

FOOTHILLS MODEL FOREST ANNUAL WORK PLAN 2004-2005

Volume II Detailed Work Plan



Volume II Foothills Model Forest Detailed Annual Work Plan

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Foothills Model Forest 2004-2005 Annual Work Plan Geographic Information Systems

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2. Introduction

The role of the GIS team is foremost one of support for the on-going projects undertaken by the FMF. The sub-heading in this section entitled *Other Relevant Information* will discuss how the GIS resources are allocated by project and will identify potential shortcomings.

This workplan will discuss project support and the two remaining major initiative that were identified at the start of Phase III.

The first initiative identified at the beginning of Phase III was the Fish and Watershed database management system. This project is near completion as the database has been developed and data have been loaded from historical systems. What remains is testing and implementation in Jasper and possibly in the Edson Fish and Wildlife office.

The second initiative is a report or set of pilot projects to assess the application of Geodatabase technology for natural resource management. During the past year the GIS team held a first meeting with GIS practitioners from FMA holders and the provincial government to address this subject. It is hoped this group will be the start of an ongoing GIS Workgroup led by the Foothills Model Forest to drive further research into improving the application of GIS in supporting Sustainable Forest Management. The first area of study identified by this group is Geodatabase design and database model templates, specifically to manage forest inventory (Alberta Vegetation Inventory) and the tracking of changes over time. The Foothills Model Forest will organize workshops and facilitated sessions to increase the knowledge level of the group and develop a data model template for storing vegetation data (Alberta Vegetation Inventory).

3. Background Information

Towards the end of Phase II the Fish and Watershed project identified that their current methods of data management did not meet the needs of the growing program. It was decided through their Activity team that an effort would be made to develop a database that would meet the needs of both the FMF and Jasper National Park. One of the key issues with the existing methods is the integration of the geospatial (e.g. lakes, streams etc.) and non-spatial (species, habitat etc.) data. The new database will utilize new technology that will store both these types of information in a single database. The new database will build on a spatial data model template developed by Environmental Systems Research Institute (ESRI) and the University of Texas. The result will be a single

integrated database with better linear analysis capabilities, better integrity checks, and a better ability to model complex linear events.

The maturation of GIS and its convergence with the Information Technology (IT) sector have produced significant advances in how geospatial information is stored and managed. Technology to house geospatial information in industry standard Relational Database Management Systems (RDBMSs) such as Oracle and SQL Server have been developed and are being implemented in applications for energy and municipal infrastructure management. This advance will see organizations storing all their information in a single database, blurring the line between spatial and non-spatial data and realizing the benefits of true GIS integration. This technology though has seen little application in the natural resource sector and presents a huge challenge to GIS professionals as the immediate benefits, skills required and the costs involved remain unclear.

Using these new tools ESRI has initiated the development of data model templates for several individual industry sections. These data model initiatives have resulted in database models to store core geometric features. Models developed to date include hydrology (ArcHydro), land parcels, transportation, pipelines and biodiversity. Users of these models can realize the following advantages:

More rapid data model design and implementation of new technology
Simplification of the integration of data across differing scales and jurisdictions.
That is the exchange of data is much more efficient and cost effective for tasks such as landscape level analysis and monitoring.

It is important to note that the development of data model templates is not to replace existing standards for data collection (i.e. the database fields/columns). Rather it is an effort that focuses strictly on the geometric features and the relationships that exist between them. The data to be collected for those features can remain in place for each business requirement.

We propose that the GIS Workgroup, led by the Foothills Model Forest organize a workshop in the coming year to first provide a better understanding of these technologies. It will then coordinate sessions facilitated by an ESRI data modeling specialist in the development of a data model template to store forest inventory GIS data. This methodology is in line with that recommended by ESRI in the collaborative development of data model templates.

4. Objectives

1.) Knowledge Creation

The FMF will hold a startup workshop for the GIS Workgroup with the intent to present the experiences to date of using Geodatabase technology and specifically the ArcHydro data model.

The FMF will organize at least one and perhaps more sessions facilitated by an ESRI data modeling specialist. The intent of these sessions is to collaboratively develop a model to store forest inventory and its changes over time.

1a. Beneficiaries and Impacts

The workshop will provide the GIS Workgroup with a better understanding of how geodatabases are designed and developed. The FMF will also present their experience with using the ArcHydro data model template to manage fish and watershed datasets. This knowledge will prepare the group to more effectively be involved in the process of developing a data model template to store forest inventory GIS layers. The outcome of the facilitated sessions will at the very least provide members with a starting point in building geodatabases. A data model template will provide a framework for all participants to store forest inventory data and facilitate more efficient and accurate integration of datasets across multiple jurisdictions and scales.

2.) Demonstration

2a. Beneficiaries and Impacts

3.) Knowledge / Technology Transfer

A workshop to train users of the Fish and Watershed database management system will be held if not complete during the 2003-2004 fiscal year.

3a. Beneficiaries and Impacts

This workshop will be a hands-on training session to familiarize users with how to input, report and analyse data in the new system. Effective application of this tool at the FMF, Jasper and possibly the Edson Fish and Wildlife office will enable much improved data management, reporting and analysis for water systems and fish habitat.

4.) Communications and Outreach

4a. Beneficiaries and Impacts

5.) Policy Support

The FMF will work with the GIS Workgroup to build a data model template to store forest inventory GIS layers.

5a. Beneficiaries and Impacts

The development of a common methodology for storage of geometric features that represent forest inventory will greatly reduce the amount of time and effort in integrating data at multiple scales and across jurisdictions. This will greatly enhance the ability to perform landscape and even provincial level analysis that depend on forest inventory data.

5. Abstract of Methodology

The FMF will continue to develop its objectives through the GIS Working Group. The FMF will organize and facilitate a one day workshop with the intent of knowledge creation amongst the group. It will do this by presenting the

knowledge gained by the FMF in working with the ArcHydro data model template.

The FMF will also organize sessions facilitated by an ESRI data modeling specialist with the intent to collaboratively develop a data model template to store forest inventory GIS layers. It is expected that the full development of such a model will take 1-3 years, depending on input from collaborators. Therefore in this first year of this initiative work will focus on business analysis amongst the group and possibly the development of a draft model.

6. Deliverables

Knowledge Creation

One day workshop facilitated by the FMF. This is considered knowledge creation (and not knowledge / technology transfer only) as it will raise knowledge amongst all attendees including the FMF.

Demonstration

Knowledge / Technology Transfer

One day workshop facilitated by the FMF.

Communications and Outreach

Policy Support

7. Timelines

Task	2003									2004		
	A	M	J	J	A	S	O	N	D	J	F	M
Fish and Watershed database development	X	X	X	X								
Working with GIS Workgroup and associated workshops	X	X				X	X	X	X	X	X	X
Support and administration	X	X	X	X	X	X	X	X	X	X	X	X

8. Site Information

9. References

10. Scientific Review

11. Improvements to Management in Forest Ecosystems

12. Amount of Money Requested From the Foothills Model Forest
\$160,000

Item Description	Project Budget
Total	<u><u>\$160,649.06</u></u>
Salaries and benefits	<u>\$121,099</u>
Software	<u>\$15,950</u>
Hardware	<u>\$9,600</u>
Training and travel	<u>\$9,200</u>
Office and Administration	<u>\$1,700</u>
Utilities	<u>\$900</u>
Insurance	<u>\$700</u>
Contingency	<u>\$1,500</u>

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
The Forestry Corp				\$5000	\$5000	

14. Proposed Payment Schedule

15. Subcontracted Work

Due to the forecasted shortcoming in GIS support allocation it is likely that some work will have to be contracted out or completed by temporary staff.

16. Project Management

Christian Weik

17. Additional Organisations requesting FRIIA Administered Monies

18. Other Relevant Information

18.1 Predicted GIS Time Allocation

The table below describes the forecasted GIS support time requirements by project.

Task	Q1	Q2	Q3	Q4	Total
Grizzly bear	40	60	60	55	215
Criteria and indicators	5	5	5	5	20
Natural disturbance	5	5	5	1	16
Fish and watershed	15	23	15	15	68
Communications	2	2	2	2	8
Jasper National Park	2	2	2	2	8
Traditional study	6	6	6	6	24
Foothills growth and yield	3	2	11	10	26
Carbon Accounting	2	2	2	2	8
Chisolm/Dogrib	0	0	0	0	0
IRM	0	0	0	0	0
Overhead (management)	40	40	40	40	160
Fish and watershed database development	3	2	2	0	7
GIS Working Group	5	3	3	3	14

Total	128	152	153	141	574
Man Days Available	120	120	120	120	480
Deficit**	(8)	(32)	(33)	(21)	(94)

** As there is a projected GIS staff time deficit for the coming year the GIS will complete work on a first come and priority basis. In the event GIS resources are still not available, GIS staff will work with project leaders to outsource where suitable.

18.2 Spatial Data Requirements

The GIS data requirements provided in the table below represent spatial and attribute data that will have to be acquired from project partners, FMF partners or from outside agencies in order to complete GIS related project tasks. These data are identified to ensure that the partners are aware of data they are expected to provide as part of signing the Annual Work Plan. In the event data are to be provided by outside agencies the project leader and, if necessary FMF GIS staff, will work together to ensure acquiring those data is achievable.

All spatial data provided to the FMF are considered confidential and will be strictly managed by the FMF GIS staff. In the event data must be provided to off-site project partners the FMF will require the signing of a data sharing agreement between the FMF and the off-site partner to ensure data security.

Data set (theme)	Source (Data required for one or more projects listed at right)	Project(s)
Alberta Vegetation Inventory (AVI)	Weldwood of Canada Weyerhaeuser Canada Sundance Forest Industries Sunpine Forest Products Alberta Government Vanderwell Contractors	Grizzly bear Fish and watershed Chisholm/Dogrib
Digital orthophotos	Weldwood of Canada Weyerhaeuser Canada Sundance Forest Industries	Grizzly bear Fish and watershed
Ecological Land Classification (ELC)	Weldwood of Canada Jasper National Park Alberta Energy**	Grizzly bear Fish and watershed Chisholm/Dogrib
Existing roads	Weldwood of Canada Weyerhaeuser Canada Sundance Forest Industries Sunpine Forest Products Alberta Government Vanderwell Contractors	Grizzly bear Fish and watershed Chisholm/Dogrib
Linear disturbance utilisation (road, seismic, other use)	Weldwood of Canada** Weyerhaeuser Canada** Sundance Forest Industries**	Grizzly bear
Compartment boundaries	Weldwood of Canada	Grizzly bear Fish and watershed
Existing pipelines, powerlines, seismic, wellsites	Alberta Energy** Alberta Government	Grizzly bear
Planned areas of exploration	Alberta Energy**	Grizzly bear
Existing and planned, active and inactive minesite boundaries	Alberta Energy**	Grizzly bear
Existing and planned minesite haul roads	Alberta Energy**	Grizzly bear

Hydrography	Alberta Government	Grizzly bear Fish and watershed Chisholm/Dogrib
Digital elevation models	Alberta Government Jasper National Park	Grizzly bear Fish and watershed Chisholm/Dogrib
Roads, trails, human use activities	Jasper National Park	Grizzly bear
IRS Satellite imagery	Alberta Government	Grizzly bear
Five year development plan	Weyerhaeuser Canada Sundance Forest Industries	Grizzly bear
Annual operating plan	Weyerhaeuser Canada Sundance Forest Industries	Grizzly bear
Planned roads	Weyerhaeuser Canada Sundance Forest Industries	Grizzly bear
Soils	Alberta Government** Weldwood of Canada**	Fish and watershed
Road-stream crossing inventory for monitoring watersheds	Weldwood of Canada	Fish and watershed
Rosgen stream classification output	Weldwood of Canada	Fish and watershed
Historical forest harvest	Weldwood of Canada	Grizzly bear Fish and watershed
Base features access	Alberta Government	Grizzly bear Fish and watershed Chisholm/Dogrib
Riparian classification	Weldwood of Canada	Fish and watershed
Administrative or jurisdictional boundaries (parks, natural areas, FLUZ, Special Places, etc.)	Alberta Government	Fish and watershed Chisholm/Dogrib
Campsites	Weldwood of Canada Alberta Government	Fish and watershed
Surficial geology**	Alberta Government	Fish and watershed
Permanent sample plot (PSP) (current state not growth)	Weyerhaeuser Canada** Sundance Forest Industries**	Grizzly bear
Land use dispositions	Weldwood of Canada	Fish and Watershed
Silviculture treatments	Weldwood of Canada	Grizzly Bear

** If data are available.

Foothills Model Forest 2004-2005 Annual Work Plan Natural Disturbance Program

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2. Introduction

The Foothills Model Forest and its' partner organisations initiated a program in 1995 to study and describe natural and cultural disturbance across over two million hectares in the Rocky Mountains and Foothills natural regions. The program, and its' inclusive projects, are designed to deliver research, communication, and implementation initiatives, support and demonstrate sustainable practices and policies within and beyond the FMF boundaries, consistent with the objectives of the 2002 Phase III proposal. This is a collaborative program involving industry and government. The work plan outlines projects to be included in the program during 2004/2005.

3. Background Information

A natural disturbance research program for the Foothills Model Forest was first designed in 1996, and has been updated eight times (Andison 1996, 1997, 1998, 1999, 2000, 2001, 2002, and 2003). It was intended to span several years, and includes a detailed list of approximately 40 individual research projects from empirical data collection, to communication, to simulation modeling. Together, the projects represent a package of potential knowledge on how natural disturbance-related processes created the historical patterns observed on the Model Forest. The projects are connected to each other mainly through scalar segregation, and are thus inter-dependent. Recognising that it is not possible to understand observed patterns through a single study, the program differentiates the study of processes into observable spatial and temporal scales, ranging from the stand to the landscape. Individual projects rely on others for either context or detail. It is the package of project results that provides the greatest level of knowledge. Consistent with the NDP workplan, and the requirements of FMF Phase III, there are three "classes" of projects under the auspices of the natural disturbance program:

Class A. The first six projects are all projects in varying stages of completion, from significant analysis, to completing reports. Resources going to these projects can be covered by the bare minimum budget.

Class B. The next two projects are new projects that will be funded by the base budget if all other funding falls through.

Class C. The last two projects are new, or extensions of existing projects, that require additional funds beyond the NDP base budget.

Consistent with the NDP long-term plan, the FMF Communications and Extension plan, and the direction given by the FMF Board of Directors, the natural disturbance program has put more emphasis on, and thought into resources necessary for communication and extension purposes. Unlike previous workplans, C&E efforts are categorized as a discreet project in this workplan, with their own budget and deliverables.

Note that at this time, we do not have all potential sources of funding secured, so the workplan may change accordingly.

4. Objectives

1.) Knowledge Creation

The objective of the Natural Disturbance Program is to describe and understand the range of patterns created by historical disturbance (primarily fire, but also other agents such as insects, disease, flooding, wind, and herbivory). The program also aims to understand and describe the underlying processes responsible for the patterns identified.

1a. Beneficiaries and Impacts

The general application of these results is to assist in the conservation of biological diversity in the Rocky Mountains and Foothills of Alberta through an improved understanding of natural disturbance processes at a range of spatial scales. With such understanding it will be possible to assess planned management activities such as forest harvesting and fire management in relation to natural ranges of variability. This information is necessary to assist managers within and outside of protected areas, as both types of jurisdictions are influenced by past and current management practices that are outside the range of natural variability.

2.) Demonstration

To continue integrating and testing the efficacy of natural pattern management strategies and tactics across a wide variety of scales and situations.

2a. Beneficiaries and Impacts

See project details.

3.) Knowledge / Technology Transfer

To provide the opportunity to apply new knowledge of natural patterns to solving practical, tractable forest management problems.

3a. Beneficiaries and Impacts

See project details

4.) Communications and Outreach

Make research results available in a variety of forms and mechanisms to maximize audience and exposure.

4a. Beneficiaries and Impacts

See project details.

- 5.) Policy Support**
Maximize / take advantage of opportunities to affect local, regional, and provincial guidelines and policies as they affect forest management practices.
- 5a. Beneficiaries and Impacts**
See project details.
- 5. Abstract of Methodology**
See attached project proposals for individual project details.
- 6. Deliverables**
- GIS data overlays and databases, technical reports, journal manuscripts, information pamphlets, presentations, and guides. See individual project work plans for details.
 - Delivery of the entire package of natural disturbance projects. This includes both time and travel costs for tasks that cover all listed projects: Compiling and tracking annual workplans and budgets, co-ordinating field activities and sub-contractors, pursuing other research / co-operative activities, exploring and reporting on research extension possibilities, and attending natural disturbance team, FMF project steering committee, and other meetings as they arise. (not described as an individual project).
 - Communication of results. Includes leading field tours, attending and presenting research results at professional and public meetings and symposia, creating and supporting posters, creation and distribution of six FMF NDP Quicknotes per year, and compiling other educational material using various media. Also includes working with other research groups and practitioners towards integrative experiments and decision-support tool development.
 - Develop broader support base through presentations, meetings, and proposals.
- 7. Site Information**
This work will potentially take place in all forested areas of Alberta.
- 8. References**
Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan. Version 8.0. FMF Technical Report.
Foothills Model Forest Phase III
- 9. Scientific Review**
All projects either/or have had reviews of methods, or the results will be published in peer-reviewed journals.
- 10. Improvements to Management in Forest Ecosystems**
This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and

functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).
 “The unmanaged forest, even without human influence, is subject to a variety of natural processes and disturbances such as succession, nutrient cycling, fire, flood, blowdown, insect attack and disease. These processes vary in duration, frequency of occurrences, size of affected area, and severity. For each type of process, there will be a particular range of variability. The result is a mosaic of natural communities representing the range of natural variability in forest ecosystems. Each of these communities plays an integral role in maintaining the diversity and function of the forest ecosystem. An understanding of “natural variability” is fundamental to the implementation of ecological management. To varying degrees, natural disturbances have been reduced in intensity, scale, and frequency through a variety of means such as fire and insect/disease suppression and abatement programs and flood control measures.”..... “Ecological management proposes that we use human activities to maintain that range of natural variability.” (from Alberta Forest Conservation Strategy, draft, July 8, 1996).

11. Amount of Money Requested From the Foothills Model Forest

- \$144,000 FMF
- \$100,000 Weldwood of Canada Ltd. / FMF
- \$23,000 Alberta SRD
- \$21,000 Jasper National Park

12. Financial Summary

The following outlines only the requested funds from FMF-related sources for projects under the auspices of the ND program. “Additions” funding sources are identified where beyond the base budget. All projects and their respective deliverables with “Funds Pending” are not commitments at this time. Please note that the “Short course” project is collaborative with the FMF Communications and Extension Program.

Project Name	Funding Source / Status					Total Maximum
	FMF (SRD)	FMF (JNP)	FMF (Weld)	ANC	Additions	
Program co-ordination	23,000	17,533				40,000
Meso-scale Landscape Patterns and Processes			10,000			10,000
Fire Effects Research Study		3,467				4,000
Edge Architecture on disturbances				15,000		15,000
Residual Heterogeneity Within Disturbances				15,000		15,000
Managing Disturbance in			5,000			5,000

Riparian Zones Communications and Extension					42,000	42,000
Riparian LWD Dendro Study					*23,000	23,000
					0	
ND Short Course Development					20,000	91,520
						**111,520
Hwy40 Demo Implementation Fund						156,000
Comparing NRV with CRV						23,000
						23,000
TOTAL						
	23,00	21,00	100,00	30,00	270,520	444,520
	0	0	0	0		

**If we are successful with external funding for this project, the “Comparing NRV with CRV” project will be funded from the base budget*

*** This represents the total cost of the project, but it will be cost-shared with FMF C&E program*

13. Proposed Payment Schedule

Details to follow in individual project proposals.

14. Subcontracted Work

Details to follow in individual project proposals.

15. Project Management

The ND program will be overseen by Dr. David Andison of Bandaloo Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest. Individual ND projects may be managed by other personnel as described in the project details.

16. Additional Organisations requesting FRIIA Administered Monies

Weldwood of Canada Ltd.
Alberta Newsprint Co. Ltd.

17. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Meso-Scale Landscape Disturbance Patterns and Processes

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2. Introduction

The Foothills Model Forest Natural Disturbance Program aims to investigate patterns and processes of disturbance across spatial and temporal scales. Although both landscape-level and stand-level scales are widely recognised, there is no reason to believe that these are the only relevant scales of observation. For instance, within landscapes, disturbance patterns vary enough to suspect that behaviour is being influenced by other factors at intermediate scales, such as riparian corridors, non-forested areas, and even soil features (influencing stand composition and structure). Landscape pattern descriptions at the simplest level do not necessarily account for these permanent landscape features. Yet these associations are vital regarding the application of this knowledge on a given landbase. This project looks at patterns at a higher level of resolution than landscape-level analysis demands, but less than more specific, directed stand-level studies require. This is the sixth and final year of a multi-year project.

3. Background Information

The data and analysis for the meso-scale and island remnants projects have already yielded three full research reports, with three more to come. The analysis was far beyond what was originally envisioned. One report will likely be outstanding for the 2004/05 year. As of March 31, 2005, this project will be completed.

4. Objectives

1.) Knowledge Creation

To understand how fire regime characteristics are influenced by biotic and abiotic landscape features at scales below the landscape-level.

1a. Beneficiaries and Impacts

Greater understanding is the first step towards more defensible and consistent decision-making, and moves science forward to new and better questions.

2.) Demonstration

N/a

2a. Beneficiaries and Impacts

N/a

3.) Knowledge / Technology Transfer

N/a

3a. Beneficiaries and Impacts

N/a

4.) Communications and Outreach

Make research results available in a variety of forms and mechanisms to maximize audience and exposure.

4a. Beneficiaries and Impacts

Everyone is targeted in order to “raise the bar” concerning the creation of a common knowledge foundation of natural pattern residual material in foothills and mountain landscapes.

5.) Policy Support

N/a

5a. Beneficiaries and Impacts

N/a

5. Abstract of Methodology

Data layers were compiled at 50m resolution ARC/INFO compatible for selected areas. We compared edge and island locations with various topographic and vegetation information through multivariate and correlation methods.

Comparisons were also made of the spatial associations of older forest remnants and patch sizes with the distribution of non-commercial forested patches. Eight areas in the foothills east, as well as one large area of JNP. Final analysis and reporting are the only remaining tasks.

6. Deliverables

Knowledge Creation

Complete.

Demonstration

N/a

Knowledge / Technology Transfer

N/a

Communications and Outreach

By Dec. 31, 2005; final report completed.

Policy Support

N/a

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
First draft manuscripts	x	x	x									

8. Site Information

This work will take place in the Rocky Mountain and Foothills Natural Regions of Alberta.

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan. FMF Technical Report.

10. Scientific Review

Independent reviews have been obtained for the methods by Dr. W.L. Baker, U. of Wyoming. All manuscripts will be submitted to refereed journals.

11. Improvements to Management in Forest Ecosystems

We have an intuitive sense of “natural patterns” at very large and very small scales. Virtually nothing is known of such patterns and process at intermediate scales. Yet, without such information, application of large and small-scale patterns under the auspices of ecosystem management may not be effective. This project fills a vital gap in our ecological knowledge base and understanding of natural patterns and how they apply to our disturbance management activities.

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).

12. Amount of Money Requested From the Foothills Model Forest

\$10,000 Foothills Model Forest from the base budget.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	10,000					
TOTAL	10,000					

14. Proposed Payment Schedule

\$10,000 - June 1, 2004

15. Subcontracted Work

Bandaloop Landscape-Ecosystem Services will be carrying out the work.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloo Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

None.

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Fire Effects Research Study

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Name: Alan Westhaver, Dave Smith
Address: Parks Canada, Jasper National Park

2. Introduction

This is the seventh year of a multi-year project to monitor the effects of fire on montane landscapes and forest stands in Jasper National park. This project is being conducted as a component of the Foothills Model Forest - Natural Disturbance Program and is being implemented jointly by the Canadian Forest Service and Parks Canada. The principle researchers are Peter Bothwell, Dr. Brian Amiro, Dr. Bill deGroot, Dr. Jen Beverly, and Dr. Vern Peters of CFS and Alan Westhaver and Dave Smith of Jasper National Park. Phase I of the project is focussed on studies in grassland/pine communities where grasslands are being heavily encroached by lodgepole pine and being substantially reduced in area. Prescribed fire is being used to restore historic processes and vegetation structure/composition. This project is monitoring resultant vegetation patterns, vegetation response and mortality, and related wildlife interactions. The project entered Phase II during the 2001/02 fiscal year with an emphasis on Douglas-fir montane communities.

3. Background Information

Phase I

Complex interactions exist among ungulates, predators, humans and vegetation in Jasper National Park, Alberta. Fire and herbivory are key parts of the interactions among these ecosystem components. Significant increases in human use, exclusion of fire, and thriving populations of elk (*Cervus elaphus*) within the montane region are impacting the ecological integrity of this vital area. Prescribed fire is being used to help restore ecosystem structure and natural processes with the goal of maintaining a landscape of open-canopy lodgepole pine (*Pinus contorta*) forest and grassland. As part of this management activity, the impact of prescribed burning, elk herbivory, and elk-fire interactions on the montane vegetation are being measured.

Permanent vegetation plots were established in 1998, some of which involved fenced exclosures to exclude elk herbivory. Plots were placed in unburned control areas and in an 80-hectare area burned in the spring of 1999, representing

both closed-forest canopy and open-forest/grassland sites. The prescribed fire was lit as lines using hand torches, and the fire behavior measured in the plots. Pre- and post-burn vegetation sampling was done, which included measurements of: tree height, condition and dbh; shrub height and crown diameter; and ground vegetation percent cover by species. About 2/3 of the pine trees were killed, and mortality estimates are in the range of model predictions. Almost all of the shrubs were burned, but Canada buffaloberry (*Shepherdia canadensis*) is now regenerating. Regenerating (*Populus tremuloides*) aspen is evident within the exclosures, but these are heavily browsed by elk in non-fenced areas. There is little impact on ground vegetation cover and phytodiversity to date, but this may change as the tree canopy opens up and the solar radiation environment changes. Vegetation recovery is being monitored annually, and it is expected that a few more years will be needed to see the full impact of fire and elk interactions. A more recent higher-intensity fire in 2001 is providing the opportunity to study the impact of fire intensity in a similar community, but it is too early to assess these effects.

A small aspen area was burned in the spring of 2003. Two fenced exclosures and two unfenced plots were established in the aspen burn. Preburn data and postburn data measured immediately after the fire have been collected so far. This fire was ignited using hand torches, and the fire behavior was measured and documented. Understanding the effect of fire on aspen ecosystem dynamics, especially diversity and elk herbivory, is valuable to the overall project because it introduces another forest cover type to compare to the well established treatments in the pine/grassland communities.

Phase II

Phase II of the study was initiated in spring of 2001 within formerly open stands of montane Douglas fir (*Pseudotsuga menziesii*). Under the influence of fire exclusion policies of the 1930s to present, montane Douglas fir stands have been altered to contain tree densities and fuel loads that significantly exceed historical ranges of variability. The study location is a series of south and west facing slopes opposite the Jackladder burns on the opposite side of the Athabasca River. The objective of Phase II is to determine if prescribed fire can be used to successfully restore historic density and structure to forest landscapes and stands that have been deprived of fire for several decades. Initial prescribed burns in this area will attempt to replicate historic stand structure by selectively reducing the density of in-grown (immature) Douglas fir and current regeneration from the understory of these stands.

Once structural integrity of the stands is restored, the historic fire regime of more frequent, stand maintaining, low intensity fires could be re-established. Some relationships between the Douglas fir beetle (*Dendroctonus pseudotsuga*) and fire will also be investigated as part of Phase II - since both forms of natural disturbance are important factors in this ecosystem. It is a question as to how the beetle will respond to fire restoration actions. The area was sampled in 2001 to

provide data on stand density, size classes, surface fuels, height-to-live-crown, and beetle activity. These pre-fire data are being used to determine prescriptions for the planned fire. This fire was originally planned for the spring 2002, however, the weather has not cooperated over the past two years, and we will attempt the burns again in spring 2004. Post-fire sampling will yield data on the effectiveness of the burn, and provide information for adaptive planning in future fires.

4. Objectives

1.) Knowledge Creation

To develop, test and refine fire prescriptions that will allow restoration of natural disturbance (fire) into montane Douglas fir stands of Jasper, Banff, Yoho and Kootenay National Parks.

To determine the results of fire restoration (prescribed fire) activities in meeting explicit ecological objectives for stand structure and composition in montane grasslands and savannah pine stands within the Foothills Model Forest.

1a. Beneficiaries and Impacts

Jasper National Park benefits by meeting a Park Management Plan (2001) commitment to focus on “promoting and co-operating in scientific studies that add to our knowledge of ecological integrity in the park and surrounding landscape”

Alberta Sustainable Resource Development and other agencies that use fire for resource objectives will benefit from results of this study as applied to their local prescribed fire initiatives.

The FMF will benefit by demonstrating the relevance of the model forest concept to protected areas.

Protected areas (mountain national parks, Willmore Wilderness, other non-commercial forest in Alberta and B.C.) will benefit by applying research finding to their jurisdictions.

2.) Demonstration

To provide tangible (operational) demonstrations of applied FMF research that are accessible to other fire practitioners and the general public.

2a. Beneficiaries and Impacts

Parks Canada will benefit through opportunities for other fire practitioners to observe, learn and participate in these experiments, view the results and apply them to their local ecosystems.

Residents and visitors of the FMF will be able to observe and understand tangible applications of FMF research as they view these research prescribed burns in Jasper National Park.

Current and future prescribed burn programs of Alberta Sustainable Resource Development will benefit from the demonstration value and positive public response resulting from these research prescribed burns and documented benefits to local wildlife populations.

3.) Knowledge / Technology Transfer

To develop innovative prescribed burn methods for achieving specific ecological objectives that can be used by FMF partners (and non-partner agencies or industry).

3a. Beneficiaries and Impacts

Prescribed fire practitioners within the FMF (JNP, SRD) and those in other agencies beyond FMF boundaries will benefit from the techniques, burn prescriptions and fire behavior models used and refined during this project.

The forest industry (e.g. Weldwood, other industry) may benefit from the potential for expanded fire use and applications as a result of this research.

4.) Communications and Outreach

This project provides exceptional opportunities for increased public awareness and understanding of natural disturbance process (and the importance of research) in the Foothills Model Forest.

4a. Beneficiaries and Impacts

The FMF will benefit since increased public awareness and understanding translate to increased support for FMF programs and those of its partners. To date, this includes signs along the Yellowhead Highway describing prescribed burns and the purpose of the experiment, with FMF as a major sponsor of the work.

5.) Policy Support

To develop new, more effective approaches for restoring fire to ecosystems in protected areas through carefully monitored operational experimentation.

5a. Beneficiaries and Impacts

Jasper National Park benefits from this project as a major Parks Canada initiative to fulfil its policy requirements (section 3.2 of Guiding Principles and Operational Policies 1994) towards scientifically based decision-making, management based on scientific research, and careful monitoring of ecological interventions.

The ways in which prescribed burns are implemented in protected areas (Wilmore Wilderness, national parks, other areas of Alberta and B.C.) are very likely to change as a result of this project.

5. **Abstract of Methodology**

Phase I

In 2004, the Aspen burn plot will be re-sampled. This includes measurements of trees, shrubs, regeneration, and ground vegetation in permanent sampling plots. Elk pellet counts will be done in the 2001 burn, the 1999 burn and control plots to track changes in ungulate use. Clip plots in all Jackladder plots will also be completed in order to compare biomass accumulation and the effect of herbivory.

Phase II

The prescribed burn is planned in the spring of 2004. If weather is unsuitable, we will try an alternative window in the fall of 2004. Fire behaviour measurements, such as rate-of-spread and flame length will be measured during the fires. Following the fire, transects measured in 2001 will be resampled to determine scorch height and mortality of younger trees. It may take several years to fully determine mortality on large trees. Surface fuels will be resampled to determine fuel consumption.

6. **Deliverables**

Knowledge Creation

- CFS and Parks Canada personnel involved in the program will continue to feature this research during future FMF science forums, national and international fire Science conferences (at least 1 in 2004).
- Dataset on relative ungulate population density in savannah-pine montane ecosystems (following the 1999 and 2001 burns). 2004 data collection and analyses complete March 31, 2005.
- Dataset on post-fire effects on Douglas Fir-montane ecosystem following planned burn for 2004. 2004 data collection and analyses complete March 31, 2004.

Demonstration/ Communications and Outreach

- Three prescribed burns (60 and 110, and 1 hectares respectively) have already resulted from this project, are observed and or visited by millions of park visitors each year and are, arguably, the most publicly noted deliverable of the FMF program.
- A permanent self-guiding interpretive trail has been built within the study area. It features the FMF research program. The fenced research plots are visible to the public, attract attention and are fitted with professionally produced signs that explain the project and it's importance to local ecosystems. We will upgrade and add to the existing signs this year (aspen plots and Douglas fir plots).
- The 2004 (weather permitting) prescribed burns in the Douglas fir forests of Hawk Mountain in JNP will also be highly visible to motorists using Highway #16 as they traverse the FMF, as well as hikers using the Overlander trail system. Demonstration of ignition techniques and fire behaviour in this ecosystem to fire personnel. Burns complete October, 2004.

- This site is frequently used as a tour site to display benefits of the FMF program to visiting scientists, foresters, educators and bureaucrats from around the world. Several local eco-tourism companies also stop regularly to view the experiments with clients. We will also provide technical tours to professional visitors as the opportunity arises.

Knowledge / Technology Transfer

- 2004 burns conducted in Douglas fir stands, 2003 burn in the aspen stand, and 1999 and 2001 burns in pine/grassland will provide managers with unique experiences and knowledge that will result in modifications to future planned prescribed burns.
- This information will be conveyed formally and informally through the fire community during annual forums, conference attendance and presentations and preparation of year-end reports.
- By inviting fire practitioners from Alberta SRD and other parks to participate in the 2004 burn, others will benefit from first hand knowledge/technology transfer opportunities.

Communications and Outreach

(See Demonstration section 2 above)

Policy Support

As part of an adaptive management approach that integrates research into operational programs, this project provides a continual flow of results and information that influences how prescribed burns are planned and implemented within Jasper National Park and other protected areas with similar forest types.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Pellet Counts		X										
<i>Prescribed fire at Hawk site</i>		X										
<i>Re-sampling at Aspen Plots</i>				X								
<i>Re-sampling at Hawk site</i>		X		X								
<i>Clip Plot (biomass) sampling</i>					X							
<i>Progress report</i>												X

8. Site Information

The sites are within Jasper National Park, and their use is approved through Park management, including having an approved environmental assessment.

9. References

Amiro, B., B. deGroot, P. Bothwell, A. Westhaver, and P. Achuff. 2002. Impacts of fire and elk browsing in the montane region of Jasper National Park. *In*: R.T. Engstrom and W.J. deGroot, (eds.) Proceedings of the 22nd Tall Timbers Fire Ecology Conference: Fire in Temperate, Boreal, and Montane Ecosystems. Tall Timbers Research Station, Tallahassee, FL, U.S.A. (in press).

10. Scientific Review

No new scientific review. Original project reviewed by scientists within the Canadian Forest Service and Parks Canada. The Tall Timbers paper was reviewed by anonymous reviewers.

11. Improvements to Management in Forest Ecosystems

The montane prescribed burns are part of the scientific information required for effective ecosystem management of national parks. The goal of the fires is to study ecosystem effects of fire, and the use of fire to achieve changes to plant and animal communities. Documentation of these successful fires will lead the way for further use of fire in forest ecosystem management.

12. Amount of Money Requested From the Foothills Model Forest

We are requesting operating funds from the Foothills Model Forest for \$3,467.30 to cover travel allowances (\$69.90/day x 27 person-days), accommodations (\$700.00 assuming we are able to stay at the Palisades Centre), vehicle travel (3 trips x 800 km/trip x \$0.20 /km), and signage (\$400.00) to highlight phase II of the project to the public and to acknowledge the FMF as a sponsor.

13. Partner Contributions

Partner estimates include a cost of approximately \$40,000 by Parks Canada to achieve the Hawk Mountain burn and to help with follow-up sampling. This includes the fire team for ignition and suppression, helicopter support, and warden (Alan Westhaver and Dave Smith) and summer student salaries. The Canadian Forest Service is contributing scientific salaries for Pete Bothwell (R.P.F.), Dr. Bill deGroot, Dr. Jen Beverly and Dr. Vern Peters (about 60-person-days) with salaries estimated at about \$13,000 and operating costs for supplies and at least one additional field trip at a maximum of \$1,000. In addition, the Canadian Forest Service will support field cost over-runs, mostly when additional field trips are required.

Partner/ Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			\$3,467			
Canadian Forest Service		1,000.			13,000.	
Parks Canada					40,000.	

14. Proposed Payment Schedule

Payment made to the Canadian Forest Service in April 2004 to cover expenses for the 2004/05 fiscal year.

15. Subcontracted Work

None.

16. Project Management

Project Manager: Pete Bothwell R.P.F., Canadian Forest Service
Jasper National Park Manager: Alan Westhaver/Dave Smith

17. Additional Organisations requesting FRIIA Administered Monies

None.

18. Other Relevant Information

This project was funded by Foothills Model Forest in 2001/02 for the amount of \$3000, 2002/03 for \$1806, and in 2003/04 for \$3,427. A progress report was submitted for the fiscal year ending March 31, 2003, with another to be submitted by March 31, 2004.

Foothills Model Forest 2004-2005 Annual Work Plan

Edge Architecture of Fires

1. Prepared by

Name: Dr. David Andison
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2. Introduction

Disturbance research at other scales at the Foothills Model Forest has, or will be defining the conditions under which edges are formed by fires. However, to date, no knowledge exists at finer scales of the detailed structural and compositional characteristics of these edges. We may not be taking full advantage of the natural disturbance patterns at coarser scales if we assume that every edge is the same, and formed in the same way. At the most fundamental level, rarely are fire edges as sharp as the ones we create in forest management. On the other hand, there are likely circumstances under which edges of various degrees of sharpness and type are formed. We hypothesize that these differences are related to either or both of a combination of biotic and abiotic features. Ultimately, we hope to create a predictive and descriptive model of fire edge architecture.

3. Background Information

Edge details represent the finest level of detail (so far) that the long-term research plan for the natural disturbance program defines. With the completion of several projects at coarser scales, this project will form a perfect “fit” for practical purposes. The practical implications of the understanding of edge architecture include potentially altering the ecological impacts of the cultural edges, the design and planning of prescribed fires, and the windfirmness of designing cutblocks. Yet, as important as this is, there was no opportunity to collect these data prior to the large fires north of the FMF, and west of JNP. Despite the lack of suitable sample areas when the original long-term workplan was drafted for the NDP, this project was outlined as one that would be supported in this document. The Virginia Hills fires, and the fire adjacent to JNP in the Mount Robson Provincial Park present an ideal opportunity to learn about edges in ecologically similar conditions to that which exist on the FMF.

In 2001 and 2002, we have completed sampling in the Virginia Hills fire. This project was in the workplan for last year, but was identified as one that would be completed only if additional funds became available. These funds did not materialize, so it is in this year’s workplan as part of the base budget.

4. Objectives

1.) Knowledge Creation

The main objectives of this study are to understand the structure and composition of edges formed by fires, and how and why edge architecture might change in space.

1a. Beneficiaries and Impacts

Greater understanding is the first step towards more defensible and consistent decision-making, and moves science forward to new and better questions. Knowledge of how edges form under natural conditions would be useful for setting targets for burn and cutblock plans, as well as potentially offering a “natural” solution to practical problems such as wind protection.

2.) Demonstration

N/a

2a. Beneficiaries and Impacts

N/a

3.) Knowledge / Technology Transfer

N/a

3a. Beneficiaries and Impacts

N/a

4.) Communications and Outreach

Make research results available in a variety of forms and mechanisms to maximize audience and exposure.

