hwy40 planning team has no control or influence over how much area will be disturbed.

On the other hand, it is well within the bounds of the project mandate to evaluate the area disturbed from a natural range perspective. Most of the 8 questions listed above are still valid. Depending on the area, the disturbed area necessary to meet the collective strategic wood volume objectives of the partners requires 3,500-6,000 ha of harvesting in the next 10 years, plus whatever areas may be burnt via fire prescriptions. In other words, 3,500-6,000 ha of disturbance in the study area over the first 10 years is the current range of variation, established by higher-level plans.

How does this area align with the natural range of variation? There are two ways of answering this question. First, we generated an historical burn probability table for the Hwy40 study area. For example, over the next 10 years, there is a 50% chance that at least 4,500 of the 70,000 ha would burn (in bold blue in Table 1) under the historic fire regime scenario. This number falls comfortably within the proposed decadal disturbance level of 3,500-6,000 ha, suggesting that CRV is not inconsistent with NRV in this case.
The other way of considering proposed disturbance levels is within the context of the existing landscape condition. For example, we know the forests in this area burn on average every 80-110 years (Andison 2000), which translates into an average burnt area of about 7,000 ha every 10 years. Note that the difference between this estimate, and the previous one is the “at least” clause for the probabilities in Table 1.

But of course burning is not a constant over time, and we can have several decades of no fire activity followed by one with very high levels of burning. Allowing for these natural levels of variation over many centuries would create old forest levels something like those shown in green in Figures 4 and 5. The current levels of old forest in the study area (shown by the blue arrows) suggest that old forest levels today are on the high to very high end of the natural range. Within the next 10 years, they will become extremely high.

This by no means translates into a requirement for disturbance – FMF research suggests that many large contiguous older patches of forest existed naturally. We also know that we have fewer of these large old contiguous patches of forest on foothills landscapes today than occurred naturally (Andison 2003). Furthermore, the biological value of these older areas is well recognized.

However, whatever the reason, and regardless of how many other such areas exist in the foothills, the fact remains that the study area has to some degree beaten the odds until now with respect to wildfire activity. It is well recognized that large areas of older conifer forest pose an increased risk from natural disturbance agents. In particular, both wildfire

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and mountain pine beetle currently pose significant threats to not only the study area itself, but the forests, timber, and habitat well beyond its borders.

So here is what we have learned:

1. **What is the natural range of variation (NRV)?** On average, burnt about 7,000 ha burnt every 10 years in the study area, although it varied dramatically. Over extended periods of time the level of older forest that occurred naturally varied between zero and over 50% of the study area.

2. **What is the current range of variation (CRV)?** The level of disturbance dictated by higher-level plans requires 3,500 – 6,000 ha in the study area for the first decade. This is slightly lower than the “average” historic level, but well within the natural range. The high existing, and projected future very high levels of older forest are becoming a concern from a natural disturbance risk perspective.

3. **(Why) Is NRV different than CRV?** The only NRV concern is the high existing levels of old forest, that are a result of both fire control efforts, the avoidance of this area by forest management companies over the last 20 years due to woodland caribou concerns, and also probably some degree of “luck of the draw” in terms of wildfire threat. However, CRV was determined by higher-level plans, and the Hwy40 planning team has neither the mandate nor the authority to change it.

4. **What management objectives would converge with moving towards NRV in this case?** Reducing the level of older forest in the study area may reduce wildfire threat, reduce MPB threat, and allow greater access to mature timber and natural gas resources, both of which translate into social and economic benefits.

5. **What management objectives would conflict with moving towards NRV in this case?** A reduction in the level of old forest in the study area may reduce the local habitat quality for woodland caribou - although to be fair, this prediction does not specifically include the type of disturbance design that the Hwy40 project is proposing. However, in the end, there is undeniably wildlife habitat risk involved in reducing old forest levels any more than proposed.

6. **(How) can we move towards NRV from CRV?** It is not within the power of the Hwy40 planning team, and it is not the mandate of this project, to deal with this particular question.

7. **Are there policy or practise implications?** On a practical level, this analysis suggests that feedback from an operational planning process to the strategic level of planning might make forest management planning more robust. Strategically, it is a simple matter to choose decadal disturbance levels either higher or lower than those we were given in response to a perceived risk of one type or another. For example, the local MPB risk today is far greater than it was two years ago when we did our original analysis. We already know from the BC experience that this natural disturbance vector has the potential to significantly impact virtually all local and regional values – of all types. So,
what value, if any, is this type of operational planning process to that level of decision-making?

8. **What are the new questions / issues?** Are all disturbances equal in their ability to influence risk of various types, and impact values? Although often hotly debated, there was no consensus on the planning team, and no precedent in the literature, in terms of whether, or to what degree the impacts of a natural based disturbance plan might differ from those of other cultural disturbance activities in terms of influencing the values at stake.

**Planning Decision #2: How Big Are Disturbance Events?**
The second question in the sequence for the Hwy40 planning team was the size of the disturbance events. To address this, we first needed to know how much event area to look for. In this case we adopted the FMF definition of a disturbance event (sensu Andison 2006).

We know from question #1 (see above) that we are looking for 3,500 – 6,000 ha of disturbed area. We also know from Andison (2006) that an event includes an average of about 8% of its area in island remnants, and another 31% in matrix remnants. In other words, about 39% of the area of the average foothills wildfire event is at least partially unburnt.

So, with a target disturbance level of 3,500 – 6,000 ha, assuming a 39% residual level for the sake of argument, we need about 4,865 – 8,340 ha of event area, calculated as follows:

\[
3,500 \text{ ha disturbed} + (39\% \text{ of 3,500 ha}) \text{ residual} = 4,865 \text{ ha event}
\]
\[
6,000 \text{ ha disturbed} + (39\% \text{ of 6,000 ha}) \text{ residual} = 8,340 \text{ ha event}
\]

In other words, the Hwy40 planning team needed to identify 4,900 – 8,300 ha of disturbance event area (within which there will be only 3,500 – 6,000 ha disturbed). So how would Mother Nature distribute do this?

**Figure 6. Historic Disturbance Event Size Distribution for the Upper Foothills and Subalpine Landscapes (from Andison 2006)**

The natural range of wildfire event sizes on the landscapes relevant to the Hwy40 area suggests that most of the disturbed area is accounted for by large wildfires. In fact, wildfires larger than 600 ha cover 90% of the foothills landscape (Figure 6). In contrast, over the last 50 years, the largest disturbance in the Hwy40 area was only 106 ha.
The sharp contrast between historical disturbance event sizes and the existing cultural event sizes strongly suggests that distributing the required area of disturbance in the Hwy40 area into one or two large events would be ideal from a natural pattern perspective.

Given this as the foundation, the Hwy40 planning team then considered the impact of having one or two large disturbance events from the perspective of other values. Ecologically, we know that clustering disturbance activities into a small area allows for larger areas of intact interior forest elsewhere, which benefits woodland caribou and other old forest interior species. Fewer events translate into fewer roads, which is more economical, and benefits both caribou and grizzly bear. A single large event also has the potential to provide a substantial barrier to both wildfire and mountain pine beetle. One possible drawback of a single large event is that it may not be appealing from a social perspective, although it does provide an opportunity for discussion and education.

Based on this analysis, the planning team agreed to look for opportunities for creating one (ideally) or two (our second choice) disturbance events in the Hwy40 area covering a total area of 4,900 - 8,300 ha.

So here is a summary of what we have learned:

1. **What is the natural range of variation (NRV)?** Historically, large to very large disturbance events dominate the landscape area.

2. **What is the current range of variation (CRV)?** Virtually all existing cultural disturbance events in the study area are small to very small.

3. **(Why) Is NRV different than CRV?** The cultural disturbance patterns there now are a legacy of the previous land management paradigm, combined with the cumulative impacts of two fundamentally different systems of land management (energy and forestry). What little cultural disturbance activity in the study area is accounted for by well sites, gravel pits, and a few harvest blocks that were devised during a time when it was thought that small, well-spaced harvest blocks reduced the impact of harvesting across the landscape.