4a. Beneficiaries and Impacts

Everyone is targeted in order to “raise the bar” concerning the creation of a common knowledge foundation of natural pattern residual material in foothills and mountain landscapes.

5.) Policy Support

N/a

5a. Beneficiaries and Impacts

N/a

5. Abstract of Methodology

The population of edges is limited to that part of the Virginia Hills fire that is not, and will not be affected by salvage cutting, and the Robson Valley fire. Ideally, it would be best to distribute samples in both fires to represent a wider range of edge and ecological conditions, but that decision will be made when practical considerations are taken into account when more is known about logistics and travel costs. When this decision is made, the areas of one or both fires will be classified according to eligibility criteria. If possible, the edge types will be stratified based on matrix forest or fuel-type, topography, and known intensity (from fire behaviour information). It is possible that post-stratification would be

more efficient – decision to be made at a later date. A minimum of twenty-five transects will be installed in various locations. Length will vary since the transects will extend 10m into the matrix forest and the fire on each end. Within the transect, each tree will be mapped, and diameter and species taken, as well as height-class. The ecological site-type will be determined, and local topographic and soil conditions noted. Analysis will consist of a variety of descriptive summaries including the width of the edge zone, and a description of the remaining live and dead-standing stems. Various hypotheses will be testing including the tendency of larger trees and/or softwoods to survive, and the relationship between edge width and type, and various biotic and abiotic features.

6. Deliverables for 2004/05
Knowledge Creation
 (complete).

Demonstration
 N/a

Knowledge / Technology Transfer
 N/a

Communications and Outreach

- By March 31, 2005; Edge architecture of disturbances on Foothills and Mountain landscapes of Alberta. Alberta Foothills Disturbance Ecology Research Series, Report No. X.
- By March 31, 2005, results included in at least one FMF NDP Quicknote.

Policy Support
 N/a

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Manuscript			x	x	x	x							

8. Site Information

This work will take place in the Rocky Mountain and Foothills Natural Regions of Alberta.

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan, Version 8.0. FMF Technical Report.

10. Scientific Review

The methods for this project have been reviewed by Dr. Temesgen Hailmeriam of UBC, and Dr. John Spence, U. of Alberta.. The manuscripts that result from this project will be submitted to peer-reviewed journals.

11. Improvements to Management in Forest Ecosystems

The major benefit of this project is to create more ecologically viable, and - potentially –more wind-firm edges in harvest blocks.

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).

12. Amount of Money Requested From the Foothills Model Forest

\$15,000 Foothills Model Forest

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	15,000					
TOTAL	15,000					

14. Proposed Payment Schedule

May 1, 2004, \$15,000

15. Subcontracted Work

Bandaloop Landscape-Ecosystem Services will be carrying out the work.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

Weldwood of Canada Ltd.

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Residual Heterogeneity Within Disturbances

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2. Introduction

At the finest level of resolution, even the most severe disturbances leave live and dead material within them. Up to this point we have (or are planning on) identified and studied island material and edge or transition zones in fires, and one study by Farr and Spitz (1998) has studied dead downed material in fires. The study of the detailed pattern of material left over after fire is then one of the last remaining pieces of the puzzle (consistent with the NDP long-term research plan).

3. Background Information

This is the only opportunity we have of looking at “natural” patterns after fire at very fine scales. Knowledge of fine-scale patterns has implications for not only harvesting methods and targets, but also burn planning targets, and biodiversity monitoring guidelines.

Data has been collected and entered. Analysis and report writing remain. This project was not completed in 03/04 due to unforeseen personnel shifts in the ND program.

4. Objectives

1.) Knowledge Creation

To define the pattern of non-island residual material on a fire, including live standing material, dead standing material, and mineral soil exposure.

1a. Beneficiaries and Impacts

Greater understanding is the first step towards more defensible and consistent decision-making, and moves science forward to new and better questions.

Potentially, this augments the island remnants study by describing non-island residual material within a disturbance – operational guidelines.

2.) Demonstration

N/a

2a. Beneficiaries and Impacts

N/a

3.) Knowledge / Technology Transfer

N/a

3a. Beneficiaries and Impacts

N/a

4.) Communications and Outreach

Make research results available in a variety of forms and mechanisms to maximize audience and exposure.

4a. Beneficiaries and Impacts

Everyone is targeted in order to “raise the bar” concerning the creation of a common knowledge foundation of natural pattern residual material in foothills and mountain landscapes.

5.) Policy Support

N/a

5a. Beneficiaries and Impacts

N/a

5. Abstract of Methodology

Identical to that outlined in the edge architecture project, sample areas in the Virginia Hills and Robson areas will be chosen based on ecological and practical considerations. Field sampling will consist of 20m square plots, within which an inventory of standing materials will be taken, along with degree of damage.

Smaller plots within this 20m plot will make estimates of mineral soil exposure. Site-type descriptions will be done, if possible on burnt areas. Analyses will be mostly descriptive, but will include tests of if/how topographic features affect the amount or type of material remaining.

6. Deliverables

Knowledge Creation

Complete.

Demonstration

N/a

Knowledge / Technology Transfer

N/a

Communications and Outreach

- By March 31, 2005; *Residual heterogeneity on Foothills and Mountain landscapes of Alberta. FMF Natural Disturbance Program Research Series No. X.*

Policy Support

N/a

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Analysis and preliminary report						X	x	x	x			

8. Site Information

This work will take place in the Rocky Mountain and Foothills Natural Regions of Alberta.

9. References

Andison, D.W. 1997. Landscape fire behaviour patterns in the Foothills Model Forest of Alberta. FMF Technical Report.
Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan, Version 8.0. FMF Technical Report.

10. Scientific Review

The methods for this project have been reviewed by Dr. Temesgen Hailmeriam of UBC, and Dr. John Spence, U. of Alberta. The manuscripts that result from this project will be submitted to peer-reviewed journals.

11. Improvements to Management in Forest Ecosystems

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).

12. Amount of Money Requested From the Foothills Model Forest

None

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Alberta Newsprint Co.	15,000					
TOTAL	15,000					

14. Proposed Payment Schedule

FMF July 1, 2004 - \$15,000.

15. Subcontracted Work

Bandaloop Landscape-Ecosystem Services will be carrying out the work.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

Weldwood of Canada Ltd.

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Managing Disturbance in Riparian Zones of Alberta - II

1. Prepared by

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2. Introduction

The Foothills Model has been focusing for several years on describing “natural” patterns and processes of disturbance at multiple spatial and temporal scales, as well as the status of fish populations on the FMF landbase. Not surprisingly, the publication, presentation and distribution of the results have spawned important questions about our desire and ability to create more “natural” landscapes within riparian zones. The natural disturbance model suggests that disturbance by fire, flood and wind is a frequent and critical process in riparian zones, but there are justifiable concerns about impact of traditional harvesting on aquatic and terrestrial habitat and soil values.

For the last two years, the Natural Disturbance and the Fish and Watershed Programs joined forces to focus efforts on specific questions about the creation of Large Woody Debris (LWD) from disturbance, LWD function, and stream classification and morphology. This work was driven by a multi-stakeholder group, and the work funded by the FMF the Chisholm-Dogrib Research Initiative, and most of the companies involved. The majority of the research and analysis has been complete, but the group expressed their desire to further the agenda by making efforts to communicate our results and recommendations, and expand the membership of the group to discuss and integrate possible adaptive management solutions.

3. Background Information

There is no argument that riparian zones are special landscape features. They provide clean water, aquatic habitat, and unique terrestrial habitat, all of which represent the most basic, elemental “biological functions” that cannot be duplicated on other parts of the landscape. Thus, if we wish to sustain these (land and water) landscape functions, we must find an appropriate management strategy for riparian zones. Our current management strategy in riparian zones is to protect them from all forms of disturbance, either through the application of buffers during harvesting, or fire, insect, and disease control policies.

Considering the unique and sensitive nature of riparian zones, it is difficult to argue with this conservative strategy. For example, riparian vegetation regulates water temperature, mitigates overland water and sediment inputs, provides large woody debris (Berg *et al.* 1998), and controls stream channel form, all of which affect fish and macro invertebrate populations. Any terrestrial disturbance activity will alter these attributes, altering aquatic habitat and population levels as

well (Marshall *et al.* 1997, MacIver and Starr 2001). However, the application of what amounts to a passive management strategy has some significant ecological risks. By not allowing disturbance activities in riparian zones, we will be creating very high levels of old, linear riparian habitat (with no “core” habitat), not allow for the recruitment of young riparian habitat, create fragmented landscapes by diminishing the opportunities for creating a range of disturbance patch sizes (Andison and Marshall 1999), and increase the overall landscape risk to natural disturbance by leaving a high density of nodes of older, less vigorous forest across the landscape (Andison and McCleary, 2001). The problem of suitable management strategies for riparian zones is both serious and widespread - Is it possible to manage riparian zones sustainably for *all* ecological values? We hypothesize that the answer to this question lies not in our strategies, but rather our tactics. It is not disturbance *per se* that is the problem, but rather the manner in which we have been managing disturbance in riparian zones. The original riparian management project has been completed. This is an outreach extension of that program.

4. Objectives

1.) Knowledge Creation

Complete (but see the FMF Fish and Watershed Program)

1a. Beneficiaries and Impacts

n/a

2.) Demonstration

N/a.

2a. Beneficiaries and Impacts

N/a

3.) Knowledge / Technology Transfer

Develop a common, leading-edge baseline understanding between regulators, resource managers and scientists of the interaction between riparian dynamics and disturbance, and which management practices best facilitate this interplay and sustain the desired ecological values.

3a. Beneficiaries and Impacts

The landscape ecosystem will ultimately be better managed if all players have a single common understanding of the state of knowledge and practices.

Scientists will benefit from having a clear and universally agreed upon set of future research expectations.

4.) Communications and Outreach

Maintain continual contact with, and maximize the value of the experience and opinions of, all partners throughout the duration of the project.

4a. Beneficiaries and Impacts

Everyone benefits by being involved in all stages of project development together.

5.) Policy Support

Facilitate a shift towards more sustainable guidelines, groundrules, and management expectations in riparian zones.

5a. Beneficiaries and Impacts

Forest industry will benefit by implementing more sustainable management practices, and potentially addressing a wider range of values. Government regulators will benefit by having more defensible, holistic management guidelines.

Future guideline and policy development will benefit by the process of building trust and knowledge together in this project.

5. Abstract of Methodology

The original project included three interconnected elements; team building and linkages, classification, and baseline knowledge gathering of the natural range of variation, and function of LWD. A fourth element, the dendrochronological study of LWD in streams, was, and still is a natural disturbance program project that also links with the baseline knowledge gathering.

The LWD dendro study has been previously discussed in this workplan, and any knowledge gathering or classification extensions of the previous work will be described in the Fish and Watershed workplan.

This project includes only communication and extension activities. Methods will involve presentations, and possibly a small workshop or other meetings to help develop the ideas from the riparian group further, and expand the membership to include other regulators and managers.

6. Deliverables

Knowledge Creation

N/a (but see the Fish and Watershed Program workplan).

Demonstration

N/a

Knowledge / Technology Transfer

Facilitate where needed (through meetings, workshops, or guest lectures) any opportunities to generate continued involvement of current partners, and add partners to the list of participants.

Communications and Outreach

By March 31, 2005, at least one integrated presentation of results and progress to date by representatives of the FMF riparian group.

Policy Support

None this year.

7. Timelines

Team building is an ongoing task, while the other elements of this year’s workplan are all very immediate needs.

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Communication & facilitation as required	x	x	x	x	x	x	x	x	x	x	x	x

8. Site Information

This work will take place across Alberta.

9. References

Andison, D.W., and K. McCleary, 2002. Disturbance in riparian zones on Foothills and Mountain landscapes of Alberta. Alberta Foothills Disturbance Ecology Research Series, Report No. 3. Feb. 2002. Foothills Model Forest, Hinton, Alberta.

Andison, D.W. and P.L. Marshall. 1999. Simulating the impact of landscape-level biodiversity guidelines: A case study. The Forestry Chronicle. 75(4): 655-665.

Berg, N., A. Carlson, and D. Azuma. 1998. Function and dynamics of woody debris in stream reaches in the central Sierra Nevada, California. Canadian Journal of Fisheries and Aquatic Sciences. 55: 1807-1820.

McIver, J.D., and L. Starr. 2001. A literature review on the environmental effects of post fire logging. Western Journals of Applied Forestry. 16: 159-168.

Minshall, G.W., C.T. Robinson, and D.E. Lawrence. 1997. Postfire responses of lotic ecosystems In Yellowstone National Park, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences. 54: 2509-2525.

Rot, B.W., R.J., Naiman, R.E. Bilby. 2000. Stream channel configuration, landform, and riparian forest structure in the Cascade Mountains, Washington. Canadian Journal of Fisheries and Aquatic Sciences. 57: 699-707.

10. Scientific Review

The methods used for any analysis have been developed in combination with various scientific experts from the University of Alberta, Alberta Research Council, and the Foothills Model Forest.

11. Improvements to Management in Forest Ecosystems

This project is uniquely designed to directly address sustainable forest management solutions in riparian zones through cooperation, sound science, and adaptive management.

12. Amount of Money Requested From the Foothills Model Forest

\$5,000 Foothills Model Forest

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	5,000					
TOTAL	5,000					

14. Proposed Payment Schedule

April 1, 2004 - \$5,000.

15. Subcontracted Work

Bandaloop Landscape-Ecosystem Services

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services.

17. Additional Organisations requesting FRIIA Administered Monies

Rick Bonar, Weldwood of Canada, Ltd.

18. Other Relevant Information

None.

**Foothills Model Forest 2004-2005 Annual Work Plan
Natural Disturbance Program Communications and Extension**

1. Prepared by

Name:	Dr. David Andison	Lisa Jones
Address:	3426 Main Ave., Belcarra, BC, V3H 4R3	Foothills Model Forest P.O. Box 6330, Hinton, Alberta
Phone:	(604) 939-0830	
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2. Introduction

The FMF ND program has amassed a considerable amount of natural pattern knowledge over the past eight years. Although much research remains, there is an increasing need to pass this knowledge on to broader audiences. This is not a distinct “project” in the same way that other elements of the ND program are, but it has not reached the point at which C&E efforts should be recognized as unique contributions.

3. Background Information

The FMF ND program has been doing communication and extension for many years already (Andison 2003). It initiated the Quicknote program almost four years ago, and boasts a library of 23 notes and counting. The exclusive distribution list for these notes numbers in the hundreds, and the audience is international. In addition, the ND program has been invited to speak at no less than ten workshops (above and beyond group FMF presentations), presented at two international scientific conferences, hosted two workshops, and published four full reports.

Part of the ND workplan for 03/04 was dedicated to developing a Communications and Extension (C&E) Plan for the ND Program. This has now been completed (Jones 2003), and provides much needed formal context for past and future C&E activities of the ND Program. This “project” includes elements directly from that plan. Although all of the material used for C&E efforts originates from existing and past ND Program projects, it was felt that recognizing C&E efforts as unique and important components of the overall program, with distinct deliverables, was important at this point. We will likely continue to recognize C&E efforts as “projects” in this way from now on in workplans.

4. Objectives

1.) Knowledge Creation

None.

1a. Beneficiaries and Impacts

n/a.

- 2.) **Demonstration**
None.
 - 2a. **Beneficiaries and Impacts**
n/a.
 - 3.) **Knowledge / Technology Transfer**
To provide new knowledge on natural disturbance patterns and processes in such a way that facilitates integration into existing or new planning frameworks.
 - 3a. **Beneficiaries and Impacts**
Planners, managers, regulators.
 - 4.) **Communications and Outreach**
Make research results available in a variety of forms and mechanisms to maximize audience and exposure.
 - 4a. **Beneficiaries and Impacts**
Planner, manager, regulators, scientists, the public, special-interest groups.
 - 5.) **Policy Support**
To provide new knowledge on natural disturbance patterns and processes in such a way that facilitates integration into existing or new policies.
 - 5a. **Beneficiaries and Impacts**
Industry, regulators.
5. **Abstract of Methodology**
A series of communication tools will be used, including presentations, tours, targeted workshops, research-series reports, interpretive-series report, Quicknotes, scientific manuscripts, posters, and lectures. Each is designed for specific C&E objectives, and is more fully described in the FMF ND C&E Plan (Jones 2003).. We have also agreed to conduct a review of the FMF ND Program in 2004/05, which we intend to help us not only evaluate our effectiveness in the past, but help map out a future for the program.
6. **Deliverables**
- Knowledge Creation**
Internal review of the FMF ND program.
 - Demonstration**
N/a.
 - Knowledge / Technology Transfer**
At least one “Integration Series” report.
Two draft manuscripts to peer-reviewed journals
At least one presentation at a major scientific conference

Communications and Outreach

6 FMF ND Quicknotes

At least eight workshop / symposia presentations

At least four Model Forest presentations / tours

At least two new ND posters

Policy Support

At least one presentation to senior SRD staff.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Communication and Extension Activities as Above	x	x	x	x	x	x	x	x	x	x	x	x

8. Site Information

Most of this work will take place in Alberta, but some of it beyond.

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan, Version 8.0. FMF Technical Report.

Jones, L. 2003. Communications and Extension Plan for the Foothills Model Forest Natural Disturbance Program. Technical Report, Foothills Model Forest, Hinton, Alberta.

10. Scientific Review

The project is not science-based. However, with respect to the methodological approach taken for communications and extension, the C&E plan for the ND program was developed from a communications and extension professional as a result of an external, objective Request For Proposals (RFP).

11. Improvements to Management in Forest Ecosystems

Any increase in the understanding of new scientific knowledge by as wide as possible an audience can only lead to improvements in how forest ecosystems are managed.

12. Amount of Money Requested From the Foothills Model Forest

\$42,000 Foothills Model Forest.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	42,000					
TOTAL	42,000					

14. Proposed Payment Schedule

N/a

15. Subcontracted Work

Bandaloop will be carrying out some of the work.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

none

18. Other Relevant Information

None

**Foothills Model Forest 2004-2005 Annual Work Plan
Dendroecological Analysis of Large Woody Debris in Riparian Zones**

1. Prepared by

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2. Introduction

The one place we most expect to find more complex disturbance history is within riparian zones. The type, timing, and severity of various disturbance agents can have dramatic impacts on the amount, timing, and type of in-stream large woody debris recruitment, and terrestrial stand habitat dynamics. We have been unable to study this question in any great detail.

3. Background Information

We have done an excellent job of describing the pattern of disturbance in riparian zones, but we have not yet dealt with the processes. The best way to do so is to re-construct their history using dendrochronological methods – using cross-dating of tree-rings to determine the year of death and/or recruitment of an individual tree near and/or into a stream system. This is an infinitely more precise method of “knowing” than simple streamside inventories of woody debris. Nor does the streamside inventory method tell us anything about the stand or age dynamics of the riparian forest, or what type, severity, or size of the initiating disturbance was (fire, flooding, beaver, erosion, gap dynamics, or even wind). This information is potentially vital towards stand-level management criteria in riparian zones. However, there is a risk that these methods will not be fruitful, either because tree-rings will be unavailable or unreadable.

From 2001-03, we ran a small pilot study to determine the feasibility of the sampling methods within the FMF. We not only were successful in extracting readable cores and “cookies” from in-stream LWD, but were able to date some of this material to more than 100 years ago (Daniels and Powell 2003). This represents the expansion of the project to a full set of samples and sites in the Alberta Foothills.

4. Objectives

1.) Knowledge Creation

Ultimately, to understand the exact processes and scales of disturbance in riparian zones on the FMF.

1a. Beneficiaries and Impacts

Greater understanding is the first step towards more defensible and consistent decision-making, and moves science forward to new and better questions.

Forest industry has better “natural” knowledge with which to choose management regimes for riparian zones.