4. **What management objectives would converge with moving towards NRV in this case?** Increasing the size of disturbance events would potentially meet the objectives of many of the identified values in the study area, including minimizing access, reducing cost, mitigating fire threat, reducing MPB threat, and minimizing the larger impacts on habitat for species that require interior old forest (because it results in vast areas of undisturbed forest for most of the study area).

5. **What management objectives would conflict with moving towards NRV in this case?** The most obvious value that may conflict with the adoption of very large disturbance events is social acceptance. There is also a risk that a large disturbance event would have the potential to negatively affect the migratory habits of the local woodland caribou herd. Finally, if the concept of a single disturbance event in the Hwy40 area were ever to be imposed at a higher level of policy, there would potentially be a cost in terms of revenue from the energy sector.
6. **(How) Can we move towards NRV from CRV?**  The Hwy40 planning team unanimously accepted the concept of developing one or two harvesting disturbance events of the appropriate size for the study area, and there were no significant regulatory barriers. However, it became clear that the planning team had little to no power to influence the size or location of disturbance activities of the energy sector over the next 10 years within the study area.

7. **Are there policy or practise implications?**  The regulatory requirements for operational harvesting designs in Alberta are flexible enough to allow for the design of large harvest events. However, this is potentially the largest cultural disturbance event in Alberta, and there may be public perception issues to consider. The removal of a large amount of timber from a small area over a short period of time may pose practical challenges for the forest management companies. The ability of the energy sector to fit within a medium-term disturbance plan in terms of size and location of disturbances is currently not consistent with an NRV approach, and is well beyond the mandate of the Hwy40 planning team.

8. **What are the new questions / issues?**  Are there locations for the event(s) that facilitate the potential negative impacts of large disturbances? (How) Does the energy sector fit into a strategy of clustered disturbance activities?

**Planning Decision #3: Where Do We Put the Disturbance Event(s)?**

After identifying how much area to disturb over the next decade and how large the disturbance events should be, the Hwy40 planning team next tackled the question of location. Consistent with our experimental planning process, the first question we asked was “What would Mother Nature do?” In other words, are there places within the study area that are significantly more likely to have a 4,900 – 8,300 ha fire event? In short, no.

However, we do know that natural wildfire events are very simply shaped – basic outlines that anyone could draw. So we started drawing. Using the available spatial data and the perceived requirements of the identified local values, planning team members tabled an exhaustive list of potential disturbance event locations. This “disturbance design” exercise was value-free based largely on the expert opinion of both core and extended planning team members. This exercise yielded eight different disturbance scenarios, some of which were entirely based on the perceived needs of a single planning value.

**Figure 7. Three Options for the Location of Disturbance Event(s) Generated by the Planning Team for the Hwy40 North Demonstration Area.**
These eight scenarios were then filtered through a coarse set of logical criteria such as feasibility, overlap, obvious and significant negative impacts on other values, and adherence to higher-level plan objectives. This process quickly reduced the list to the three disturbance event scenarios (Figure 7). Keep in mind that the events shown below illustrate only an outline of the disturbed area – recall that only an average of 60% of the area within a natural wildfire event is completely burnt.

The next step was to evaluate each event scenario in terms of other objectives. We did this by trying to identify and take advantage of a series of key “planning indicators” based on the best available science representing each of the most critical local values. The team developed and/or acquired, but ultimately agreed to adopt seven planning indicators; 1) Fire threat mitigation, 2) Wood fibre quality, 3) Woodland caribou habitat, 4) Grizzly bear habitat, 5) Integration of industrial activity, 6) Access, and 7) Opportunity for viewing and learning. In some cases, we had hard numbers to work with (Grizzly bear RSF models, woodland caribou habitat), and for other indicators we relied on expert opinion of the team members (fire threat mitigation, wood fibre quality). The members of the planning team then subjectively scored each scenario based on these seven criteria.

The scores suggested that disturbance scenarios A and C in Figure 7 both had merit. But rather than choosing one or the other, the team decided to combine the two scenarios in an effort to capture the best parts of each. The resulting disturbance scenario from this process is shown in Figure 8.

Soon after the team meeting at which we agreed to develop the scenario shown in Figure 8 as the rough outline of our 10-year disturbance plan, the planning team received an alternative disturbance scenario from an individual external to the Hwy40 process and planning team (Figure 9). The nature of the specific concern raised with respect to the disturbance scenario in Figure 8 was the potential risk of creating a barrier to woodland caribou movement from summer to winter habitat. Although the team agreed to develop a series of east-west travel corridors through the disturbance event shown in Figure 8 to facilitate wildlife movement, the source of the
alternative scenario felt that a more significant “corridor” of undisturbed forest was necessary for caribou movement.

The planning team responded to this suggestion in two ways. There were those concerned that any externally imposed scenario compromised the integrity of the originally agreed upon Hwy40 planning process. A representative from the agency responsible for the alternative scenario sits on the planning team. There was also the issue of this particular scenario including areas beyond the study area – which represented another breach of the original terms. Those supporting the alternative scenario were more comfortable with a conservative and singular approach to woodland caribou management in light of how little we still understand about how and why they migrate.

Because the external disturbance scenario suggestion came from a regulatory agency, this situation created somewhat of a deadlock on the planning team that required the attention of the project team, and ultimately senior people within ASRD to resolve. The strategic direction given to us was to develop and implement the ANC and HWP part of the disturbance event, collar and monitor local caribou to see if / how they respond to it, and then revisit the location of the FFP planning scenario at a later date.

Here is what we learned at this stage of planning:

1. **What is the natural range of variation (NRV)?** Historically, there is virtually no difference in the probability of a disturbance event(s) occurring in one part of the study area versus another.

2. **What is the current range of variation (CRV)?** All things being equal we would prefer to follow logical “woodsheds” from a timber management perspective, and high potential areas in terms of energy sector potential. The current natural gas “play” in the Hwy40 area represents the most likely location of concentrated energy sector activities over the next decade. The Hwy40 planning process is unable to impact the future disturbance locations of the energy sector.

3. **(Why) Is NRV different than CRV?** CRV has been entirely driven by the available timber and natural gas resources to this point. Concentrating activities in one area is consistent with NRV planning. If cultural disturbance activities occur beyond our plans, it will be for one or both of two reasons: the energy sector, or managing the MPB threat. We have no control over either possibility.

4. **What management objectives would converge with moving towards NRV in this case?** The chosen location is very close to optimal for fire threat and MPB mitigation, and it results in few, if any, new road access corridors over the short term since most of the proposed disturbance is already well represented by various energy sector agencies. This option would leave the vast majority of the study area intact - all of which is high to very high woodland caribou habitat. Finally, the position of the proposed disturbance scenario maximizes the opportunity of the public to experience, and comment on the effort, and to benefit from new knowledge on the biological response of woodland caribou since the outcome will be a previously untested disturbance design.
5. **What management objectives would conflict with moving towards NRV in this case?** The location of the disturbance partially overlaps with known caribou habitat.

6. **(How) Can we move towards NRV from CRV?** The location decision did not require natural pattern input. It was made entirely based on other values.

7. **Are there policy or practise implications?** The location decision did not require natural pattern input.

8. **What are the new questions / issues?** The most obvious issue this planning step raised was the integrity of the Hwy40 planning process itself. No matter how well intentioned it may have been, the imposition of a planning scenario from someone who at no time was part of the planning team, for the benefit of a single identified value, represents a fundamental failure of the use of natural patterns as a foundation for planning. If we could not make it happen in a demonstration project, it raises the question of whether or not it could ever happen elsewhere.

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**Planning Decision #4: Planning Event Details**

At this point the Hwy40 planning team has agreed on the size, shape, orientation and general location of the area in which disturbance activities will take place over the next 10 years in the Hwy40 study area. The next step is to translate this generalized disturbance scenario into a more precise natural pattern spatial entity known as the “disturbance event”. This translation is a function of five considerations:

1. No disturbance planning within the Hwy40 part of the Willmore Wilderness Area.
2. 10-year harvest levels are pre-determined for all forest management companies involved.
3. Harvesting and transporting trees is more efficient it is when done in “woodsheds”.
4. Non-merchantable and inaccessible areas will all be left as harvest residuals - although some of these areas may be burnt through prescriptions.
5. Some merchantable forest areas within the event will be left as harvest residuals – although some of these areas may be burnt through prescriptions.