- 2.) **Demonstration**
To understand if/how dendrochronological techniques may be used to reconstruct detailed riparian disturbance history in Foothills landscapes.
 - 2a. **Beneficiaries and Impacts**
The scientific community will benefit significantly from gaining such knowledge, and the techniques could be expanded to include many other applications not otherwise tested.
 - 3.) **Knowledge / Technology Transfer**
N/a
 - 3a. **Beneficiaries and Impacts**
N/a
 - 4.) **Communications and Outreach**
Make research results available in a variety of forms and mechanisms to maximize audience and exposure.
 - 4a. **Beneficiaries and Impacts**
Everyone is targeted in order to “raise the bar” concerning the creation of a common knowledge foundation of natural pattern residual material in foothills and mountain landscapes.
 - 5.) **Policy Support**
Potentially, define new types of management options for riparian zones.
 - 5a. **Beneficiaries and Impacts**
Industry and regulators will share the new understanding towards building new, more sustainable riparian management tactics.
5. **Abstract of Methodology**
Subjective field selections for at least 12 sample sites will take place across all natural sub-regions along large river systems (targeting those areas that we know have been impacted by other, small scale disturbance activity). River reaches will be walked to locate downed and live and dead adjacent trees. In addition, the terrestrial zone adjacent to the rivers will be walked to look for any physical evidence of disturbance (stumps, scars, damage, etc). Live trees will be randomly selected for evidence of “release” (indicating adjacent tree death). Selected trees within or adjacent to the rivers will be cored and/or a complete cookie taken (depending on within-stream “function” and location of the tree or bole at the time). Finally, approximately 20 other live trees per site will be sampled to generate a local chronology. Up to 20 such candidate areas will be sampled. Tree samples will be sanded, and tree-ring widths and/or scar-dates recorded using standard tree-ring methodologies (available upon request). A master chronology will be developed (if possible) for the area, and the distribution and dates of small-scale disturbances noted.

6. Deliverables

Knowledge Creation

Final results beyond the pilot study of Daniels and Powell (2003) will not be forthcoming until 2005/06.

Demonstration

N/a.

Knowledge / Technology Transfer

N/a

Communications and Outreach

Progress report by March 31, 2004.

At least one presentation to FMF partners.

Policy Support

N/a

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Field Sampling		x	x	x	x								
Lab preparation and measurements of samples								x	x	x	x	x	
Mid-term report												x	

8. Site Information

This work will take place in the Rocky Mountain and Foothills Natural Regions of Alberta.

9. References

Daniels, L.D. and S.R.E. Powell. 2003. Dendroecological Analysis of Large Woody Debris in Riparian Zones of Foothills Landscapes of Alberta. Pilot Study Report. Department of Geography, UBC, Vancouver, BC.

10. Scientific Review

Standard dendrochronological methods will be applied consistent with the literature. If successful, this project will become a graduate thesis for one graduate student (meaning that at least four well-qualified academics will be overseeing the project), and result in at least one publication in a refereed journal.

11. Improvements to Management in Forest Ecosystems

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and

functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).

12. Amount of Money Requested From the Foothills Model Forest

\$23,000 Foothills Model Forest *or* OPEN FRIA.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	23,000					
TOTAL	23,000					

14. Proposed Payment Schedule

April 1, 2004 - \$23,000.

15. Subcontracted Work

University of BC, Department of Geography will be carrying out the work. Bandaloop will oversee the pilot study on behalf of the FMF.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIA Administered Monies

Weldwood of Canada Ltd.

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Introduction to Natural Disturbance Short Course Development

1. Prepared by

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2. Introduction

Interest in natural disturbance patterns has grown at a rapid pace over the last ten years within Alberta and beyond. New research results on natural disturbance patterns and processes are quickly absorbed by an ever-broadening audience of managers, planners, regulators, scientists, and the public. And although the work is far from complete, a substantial collection of natural disturbance knowledge has been generated.

The interest in, and attraction to natural disturbance emulation strategies is understandable. Such knowledge can potentially be used as ecologically-defendable “coarse filters” to help guide forest management decision-making. Coarse filters offer considerable benefits. Consider the prospect of choosing and managing towards a landscape design that is not only described in familiar and direct terms of vegetation structure and composition, but is (at least theoretically) based on a form of ecological integrity.

We have also observed some remarkable convergences between natural patterns and other sustainable forest management (SFM) objectives. For example, natural patterns demonstrate a logical and positive link to fire threat mitigation, large mammal habitat, avian habitat, aesthetics, access planning, old growth management, and even harvesting costs. This list alone represents a tremendous opportunity. Furthermore, natural patterns are by their very nature variable, thus allowing for the flexibility to accommodate, as opposed to compete with, other management objectives.

However, despite its potential, using natural disturbance patterns to help forest management is still a fragile proposal. There is broad agreement by forest and land managers that the concept of using natural patterns to guide management decisions is a good idea. However, there is an obvious and significant gap on how, where, when, and even if natural patterns should be applied in forest management decision-making. This disparity is potentially affecting the quality of forest management activities as they relate to the ultimate goal of SFM. For example, small differences in levels of understanding, perception, or the meaning of natural disturbance terms can lead to disagreements, prolonged approval process, and the rejection of what might be progressive plans. These in turn lead to the erosion of trust, decreased likelihood of achieving adaptive forest management, and the adoption of more conventional rules. Ultimately, this may lead to the rejection of all natural disturbance (ND) strategies or tactics, which

may represent a significant lost opportunity for Alberta, and potentially a diminished progression of sustainable forest management ideals. Such are the growing pains of any new idea. Everyone in Canada is struggling with practical ND integration issues today. The thirst for understanding of natural disturbance concepts was demonstrated by the feedback at our own natural disturbance symposium in 2001, as well as from the size and composition of the mailing list of, and positive feedback on, the FMF Natural Disturbance Program “Quicknote” series. The solution for many other jurisdictions has been to develop prescriptive “guidelines” that mandate the details of how, what, and where to harvest. However, this solution does not always allow for exploration and experimentation, or necessarily a true understanding of the value of coarse-filter knowledge. It removes the need to seek creative viable solutions, which means that natural patterns become yet another set of variables thrown into the planning melting pot. The BC biodiversity guidelines are an excellent example of this predicament.

The Foothills Model Forest Natural Disturbance Program strongly supports the more flexible Alberta approach to moving forward with ND integration. However, we suggest at this point that the answers lay less in science than they do education and communication - based on sound science. By exposing Alberta’s foresters, in both industry and government, to the same basic general level of knowledge about NRV as we know it today, we are better able to build a universal foundation of understanding and language. Education is one of the critical first steps towards the successful integration of any new ideas. A structured and strategic approach best ensures the full potential of natural disturbance decision-making systems (whatever that may be) are realized. This approach better ensures that ND does not become an untested “fad” because years of accrued knowledge are not effectively transferred to those making forest management decisions.

Towards this, we propose to develop an intensive two-day short course “primer” on natural disturbance. As the first in a series of such short courses, this one will cover the basics, including nomenclature, the theoretical underpinnings, examples of comparisons with current practices, different models of integration, an overview of research challenges, and research output interpretation. Furthermore, the challenging nature of ND knowledge is such that the course will emphasize “learning by doing” through hands-on exercises. We intend this course for virtually all levels and types of decision-makers and regulators in Alberta to allow them to create, discuss, debate, and resolve planning integration issues *together* relating to natural patterns. Although the initial development of this course will focus on Alberta and Saskatchewan, the material will be generic, and we anticipate exporting this course to other provinces since this need is a universal one, as our letters of support and research suggest.

3. Background Information

There is no shortage of material on which to draw for such a course. The Natural Disturbance Program of the Foothills Model Forest has been involved in natural pattern and process research for seven years. This program was from the

beginning an extensive program driven by practical questions, and designed to address pattern and process questions from a range of spatial and temporal scales (Andison 2003). The long-term research plan now has over 50 different projects listed, of which almost half have at least been initiated. We have also entered into an important implementation phase of the work, concentrating on opportunities for integrating ND knowledge into planning and monitoring programs. In addition, there is a growing emphasis on natural pattern research at other institutions such as the Sustainable Forest Management Network which we can, and will, draw upon.

Based on research, a professional development course of this nature does not currently exist. Research included internet searches and interviewing individuals across North America involved in the field of forest management extension. Based on secondary research, interviews with both industry and government representatives, and the overwhelming response from potential supporters of this idea during the drafting of the proposal, there is a need for this short course, in and beyond Alberta.

Also please note that it is our intention to apply to the Saskatchewan Forest Development Fund for the same level of funding for the same project. Should we be successful with both applications, we would only require 50% of the funds being requested by this application.

4. Objectives

1) Knowledge Creation

None.

1a. Beneficiaries and Impacts

n/a

2) Demonstration

None

2a. Beneficiaries and Impacts

n/a.

3) Knowledge / Technology Transfer

To help develop a common understanding of the concepts, terms used, potential value, techniques, issues and opportunities of a coarse-filter approach to sustainable forest management.

3a. Beneficiaries and Impacts

Planners, managers, regulators.

4) Communications and Outreach

To help develop a common understanding of the concepts, terms used, potential value, techniques, issues and opportunities of a coarse-filter approach to sustainable forest management.

4a. Beneficiaries and Impacts

Planner, manager, regulators, scientists, the public, special-interest groups.

5) Policy Support

To help develop a common understanding of the concepts, terms used, potential value, techniques, issues and opportunities of a coarse-filter approach to sustainable forest management.

5a. Beneficiaries and Impacts

Industry, regulators.

5. Abstract of Methodology

Develop Course Plan. The course director and course leader will meet with the Hinton Training Centre and Saskatchewan Institute of Applied Science and Technology to develop a course plan. Such a plan details the following:

- Course goal
- Course objective
- Identify audiences
- Identify learning outcomes
- Set indicators of success
- Develop course outline and content
- Course development, including materials. After a course plan has been developed and approved by the program partners and course sponsors, a curriculum developer will be used to develop the curriculum, and help design materials for this two-day short course. At this stage, the interaction between the course director (Andison) and the curriculum developer will be crucial. The complex and contentious nature of ND strategies is such that a curriculum developer will require considerable familiarity with the material. Furthermore, much of the materials used in the course will come from the Interpretative Reports of the FMF Natural Disturbance Program. While this is occurring, the Foothills Model Forest Communications and Extension Program will begin to promote the short course through existing and new channels.

Interpretive Course Material. The Natural Disturbance Program will develop a new tool called “Interpretive Reports”. This tool will bridge a gap between the existing brief “Quicknotes” and the much more detailed research reports. The objective of an interpretive report is to present knowledge that can be integrated into forest management practices. Each Interpretive Report will be limited to ten to twenty pages, be very visual and will use everyday language. Material from these reports will be used to develop associated course material.

Course Marketing and Delivery. The Foothills Model Forest by collaborating with its partners and course sponsors will promote the course. Course delivery will be done on a cost-recovery basis, and if possible, a portion of course development dollars will be recovered. If course development dollars are recovered they will be reinvested into future Natural Disturbance short course development.

Focus Groups to Direct Future Short Courses and Knowledge Transfer Activities. The *Introduction to Natural Disturbance* course gives industry and government

the foundation to begin integrating natural disturbance concepts into forest management plans and practices. However, additional extension and knowledge transfer activities will be required. Therefore it is proposed that focus groups are conducted immediately after the delivery *Introduction to Natural Disturbance* short course. The focus groups will help identify information and knowledge gaps in the existing course, and guide direction and content of future short courses and extension activities.

6. Deliverables

Knowledge Creation

Detailed report that summarizes future knowledge and technology transfer needs of sustainable forest management professionals.

Demonstration

N/a.

Knowledge / Technology Transfer

Delivery of short course to sustainable forest management professionals in Alberta and Saskatchewan.

Communications and Outreach

Delivery of short course to sustainable forest management professionals in Alberta and Saskatchewan.

Policy Support

Delivery of short course to sustainable forest management professionals in Alberta and Saskatchewan.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Develop course plan	x	x										
Course Development			x	x	x	x	x	x	x			
Interpretive Course Material			x	x	x	x	x	x	x			
Course marketing and delivery										x	x	x
Focus group feedback												x

8. Site Information

Course development & coverage - Alberta and Saskatchewan (as a minimum).

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan, Version 8.0. FMF Technical Report.

Jones, L. 2003. Communications and Extension Plan for the Foothills Model Forest Natural Disturbance Program. Technical Report, Foothills Model Forest, Hinton, Alberta.

10. Scientific Review

The course will be developed using a variety of educational professional consultants both internal and external to the project team. The natural disturbance pattern material used for the course will come from a variety of sources, and most of it will either be already published in refereed journals, or will be at some point in the future. Most of the lecture content will be gathered, if not directly provided, by Dr. Andison who is a recognized expert in this field, and has an extensive network of contacts across Canada. In any case, the content and structure of each lecture will be peer-reviewed by the appropriate expert(s).

11. Improvements to Management in Forest Ecosystems

Any increase in the understanding of new scientific knowledge by as wide as possible an audience can only lead to improvements in how forest ecosystems are managed.

12. Amount of Money Requested From the Foothills Model Forest

\$20,000 Foothills Model Forest.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	20,000					
SIAST, HTC, other FMF	30,840					
OPEN FRIA / Sask FDF	60,680					
TOTAL	111,520					

14. Proposed Payment Schedule

April 1, 2004, - \$20,000

15. Subcontracted Work

Bandaloop landscape-ecosystem services

16. Project Management

The project will be coordinated jointly by Dr. David Andison of Bandaloop Landscape-Ecosystem Services and Lisa Jones of the Foothills Model Forest. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

Weldwood of Canada, Ltd.

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Hwy40 Demo Project Implementation Fund

1. Prepared by

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2. Introduction

The volume of natural disturbance pattern results from the FMF Natural Disturbance Program and beyond has been tremendous over the last seven years. The challenge now has shifted to more practical considerations of implementation guidelines, operational realities, ecological impacts, and social and economic limitations. While small, isolated integration efforts have become fairly commonplace, no where has anyone tried to integrate a wide range of many different NRV patterns, and develop a plan based on NRV patterns from step 1 across a very large area. The Hwy40 Natural Disturbance Demonstration project (from the FMF ND 2003/04 workplan) was designed to borrow heavily from the natural disturbance toolkit to install a large experiment on or near the FMF landbase to test various ecological, social, and economic aspects of adopting some or all parts of the natural disturbance model.

The outcome from the original Hwy40 Demo project is a 10-year “disturbance plan” that identifies locations, sizes, and types of planned disturbance activities for a 70,000 ha area including parts of the Weldwood, ANC, and Weyerhaeuser FMA’s, and the Willmore Wilderness Area. This is the first such plan of its type, in no small part because it considered the entire land area for disturbance activities, and thus logging will be combined with prescribed fire and other (non-merchantable) mechanical treatments, as well as oil and gas activities where possible, to achieve our disturbance design.

Although any costs associated with traditional harvesting, roading, etc will be bourn by the FMA holders, considerable additional resources will be required to carry out the non-traditional treatments being planned. This fund will allow the Hwy40 plan to develop without compromise, spanning several years. We will also use it as “seed money” to solicit and attract other (either in-kind or monetary) support from other potential Hwy40 partners.

The importance of aggressively acting on implementing this plan (once approved) as closely as possible to the intended plan cannot be overstated. The integrity and believability of any outcomes will be judged against the degree to which the plan represented “reality”. If we fail to secure the resources or commitment to do anything but traditional harvesting and road-building, the project, and its impact on practice and policy will be significantly diminished. Securing these funds also demonstrates the commitment of the group and the FMF to seeing this project through and taking natural pattern research to the next level.

3. **Background Information**

- The three main objectives of the original Hwy 40 Demo project were:
- Evaluate the robustness of the NRV *strategy* as a package, as opposed to judging the individual pieces.
- Identify and explore potential convergences and conflicts with existing policies, practices, objectives, and other economic, social, and ecological values.
- Build a common understanding of the concept and practice of adopting a natural disturbance based plan.

The site chosen for this demonstration project is an area approximately 70,000 hectares in size spanning approximately equal parts of the Weldwood, ANC, and Weyerhaeuser FMA's, 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 la Peche caribou herd. (see Figure 1). 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 FMA's, 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 FMA's currently have plans and approvals for harvesting in the vicinity within the next 5-10 years.

Its proximity to protected areas offers the potential for some alternative management solutions perhaps not as readily available elsewhere – prescribed burning in particular.

4. **Objectives**

1.) **Knowledge Creation**

n/a

1a. **Beneficiaries and Impacts**

N/a

2.) **Demonstration**

To demonstrate how holistic disturbance planning across administrative boundaries using an NRV foundation can be implemented efficiently and effectively to meet the goals of most other SFM values.

- 2a. Beneficiaries and Impacts**
Essentially everyone benefits from an NRV demonstration project. Regulators, practitioners, environmentalists, scientists, and the public all benefit from gaining better insight into exactly what a comprehensive NRV strategy might look like on the ground, in real time, integrating real values and issues.
- 3.) Knowledge / Technology Transfer**
To demonstrate how holistic disturbance planning across administrative boundaries using an NRV foundation can be implemented efficiently and effectively to meet the goals of most other SFM values.
- 3a. Beneficiaries and Impacts**
See above
- 4.) Communications and Outreach**
N/a
- 4a. Beneficiaries and Impacts**
n/a
- 5.) Policy Support**
n/a
- 5a. Beneficiaries and Impacts**
n/a
- 5. Abstract of Methodology**
The fund will be used exclusively to pay for those disturbance activities that either fall under the jurisdiction of Alberta Sustainable Resource Development (such as prescribed burning), or for activities not normally part of “regular” harvest operating plans (such as pre-commercial thinning to create firebreaks, or mechanical treatments of non-productive areas).
We propose putting the money into an account that can be rolled over fiscal years such that we can use it when it is required. The nature of prescribed burning in particular is such that it is difficult to know exactly if or when burns will occur. And for those unfortunate instances when they do not, there are always “stand by” costs. For that matter, we have at this point no knowledge of when approvals for the final plan might be forthcoming. We simply do not want to commit to activities that are dependent on conditions beyond our control.
- 6. Deliverables**
- Knowledge Creation**
None.
- Demonstration**
- All potential prescribed burn and other non-merchantable landbase treatment plans for the Hwy40 planning area submitted and approved.

- At least one disturbance treatment completed. (note that we expect the majority of the actual treatments to take place between 2005 and 2007).

Knowledge / Technology Transfer

n/a

Communications and Outreach

A Hwy40 project-specific communications plan, which may include some or all of the following: interpretive trails, professional photos or video, tours, presentations, pamphlets, and news articles.

Policy Support

N/a

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Treatments (potential)					x	x	x	x	x	x	x	x

8. Site Information

This work will take place in the 70,000 ha area on the north side of the FMF as described above.

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan. FMF Technical Report.

10. Scientific Review

N/a at this time.

11. Improvements to Management in Forest Ecosystems

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996).

12. Amount of Money Requested From the Foothills Model Forest

\$156,000 Alberta SRD – pending.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Alberta SRD			\$156,000			
TOTAL			\$156,000			

14. Proposed Payment Schedule

FMF July 1, 2004 - \$156,000.

15. Subcontracted Work

None at this time.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloop Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

None.

18. Other Relevant Information

None.

**Foothills Model Forest 2004-2005 Annual Work Plan
Comparing the Natural Range of Variation with the Current Range of Variation for
Disturbance Patterns**

1. Prepared by

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2. Introduction

The Foothills Model Forest Natural Disturbance Program has been studying and reporting on natural disturbance patterns for several years now. A key area of study that has not been emphasized until now is the comparison of natural patterns with those patterns from current, culturally modified landscapes. The single exception to this is Report #4 on patch sizes, which compares current with natural patch sizes for old forest, disturbance, and non-forested areas.

This type of direct knowledge, of the differences between natural and current patterns, is acknowledged by our partners as the first step towards integrating natural patterns in planning and management.

3. Background Information

If this project gets funding, the ND activity team will decide as a group which natural pattern(s) will be compared and how. There are several choices, including residuals, events, patches, and even disturbance cycles.

4. Objectives

1.) Knowledge Creation

To understand in what ways, and to what degree natural patterns differ from patterns generated by current practices and cultural impacts.

1a. Beneficiaries and Impacts

Ultimately, the managers and planners will have the most significant impact on how and to what degree natural patterns are used towards SFM goals. This project specifically aligns NRV scientific output with more typical management planning terms.

2.) Demonstration

N/a

2a. Beneficiaries and Impacts

N/a

3.) Knowledge / Technology Transfer

N/a

3a. Beneficiaries and Impacts

N/a

4.) Communications and Outreach

Make research results available in a variety of forms and mechanisms to maximize audience and exposure.

4a. Beneficiaries and Impacts

Everyone is targeted in order to “raise the bar” concerning the creation of a common knowledge foundation of natural pattern residual material in foothills and mountain landscapes.

5.) Policy Support

N/a

5a. Beneficiaries and Impacts

N/a

5. Abstract of Methodology

For whatever pattern(s) we decide to compare:

Identify the most appropriate level of planning.

Identify the most appropriate planning tool or indicator that relates most to the pattern in question.

Convert the scientific / landscape ecology terms into planning and management terms.

Identify and adapt the necessary data layers and other information.

Apply or adapt the methods used to devine NRV for CRV delineation.

Compare the output, methods, data, and identify any inconsistencies.\

Identify the “gap” between NRV and CRV and critically consider the issues and opportunities associated with closing that gap in the near and intermediate future.

6. Deliverables

Knowledge Creation

Complete.

Demonstration

N/a

Knowledge / Technology Transfer

N/a

Communications and Outreach

By Dec. 31, 2005; final report for one natural pattern completed.

Policy Support

N/a

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Identify, compare patterns, data, methods & indicators					x	x	x	x	x	x		
Draft reports											x	x

8. Site Information

This work will take place in the Rocky Mountain and Foothills Natural Regions of Alberta.

9. References

Andison, D.W. 2003. Foothills Model Forest Disturbance Dynamics Long-Term Research plan. FMF Technical Report.

10. Scientific Review

Independent reviews have been obtained for the methods by Dr. W.L. Baker, U. of Wyoming. All manuscripts will be submitted to refereed journals.

11. Improvements to Management in Forest Ecosystems

This project contributes to the development of management strategies that are in concert with the concept of ecological management, which is “an evolving approach that focuses on ecological processes and ecosystem structures and functions, while sustaining the types of benefits that people derive from the forest” (Alberta Forest Conservation Strategy, draft, July 8, 1996). More specifically, this is a logical step towards realizing the potential of using natural patterns in management, monitoring, and planning.

12. Amount of Money Requested From the Foothills Model Forest

\$23,000 Foothills Model Forest pending approval of external funds for the LWD dendro study.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	23,000		23,000			
TOTAL	23,000		23,000			

14. Proposed Payment Schedule

\$23,000 - June 1, 2004

15. Subcontracted Work

Bandaloop Landscape-Ecosystem Services will be carrying out the work.

16. Project Management

The project will be overseen by Dr. David Andison of Bandaloo Landscape-Ecosystem Services. Administrative support will be provided by the Foothills Model Forest.

17. Additional Organisations requesting FRIIA Administered Monies

Weldwood of Canada Ltd. (pending funding)

18. Other Relevant Information

None.

Foothills Model Forest 2004-2005 Annual Work Plan Aboriginal Involvement Program

1. Prepared by

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2. Introduction

The project is entering its second year under the direction of the FtMF Aboriginal Coordinator and the arduous process to get four aboriginal communities is finally getting underway with “Guiding Principles” letters of understanding. The project will enter its second year beginning 2004 with four “Memorandum of Agreements (MOA)” contracts complete with TCS/referral process guiding principles. Each community study will last 2 years and an additional year to complete their legacy culture books from their gathered data that they will share with the FtMF. Anticipate that as many as three of four more stakeholder communities would be proposed to undertake similar programs starting in 2005. Program could last several years.

3. Background Information

In an attempt to more clearly understand the needs of aboriginal communities historical ties to the landbase, the FtMF participated in Weldwood’s Aboriginal roundtable. Because of the complex nature of aboriginal interest in the region, the round table concept proved ineffective. Weldwood is addressing aboriginal interests and issues through individual contact and agreements with aboriginal groups contained within, or having current interests in, the company’s Forest Management Area (FMA).

Through consultation, the FtMF Board of Directors has identified the need for a traditional and cultural study (TCS) on lands within the FtMF landbase. In 2001, a program based on elder consultation was initiated and resulted in the development of the TCS protocol for the completion of such a study. Once the draft protocol was completed, it was introduced and endorsed by the local elders at a formal conference held in Hinton. While there are still some questions surrounding the TCS protocol, a Steering Committee consisting of FtMF General Manager, Weldwood, and aboriginal representatives had been established to develop the terms of reference for a possible TCS. The FtMF has recruited a Coordinator/Team Leader in a full-time capacity for Phase III to work on the aboriginal initiative.

4. Objectives

1.) **Knowledge Creation**

The objective of the Traditional Cultural Study (TCS) is to gather aboriginal community sensitive sight location information in the FMF landbase complete with elder's oral history so sensitive sights will be identified so as to not be disturbed by resource management. The program will also develop trust between the aboriginal communities and resource industries through creation of an aboriginal community / FtMF protocol information process and a GIS repository under the terms of reference developed by the Enhanced Aboriginal Initiative Steering Committee.

1a. **Beneficiaries and Impacts**

The application of this knowledge will benefit the aboriginal communities involved by providing recording GIS historical documentation through transcripts, audio and videotapes. An indirect benefit to regional resource companies will be a sensitive sight avoidance referral mechanism which will produce project certainty regarding aboriginal sensitive sight disturbance concerns. This process will be delivered in accordance with the TCS protocol process. The creation of a repository for the communities will create a value for the information collected and help in the assurance of the knowledge being available for future generations of aboriginals.

2.) **Demonstration**

The development, through negotiation, of a Traditional Cultural Study and its data management, in a central repository under a controlled process, will provide well defined procedures and develop trust and aid in building a working relationship between industry, government and aboriginal communities.

2a. **Beneficiaries and Impacts**

Initially the application of this process will benefit the capacity building capability of aboriginal communities involved in the first studies, then the communities identified as traditionally using the FMF area. This sensitive sight avoidance mechanism benefit extends to the natural resource industries working within the FMF area and the main land and resource managers as well. As there is not a defined process provincially, the ultimate goal is to go beyond the boundaries of the FMF and set a provincial standard and possibly influence policy.

3.) **Knowledge / Technology Transfer**

The opportunity exists for capacity building at a number of levels through data management systems and their use. Through TCS we are hoping that knowledge of various FMF programs will come to light in the aboriginal communities, and that the study process will result in a better understanding of the aboriginal communities by natural resource industries and governments.

3a. Beneficiaries and Impacts

Working with aboriginal communities, resource managers, partner organizations and other groups in increasing capacity, documenting oral knowledge and developing a secure data management system, supports the CFMN goal on meaningful involvement of aboriginals in sustainable forest management.

4.) Communications and Outreach

Through the processes and systems developed, the FMF will assist the aboriginal communities with development of their TCS/referral process. A development of trust and responsibility will be developed through information sessions and cultural exchanges.

4a. Beneficiaries and Impacts

The beneficiaries will include the aboriginal communities, the FMF Board of Directors, the partner organization, the FMF staff, contractors, the Model Forest network and other natural resource organizations.

5.) Policy Support

The TCS/referral process may result in the examination of forest and natural resource policy as it relates to management on public lands, where aboriginal interests have been communicated.

5a. Beneficiaries and Impacts

The beneficiaries will be the aboriginal peoples, natural resource industries, governments and the people of Alberta and Canada.

5. Abstract of Methodology

N/A

6. Deliverables

Knowledge Creation

Traditional Cultural Study/referral process for four aboriginal communities complete with TCS format so they can undertake and complete their studies, to be started by April 2004 with completion by March 31, 2006. Workplan will be developed and facilitated with communities, which will include: roles responsibilities, number elders and how they will get the work completed and the information into the FtMF by Jan/Feb 2004.

Demonstration

The completion of an agreed to process for the FMF and four aboriginal communities for documenting traditional knowledge, March 31, 2004. The construction of a secure records management system for the storage and management of the aboriginal study data.

Knowledge / Technology Transfer

Implementation of the aboriginal TCS data repository for aboriginal communities and FMF as per agreed to criteria, April 2004. Continue to improve project information packages that will be distributed to funders and partners.

Communications and Outreach

Working with the aboriginal communities and the partner organizations in culture exchanges and information sharing sessions/workshops, on-going throughout the program to be implements at milestones. Continue to create and maintain FtMF TCS/referral process awareness stewardship amongst aboriginal stakeholder communities, industry and government.

Policy Support

Reports of progress and capacity of the system for use by aboriginal communities, natural resource base industries, and governments, ongoing. Aboriginal community/industry referral process that will address aboriginal community ties to the land disturbance issues. Communities will share quarter sections of blank and void information with the FtMF which will contain areas of interest within them and a community referral contact.

7. Timelines

Task	2004											
	J	F	M	A	M	J	J	A	S	O	N	D
Months	J	F										
	J	F										
	J											
TCS Training	X	X	X	X	X	X						
Personal work plan and review		X										
Steering Committee meetings	X		X		X		X		X		X	
TCS/referral agreements for 4 communities				X	X	X						
Community work plans developed				X								
Records management system					X	X	X	X	X	X	X	X
Data repository – info gathering					X	X	X	X	X	X	X	X
Information sessions/workshops/presentations	X	X	X	X	X	X	X	X	X	X	X	X
Progress reports			X			X			X			X

8. Site Information

9. References

10. Scientific Review

11. Improvements to Management in Forest Ecosystems

12. Amount of Money needed for 2004 program

2004-2005 activities for the position of an Aboriginal Coordinator/Team Leader and program development and management \$200,000.00

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	100,000		40,000			
Canadian Forest Service Aboriginal Program						
Aboriginal Affairs and Northern Development		20,000	20,000			
Weldwood FRIAA		75,000				
CAPP			85,000			
Aboriginal communities					80,000	
Philanthropy			5,000			

14. Proposed Payment Schedule

All promised and pending contributions with exception to Aboriginal Affairs are dependant upon the community agreements.

15. Subcontracted Work

Training, fund raising & administrative

16. Project Management

Once communities get underway

17. Other Relevant Information

Consent of communities and other organizations involved

Necessary research permits or awareness need to be in place with SRD and Jasper National Park and will need to be in effect for the duration of the program.

Need to create awareness of program nationally in 2004 not just locally.

Travel to the Manitoba Model Forest in 2004.

TCS/Referral Process is focused on undertaking and getting FtMF stakeholder communities underway with their TCS so that an aboriginal community/industry referral process can be created to address the aboriginal ties to the land disturbance issues.

Budget will vary with amount of participating communities.

Program subject to funding.

Operating costs alone for 2004 estimated at 140K.

Foothills Model Forest 2004-2005 Annual Work Plan Fish and Watershed Program

1. Prepared by

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2. Introduction

The objectives for the Fish and Watershed program as stated in the Phase III proposal were to:

Continue the channel classification / riparian management project.

Focus on technology transfer and planning assistance for end users of research products.

Initiate research into angler and access effects on fish and aquatic ecosystems, including participation in one or more demonstration areas that serve as adaptive experiments and examples of integrated planning (note that in 2004/2005 further work on this project was deferred until development of detailed terms of reference by users).

Continue development of a fish/watershed monitoring program, and evaluation of road stream crossings.

Continue to build tools that provide a linkage between aquatic resources and operational planning.

Provide watershed and fisheries advice to land and resource managers.

3. Background Information (Year 2 Update)

Year 2 included the successful closure of a major multi-year project on the effects of land-use activities on fish and fish habitat, completion of the annual operational inventory project and the initiation of several new projects intended to meet Phase III objectives. The diversity of our activity team and project partners also increased and a number of new projects have received support in principle.

Program staff included one full-time biologist and two part-time technicians. This represents a significant reduction from Phase II staffing levels. However, the smaller team supported by consultants as required, was successful at achieving Phase III objectives during Year 2.

Early in Year 2 all required deliverables for a multi-year contract with the ACA were submitted and accepted. Deliverables included reports on road stream crossings, stream classification, historical changes in fish populations and their habitats and changes to angling regulations. All reports were posted on the Foothills Model Forest website. During a three-week period in November, the "Overview Fish Passage Assessment at Stream Crossings within the Monitoring Watersheds" was downloaded 166 times, representing 66% of all program reports downloaded. Although there have been few inquiries on the other reports, the

Alberta Conservation Association, the Alberta BioMonitoring Program, Jasper National Park and ASRD/AENV are in the process of developing fish and fish habitat indicators and there may be an opportunity for these groups to learn from the work that we undertook.

The Operational Inventory was completed at a total of 39 sites during the summer of 2003. The inventory project provided an opportunity to test the new database developed by the GIS Program. All field data were entered and summarized on new output reports that included description of pool features and colour photographs from each site. Using an automated process developed by the GIS Program, all data from the previous three years of data were loaded into the standard provincial dataforms and provided to ASRD-FWD in Edmonton for incorporation into their province-wide database.

In the area of stream crossings, two demonstration sites were constructed as a follow-up to FtMF assessments. These include fish passage remediation structures at the CN – Hardisty Creek crossing and the JNP Hwy 16 – Talbot Lake outlet stream crossing. A design for signage and a viewing facility at the Hardisty Creek crossing was initiated with full support from CN. In addition, detailed fish passage remediation designs were completed at three additional crossings in the Hardisty Creek watershed with support from Weldwood and the Town of Hinton. The detailed design process, results and costs were also intended to assist crossing owners during their remediation efforts at other locations. The Hardisty Creek project also included production of streambank, floodplain and fish habitat remediation designs for the Kinsmen Park. The fish habitat and fish passage remediation designs will allow the crossing owners and habitat stakeholders to proceed with fund raising and construction during Year 3.

A collaborative effort with the Natural Disturbance Program – Managing Disturbance in Riparian Areas - was nearing completion at year end and some of the findings were prepared for presentation at the April 26-28, 2004 Forest Land – Fish II Conference. The funding model for this project, where core funds were used to leverage support from a variety of other agencies, may serve for future related projects such as the Large Woody Debris and Sediment Budgets project.

In the Local Level Indicators Program, a review of the shared goals of the various FtMF partners was completed and then a workshop to identify opportunities for GAP analysis was undertaken. As an outcome from these events, the roles and opportunities for the Fish and Watershed Program to support aquatic indicator development and data collection were described in a preliminary proposal. Based on the response from the preliminary proposal, a more detailed proposal will be prepared in Year 3.

During Year 2, membership on the steering committee for the Forest Land –Fish II Conference was expanded to include seven organizations. A professional conference organizer was hired and all other preparation measures for a

conference with 40 presentations and a target audience of 350 are underway. See <http://www.fmf.ab.ca> for details.

4. Objectives

1.) Knowledge Creation

Our knowledge creation efforts will continue to focus on riparian management, stream crossings and local level indicators. Detailed proposals will be developed for one project in each of these three target areas. If all proposals are supported, a second full time professional will be hired as a project manager for at least one of the projects. In addition to new detailed proposals, we will endeavour to produce two manuscripts from previously undertaken research and also produce maps useful for operational planning with findings from previous work.

1a. Beneficiaries and Impacts

Beneficiaries of riparian management project (LWD and sediment budgets) are forest managers within the Foothills Model Forest. This includes the people responsible for planning and regulating harvest activities with the Weldwood FMA and also includes Jasper National Park personnel who may be planning fuel modification projects near riparian areas. Other beneficiaries include forest managers and regulators, particularly those in other foothills areas of Alberta.

The beneficiaries of the proposed LLI work include resource managers, resource stakeholders and other groups interested in the LLI process.

The beneficiaries of the proposed stream crossing association are primarily crossing owners who are interested in achieving fish passage and water quality conservation at their crossings.

2.) Demonstration

Demonstration site development efforts will focus on Hardisty Creek within Kinsmen Park. These efforts will be done collaboratively with other stakeholders in the Hardisty Creek Watershed Restoration Project.

2a. Beneficiaries and Impacts

The beneficiaries will include resource managers, resource stakeholders and other groups interested in fish passage, stream bank and fish habitat restoration. A provincial stream bank restoration working group has recently been struck within the Peace River area with representatives from government and industry and we will present our planning process, designs and outcomes to this group for their consideration and potential application. The local community and participants in the Hardisty Creek Restoration Project should also benefit.

3.) Knowledge / Technology Transfer

We will continue with our Operational Inventory Program and provide information that is relevant to Weldwood's ongoing forest planning activities.

The Forest Land – Fish II Conference should foster a mutual understanding on the concepts and benefits of sustainable forest management issues among policy makers, practitioners, researchers and the public.

3a. Beneficiaries and Impacts

The intended audience includes both the scientific and management communities. The scientific community includes biologists employed by other agencies in the province of Alberta. The management community includes staff of Weldwood, ASRD, Jasper National Park and other agencies.

4.) Communications and Outreach

As in Year 2, outreach programs will be produced for technical, management and public audiences. The Communications Program will develop public programs with our assistance.

4a. Beneficiaries and Impacts

Public programs are intended for local residents and visitors to the area. The information may also be used to educate stakeholder groups such as FRAG.

5.) Policy Support

Our efforts are intended to influence policy such as the Provincial Forest Operations Ground Rules. In addition, our work with Local Level Indicators may influence the policy established by other government initiatives.

5a. Beneficiaries and Impacts

Our proposed work should influence a range of resource stakeholders. as well as participants in other adaptive management efforts.

5. Abstract of Methodology

A number of candidate projects were identified for Year III. All candidate projects will start from a preliminary proposal that requires endorsement from the activity team, including Board Liaisons. Approved projects will then proceed to the detailed proposal stage where project outcomes, additional external funding sources and project partners will be identified. Once commitments are received from partners, project initiation would follow. This approach has proved successful on a number of Phase III projects that have proceeded beyond the detailed proposal stage including:

Forest Land – Fish II Conference

Hardisty Creek Fish Passage and Fish Habitat Remediation Plan

CN – Hardisty Creek stream crossing remediation demonstration site

Highway 16 - Talbot Lake Outlet stream crossing remediation demonstration site

Managing disturbance in riparian areas project

Phase III, Year 3 will include development of up to four new detailed proposals addressing the three key program issues (riparian management, stream crossings and local level indicators). Core funds will serve as seed funds for these projects that require substantial outside support in order to be feasible.

6. Deliverables

Knowledge Creation

- Detailed proposal for implementation of the local level indicators strategy.
- Detailed proposal for LWD sediment budget research project and pilot field study.
- Detailed proposal for stream crossing association.
- Version 1 of fish presence/absence map for Weldwood FMA and extrapolation into Jasper.
- Manuscript: Probability of fish occurrence.
- Manuscript: Effects of Dogrib fire on channel stability and large woody debris recruitment in small foothills streams.
- Overview culvert assessment for Athabasca River north tributaries in Jasper National Park.

Demonstration

- Detailed proposal for restoration at Kinsmen Park, Hardisty Creek.

Knowledge / Technology Transfer

- Map and report of 2004 Operational Inventory of Fish and Fish Habitat. December 31, 2004.
- Forest Land – Fish II Conference and Proceedings. April 26-28, 2004.

Communications and Outreach

- FMF public programs with fish and watershed program content as determined by our activity team. June 31, 2003.
- Two quick notes covering a range of fish and watershed program topics. March 31, 2005.
- Detailed proposal for stream classification extension / training program.

Policy Support

- Contribute during the revision of the riparian management portion of the Weldwood Operating Ground Rules.
- Contribute during the revision of the riparian management portion of the Provincial Timber Harvest Operating Ground Rules.