Recall that we allowed for a total of 39% residual area when calculating the total area of the disturbance - representing the historical average for wildfires. Furthermore, the companies agreed to leave about 20% of the merchantable forest area in residuals. Using these numbers as guides, we identified merchantable and logically efficient woodsheds in and near the original disturbance scenario to meet the allowable cut requirements of each higher-level plan.

Although we will be doing some prescribed burning in some of the residual areas, the “merchantable woodsheds” image below is the equivalent of the “disturbed patches” of wildfires. And using the disturbance event-defining rules developed and used by the FMF Natural Disturbance Program (Andison 2006), the event outline for the Hwy40 disturbance plan generated from those disturbed patches is shown on the right in Figure 10.
The final disturbance event that the Hwy40 planning team agreed to develop is 8,129 ha, of which 2,416 ha is potentially non-merchantable residual, and 1,143 ha is potentially merchantable residual. The total undisturbed area of 3,559, or 44%, seemingly exceeds our original residual target of 39%. However, keep in mind that 1) about 6% of the area already exists as long-term disturbances such as roads and well sites, and 2) prescribed burning will disturb some of these residual areas.

Here is what we learned at this stage of planning:

1. **What is the natural range of variation (NRV)?** On average, natural wildfires in this part of the world have an average of 39% of their area in some form of residual, although the variability is tremendous. Wildfires also moderately select against forested areas (in favour of non-forested areas) in terms of residual locations. A very rough rule-of-thumb is that about 36% of forested areas in an event wind up as residuals, and about 60% of non-forested areas (depending on the ratios of each). Of the treed portions of an event, older forest has just as much chance of becoming a residual as younger forest. And finally, although hardwood stands are less likely to burn than softwood areas, the entire study area is almost pure softwood, so this is not an issue with respect to residual patterns.

2. **What is the current range of variation (CRV)?** Total residual levels in past harvesting events are in the neighbourhood of 5-20% on average, although a two pass harvesting system technically leaves at least 50% “residual” with each pass. Mature (or merchantable) residual levels tend to be close to zero historically. Also traditional harvest designs are such that all non-merchantable and non-forested areas have a 100% chance of being a residual.

3. **(Why) Is NRV different than CRV?** The main reasons why they are so different is a) the requirement of forest harvesting to disturb only areas of mature to over mature timber, b) the historic perspective that leaving merchantable timber behind was a failure to fully utilize the resource, and c) leaving behind “residuals” were not considered a high priority until very recently. It is also important to keep in mind that our ability to control residual design typically extends only to forest management, and not beyond to energy sector development.
4. **What management objectives would converge with moving towards NRV in this case?** A more representative amount and mixture of undisturbed residuals would have higher biological value for woodland caribou and beyond. For example, mature residuals ensure that there would be lichen, and a higher amount of residuals would provide more opportunities for hiding cover and travel corridors.

5. **What management objectives would conflict with moving towards NRV in this case?** A more representative mixture of undisturbed material potentially leaves spatial stepping-stones for the spread of both wildfire and MBP. Any merchantable timber left behind as forgone wood (i.e., not to be taken in a subsequent pass) is an economic loss.

6. **(How) Can we move towards NRV from CRV?** The decision to use 39% as the overall residual target, including 20% residual for harvesting, was agreed upon by the planning team. The use of prescribed fire to disturb non-forested and non-merchantable areas is also one of the fundamental components of the Hwy40 project.

7. **Are there policy or practise implications?** The issue of whether, or to what degree merchantable timber may be left behind as forgone wood links directly to wood supply policies of FMA’s. There is also a shared responsibility issue. The FMA’s are responsible for managing the productive part of the landbase only. It falls upon the provincial government to “manage” non-forested and unproductive areas. Yet our task is to develop a single plan that envelops both. Furthermore, the risks involved in prescribed burning are often unacceptable to forest management companies. Finally, there is the issue of the degree to which planned residuals will remain undisturbed in light of increasing levels of energy sector activity.

8. **What are the new questions / issues?** The “survivorship” of residuals, the actual biological impacts of the innovative residual design on caribou and other species, the level of collaboration commitment from local energy companies, and the acceptance of the risks of prescribed fire as a legitimate land disturbance tool area all valid issues yet to be resolved.

As of this date, the Hwy40 planning team has progressed this far. The next, and final, major planning question yet to be fully addressed is the exact amount, size, locations, types, and spatial orientation of the various disturbance elements and residuals.

**Obtain Planning Approvals**
ANC has already received preliminary harvest plan approval for their portion of the plan from ASRD, and HWP will be submitting theirs directly for final approval this winter. FFP is still two years away from harvesting in the area, and is now in fact consumed by operational plans that deal with the MPB threat.

Forest Protection Branch of ASRD within the next several months will identify locations and objectives for prescribed fire opportunities within the disturbance event, and develop and submit their own plans for approval.
Both harvesting and prescribed fire activities are likely to begin early in 2007.

**Establish an Adaptive Monitoring / Research Program**

Recall that one of the hypotheses of using natural patterns as the foundation for planning is that it creates viable solutions for most, if not all, other values. Thus, it was always the intention of the Hwy40 project to monitor the biological, social, and economic impacts of the Hwy40 disturbance plan. Throughout the planning process, the need for such an approach was only reinforced. The sheer number of new questions and issues raised by the process of planning to this point is a testament to the success of the process, but also the need for wise monitoring.

The most obvious target of such a program is woodland caribou. In 2005, under the auspices of the Hwy40 project, we successfully acquired financial support from OPEN FRIP, ANC, and HWP towards a local woodland caribou monitoring program. The Hwy40 project represents an entirely unique opportunity to evaluate the response of caribou to the first “natural-based” plan in the province. The potential for gaining significant new knowledge with respect to caribou movement and resource selection is tremendous.

Last fall, we purchased 12 radio collars and developed, submitted, and received approval for a capture permit to Fish and Wildlife Branch of ASRD as per provincial regulations. At the time, the F&W representative on the Hwy40 planning team agreed to be the lead on a spring capture of a maximum of six Hwy40 animals. Unfortunately, the necessary weather conditions for the safe capture of caribou did not occur until very late in the winter, and only then for a few days. Three attempts were made to locate the Hwy40 animals for potential collaring over that time, none of which were successful.

At the same time, significant effort was being expended to identify and secure additional components of a biological monitoring program. It was agreed that both the FMF Grizzly bear Program, the FMF Fish and Watershed Program, and the FMF Social Science Program could all use the Hwy40 plan as key components of their respective research initiatives. The potential in each case is currently being explored and developed. The Canadian Wildlife Service expressed interest in testing the impact of the Hwy40 design on local avian populations, and the University of Saskatchewan is interested in evaluating the impacts of prescribed burning on the physical and chemical attributes of soils in non-forested areas.

During the summer of 2006, the Hwy40 project team secured the services of a dedicated wildlife biologist to coordinate all monitoring and research efforts in the Hwy40 study area. To this point, we are hopeful that a fall caribou capture will be successful, and that some, if not all of the proposed collaborations will be initiated.

**Communicate**

From the outset, we realized that this was a complex project. It introduced a strategy that not consistent with tradition, included four land management partners and ten planning partners, imposed an imprecise planning process on a planning team that were clearly not all entirely comfortable with idea of operational planning as a group, and challenged individual beliefs in what it is we are managing and how, all on a study area that is politically charged and value-laden. The closing of the Grande Cache mill, and the
transition of the management responsibility from Weyerhaeuser to Foothills Forest Products over a period of more than a year, further increased the complexity of the project. And finally, this all happened over the span of a provincial election, which meant "black out" dates were in effect for public participation from ASRD representatives.

In anticipation of the significant communications effort required, the Hwy40 Project is the only individual project within the FMF to have its own communications plan. In fact, the communications effort began over three years ago – prior to the formalization of the project proposal itself. Presentations on the concept of the Hwy40 project were given to all of the key partners to solicit feedback. Support for the conceptual outline of the Hwy40 project by high-level decision-makers by each of the partner organizations was significant and unanimous.

The communications focus more recently has expanded to translate the concept into a practical reality for managers, planners, and field operations personnel. The solution to this was a multi-faceted approach; 1) talk about the project to professionals and the public at every opportunity, 2) create a stand-alone website with all critical information, 3) provide detailed project reports such as this which provide not only the details of the Hwy40 process, but also a critique of lessons learned, and 4) initiate a series of one-page project updates, distributed widely across the province. To date, more than 50 Hwy40 presentations have been given over the past three years to town councils, provincial and federal politicians, professionals both within and outside of Alberta, and the public. We have also done more than 10 field tours with ENGO’s, the public, politicians, senior bureaucrats, and forest industry customers.

This report is the second submitted to FRIAA. The first document in March of 2004 was a preliminary report, and all of its material has been included in this final report. When the Hwy40 planning process ends (sometime midway through 2007), a third and final project report will be completed which will include most of this material, plus information on the last planning steps, and any new insights. This last report will also include a suggested planning process to use for the next attempt at a natural disturbance based operational plan, based on our experiences.

Since July of 2004, 14 one-page project updates have been distributed electronically to about 200 people within and beyond Alberta (far exceeding the original objective of a single Hwy40 “Quicknote” in the original OPEN FUNDS proposal). They cover topics that range from the conceptual foundations of the project to the organization of the teams, to the progress of the planning team. It is anticipated that at least another four such updates will be written and distributed over the next year, and possibly beyond. These updates are modelled in both form and function after the FMFND Program “Quicknotes” series, which are the single most popular communications tool of the ND Program. Informal feedback from these updates has been consistently positive, and comes from a wide range of sources, depending on the topic. See Appendix A for all 14 of these updates.

The Hwy40 website was created in the spring of 2005 and has since then had over 90,000 "hits". The website contains all of the information available in the Hwy40 updates, as well as PDF downloads of each issue. It also provides some images, maps, and contacts.

As the various disturbance plans begin to become a reality, the communications effort will shift to how the team members deal with issues of a practical, operational nature. Along
those lines, we are hoping to create an interpretive trail, perhaps linked to a public “turnout” along Hwy40. Communications will also begin to focus on monitoring efforts.

Finally, this report marks the beginning of the focus on communicating the Hwy40 process to a wide range of audiences. Consistent with our objectives, the success of this project hinges not as much on whether, or to what degree we were able to follow a natural pattern planning foundation, as it is on clearly and openly talking about the successes and failures of our ability to do so. The whole point of this project is to help begin to develop an outline of how a natural pattern foundation might work – the template that we have been lacking until now. Part and parcel with that is a thorough and objective review of the process that we went through to complete our planning.

LESSONS LEARNED
With most some of the plans still on the verge of being submitted for approval, it is possible to summarize some of the highlights of the learnings from the planning process thus far.

1. **The concept of using natural patterns as a foundation for planning worked.**
   Once we agreed to and got moving with the planning process, it almost always resulted in a decision that was unanimous, and at least had the potential to meet the requirements of all of the identified ecological, economic, and social values. In other words, the idea is basically sound.

   Furthermore, although there in hindsight, there is plenty of room for improvement in the details, the overarching structure that we created for the project was basically sound. The fundamentals of the partnership of the land management agencies, the scope and size of the project, the composition and structure of the various teams, even the location itself, all proved to be wise choices that served us well.

2. **There is tremendous interest in the project, and support of the concept.**
   Even before the planning team began their work, we went to great lengths to outline, and solicit feedback on, the Hwy40 concept to high-level decision-makers within each of the partner organizations. This included a large number of presentations, meetings, and personal tours – many of which were initiated by the respective audiences. In the end, there was unanimous, strong support from all partners for the concept.

   The planning process itself was both longer, and more complex than anyone first imagined, and involved several unanticipated events that caused extra work and delays. Not once throughout this process did a single partner, at any level of the hierarchy, suggest that the original project mandate or study area be changed, let alone abandoned. Attendance at planning team meetings over a period of almost three years was very high, and discussions and debates were thorough and meaningful, suggesting that everyone was fully engaged.

   The feedback from the website and the updates suggests that interest in the project idea is both broad and deep. Many people following the progress of the project live outside of Alberta.
This all suggests that the project has “hit the mark”, which further suggests that our original objective of emphasizing communications and talking about the process is critical, and must continue for some time to come.

3. **The plan features many innovations.** In terms of process, this is the first attempt at an holistic “disturbance plan” in Canada, the sheer size and complexity of the planning team is unique, and it is the first known forest land plan to use detailed natural pattern knowledge and expertise as the foundation for all planning decisions. In terms of the outcome, the sheer size of the proposed disturbance plan, the amount and spatial arrangement of residuals, the timing of the disturbance activities, the integration of prescribed burning with harvesting, and the direct linkage to a monitoring program all represent precedents in Alberta. Regardless of that which we were unable to achieve for one reason or another, the list of accomplishments is impressive.

4. **There was a disconnect between support of the concept, and the acceptance of the reality of the manifestation of the strategy.** Despite widespread agreement with the project concept, there was not always agreement with how the concepts translated into reality. On more than one occasion various partners balked at the either the direction of, or decisions made by, the planning team in fact, there was both rebellion (with respect to the process), and outright rejection (of some of the planning outcomes) over the course of the last two years.

In perfect hindsight, some of these issues could have been avoided with a more robust planning process and a more articulate terms-of-reference document (TOR) for the planning team. For example, many of the significant planning issues we encountered during the process were related in some form or another to the relative importance of one voice and/or value over all others. The fact that such instances occurred at all, given the conceptually broad-based nature of the project, suggests that we were not as diligent as we should have been with respect to defining the rules and specific responsibilities for the planning team. Obviously, more rigorous frameworks were required. The challenge in this case is that the Hwy40 team was the proverbial “guinea pig” of NRV foundation planning, and we they were not given the benefit of previous experience.

However, it is unlikely that even a tightened TOR, and/or a more detailed planning process, would have been entirely successful since some of the issues were institutional in nature, and associated with specific desires, and/or perceived exclusive territory of various agencies of the provincial government. In the end, there was no single consistent message about forest land management being delivered by the government. Thus there were institutional issues that affected the project that extend far beyond the ability or authority of the project to deal with. Notwithstanding the many innovations that we achieved within the Hwy40 project, as long as these institutional barriers exist, a more fully articulated “disturbance plan” will not be possible in Alberta.

5. **The “open” process of planning required was a challenge.** Despite the development of overarching terms of reference for planning, and a careful articulation of the content of the planning team by the project team, the open-ended nature of the Hwy40 process as a first attempt at natural pattern planning was daunting to some on the planning team. Several members were clearly well beyond their “comfort zones”. The anxiety was entirely understandable, and is an unfortunate by product of the novelty of the project.
Over the next several weeks, a suggested planning outline and structure for natural pattern foundation operational planning will be written based on the combined experiences of the Hwy40 planning team. We want to ensure that we build on this new knowledge and make the next effort that much smoother.

6. **Two tenure systems = many disturbance plans.** The planning model we most often referred to during the Hwy40 process was that for Annual Operating Plans (AOPs) under the auspices of the forest management system of tenure. Unfortunately, the system of tenure for the energy sector in Alberta is entirely separate, and very different from that of forest management. At an operational level of planning, this difference was essentially a “hard wired” attribute for the Hwy40 project. We did our best to work with the two systems, but in the end, the potential to create a truly singular disturbance plan that includes all cultural disturbance activities for a 10-year period is very small under the existing policies.
Literature Cited


Appendix A

Highway 40 North Demonstration Area Project Updates
A Highway 40 North Demonstration Project Update
Putting Natural Disturbance Research to Work

Issue #1   July 2004                  By: David W. Andison

What Is It All About?

The Foothills Model Forest (FMF) Natural Disturbance (ND) program has been studying natural disturbance patterns for eight years. Thanks to a comprehensive long-term plan, more is known about the historical disturbance patterns of west-central Alberta than almost anywhere else in North America. This research focus is demonstrated in the 26 FMF ND Quicknotes to date (for a complete list, visit www@fmf.ab.ca).