7. Timelines

Task	2003										2004		
	A	M	J	J	A	S	O	N	D	J	F	M	
1. 2004 Operational Inventory	X	X	X	X	X	X	X	X	X				
2. JNP fish and fish habitat inventory at stream crossings.				X	X	X	X	X					
3. Version 1 of fish presence/absence map for Weldwood FMA and extrapolation into Jasper.	X	X											
4. Forest Land – Fish Conference proceedings and two FtMF presentations.	X												
5. Manuscript: Probability of fish and fish habitat occurrence.	X	X	X	X	X	X	X	X	X	X	X	X	
6. Manuscript: Effects of Dogrib fire on channel stability and large woody debris recruitment in small foothills streams.	X	X	X	X	X	X	X	X	X	X	X	X	
7. Fund-raising and implementation of stream restoration at Kinsmen Park, Hardisty Creek.	X	X	X										
8. Detailed plan for completing Phase III local level indicators report.	X	X	X	X	X	X	X	X	X	X	X	X	
9. Detailed proposal for LWD sediment budget research project.	X	X	X	X	X	X	X	X	X	X	X	X	
10. Detailed proposal for stream crossing association.	X	X	X	X	X	X	X	X	X	X	X	X	
11. Detailed proposal for stream classification extension.	X	X	X	X									
12. FMF interpretive programs with fish and watershed content.	X	X	X	X	X	X							
13. Quick notes.	X	X	X	X	X	X	X	X	X	X	X	X	

8. Site Information

Work will be conducted within the FMF. Riparian research projects may occur in other parts of the province.

9. References

Provided on request.

10. Scientific Review

For all technical papers, scientific review will be requested from a number of individuals considered to have a background or expertise in the area of study involved. The review will not be limited to members of the activity team and may include academics and private sector professionals who are knowledgeable in the area of study. The project leader will ensure that reviewers have at least three weeks to provide their comments.

11. Improvements to Management in Forest Ecosystems

Today’s managers are tasked with considering the structure and function of forest ecosystems into their planning activities. The FMF watershed and stream classification system and riparian management projects are intended to provide practical tools to assist managers and field technicians describe the structure and function of these systems in a meaningful manner.

Forest ecosystem managers also have limited resources. They have indicated that they need maps and management frameworks that organize complex scenarios. The products that we are in the process of developing are intended to be very practical in their application.

12. Amount of Money Requested From the Foothills Model Forest

This workplan was based on a budget of \$147,000 from the Foothills Model Forest.

13. Partner Contributions

Partner/Organization	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	\$147,000					

Additional funds will be pursued following the production of the detailed project proposals.

14. Proposed Payment Schedule

Payments from each of the above partners are requested on a quarterly basis.

15. Subcontracted Work

Subcontracted work has not been identified for any of the tasks identified. However, the activity team may consider contracting outside expertise to address any specific tasks or issues that are beyond the area of expertise of the FtMF staff.

16. Project Management

Richard McCleary will oversee all projects. The Operational Inventory Project may be delegated to a senior technician. Will we recruit a full time person to coordinate the stream crossing association.

17. Additional Organizations requesting FRIIA Administered Monies

18. Other Relevant Information

Fish collection permits will be required for proposed research work to be conducted within Jasper National Park and the lands managed by the Alberta Sustainable Resource Development. Applications will be submitted to appropriate agencies. Permits will be also be required should the Hardisty Creek project proceed to the implementation phase. Permits and authorizations will be obtained from Fisheries and Oceans Canada, Alberta Sustainable Resource Development and Alberta Environment. Hardisty Creek has been designated as non-navigable and therefore our project will not trigger the Canadian Environmental Assessment Act.

Foothills Model Forest 2004-2005 Annual Work Plan Woodland Caribou Project

1. Prepared by

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2. Introduction

The Foothills Model Forest Woodland Caribou Program was initiated in 1993 as a component of FMF - Phase 1. The original program built on work that had been initiated in 1981 by the Alberta Fish and Wildlife Division. The original objective was to test for temporary or permanent exclusion of one woodland caribou herd from timber harvest areas. The project analyzed 16 years of winter range distribution between 1981 and 1996 (Smith *et al.* 2000). Timber-harvest strategies were recommended that (i) ensured an adequate area of suitable habitat (ii) minimized the amount of fragmented area, and (iii) in the short term, avoided core areas of woodland caribou use. A subsequent proposal was submitted for the FMF – Phase II program.

3. Background Information

During FMF - Phase II, the program expanded to include the 3 main herds in west central Alberta. A multi-partnered, comprehensive program plan was developed and the 3-year plan was completed in March 2002. A new 3-year plan has been developed and this application forms a part of the greater program. Adult female survival, calf recruitment and distribution continued to be cornerstones of the trend validation program and these parameters were collected for all 3 herds. Research highlights included the completion of 3 MSc thesis (Oberg 2001, Szkorupa 2002, Kuzyk 2002), the initiation of a 4th MSc program (Smith 2001) and a Ph.D. Program (Lessard 2001). Paula Oberg's thesis entitled, "Responses of mountain caribou to linear features in a west central landscape" documented a reduction in caribou use of habitat adjacent to linear disturbances (the exception being older seismic lines). Tara Szkorupa's work confirmed the importance of old forests with moderate to heavy canopy coverage as caribou habitat. Gerry Kuzyk's thesis, "Wolf distribution and movements on caribou ranges in west – central Alberta" focused on wolf activity and distribution in a managed forest as an initial examination of potential predator affects on woodland caribou. Kirby Smith's MSc thesis work, "Woodland Caribou Demography and Persistence Relative to Landscape Change in west central Alberta" is an initial attempt at examining thresholds of industrial activity as it relates to woodland caribou conservation. Bob Lessard's Ph.D. thesis will develop population dynamics models that assess the information gains from monitoring recruitment rates, diet composition and mortality rates as well as addressing management implications in a multi-stakeholder context. Finally, Layla Neufelds' MSc thesis will provide an

expanded aspect of “predator/prey/landscape change” mechanics by tracking GPS collared wolves and caribou simultaneously, by examining the summer diets of wolves and by linking wolf/caribou distribution to landscape features. This will tie much of the previous work together to assist managers in making landuse decision based on empirical data from west central Alberta.

During the first 2 phases of the program, the Foothills Model Forest has acted as a catalyst to bring about a comprehensive woodland caribou conservation program as a pre-requisite for sustainable management. What is now a regional initiative enjoys the support of the timber industry, the oil and gas industry and both the Federal and Provincial Governments. Results from this work have been incorporated into Detailed Forest Management Plans for Weldwood, Weyerhaeuser, Alberta Newsprint Company and Canfor. In addition, the recently published “Status of woodland caribou in Alberta” (Dzus 2001) relied exclusively on the work conducted by the West Central Alberta Caribou Standing Committee (which included the support from the FMF) for the Eastern Slopes portion of the province. Most recently, the initiative to develop a regional Habitat Supply Assessment for woodland caribou in west central Alberta is incorporating the MSc research of Paula Oberg, Tara Szkorupa and Gerry Kuzyk, the previous FMF research (Smith *et al.* 2000) along with timber harvest projections from the 4 FMA holders.

4. Objectives

1.) Knowledge Creation

The FMF woodland caribou program will focus on the mechanics of the relationships that have been documented to date (i.e. use of older forests by caribou, avoidance of active timber harvest, avoidance of roads). The opportunity now exists to implement, test and validate some of the strategies designed to mitigate potential problems; however, there are a number of questions that need to be addressed in order to examine the range of land-use changes and chose the most appropriate strategies.

1a. Beneficiaries and Impacts

All land managers, wildlife agencies and industrial companies that operate in woodland caribou range will benefit from this work in terms of increasing the knowledge necessary to conserve this species in an industrial landscape. Ultimately, society will benefit as a whole if it can be demonstrated that sustainable resource development is achievable through adaptive management.

2.) Demonstration

To be able to demonstrate sustainable resource management by conserving a threatened species within an industrialised landscape.

2a. Beneficiaries and Impacts

This initiative will focus on land management areas that will demonstrate, in quantitative terms, the effects of landscape change on woodland caribou habitat use and population response.

- 3.) **Knowledge / Technology Transfer**
 To disseminate information that may be applied to conservation of a threatened species at a landscape scale in a managed forest setting. It is anticipated that the results of this work can be applied in many other jurisdictions.
- 3a. **Beneficiaries and Impacts**
 The Foothills Model Forest Woodland Caribou Program will allow validation of the habitat supply model, which is being developed by the WCACSC in partnership with the timber industry, the oil and gas industry, SRD and the University of Alberta. Results from the FMF Caribou Program have been presented at technical sessions in Alberta and the Yukon Territories. Requests for presentations of this information have increased in recent years, including both talks (e.g. Global Environmental and Outdoor Education Council, Grande Yellowhead Teachers Fall Conference, Alberta Chamber of Resources) and written submissions (Newsletters, Research Notes). The inclusion of this information in the NES IRM ALCES model will be of particular importance to the public's appreciation of cumulative effects. Also, same as 1a.
- 4.) **Communications and Outreach**
 To communicate scientifically sound results that withstand the rigours of peer review and are applied in many jurisdictions to conserve this threatened species in a managed forest setting.
- 4a. **Beneficiaries and Impacts**
 This initiative will increase the understanding of both resource managers and the public of the effects of landscape change on the habitat availability and population response of this threatened species; *one that was chosen as a biodiversity indicator by the FMF.*
 See 1a, plus the scientific public in general.
- 5.) **Policy Support**
 To assist policy/decision makers and the general public in helping to form policy that can address the goals of **sustainable resource management.**
- 5a. **Beneficiaries and Impacts**
 See 1a
5. **Abstract of Methodology**
 Validation of population trends: Important demographic parameters will be measured, including herd size, calf recruitment and adult survival. These data will validate population trends, and may enable research on the factors affecting populations. Validation of population trends will also be combined with historic data on landscape condition, to determine the effects of industrial development on caribou populations (this will be completed through a graduate student project at the U of A). VHF collars and aerial surveys will be used for population assessments.

Caribou habitat requirements: Caribou habitat and landscape requirements, and response to landscape change will be analysed to assist in planning for long-term habitat supply, specifically in relation to planned timber harvesting and oil & gas exploration/development. Four years of Global Positioning System (GPS) location data, collected from collars on adult female caribou, will provide information on the areas selected by caribou. These collars will be deployed on caribou for 2003-04, to collect additional data (including data on summer habitat use). Recently completed graduate research on caribou habitat selection will be expanded on, to determine the broader landscape requirements of caribou (including factors such as patch size and adjacency).

Predator-prey interactions: Research will continue on the spatial distribution and habitat use of wolves. Data from GPS collared wolves will be used to determine how wolves respond to linear disturbances and other landscape changes. The factors affecting wolf densities will be examined and subsequent effects on caribou populations will then be evaluated.

Human activities: Research will be conducted on ways to reduce the human footprint, to ensure that industrial activity in caribou ranges is consistent with caribou conservation.

6. Deliverables

Knowledge Creation

- We will validate population trends through the basic indicators of adult female survival, calf recruitment and winter distribution, thus providing a long-term assessment of the effectiveness of landuse decisions. New knowledge will be gained in terms of what combinations of factors influence caribou distribution (Resource Selection Functions), how access might be managed to reduce impacts on woodland caribou and an examination of potential thresholds of cumulative effects (timber harvest plus oil and gas activity plus recreation activities). An individual animal based model will be developed that will provide a “level of risk” decision support tool to assess different landuse scenario’s (analogous to the Decision Support System originally proposed by the FMF at it’s inception). There is a direct linkage to the WCACSC Habitat Supply Program (currently contracted to Forestry Corp – Edmonton). In addition, future linkages include the fire research program in South Jasper National Park and possibly including results from FMF Grizzly Bear Program and the Foothills Growth and Yield Program in future habitat assessment models.
- The results will be reported on annually or by the end of the 5-year program plan either in the form of a publication, thesis or project report. Results will also be presented and discussed during WCACSC Annual Meetings. Newsletters will be produced as above and Quick notes will also be generated from each thesis produced. This project directly addresses the key Model Forest Program areas of maintaining biological diversity, maintaining forest ecosystem condition (and productivity), providing multiple benefits to Society and assuming Society’s responsibility for sustainable development.

Demonstration

- The 3 herds that will continue to be examined in west central Alberta will provide on the ground examples of adaptive management that have measurable criteria assessed on an annual and long-term basis. The project will be directly linked to the Highway 40 Demonstration Initiative. The Activity Team Leader, Kirby Smith, will become directly involved in the Highway 40 Demonstration Initiative in February, 2004. A number of demonstration possibilities will be considered for incorporation into this co-operative project including:
- An expanded description of the natural history of woodland caribou as it relates to land management strategies (to compliment the limited message already in place along Highway 40).
- Illustrations of how caribou and wolves use the landscape based on sequential GPS locations from radiocollared animals.
- A demonstration of selection logging along Highway 40 as a means of maintaining caribou food (lichen) while removing some timber products.
- An explanation of the intent of the *West Central Alberta Operating Guidelines for Industrial Activity in West Central Alberta* and examples of how these have been applied.
- A demonstration of some of the new techniques being applied by the Oil and Gas Industry to reduce it's "*industrial footprint*" relative to caribou conservation (i.e. heliportable, narrow seismic lines, scratch access).
- Examine the potential of ecotourism opportunities for viewing woodland caribou along Highway 40. (Make presentation to Alberta Infrastructure if Highway 40 is upgraded and more pullouts might be considered).

Knowledge / Technology Transfer

- Requests for the Canadian Journal of Zoology paper (Smith *et al.* 2000) continue to be received. In particular, this work represents one of the few publications that have examined caribou/timber harvest questions. The habitat supply, caribou response to linear developments (Oberg 2001) and preferred habitat parameters research (Szkorupa 2001), will likewise be of tremendous interest to land managers within and outside the province of Alberta. Over the next 5 years, the examination of thresholds relative to cumulative effects, comprehensive analysis of resource selection functions and continued assessment of the influence of access on 2 additional herds will be examined.
- The results will be reported on annually and/or by the end of the 5-year program plan either in the form of a publication, thesis or project report. Results will also be presented and discussed during WCACSC Annual Meetings. Newsletters will be produced as above and Quick notes will be also generated as required. The results will be made available in the FMF Annual Report.

Communications and Outreach

- The WCACSC Communications Strategy will be followed (see attached) including the following. All publications will acknowledge the contribution made by the Foothills Model Forest. Newsletters are produced by WCACSC as new

- information becomes available (usually a minimum of twice yearly). This newsletter will be made available to FMF partners and stakeholders, as well as program partners and collaborators (print and electronic copies). All graduate students will provide a thesis at the completion of their research. Peer- reviewed publications arising from their work are very desirable, and students are encouraged to follow in that direction. (Given the academic involvement of Dr's Fiona Schmiegelow and Mark Boyce from the University of Alberta, this is a very real expectation). The more reputable journals have a standard protocol for review (often 2-3 published researchers current in that field/with that species). However, given the popularity of these journals, publication may take more than 1 year.
- The results of the FMF program will be reported on annually, and by the end of the five-year program plan in the form of a publication, thesis or project reports. To meet the requirements of the FMF 2003-2004 work plan for partner reporting, WCACSC Research meetings will be held at least quarterly. Results will also be presented and discussed during WCACSC Annual Meetings. Quick notes will be produced based on each thesis and made available to FMF partners and stakeholders (print and electronic copies). A Link from the WCACSC Internet Home Page <http://www.rr.ualberta.ca/research/caribou/links.htm> to the FMF Home Page is also currently in place. Graduate students and the Team Leader will also present results at conferences and workshops when appropriate (e.g. The Wildlife Society 11th Annual International Conference, Calgary, AB September 2004).

Policy Support

- The Federal Governments Species at Risk Legislation and the ASRD Ministers' direction to initiate Recovery Plans within 2 years of the passing of the Federal Legislation provide strong policy support. It is anticipated that new information and knowledge gained from this initiative will support policies and practices aimed at SFM in ecosystems that are prone to cumulative changes brought about by resource extraction. Adaptive management is continuously facilitated, as results of caribou research become available. These findings are used to refine the *West Central Alberta Operating Guidelines for Industrial Activity in West Central Alberta*. Based on the work supported by the Foothills Model Forest, recommendations are also being proposed, or have been integrated into the *Northern East Slopes Integrated Resource Strategy*, the *Woodland Caribou Recovery Plan for Alberta* and into *Detailed Forest Management Plans*.

7. Timelines

Proposed Timelines - FMF Woodland Caribou Project

YEAR	ACTIVITY
2004	Continue large-scale caribou/wolf/alternate prey research. Continue validation of population trends. Complete landscape population dynamics model (Lessard PhD) Apply WCACSC guidelines to all industrial activities and continue monitoring population demographics of all herds to assess efficacy of land management strategies. One Quicknote by December 2004. Complete progress report by March, 2005.
2005	Initiate write-up of large-scale research program. Finalize validation of population trends. Apply WCACSC guidelines to all industrial activities and continue monitoring population demographics of all herds to assess efficacy of land management strategies. One Quicknote by December 2005. Assess effectiveness of Recovery Plan and complete monitoring for the 5-year Program Plan.

8. References

Dzus, E.H. 2001. Status of the Woodland Caribou (*Rangifer tarandus caribou*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 30, Edmonton, AB 47 pp.

Kuzyk, G.W. 2002. Wolf distribution and movements on caribou ranges in west – central Alberta. M.Sc. Thesis, Dept. of Renewable Resources, University of Alberta, Edmonton, AB. 127 pp.

Lessard, B. 2001. PhD. Proposal, Dept. of Renewable Resources, University of Alberta, Edmonton, AB

Oberg, P. 2001. Responses of mountain caribou to linear features in a west-central Alberta landscape. M.Sc. Thesis, University of Alberta, Edmonton, Alberta, Canada.

Smith, K.G., E.J. Ficht, D. Hobson, T.C. Sorensen, and D. Hervieux. 2000. Winter distribution of woodland caribou in relation to clear-cut logging in west-central Alberta. *Canadian Journal of Zoology* 78: 1433-1440.

Szkorupa, T. 2002. Multi-scale habitat selection by mountain caribou in west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta, Canada.

9. Scientific Review

As per above, all graduate students provide a thesis at the completion of their research and most often there is an expectation that peer reviewed publications arising from their work are very desirable. (Given the academic involvement of Dr's Fiona Schmiegelow and Mark Boyce from the University of Alberta, this is a very real expectation).

10. Improvements to Management in Forest Ecosystems

This project continues to be one of the few projects that we are aware of in Canada, which provides long-term monitoring of a fine filter indicator relative to sustainable forest management.

11. Amount of Money Requested From the Foothills Model Forest

\$50 000. Funding will be used for support of Layla Neufelds’ MSc thesis work which will provide an expanded aspect of “predator/prey/landscape change” mechanics by tracking GPS collared wolves and caribou simultaneously, by examining the summer diets of wolves and by linking wolf/caribou distribution to landscape features.

12. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Current Research Balance	0					
Foothills Model Forest			\$50 000			
CAPP members		\$30 000	?			
Forestry Companies		\$70 000				
ASRD			\$15 000		\$10 000	
University of Alberta					\$20 000	
Alberta Conservation Association			\$9 000		\$5 000	

13. Proposed Payment Schedule

We would like to provide invoices to the FMF for payment up to the total allocated.

14. Project Management

Kirby Smith, AFWD, Edson

15. Supporting Agencies

- West Central Caribou Standing Committee
- Alberta Conservation Association
- Weldwood of Canada
- Weyerhaeuser Canada
- University of Alberta, Department of Renewable Resources and Department of Biological Sciences
- Canadian Forest Products
- Talisman Energy Canada
- Husky Oil Canada
- Alberta Sustainable Resource Development
- Alberta Newsprint

WCACSC Web Page:
[Http://www.rr.ualberta.ca/research/caribou/Stakeholder.htm](http://www.rr.ualberta.ca/research/caribou/Stakeholder.htm)

Foothills Model Forest 2004-2005 Annual Work Plan Grizzly Bear Research Program

1. Prepared by

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2. Introduction

In 1999 the Foothills Model Forest Grizzly Bear Research Program (FMFGBRP) was initiated with a goal of providing new knowledge, tools and models to aid in the long-term conservation of this species in Alberta. Over the course of the past 5 years this program has fulfilled its mandate and has developed a number of new tools and models (Franklin et. al, 2001, Nielsen et. al. 2002, 2003, Schwab et. al. 2002, and Stenhouse et. al. 2000, 2001, 2002) that are now being used in land management planning in portions of the eastern slopes of Alberta, where we have completed this work. This work provided new insights into many aspects of grizzly bear ecology related to sustainable resource development and land management planning.

Our research team has also made some important new findings, related to grizzly bear health that have potentially serious implications for the long-term survival of grizzly bears in portions of their range.