However, the FMF is about much more than sound research. The reason that our many funding partners have supported the ND program over the years is the FMF commitment to help integrate this new knowledge into forest management and planning. Further to that promise, the ND program initiated the Highway 40 North Demonstration project this year. The idea of the project is to demonstrate how an operational plan might take advantage of intimate knowledge of historical disturbance patterns towards developing a more sustainable plan. Despite selected incidents of integrating individual natural patterns into forest management as another decision-making filter (see below on the left), no one has yet attempted to use an inclusive list of natural patterns as a true foundation for decision-making (shown on the right).

The Current System

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In other words, the first question a planner would ask is; “what would Mother Nature do?”. The difference may seem subtle, but creates some significant opportunities. For example, it provides a focused foundation for planning decisions that uses the same language as forest management planning. A desired future forest condition can be developed, understood, communicated, and monitored in terms of sizes, shapes, frequencies, and severity of disturbance activity. Furthermore, consistent with the ideals of ecosystem-based management, the proposed planning foundation is both science-based and ecological in nature. There may often be legitimate economic, social, or ecological reasons why a particular natural pattern cannot be emulated (the elimination of all roads for example). However, for the first time we can say that all planning decisions begin with, and are evaluated against, an understanding of the ecosystem.

The good news is that early attempts to integrate natural patterns into management have revealed many positive synergies. For example, more “natural” disturbance patterns create fewer roads and leave more residuals, both of which have several other economic, social, and ecological benefits. However, despite this potential, no one knows whether or not adopting such a foundation will deliver a more sustainable forest management plan in the end. We do not even know whether adopting more natural patterns will be economically feasible, socially-acceptable, or conflict with existing policies and practices. This project is designed to address those questions, and is thus potentially relevant to anyone involved in natural resource management activities.

For more information on the Hwy40 North Demonstration project, please contact: Dr. David Andison, Bandaloop Landscape Ecosystem Services, Tel.: (604) 939 – 0830, Email: andison@bandaloop.ca, or visit www.fmf.ab.ca

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The Hwy40 Project Concept
Finding the best site for any type of demonstration project is essential. The 70,000 ha landscape bisected by Highway 40 that we chose for this demonstration of the effectiveness of using natural pattern knowledge as the foundation for operational-scale disturbance planning was ideal for several reasons:

1) **Landscape Integrity**. The existing forest composition, structure and natural disturbance patterns suggest that this landscape is an ecologically relevant entity. However, planning responsibility spans parts of a number of different jurisdictions, including the Weldwood, Alberta Newsprint Co., and Weyerhaeuser FMAs, the Willmore Wilderness Area, and several natural gas leases. Planning disturbance activities across administrative borders will have to become commonplace if we are to sustain ecological integrity.

2) **The Plan is “Real”**. The three forest management companies were all required to develop operational plans for this area this year according to their strategic commitments to the province. So this project is not creating any new work. In fact, an important question we are interested in answering is whether this new process requires less effort overall.

3) **A Challenging Area**. There are a large number of seemingly conflicting local values. The large amount of older foothills forest translates into prime Woodland Caribou habitat, high recreational value, and high timber values. However, it also represents a high wildfire threat, which puts all of these values at risk. The area is also rich in natural gas deposits. This complexity is the best possible situation for applying a natural pattern foundation to planning to see if it can provide sustainable planning solutions to meet all of the desired objectives.

4) **Knowledge Base**. We know more about the natural disturbance history of this area than almost anywhere else in Canada. We plan on drawing heavily on that knowledge during the planning process.

5) **Visibility, Access**. Consistent with the concept of a “demonstration”, we want to maximize the feedback and learning that takes place from this experience. Having a provincial highway running through the area is a tremendous advantage. We will be developing extensive educational opportunities for the public, other professionals, and academics.

6) **Creative and Adaptive Learning**. The unique location and combination of issues means looking beyond the traditional toolbox for some planning solutions. Prescribed burning, disturbing non-merchantable areas, clustering disturbance activities both in space and over time, and detailed long-term access plans will be among the key tools. Also, existing FMF wildlife research and census data gives us the opportunity to predict wildlife responses, learn something new through continued monitoring, and apply what we learn to the next series of operational plans here and elsewhere.
A Highway 40 North Demonstration Project Update
Putting Natural Disturbance Research to Work

Issue #3   September 2004                  By: David W. Andison

Who is Involved & How?

Highway 40 North is a Foothills Model Forest (FMF) project, but it is also an operational plan. Considerable thought went into designing teams and assigning responsibilities such that the project objectives for the model forest could be met with minimal interference to the standard planning requirements for the partners.

Structurally, the project is part of the Natural Disturbance (ND) Program - one of eleven program areas at the Foothills Model Forest. The project is part of the ND work plan for 2003/04 (available from the FMF), approved by both the FMF Board of Directors and the ND Activity Team.

To initiate the project, the ND Activity Team formed a Project Team, who established the location and size of the study area, the partner base, and the overall project guidelines. The Hwy40 Project Team includes most of the ND Activity Team, the Alberta Sustainable Resource Development (SRD) Area Manager for Foothills (responsible for approving the operational plans), and representatives from Weyerhaeuser, Alberta Community Development (for the Willmore Wilderness Area), and more recently, Alberta Energy. Thus, representatives on the Project Team also serve as direct links back to their respective organizations in terms of planning. This group was also responsible for creating the composition and “rules” for the core Planning Team.

The Planning Team’s responsibilities are to develop and deliver an operational-scale disturbance plan for the area. The core Planning Team thus includes planners from each of the four land management agencies involved, a representative from the Hinton Area, a specialist in prescribed fire planning, and a specialist in natural patterns. This group quickly expanded to include individuals that could provide input on key local issues such as caribou and energy sector development. The planning team has also begun the process of contacting other experts and agencies through the “referral” process as input to the final plan.

There has already been some movement of people and agencies within the project, the most notable being the transition of forest management responsibilities in the northwest corner of the study area known as “E8”. As a result, Weyerhaeuser (Grande Cache) no longer sits on either the Project or Planning teams, and we are in the process of engaging the new forest managers, Foothills Forest Products. Furthermore, as the process matures, we fully anticipate that the list of referrals will continue to grow.

So, in fact, many people are already involved in the project at many different levels. But perhaps the most valuable lesson we have learned so far is that the effort to design a rigorous structure of roles and responsibilities for a highly complex project pays off.

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What Will This Project Produce?

The advantage of combining an operational plan with a Model Forest project is that the output serves multiple, complementary, objectives. The Hwy40 project is designed to deliver three main products:

1) **An Operational Plan.**

The project will develop a single, detailed, integrated disturbance plan for the next 10 years, and a more general projection of likely disturbance activities over the next 40 years. In other words, we will do our best to identify the timing, location, and extent of all forms of cultural disturbance for the entire 70,000 ha. However, the jurisdictional complexity in this case means that such a plan can only be realized through the delineation and submission of several individual plans, including harvesting, prescribed fire, and even access. In terms of harvesting plans, recall that the harvesting activities on the three forest management areas are "hard wired" into existing long-term plans (see Hwy40 update #2). Thus, each of these three companies needs to submit a formal operational plan to the province for approval through the normal channels to meet their legal obligations. Prescribed fire plans are submitted separately through Alberta SRD, as are access plans.

2) **An FMF Project Report.**

Developing and testing innovative, science-based techniques is meaningless without an open, critical review of the process to maximize exposure of the lessons learned. This is particularly true in this case given the variety of opinions on using natural patterns within sustainable forest management planning. The following represent some of the likely section headings in the final report:

- **Diary of events:** What happened, what decisions were made, when, and why?
- **The reality of emulating natural patterns:** A list of natural disturbance patterns that were considered in the plan, their natural range of variation (NRV), and to what degree and where the final plan was able to land within NRV. The report will also identify and fully describe the reasons for any departure from NRV.
- **Testing a new planning foundation:** One of the fundamental premises of the project is that natural patterns provide viable solutions for many other ecological, economic, and social objectives. The degree to which this hypothesis is proven true will be reviewed in detail.
- **Indicators for planning:** Plan options will be developed and chosen using various objective indicators or predictors. The choice of indicators and their links to post-disturbance monitoring will be described.
- **Cross-jurisdictional planning:** This project represents a unique collaboration between several government agencies and companies. This level of collaboration will be a key tool for developing sustainable plans for many areas across Alberta. The success of this partnership will be examined.
- **Disturbance planning:** Another potentially valuable SFM tool of the future will be moving beyond harvest planning to the more holistic disturbance planning, which considers the impacts and risks of all possible sources of cultural and natural disturbance. Integrating fire, harvesting, and energy sector development activities will be critical to the success of the plan, and well worth evaluating.
- **The process:** A full explanation of the planning process we adopted, and how and where it differed from normal procedures. The report will also discuss milestones, timing, and any surprises.

3) **Education and Communication Products.**

Consistent with the idea of a demonstration project, communication and education products will be key long-term output of the project. We have developed a separate communications plan for the project that includes various educational tools such as signage and self-guided trails off Highway 40, tours, photos and video, presentations, pamphlets, and posters. Our target audience includes everyone from practitioners to the general public.

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The ultimate goal of the Hwy40 Demo Project is to:

“Demonstrate the effectiveness of using natural disturbance pattern knowledge as the foundation for effective operational-scale forest management planning”.

In other words, is Mother Nature’s strategy for disturbing forested landscapes a useful template for operational planning? Note that this is fundamentally different than the more common question of whether natural patterns are useful guides for operational-scale forest management planning. For example, disturbance shape is obviously a useful coarse-filter guide for operational planning, realized by developing a standardized algorithm for measurement, followed by establishing averages, ranges, or maximums as guides. Hence, shape becomes another “filter” through which operational planning options are passed. The Hwy40 project goes beyond filters to process. We want to know if natural patterns (including shape) provide some guidance for how to configure the planning process as a more defendable activity of sustainable forest management. For example:

A: What is the natural range of variation (NRV) of disturbance shapes?
   (Moderately convoluted)

B: What is the current range of variation (CRV) of disturbance shapes?
   (Simple rectangles, ovals, and lines)

C: Why is NRV different than CRV?
   (Necessity of roads & seismic lines, and simple shapes are easy to plan, install, and regulate,...)

D: What management objectives would converge with moving towards shape-NRV in this case?
   (Access management, reduce caribou risk of wolf predation, reduce habitat fragmentation,...)

E: What management objectives would conflict with moving towards shape-NRV in this case?
   (Cost-efficient access to natural resources)

F: (How) can we move towards NRV from CRV?
   (Joint access planning, low-impact seismic, road de-commissioning, vary block shapes,...)

G: Are there policy or practise implications?
   (Planning and regulatory convention, potentially higher planning costs, reduced access,.. )

H: What are the new questions / issues?
   (Cost increases, regulatory challenges, ecological impacts of not being within NRV,...)

The idea is that these same questions would apply to virtually all natural patterns – disturbance sizes, event sizes, island area, island locations, and so on. I have over-simplified the example here for the sake of brevity, but it is not difficult to imagine how this new model may 1) progressively build a holistic, powerful, biological defence for planning decisions, 2) distinguish between real and perceived impediments to change, 3) clearly identify conflicts between existing objectives, and 4) generate new and important questions. Note also that the model does not require that CRV must be within NRV – only that NRV directs CRV (as in point F above).

There is little doubt that many natural disturbance patterns are valuable tools for operational planners as coarse (biological) filters. The question we pose in the Hwy40 project is whether adopting a natural pattern foundation is valuable as a template for operational planning. At first glance, it would seem to at least be more transparent, and more consistent with ecosystem-based management ideals. In any case, it is a question that our partners feel is well worth asking.

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A disturbance plan is the design of location, extent, and timing of all planned disturbance agents for a given landscape. Although planning systems for disturbance activities on forested landscapes for forestry, oil and gas, or road-building activities have existed for many years, seldom are these efforts combined into a single plan. The Hwy40 project intends to fully explore this vision.

Usually the first, and too often the last, argument over the consideration of natural pattern emulation strategies is the capacity of harvesting activities alone to emulate Mother Nature. Harvesting activities are by definition restricted to merchantable stands, which tend to be mature or over-mature, and in upland positions (i.e., not in riparian zones or wet areas). In the Alberta foothills, this accounts for about 20-40% of the landscape area at any given time (and this estimate is much lower for the remainder of Alberta). Historical, natural disturbance activities affect 100% of the landscape area (see figure below).

Yet, our ability to control disturbance activities on forested landscapes extends well beyond harvesting. The location and total length of roads can be designed over time and space, and is even now being controlled. Other mechanical disturbance activities such as thinning are valuable tools as well. We may also choose not to aggressively attack wildfires, although in the Hwy40 area this is not a viable option given the other values at risk (including human life and property, caribou habitat, and timber value).

The greatest challenge we face with the development of a disturbance plan for the Hwy40 area is the integration of the disturbance activities of the oil and gas sector. Since long-term rights to sub-surface resources are not assigned to specific locations, (as they are with timber rights) exploration and development activities for the oil and gas sector in Alberta occur on significantly shorter time-scales than that of timber management activities. Furthermore, there are over 100 companies that may be involved. Within the Hwy40 study area, we have identified seven companies with existing sub-surface leases, and invited each to participate in the disturbance planning process along with the Alberta Department of Energy.

Perhaps the most powerful tool at our disposal for the Hwy40 Demo project is prescribed burning. The potential for PB’s to disturb non-merchantable, and particularly non-forested, areas of the Hwy40 landscape is unique. However, we face a significant challenge since fire is not a deterministic tool, and some risk to other values exists, under even the most conservative burn plan scenarios.

In the end, it will be the degree to which we can combine the various disturbance activities by the various partners that will largely determine the success of the Hwy40 project to achieve the objectives.

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Playing With Fire

Wildfires are enigmatic because they are beneficial to some values and threatening to others. The problem for operational planning is that the size, location, and severity of wildfires are not predictable. The best we can do is define probabilities of burning over time. Accordingly, we generated an historical burn probability table for the Hwy40 study area. For example, over the next 20 years, there is a 50% chance that at least 13,800 of the 70,000 ha would burn (in bold blue in the upper table) under the historic fire regime scenario.

Estimating the current risk of burning is more useful, but also more difficult because human-caused ignitions increase fire risk, while fire control efforts decrease fire risk. Substantial evidence suggests that wildfire risk on current forest landscapes is lower overall than it was historically, but by how much is debatable. For the Hwy40 area we adopted a conservative estimate of reducing the area by a factor of 2 ½. Thus, over the next 20 years, there is a 50% chance of at least 5,500 ha burning under the existing scenario (bold blue in the lower table).

Quantifying the risk of natural disturbance has facilitated the development of the Hwy40 plan in several ways. First it is an excellent way to communicate the relevance of reducing the risk of wildfire as a planning objective, and it provides some realistic expectations. For example, eliminating the chance of wildfire on forested landscapes is clearly not possible. However, it would be a considerable accomplishment if we could shift the probabilities just a single level in the adjacent table by strategically locating and sizing disturbance events, and applying other fuel-modification tactics. Thus, a 50% chance of at least 5,500 ha burning in the next 20 years becomes only a 25% chance after the plan has been executed.

Quantifying fire risk is also a key ingredient for responsible operational planning. Regardless of whether we consider fire as a positive or negative influence, one must acknowledge that future wildfire impacts, somewhere, and to some degree, are a fact – forest fires will happen. Knowing this, how will they be managed such that they are consistent with strategic objectives? No one denies this is a landscape with high values, thus it may warrant unique ways of dealing with wildfire events after they occur.

Facing the reality of the risk of wildfires also inevitably leads one to adopting a broader view of sustainability. Despite our best efforts to presume and act otherwise, landscapes in this part of the world cannot be maintained in a static condition providing stable sources of habitat for individual species, wood fibre, or recreational opportunities. For instance, it may be possible to mitigate, but ultimately not prevent, the abandonment of the Hwy40 area by woodland caribou since wildfire is an unavoidable phenomenon, and caribou prefer older forest. All one can do in an operational plan is to try to maintain the high-priority values long enough - within the limits of higher-level plans - for other areas to shoulder similar responsibilities.

In the end, the quantification of wildfire risk within the Hwy40 plan can only help us make more informed and thus more responsible operational planning decisions.