The program's achievements to date are in large part a result of the partnerships we have formed within this research undertaking. These partnerships start with our numerous sponsors who believe in the principles of adaptive management and sustainable development in conjunction with conservation of this important species. Our sponsors have continued to provide ongoing support for our program during the past 5 years. Our partnerships also include the teams of scientific specialists (biologist, GIS analysts, geneticists, statisticians, veterinarians, remote sensing experts, reproductive endocrinologists, and population modelers) (see also Appendix A) who have worked co-operatively to aid in understanding the complexity of grizzly bear ecology and response to human activities. Without the teamwork and support of all these partnerships this program would not have achieved the major successes we have to date.

The success I refer to is not limited to ongoing support and data collection but rather is reflected in the numerous scientific publications that have been generated, the list of graduate students that have received degrees and training within this program, but most importantly the research results being applied by resource companies and land managers with an aim of integrating the needs of

grizzly bears into planning efforts. Applied research has been and continues to be a primary focus of our program and the most important goal.

Although we have completed the first phase of this program, and are now analyzing data sets to complete our final report, there remains a need to extend the model and tools we have developed to the other areas of the province that have grizzly bear habitat with no planning tools or models to assist in grizzly bear conservation and management. In addition we believe it is both necessary and advantageous to attempt to further our understanding of grizzly bear health parameters to environmental/landscape conditions as an aid to monitor the overall health of grizzly bear populations in Alberta over the long-term.

To move forward with this vision, this document outlines three primary areas of research, which our research team is proposing for 2004-2005. This work builds from our current accomplishments and continues investigation of new discoveries that have been made over the past five years.

PART 1. ONGOING REMOTE SENSING HABITAT MAPPING WITH RSF AND GRAPH THEORY MODELING – (RESEARCH TEAM STENHOUSE, FRANKLIN AND BOYCE)

1. Progress to Date

Over the past 5 years the Foothills Model Forest Grizzly Bear Research Program has made significant advances in improving our understanding of how grizzly bears use forested landscapes along the eastern slopes of Alberta. This research program has also developed new tools and models to assist in sustainable forest management practices and decisions concerning the long-term conservation of grizzly bears. These include:

A satellite image classification and greenness estimation protocol for large areas and long time periods.

Remote sensing tools to map and identify grizzly bear habitats and human use features at the landscape level.

The use of resource selection function models (RSF) to predict probability of grizzly bear occurrence at the landscape level. Grizzly bear response to cutblocks is one finding of this exercise.

The use of graph theory models to identify grizzly bear movement corridors at both the home range (watershed) and landscape level.

A multi-disciplinary team of researchers from the Foothills Model Forest, the University of Alberta, University of Saskatchewan, and the University of Calgary developed these tools and models. These products have now been tested and validated in a 10,000-km² study area along the east slopes of Alberta adjacent to Jasper National Park and Whitehorse Wildland Park. Validation of these products is currently underway (2003-2004) for an extension area north from Highway 16 to the Berland River and south from the Brazeau River to the Clearwater River. This work is proceeding on schedule and budget. Findings from this work have been peer reviewed and published in the scientific literature (see Franklin et al.

2001, Nielsen et al. 2001, and Schwab et al. 2002). We now have proven models and tools to apply in the management and planning of forest resources to support the management and conservation of grizzly bears in a large portion of the eastern slopes and foothills of the northern Rocky Mountains of Alberta. We propose to extend the classification and mapping of grizzly bear habitats along the eastern slopes and foothills south to the Montana border in 2004-2005, where there are ongoing immediate needs for forest management planning. There are also plans beyond 2004-2005 to expand north into the Boreal forest in 2005-2006. This will enable us to test and refine the tools and models in new areas in order that they may be applicable over a wider landscape. We clearly recognize that models developed for the Foothills natural sub-region may be different from those required in the Parkland, Grassland and Boreal sub-regions of Alberta. The basic approach we have used to generate and test the current models will still apply to different landscapes and we envision that new model coefficients will be required. The collection of new test data when combined with new remote sensing based habitat maps will allow the development of “ecosystem appropriate” models. This research represents a continuation of new approaches to integrating grizzly bear habitat mapping with forest planning at multiple scales. Having these products will aid foresters and land managers with sustainable forest management practices and decisions.

Grizzly bears are a resource that has a high value among the public of Alberta both from a recreational perspective and as an indicator of ecosystem health. Other forest resources such as pulp, lumber, oil and gas also provide significant economic benefit to Albertans. This research seeks to ensure that grizzly bears and other forest resources can continue to provide benefits to Albertans. Grizzly bear habitat in Alberta covers an area of approximately 228,000 km², and at the completion of this phase of this program we will have habitat maps and models available for 143,488 km² or 63% of the Alberta range of this important species. The ultimate goal of this program will be to have one seamless grizzly bear habitat map, with appropriate validated predictive maps and models for the entire currently identified grizzly bear range in Alberta.

2. Goal

Building on the work currently underway (2003-2004), the research team would like to continue the development of a seamless grizzly bear habitat map and RSF/Graph theory models for an area that would extend along the eastern slopes to the Montana border. These products would provide land and resource managers with new mapping products and tools to use for making forest resource planning and management decisions which support conservation of grizzly bears in Alberta. This will allow habitat and movement requirements of grizzly bears to be taken into account during the development of forest resources and assist in providing for sustainable forest management.

3. Objectives

To build upon and extend the remote sensing habitat map work already completed in a 103 405-km² portion of the province to include adjacent regions along the eastern slopes of Alberta down to the Montana border (Figure 1).

To prepare maps showing probability of grizzly bear occurrence (RSF models) on the wider landscape.

To prepare maps showing potential movement corridors for grizzly bears (Graph Theory Models) on the wider landscape.

Collect a data set of grizzly bear habitat use and movement patterns in these areas for testing and refining RSF and graph theory model performance.

To deliver these tools to land and resource managers in both government and industry and provide training on interpreting maps and model outputs to ensure these products are widely used for resource and land management planning.

4. Geographic Areas

The proposed program would be an extension of work that our team completed in 2003 and the expansion work identified in 2003-2004. We propose to expand south along the foothills and east slopes down to the Montana border in 2004-2005. A map of the study area is presented in Figure 1. The map illustrates the planned extension area proposed for 2004-2005 and also shows the proposed extension area planned for 2005-2006 further north into the Boreal forest.

Funding for the Boreal forest expansion will be sought at a later date. This southern study area was selected to not only build upon work currently completed, but based on identified portions of the eastern slopes where significant land use activities are occurring and industry sectors have identified new exploration and development plans. Currently no habitat mapping products or tools are available to assist land use managers and forest management area holders in addressing habitat use and movement corridors for grizzly bears in this area. The area is adjacent to two National Parks (Banff and Waterton), and includes a number of Parks and Protected areas in Alberta. The proposal meets the landscape priorities for sustainable forest management. A significant body of evidence (see Stenhouse and Munro 1999, 2000, and 2001) suggests that grizzly bears have large home ranges and depend on lands adjacent to Parks to meet their annual requirements.

5. Work plan

Objective 1:

Create a seamless integrated grizzly bear habitat map to cover an area along the eastern slopes of Alberta. This will build upon and extend the work already completed in a 103 405-km² portion of this area.

Activities:

- Acquire the necessary satellite images for processing (N=3).
- Pre-process images (atmospheric correction, edge matching, etc.).
- Image classification.
- Collect and assemble all current human use GIS data sets.
- Ground truthing of images from existing data sets and field data.

Timelines: Activity one will be completed for the south extension area by December 2004.

Objective 2:

Utilizing map products from Objective 1 and existing RSF models and established coefficients, analyze this area and create probability of grizzly bear occurrence map products for two different seasons (pre and post berry).

Activities:

- Working with current RSF model coefficients conduct model runs on these new landsat scenes.
- Using new GPS grizzly bear telemetry data collected during the summer of 2004, test, validate and modify where necessary the RSF models.
- Prepare and distribute final probability of grizzly bear occurrence maps.

Timelines: RSF model work requires finished habitat map layers so we cannot begin this work until the map layers are completed. Therefore this work will start in December 2004 and be completed by April 2005 for the southern extension area.

Objective 3:

Utilizing products created in Objectives 1 and 2, use recently completed and tested graph theory model results to generate landscape level grizzly bear movement corridor maps.

Activities: -Utilizing the RSF landscape level map output file, we will conduct graph theory model runs with current validated coefficients for the new Landsat scenes.

Timelines: This work is also linked to the creation of a habitat layer and also the RSF model output runs. Therefore we will also be starting this work in December 2004 and will have it completed and distributed by April 2005 for the southern extension area.

Objective 4:

Collect a data set of grizzly bear habitat use and movement in these areas for testing RSF and graph theory model performance. *(Note: validation of these models on new landscapes is considered an important component of this work. Hence we feel it is important to collect test data from these new areas, the proposed testing will provide models which are both science based and empirically tested)*

Activities: -In order to properly test and validate the existing model outputs and results in new landscapes it is important to collect a sample of bear habitat use and movement data within areas identified within the new Landsat scenes.

-We plan to capture and collar a total of 15 grizzly bears in the identified geographic area to collect GPS location data for model verification purposes. This data will only be collected for this purpose for 1 year (2004). It is important to point out that these collars do not have to be purchased (15 x \$5K = \$75K), but are now in hand as assets of the FMF grizzly bear research program. We only require funding for collar batteries and ear tag transmitters (\$20K).

Timelines: The capture and collaring for the southern extension area will take place in May-June of 2004. Data collection would occur every month through

programmed data uploads and collars would be recovered in the spring of 2005 after den emergence.

Objective 5:

Deliver these tools to land and resource managers in both government and industry and provide training on interpreting maps and model outputs to ensure these products are widely used for conservation planning and stewardship. We plan to deliver these products and information to the AFPA (Alberta Forest Products Association) and its members, CAPP (Canadian Association of Petroleum Producers) and its members, and ASRD (Alberta Sustainable Resource Development) through a series of formal workshops to be held in the spring of 2005. The workshops for our 2003 work and products are scheduled for the spring of 2004. *(Although this is listed as objective 5 it is the most important component of this proposal. However this objective cannot be delivered without the completion of objectives 1-4.)*

Activity and Timeline:

All final products and reports will be completed and distributed by April 2005 for the southern extension area to both government land and resource management staff and industry partners. Workshops will be conducted in the spring of 2005.

6. Results And Key Deliverables

A seamless grizzly bear habitat map for the target area along the eastern slopes. RSF map products and coefficients for this study area (tested and validated).

Landscape level grizzly bear movement corridor maps for this study area (tested and validated).

A series of workshops designed to introduce the tools and models to land and resource planners in both government and industry.

Final products and reports will be available to the general public through the Foothills Model Forest.

At the completion of this project, land and resource planners in both government and industry sectors in this region will have the tools and models to make informed decisions, taking into account grizzly bears requirements, which will be a significant step forward to ensuring the sustainable use of forest resources while providing for the long-term survival of grizzly bears.

7. Evaluation

The models and outputs from this work will be evaluated using statistical procedures to determine the degree of fit with test data sets. Habitat map products will be evaluated using standard GIS remote sensing mapping evaluation schemes. The use of these new tools will be tracked through the government and industry planning process.

8. Budget Information

Operating Plan for the period April 1, 2004 to March 31, 2005:

Expenditures	Amount
	Cash
Purchase Landsat Images (N=3)	\$4000
Pre-process Landsat Images (3x \$6K)	\$18,000
Image classification (3x \$8K)	\$24,000
Ground truthing of 4 landsat scenes (3x \$16K)	\$48,000
Assembly of human use GIS data sets (4 weeks)	\$12,000
RSF modeling for 3 TM scenes (4 months)	\$15,000
Movement corridor modeling (4 months)	\$15,000
Capture and collaring costs of 15 bears	\$65,000
Collar data collection (remote via aircraft)	\$25,000
Map production/report preparation	\$3,000
User workshops (N=3)	\$10,000
GIS staff support	\$18,000
Computer hardware and software support for expanded area	\$5,000
GPS batteries and ear tag transmitters	\$20,000
Travel and meeting costs with program collaborators	\$5,000
Total	\$287,000.00

9. Papers resulting from habitat mapping project to date:

Franklin, S.E., G.B. Stenhouse, M.J. Hansen, C.C. Popplewell, J.A. Dechka, and D.R. Peddle. 2001. An integrated decision tree approach (IDTA) to mapping land cover using satellite remote sensing in support of grizzly bear habitat analysis in the Alberta Yellowhead Region. *Canadian Journal of Remote Sensing*, 26: 579-592.

McDermid, G.J. 2003. Remote Sensing for Large-Area Ecosystem Management. PhD Comprehensive Exam. Department of Geography, University of Waterloo, Waterloo, Ontario, Canada.

Nielsen, S.E., M.S. Boyce, G.B. Stenhouse and R.H.M. Munro. 2001 Modeling grizzly bear habitats in the Yellowhead Ecosystem of Alberta: taking autocorrelation seriously. *Ursus* 13:45-56.

Nielson, S.E., M.S. Boyce, G.B. Stenhouse, R.H.M. Munro. 2003. Development and testing of phenologically driven grizzly bear habitat models. *Ecoscience* 10(1):1-10.

Schwab, B., C. Woudsma, G. B. Stenhouse, S.E. Franklin, and S.E. Nielsen. 2002. Connections That Matter: Graph Theoretic Analysis of Grizzly Bear Movement in the Yellowhead Ecosystem, Alberta, Canada. *Ursus* (in press).

Stenhouse, G.B. and R.H. Munro. 1999, 2000, 2001, and 2002. Foothills Model Forest Grizzly Bear Research Project annual research reports. Available online @ www.fmf.ab.ca

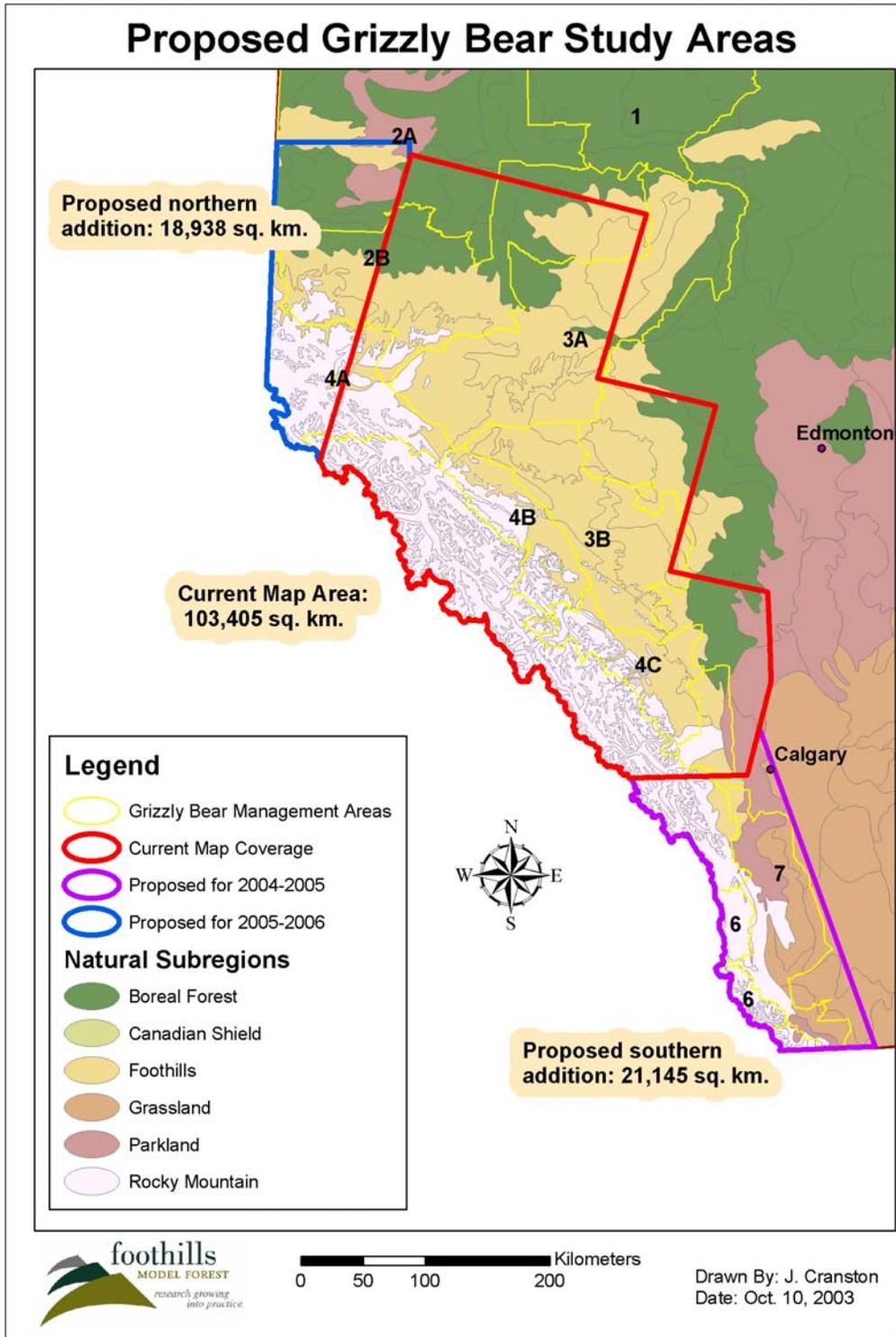


Figure 1. Proposed expansion areas for 2004 and 2005.

PART 2. RELATIONSHIPS BETWEEN GRIZZLY BEAR HEALTH PARAMETERS AND ENVIRONMENTAL CONDITIONS. (RESEARCH TEAM: STENHOUSE, CATTET AND GIBEAU)

1. Overview of Animal Health and Population Level Implications

The persistence of animal populations over time is related to a combination of factors including: suitable habitat, birth rates, mortality rates, food resources, and the overall health of individuals within the populations. If animals are in poor health as a result of disease, inadequate nutrition, chronic or acute stress, or a combination of these and other factors, the long-term persistence of the population can be threatened. We believe that when animals are in poor health, demographic characteristics (mortality and birth rates) and individual growth/development may be affected. However, if most animals in a population are in good health we believe that this population unit would remain stable or increase over time as long as a human-caused mortality is in check. A full, or at least a more comprehensive understanding, of the health status of grizzly bear populations in Alberta, when linked to landscape or environmental conditions is vital to ensure the long-term survival of this species. It is important for wildlife managers to remember that grizzly bears have one of the lowest reproductive rates of any terrestrial animal.

2. Background

We have been assessing and monitoring the health of individual grizzly bears since 1999 as part of standard handling and processing protocols with study animals. Because no single measure can provide a reliable picture of health, the combination of many measures has been our approach. These including physiological function (heart and respiratory rates, body temperature), body condition, and a broad array of blood analyses.

Over the past 5 years our research team has made some important new findings from this grizzly bear health data set that have potentially serious implications for the long-term survival of grizzly bears in portions of their range. These findings and the relationships suggested are not perfectly clear but are certainly cause for concern for wildlife managers and conservation biologists. The following findings form the basis for Part 2 of this research proposal and highlight the need for further investigation.

3. Summary of Key Findings

Another team of researchers has been conducting the East Slopes Grizzly Bear Project (ESGBP) during the period of 1994-2002. Their study area is approximately 160 km. south of the Foothills Model Forest Grizzly Bear Project study area.

The ESGBP research showed that this population had one of the lowest reproductive outputs of any grizzly bear population studied to date in North America. (Garshelis et. al submitted). They also found that the average age of first

reproduction of a surviving cub litter was 8.4 years and the population had an average litter size of 1.84 cubs. This population also had a long inter-litter interval (4.4-4.5 years). Again these data suggest that the ESGBP grizzly bear population has the lowest reproductive output known to scientists.

These findings are of great interest to our research team since the population we have studied over the past 5 years have not displayed these same demographic parameters and in fact we have a number of 4-year-old females mating and rearing cubs. Therefore, working with our southern colleagues we obtained data sets and blood serum samples from their study population to compare with FMF research animals. Our comparisons centered on possible differences in body conditions, and reproductive hormone levels between these two populations.