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Monitoring Comes Naturally

Over the last several years, a large number of federal, provincial and local level programs have been initiated for monitoring the ecological, economic, and social impacts of management activities on forested landscapes. Much of this effort has gone into designing effective and meaningful indicators based on a widely accepted set of criteria. By design, most such monitoring programs function as “stand alone” systems, independent of planning and management activities.

Adopting a natural pattern planning foundation suggests another possibility exists.

One of the advantages of using a natural pattern foundation for operational planning as we have for the Hwy40 project is that it creates a logical, testable, flow of questions that could form the very backbone of a dynamic and integrated monitoring system. For example, consider the following sequence of questions along with the ‘monitoring system’ interpretations:

A: What is the natural pattern in question?  
(Monitoring Term = Coarse filter indicator)

B: What is the natural range of variation (NRV) of that pattern?  
(Monitoring Term = Historical pattern of a coarse filter indicator)

C: What is the desired future forest condition of that pattern?  
(Monitoring Term = Coarse filter indicator target)

D: What are the species / functions most likely affected by that particular natural pattern?  
(Monitoring Term = Fire filter indicator)

E: What is the most likely response(s) of those species / functions?  
(Monitoring Term = Fine filter indicator target)

This simple model has tremendous significance for monitoring. Consider that this logical questioning not only helps to identify meaningful indicators, but also distinguishes different types of indicators. Coarse filter indicators describe the disturbance patterns, and are thus useful for compliance monitoring. Fine filter indicators measure the impacts of the disturbance activities, and are thus useful for effectiveness monitoring.

Recognizing these two types of indicators allows us to make predictions about the likely impacts of management activities on key ecological, economic, or social concerns. In the case of the Hwy40 project, preliminary predictive models already exist for several key species, including caribou and grizzly bear. This is an ideal opportunity to test / validate these models and strengthen them through directed learning. For many other species, predictive models are not possible because we lack sufficient knowledge. In such instances, this same line of questioning identifies knowledge gaps and generates strong hypotheses to guide local research activities. Either way, we gain new understanding by intimately linking management with research.

In the end, even this simple, generic model reveals the potential power of using natural patterns as guides not just for planning, but for monitoring as well. But at this point it is all theory. The Hwy40 project will test the theory by integrating indicators and model predictions into the disturbance plan, and seek new partnerships to pursue the necessary measurements and research. Since this also potentially affects the development and application of local-level monitoring programs, the FMF Local Level Indicators (LLI) program is already actively involved.

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Good Data = a Good Start for Planning

The Hwy40 Planning Team (see Hwy40 update #3) has met a total of 13 times since the fall of 2003. One of the first priorities as a team was to gather and merge available data and information across multiple administrative boundaries. This included:

- **Forest inventory.** The forest inventory is the primary tool of the forest management companies (ANC, FFP, and WF) to determine how much wood of a certain quality is available for harvest. These data came in various formats. The inventory information from ANC and West Fraser was of the most recent and comprehensive version of Alberta Forest Inventory (AVI). The inventory available for Foothills Forest Products was the next to last version of AVI. The inventory available for the Willmore is much older and less precise.

- **Existing oil and gas leases.** These data included the year of application, the area, and the company. This allowed us to identify the key players, and the current “plays” locally.

- **Ultimate potential map.** The Alberta Department of Energy has created a coarse scale map showing the relative potential for energy resource development for Alberta.

- **Existing infrastructure.** Although the planning area is relatively “natural”, there are pockets of industrial disturbance activity such as natural gas development, roads, seismic lines, and forest harvesting.

- **Caribou radio collar data.** Multiple locations of five GPS collared individuals between Feb. 2001 and March 2003 were made available on the A La Peche caribou herd (with a total population of 175-200). These animals represent a small part (about 30 individuals) of the herd that continue to migrate annually from the Willmore (in the summer) east across highway 40 for the winter.

- **Wildfire threat.** A combination of weather data, fire behaviour fuel type information, historical fire ignition patterns, landscape values at risk and suppression capacity were used to generate a relative index of wildfire threat potential. A significant percentage of the planning area falling within the high to extreme threat levels.

- **Mountain pine beetle (MPB) threat.** The Alberta government has been identifying and managing the spread of MPB eastward for several years using a combination of decision support tools and vigilant monitoring. The Hwy40 area represents one of several potential pathways of MPB invasion into Alberta due to the convergence of topographic, and stand density, age, and compositional factors.

- **Natural disturbance pattern history.** Through ongoing research from the Natural Disturbance Program at the FtMF, we know more about the details of how often, how large, where, and how severely forest fires burnt in this area than anywhere else in Canada.

- **Existing strategic plan objectives.** As an operational-level planning exercise, it was necessary to compile the objectives from the strategic plans of the various agencies involved.

These data and information were overlaid within the FtMF Geographic Information System and used by the planning team. These data were the primary mechanism by which the team initially identified potential areas for integrated disturbance activity for the first 10-year period.

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Question #1: How Much Disturbance is “Natural”?  

Recall that the first question for each planning decision in the Hwy40 project is “What would Mother Nature do?” (Update #5). The first logical decision in that sequence relates to the total area to be disturbed in the study area. However, since the Hwy40 project is an operational plan, the area disturbed is dictated by the respective strategic plans of each partner. Thus, the Hwy40 planning team has no control or influence over how much area will be disturbed (see Update #4). On the other hand, it is well within the bounds of the project mandate to evaluate the area disturbed from a natural range perspective. Depending on stand characteristics, the disturbed area necessary to meet the collective strategic wood volume objectives of the partners requires 3,500-6,000 ha of harvesting in the next 10 years, plus whatever areas may be burnt via prescriptions. In other words, the Hwy40 planning team is obligated by existing strategic plans to allocate 3,500-6,000 ha of disturbance in the study area over the first 10 years. How does this area align with the natural range of variation? There are two ways of answering this question. First, recall from Hwy40 Update #7 that the probability of different levels of natural wildfire activity is known. For example, we know that there is almost a 50:50 chance of at least 4,500 ha burning historically in the next 10 years, which is about the average area of our target range. In other words, the proposed disturbance level is almost exactly the average of the historic level. So far, so good.

The other way of considering proposed disturbance levels is within the context of the existing landscape. As the adjacent figures demonstrate, the study area currently has high to very high levels of old forest relative to natural conditions. This by no means translates into a requirement for disturbance – FMF research suggests that many large contiguous older patches of forest existed naturally. Furthermore, the biological value of these older areas is well recognized. However, it is also well recognized that large areas of older conifer forest pose an increased risk from natural disturbance agents. In particular, both wildfire and mountain pine beetle currently pose significant threats to not only the study area itself, but forests and habitat well beyond its borders.

In summary, although the first question of “how much?” was pre-determined for the Hwy40 planning team by higher-level plans, the comparison of this range to the historical range provided the planning team with useful information. Furthermore, differentiating between the historical probability of disturbance, and the existing landscape conditions was valuable.

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Question #2: How Large are the Hwy40 Disturbance Events?

The second question in the sequence for the Hwy40 planning team was the size of the disturbance events. But first, we needed to know how much event area to look for. We know from question #1 (see update #10) that we are looking for 3,500 – 6,000 ha of disturbed area. We also know from FMF Natural Disturbance research that the average foothills wildfire event (see FMF ND Quicknote #22) includes about 8% of its area in island remnants, and another 31% in matrix remnants. In other words, about 39% of the area of the average foothills wildfire event is unburnt. So, if we have a target of 3,500 – 6,000 ha of disturbance, and we assume a 39% residual level, we need 4,865 – 8,340 ha of event area, calculated as follows:

\[
3,500 \text{ ha disturbed} + (39\% \text{ of } 3,500 \text{ ha}) \text{ undisturbed} = 4,865 \text{ ha event}
\]
\[
6,000 \text{ ha disturbed} + (39\% \text{ of } 6,000 \text{ ha}) \text{ undisturbed} = 8,340 \text{ ha event}
\]

In other words, the Hwy40 planning team needed to identify 4,900 – 8,300 ha of disturbance event area (within which there will be only 3,500 – 6,000 ha disturbed).

So how would Mother Nature distribute this over space? The natural range of wildfire event sizes on the landscapes relevant to the Hwy40 area suggests that most of the disturbed area is accounted for by large wildfires. In fact, wildfires larger than 600 ha cover 90% of the foothills landscape. In contrast, over the last 50 years, the largest disturbance in the Hwy40 area was only 106 ha. This strongly suggests that distributing the required area of disturbance in the Hwy40 area into one or two larger events would be ideal from a natural pattern perspective.

The Hwy40 planning team then considered the appropriateness of having one or two large disturbance events from other perspectives. Ecologically, we know that clustering disturbance activities into a small area allows for larger areas of intact interior forest elsewhere (FMF ND Quicknote #26), which benefits woodland caribou and other old forest interior species. Fewer events translate into fewer roads, which is more economical, and benefits both caribou and grizzly bear. A single large event also has the potential to reduce wildfire threat, and provide a barrier to mountain pine beetle. One possible drawback of a single large event is that it may not be appealing from a social perspective, although it does provide an opportunity for discussion and education.

In this case, by first asking, “what would Mother Nature do?”, we identified a natural event size pattern that also provides solutions for several other local values. Based on this analysis, the planning team agreed to look for opportunities for creating one or two disturbance events in the Hwy40 area covering a total area of 4,900 - 8,300 ha.

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Question #3: Where Does the Disturbance Go?

After identifying how much area to disturb over the next decade and how large the disturbance events should be, the Hwy40 planning team next tackled the question of location. Consistent with our experimental planning process, the first question we asked was “What would Mother Nature do?”. In other words, are there places within the study area that are significantly more likely to have a 4,900 – 8,300 ha fire event? The short answer is “no”.

However, we do know that natural wildfire events are very simply shaped – basic outlines that anyone could draw. So we started drawing. Using the available spatial data (see update #9), and the perceived requirements of the identified local values, planning team members tabled an exhaustive list of potential disturbance event locations. This “disturbance design” exercise was value-free based largely on the expert opinion of the (core and extended) planning team members (see update #3). This exercise yielded eight different disturbance scenarios.

These eight scenarios were then filtered through a very coarse set of logical criteria such as feasibility, overlap, obvious and significant negative impacts on other values, and adherence to higher-level plan objectives. This process reduced the list to the three disturbance event scenarios shown below in red (see update #2 for a detailed map of the study area). Keep in mind that the events shown below illustrate only an outline of the disturbed area – only 50-80% of the area within a natural wildfire event is actually disturbed (see update #11).

The next step was to evaluate each event scenario in terms of other objectives. We did this through a series of objective “planning indicators” based on the best available science representing each of the most critical local values. The team developed and/or acquired seven planning indicators; 1) Fire threat mitigation, 2) Wood fibre quality, 3) Woodland caribou, 4) Grizzly bear, 5) Integration of industrial activity, 6) Access, and 7) Opportunity for viewing and learning.

As one can imagine, the planning process described above was neither brief nor straightforward. On the other hand, it was highly informative. We learned a lot about the viability of the proposed new planning process during this phase. And in the end, the team agreed on a single (blended) general location for disturbance activities (see adjacent figure). This scenario came close to optimizing the values for all seven planning indicators.

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Question #4: How Do We Turn a Scenario into an Event?

At this point the Hwy40 planning team has agreed on the size, shape, orientation and general location of the area in which disturbance activities will take place over the next 10 years in the Hwy40 study area (shown below on the left). The next step is to translate this generalized disturbance scenario into a more precise natural pattern spatial entity known as the “disturbance event”.

This translation is a function of five considerations:
1) No disturbance planning within the Hwy40 part of the Willmore Wilderness Area.
2) 10-year harvest levels are pre-determined for all forest management companies involved.
3) Harvesting and transporting trees is more efficient it is when done in “woodsheds”.
4) Non-merchantable and inaccessible areas will all be left as harvest residuals - although some of these areas may be burnt through prescriptions.
5) Some merchantable forest areas within the event will be left as harvest residuals – although some of these areas may be burnt through prescriptions.

Recall from Update #11 that we allowed for a total of 39% residual area when calculating the total area of the disturbance - representing the historical average for wildfires. Furthermore, the companies agreed to leave about 20% of the merchantable forest area in residuals. Using these numbers as guides, we identified merchantable and logically efficient woodsheds in and near the original disturbance scenario to meet the allowable cut requirements of each higher-level plan.

Although we will be doing some prescribed burning in some of the residual areas, the “merchantable woodsheds” image below is the equivalent of the “disturbed patches” of wildfires. And using the disturbance event-defining rules developed and used by the FMF Natural Disturbance Program (see the FMF ND Interpretation Note #1), the event outline for the Hwy40 disturbance plan generated from those disturbed patches is shown in the image below on the right.

The final disturbance event that the Hwy40 planning team agreed to develop is 8,129 ha, of which 2,416 ha is potentially non-merchantable residual, and 1,143 ha is potentially merchantable residual. The total undisturbed area of 3,559, or 44%, seemingly exceeds our original residual target of 39%. However, keep in mind that 1) about 6% of the area already exists as long-term disturbances such as roads and well sites, and 2) prescribed burning will disturb some of these residual areas.

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Question #5: How Will We Know If / How Caribou Are Affected?

The disturbance planning process described by Updates #10-13 is the responsibility of the Hwy40 Planning Team (Update #3). However, recall that developing a disturbance plan is only one of the objectives of the Hwy40 Project. Another is the intelligent, adaptive monitoring of the response of the local ecosystem to the planned disturbance activities (Update #8).

To monitor a managed landscape in a scientifically defendable manner requires significant planning. Accordingly, as the Hwy40 Planning Team began its work more than two years ago on the disturbance plan, the Hwy40 Project Team started developing partnerships and support for an adaptive monitoring program.

There was unanimous agreement that one of the priorities for a Hwy40 monitoring program is woodland caribou. Given the status and profile of woodland caribou, and the exceptional opportunity available in the Hwy40 study area, we presumed that attracting collaborators would not be difficult. Unfortunately, two years ago, no provincially coordinated caribou program was yet in place with which to collaborate research programs. As a result, the primary wildlife management and research organizations in Alberta at the time were reluctant to collaborate with us. However, if we waited much longer, this unique scientific opportunity would be lost. Faced with this dilemma, we chose to forge ahead independently, with the following provisions:

1) Solicit input and advice from as many experts as possible,
2) Ensure that all relevant agencies are kept abreast of our work,
3) Continue to encourage research partnerships, and
4) Design research activities to maximize the potential for our data and results to fit within any future provincially coordinated program.

We have three things working together in our favour in the study area; 1) historical GPS location data exist for several Hwy40 animals, 2) most of the Hwy40 study area is high potential caribou habitat, and 3) disturbance activities over the next decade will be spatially concentrated. In other words, we (will) know how caribou have used the study area, and the Hwy40 disturbance design will leave a significant amount of high quality caribou habitat intact. In fact, the caribou model provided to the Hwy40 planning team predicted that the Hwy40 disturbance plan (Update #12) would not result in a population decline. Just being the first to test the veracity of this model justifies the investment in caribou monitoring. However, our questions go far beyond that to asking how, why, and when caribou move across the landscape. We felt this addresses some of the most important questions with respect to the long-term sustainability of caribou today; what are the mechanisms by which herds choose to move / migrate to other parts of the landscape? This is the only place in Alberta, and perhaps in all of Canada, that has the capacity to address this question at low risk to local populations.

Our monitoring concepts were highly successful in attracting support. We secured funds in 2005 to purchase and deploy 12 GPS radio collars. In the spring of 2006 we collared one animal, and in December of 2006 we collared seven animals, thanks to the efforts of our new Hwy40 monitoring coordinator, Matthew Wheatley. Matt hopes to deploy the remaining five collars this winter.

Over the long term, we hope to be able to monitor caribou for several years after disturbance activities have ceased. Efforts also continue to build research collaborations / support.

For more information on the Hwy40 North Demonstration project, please contact: Dr. David Andison, Bandaloop Landscape Ecosystem Services, Tel.: (604) 225 – 5669, Email: andison@bandaloop.ca, or visit www.fmf.ab.ca.