Our first comparison looked at possible differences in body condition (Cattet et al. 2002), which was defined as “the combined mass of fat and skeletal muscle in an animal relative to its body size”. We calculated BCI values, which can range from -3.0 to +3.0, by using the standardized residuals from the regression of total body mass against a linear measure of size and body length. This analysis found that when comparing bears captured at the same time of year the ESGBP animals were in poorer body condition. Adult males showed the largest difference within the comparisons made. (See Table 1.)

Table 1. Comparison of Body Condition Index (BCI) values between the Eastern Slopes and Foothills Model Forest Grizzly Bear Projects for grizzly bears captured during either May or June.

Sex (Age Class)	Body Condition Index ^A (mean ± SE; [n])		Statistical Significance ^B (p)
	ESGBP	FMFGBP	
Female (all ages)	-0.43 ± 0.13 [22]	-0.13 ± 0.13 [37]	0.14 ^{ns}
- subadult (< 5 yrs)	-0.59 ± 0.38 [6]	-0.25 ± 0.25 [16]	0.48 ^{ns}
- adult (≥ 5 yrs)	-0.37 ± 0.11 [16]	-0.04 ± 0.13 [21]	0.08 ^{ns}
Male (all ages)	-0.16 ± 0.23 [21]	+1.00 ± 0.22 [23]	< 0.001***
- subadult (< 5 yrs)	-0.45 ± 0.35 [9]	+0.47 ± 0.29 [10]	0.06 ^{ns}
- adult (≥ 5 yrs)	+0.05 ± 0.31 [12]	+1.41 ± 0.29 [13]	0.004**

^A Mean BCI values were compared between studies using a *t*-test for two independent samples.

^B Statistical significance was assigned when the probability of a Type I error was equal to or less than 0.05. Non-significant = ns, $p \leq 0.001 = **$, and $p \leq 0.001 = ***$.

Following this analysis we investigated an index of reproductive function by looking at blood serum concentrations of various reproductive hormones. This analysis revealed that in both sexes, luteinizing hormone (LH) concentrations were significantly higher in the FMF grizzly bear population. (See Tables 2 and 3)

Table 2. Comparison of reproductive hormone concentrations between the Eastern Slopes and Foothills Model Forest Grizzly Bear Projects for female grizzly bears captured by leg-hold snare during either May or June.

Hormone (Units)	Serum Concentration ^A (mean \pm SE)		Statistical Significance ^B (<i>p</i>)
	ESGBP (<i>n</i> = 14)	FMFGBP (<i>n</i> = 29)	
Progesterone (ng/ml)	2.54 \pm 0.63	2.82 \pm 0.35	0.67 ^{ns}
Estradiol (pg/ml)	10.6 \pm 1.2	13.5 \pm 1.0	0.11 ^{ns}
Luteinizing hormone (ng/ml)	0.13 \pm 0.05	0.39 \pm 0.08	0.006**
Testosterone (ng/ml)	0.28 \pm 0.05	0.29 \pm 0.04	0.89 ^{ns}

^A Mean hormone concentrations were compared between studies using a *t*-test for two independent samples.

^B Statistical significance was assigned when the probability of a Type I error was equal to or less than 0.05. Non-significant = ns and $p \leq 0.01 = **$.

Table 3. Comparison of reproductive hormone concentrations between the Eastern Slopes and Foothills Model Forest Grizzly Bear Projects for male grizzly bears captured by leg-hold snare during either May or June.

Hormone (Units)	Serum Concentration ^A (mean \pm SE)		Statistical Significance ^B (<i>p</i>)
	ESGBP (<i>n</i> = 16)	FMFGBP (<i>n</i> = 17)	
Luteinizing hormone (ng/ml)	0.07 \pm 0.04	0.33 \pm 0.09	0.01*
Testosterone (ng/ml)	0.85 \pm 0.26	0.91 \pm 0.22	0.86 ^{ns}

^A Mean hormone concentrations were compared between studies using a *t*-test for two independent samples.

^B Statistical significance was assigned when the probability of a Type I error was equal to or less than 0.05. Non-significant = ns and $p \leq 0.05 = *$.

4. Interpretation of Findings

The differences in BCI values between the two populations is very interesting and suggests that landscape and/or environmental factors may be influencing body

condition and growth rates in populations that are in fairly close proximity. The difference in LH hormone values, especially in males, may suggest that reproductive capacity may be different between these two populations. Since LH secretions stimulate the development of ovaries in females and testes in males it is possible that lower levels may impede “normal” reproductive development and function in males. When one combines the findings of significant differences in males with both BCI and LH values, the resulting low reproductive output observed in the ESGBP may be related to these observed differences. We also understand that the function of the reproductive system in mammals is dependant on food quality and quantity, therefore we believe that the data presented on LH and BCI values in these two populations is likely being affected by nutrition. Traditionally biologists focused a significant amount of research effort on the female cohort of grizzly bear populations and this new data suggests that we must look at both sexes to understand the complete spectrum of productivity in these populations. Other research findings from the FMFGBRP suggest that the behavioral associations between male and female grizzly bears may also be an important factor in understanding reproductive outputs (Stenhouse et al. in prep.).

We feel it is important to follow up on these findings to try to understand the mechanisms involved with this low (and higher) reproductive output and to determine if low LH values are indeed reducing the reproductive health of male grizzly bears. These factors should be considered by managers when trying to understand if grizzly bear populations are healthy and likely to be sustained or grow. This work will provide new tools and techniques for monitoring changes in grizzly bear health status, which may also serve as a means to detect unsuitable habitat conditions for grizzly bear conservation.

5. Research Plan

The FMFGBRP has the most extensive and comprehensive data set (movements, health, habitat use, human use characteristics, genetic relationships, etc) of any grizzly bear program in North America. It is important for us to fully explore and analyze all available data that is currently in place to determine possible correlations to health parameters (including reproductive function) and landscape conditions and human use variables. In addition, the FMFGBRP is planning to expand its activities southward in 2004 and will be capturing and collaring a sample of 15 grizzly bears from the Clearwater River to the Montana border (see figure 1.) This sample of bears will provide a unique opportunity to compare both BCI and reproductive hormone levels in grizzly bears inhabiting different landscapes along the east slopes of Alberta.

6. Objectives

Undertake a thorough and extensive analysis of existing FMF grizzly bear health data along with all available GIS based landscape and environmental data sets. In conjunction with ongoing FMFGBRP activities collect appropriate health parameter data from all study animals captured as part of ongoing field activities.

The research team will also organize and coordinate the collection of these samples and data with other management agency (federal and provincial) personnel who may handle grizzly bears as part of control or safety efforts.

Methods

Objective 1: Analysis of Existing Health and Environmental Data

Compile all existing grizzly bear health data and link this information to environmental/landscape variables which include:

Road densities

Levels of road use (motorized/non-motorized, high, medium and low)

RSF models and grizzly bear food models (habitat quality)

Degree of landscape fragmentation

Forest seral stages within the home range

Levels of human activity (mining, oil and gas development, etc.)

Annual landscape change

Working with the existing datasets gathered over the past 5 years, our research team (Biologists, GIS analysts, veterinarians, and statistician) will conduct this detailed analysis to look for correlations and patterns within these data. This complicated spatial analysis is necessary to ensure that we have included as many of the environmental factors that are suspected to influence grizzly bear conservation. A full report and scientific paper will be completed on this work and submitted to a journal in 2004.

Objective 2: Collection and Analysis of Additional Grizzly Bear Health Data

In conjunction with ongoing FMFGBRP activities collect samples (as per current protocol – BCI, blood samples, etc.) from all research study animals (N=15) that will be captured and fitted with GPS collars in the 2004 field program. The importance of having GPS location data from these bears is important to help us understand the home ranges and landscape conditions that these bears are exposed to. In addition to the standard samples collected we also hope to collect semen samples from males bears and conduct ultrasonographic examination of the gonads of both male and female bears. These data will assist in understanding the current research findings mentioned previously. When this work has been completed we will have baseline data from grizzly bear populations along the eastern slopes ranging from the Montana border to Grand Cache.

Each year in Alberta, conservation officers and park wardens capture and handle a number of grizzly bears as part of ongoing bear/human conflict situations. Unfortunately to date, the regular and standardized collection of physiological data and samples has not occurred in an organized and coordinated manner. In order to improve this situation, and to increase our samples sizes and understanding of health parameters, we propose to coordinate an improved data and sample collection effort with these field staff. This will entail the preparation of field sheets, sample collection kits, and instructional materials. All samples will

be analyzed through the currently established laboratories and staff that we have been working with over the past 5 years.

7. Management Implications

The data collected on grizzly bear health status over the past 5 years in the FMFGBRP represents a significant investment in resources and data collection. These data are now available to assist us in trying to further understand the relationships between environmental conditions and the health of a grizzly bear population. Our research team believes that an improved understanding of these relationships will be key to land use management decisions in grizzly bear habitat in Alberta. These data represent the only comprehensive long-term (5 years) grizzly bear health data set ever collected in the province. Putting these data into use will assist all stakeholders who are involved in sustainable management practices by ensuring we are utilizing the best available science in management decisions.

This project will also provide new tools and techniques for monitoring changes in grizzly bear health status that may also serve as a means to detect unsuitable habitat conditions for grizzly bear conservation. This improved understanding will form a critical component of future habitat stewardship conservation efforts.

8. Budget Requirements

Objective 1: Analysis of Existing Health and Environmental Data

Statistician support	15 days x \$ 400/day	\$6,000.00
GIS analyst support	10 days x \$ 300/day	\$3,000.00
Project Meeting	2 days x \$ 400/day	\$ 800.00
Publication costs	(estimated)	\$2,500.00
	Subtotal	\$12,300.00

Objective 2: Collection and Analysis of Additional Grizzly Bear Health Data

Sample collection kits (purchase materials and assemble)	\$8,000.00	
Distribution of kits and instructional materials (non-research staff)	\$2,000.00	
Meetings with Cons. Officers and Park Wardens (2 x \$ 400)	\$ 800.00	
New field equipment (field ultrasound, and semen collection)	\$20,000.00	
Laboratory analysis of samples (U of Illinois, and Saskatchewan)	\$15,000.00	
Immobilization drugs and supplies (N=15 bears)	\$10,000.00	
Capture crew wages (2 staff for 2 months)	\$24,000.00	
Helicopter costs for aerial capture (20% of total) 100 hours	\$16,000.00	
Field Veterinarian (travel and accommodations)	\$ 7,000.00	
Freight and shipping of samples	\$ 2,000.00	
	Subtotal	\$104,800.00
	TOTAL	\$117,100.00

9. References

- Cattet, M.R.L., N.A. Caulkett, M.E. Obbard and G.B. Stenhouse. 2002. A body condition index for Ursids. *Canadian Journal of Zoology* 80: 1156-1161.
- Franklin, S.E., G.B. Stenhouse, M.J. Hansen, C.C. Popplewell, J.A. Dechka, and D.R. Peddle. 2001. An integrated decision tree approach (IDTA) to mapping landcover using satellite remote sensing in support of grizzly bear habitat analysis in the Alberta Yellowhead Region. *Canadian Journal of Remote Sensing*, 26: 579-592.
- Nielsen, S.E., M.S. Boyce, G.B. Stenhouse and R.H.M. Munro. 2002 Modeling grizzly bear habitats in the Yellowhead Ecosystem of Alberta: taking autocorrelation seriously. *Ursus* 13: 45-56.
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- Schwab, B., C. Woudsma, G. B. Stenhouse, S.E. Franklin, and S.E. Nielsen. 2002. Connections That Matter: Graph Theoretic Analysis of Grizzly Bear Movement in the Yellowhead Ecosystem, Alberta, Canada. *Ursus* (in press).
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PART 3. GRIZZLY BEAR CAMERA COLLAR PROJECT (PHASE 2).

1. Background

In 2003 in conjunction with new program collaborators at the University of Calgary (Geomatics Engineering Department) we initiated a pilot project to determine if we could enhance our understanding of grizzly bear habitat use and selection. Over the first four years of the Foothills Model Forest Grizzly Bear Research Project we collected large amounts of GPS location data from collared bears. During this time we also had been able to visit many of these locations to try to determine what activities the bear might have been engaged in at these locations, and also foods they might have been eating at these sites. This approach represented the “standard methodology” in wildlife biology to acquire these data, however it is widely recognized that this approach has significant limitations. For example; we often visit use sites up to 2-3 weeks after the bear has left the area and during this time carrion can no longer be found and vegetation phenology has changed. We are forced to sub-sample the GPS locations and logistic considerations force us to concentrate on the easiest locations to travel to, and finally we cannot understand from the GPS data whether a bear has accompanied

or in association with other bears or humans thus affecting habitat use information.

In an attempt to improve on our methods, and hence increase our understanding of grizzly bear habitat use we initiated a pilot project where two digital camera systems were designed and constructed by Andrew Hunter and Naser El-Sheimy of the Geomatics Section in the Department of Engineering at the University of Calgary. These researchers designed, constructed and tested a new system whose purpose was to collect a still digital image on an hourly basis (daylight only) to integrate with GPS data points being collected by the existing GPS radio collars.

The pilot work that we conducted last season answered many important questions for the research team. We learned, for example, that the bears would accept an additional 300 grams in total collar weight and would not remove the collars because of the addition of the camera unit. We were pleased that the camera lenses remained clear and functional over the test period, and most importantly we proved that the images we acquired could play an important role in both habitat map validation and food use models being developed.

2. Next Steps

The research team believes that we can improve upon the camera system design used in the pilot work undertaken last year and also investigate and develop a fully integrated motion sensing collar. This collar will also include other sensors such as a magnetometer to determine direction and an accelerometer to monitor the movement of the bear between GPS fixes. It is expected that continuous monitoring of grizzly bears will provide new insights into grizzly bear behaviour across a range of research areas. In particular we are interested in utilizing the temporal component of the location data to obtain a greater understanding of grizzly bear habitat use with respect to foraging and travel corridors, as these patterns of habitat utilization can be passed on to land managers to ensure the protection of grizzly bear habitat at levels that can sustain Alberta's grizzly bear population. This work links directly with current research findings and activities within the FMFGBRP.

3. Objectives

Observation of moving point objects is an important research area within the wildlife sciences. The same concepts of motion can also be applied to other research domains such as the social sciences, geo-marketing, transport GIS (TGIS), or even the political sciences. For example, a telecommunication company might be interested in the spatial-temporal behavior of cellular phone users for public relations or network expansion planning. The organization and planning of GPS-tracked snow removal trucks in a city is an example of motion analysis for TGIS. In the social sciences, political entities such as communities can be plotted over time in an abstract ideological space between the extreme left, right, conservative and progressive, for example. All these phenomena can be reduced to the basic phenomena of moving points and may then be analyzed using

similar spatial-temporal analysis methods. The long-term goal of this research project is to measure, quantify and develop a flexible analysis concept for the integrated examination of motion parameters of moving point objects within a temporal based reference frame. This proposal addresses both the short-term objectives of the research; to build and deploy on 10 adult grizzly bears, digital camera systems on existing GPS radio collars, and the longer term goal of developing a fully integrated position and motion sensing collar for grizzly bears with digital image acquisition and communication capabilities. The data from these collars will then be used to develop spatial-temporal analysis concepts.

4. **Work Completed to Date**

Research undertaken to date has concentrated on the development of the camera component of the motion collar. A number of compact digital cameras were reviewed to determine their suitability in terms of size, power consumption and image quality. A total of eleven cameras were reviewed from which the Casio EXILIM EX-S2 was selected. Prior to designing suitable packaging to withstand the rigors of grizzly bear life, this camera weighed 86gm and measured 88mm (width) by 55mm (height) by 11mm (depth), and included an imaging system that was capable of 1,280 by 960 pixels with a colour depth of 24 Bits. A Two Factor (image size and image quality) Factorial Analysis indicated that there was no significant difference in visual quality of images taken at 1280 by 960 pixels or 960 by 800 pixels, or images taken at normal or high image quality, indicating that increased resolution or image quality would not provide added benefit. However, it was also determined that images taken at 640 by 480 pixels with normal image quality were acceptable from an operational perspective.

Upon selection of the camera, battery components, additional circuit boards, packaging and software were developed and tested during the spring of 2003. The finished camera was approximately 50mm wide, 25mm deep and 95mm long. Figure 2 highlights the lens opening on the right-hand side of the case, while Figure 3 gives an indication of the size of the camera relative to the GPS collar. The battery pack used to power both the GPS and the camera is the brown box mounted to the right of the GPS controller – the black box on the right side of the collar. When worn by a bear the battery hangs downwards with the camera pointing to the side.



Figure 2. Camera Prototype Developed for Grizzly Bear Collar



Figure 3. Camera Mounted on Grizzly Bear Collar

Two cameras were then deployed on Grizzly Bears (G7 and G37) in July of 2003. Figure 4 provides a selection of images that were obtained from G7 during field-testing.

5. Future Development

This project can be seen in two stages. The first stage focuses on the modification, testing and construction of 10 new camera systems for attachment and field-testing in the spring of 2004. We need to begin this work as soon as possible to make delivery schedules for field deployment with the spring grizzly bear capture season.

The second stage of this project focuses on ongoing development of several logical interrelated components. It starts with the investigation and selection of hardware for the monitoring of grizzly bear motion, and the construction of a new grizzly bear collar that incorporates development work currently being undertaken to enhance existing GPS collars so that digital imagery can be acquired at the same time. The research will continue with the development of a plausible data model for representing spatial-temporal locomotion and includes the development of software applications necessary for the acquisition of motion data. It closes with the evaluation and testing of a prototype grizzly bear collar that acquires spatial-temporal motion data. Functionality and performance of the prototype will be tested within a wilderness environment to ensure all design goals are met.



Figure 4: Images Acquired During Field Testing

6. Motion Collars

Task 1: Hardware Investigation

The goal of this phase will be to investigate, assess and select small, low-cost sensors that can monitor the movement of grizzly bears. The sensors will include accurate low-cost motion sensors such as magnetometers and/or gyroscopes, inertial sensors such as accelerometers and pedometers, and improved digital imaging systems that have the potential to meet the performance objectives of the Foothills Model Forest Grizzly Bear researchers. GPS chips will provide the primary motion/position information; as such low-cost receivers from the major GPS suppliers such as Trimble and Nemerix will also be investigated.

Communication technology will also be investigated so that motion data can be accessed without interference to the grizzly bears. The performance of the motion sensors will be assessed under different conditions using precise linear and angular turntables. The research goal will be to identify the main factors affecting the accuracy of the sensors and to determine a cost/performance measure, from which the most suitable configuration will be selected.

Task 2: Data Model and Software Development

To ensure that the data requirements of the Foothills Model Forest Grizzly Bear Research Program are met, a Needs Analysis shall be undertaken from which an appropriate data model for the storage of motion data, and temporal model for the

acquisition of data shall be developed. Software shall be developed to control, acquire and store the GPS, and sensor information. All data streams will be precisely time-tagged using the GPS receiver generated Pulse per Second (PPS) signal to ensure the synchronize data to a unified time frame. In order to minimize errors resulting from deficient sensor synchronization, the software will utilize a series real-time clock to capture and time-tag information from all sensors.

Task 3: Extension to Prototype Design

This research task deals with the actual design and prototyping of an integrated circuit board, which includes:

Designing of circuitry for an integrated board, and development of detailed specifications for the sensors, including the mounting of the hardware on a grizzly bear collar;

Design and development of a low cost Analog to Digital converter for the extraction of acceleration and angular velocity inertial signals from data provided by the motion sensors; and the

Integration of communication technology for the remote access of data.

The prototype will utilize multi-layer, surface mount printed circuit (PC) board technology, which will allow the integration of system components in a more compact manner. Furthermore, it allows for the isolation of critical system components and signal paths. Because the motion sensors are for use on an animal collar, one of the primary design goals is the minimization of the physical dimension of the prototype, as such, surface mount components will be used wherever possible. The PC board layout will be submitted to a commercial PC board-processing laboratory for fabrication. The prototype boards will be manually populated and tested in-house prior to final assembly of the system hardware.

7. Evaluating and Testing

The results of tasks described in this section will be used to validate design decisions against design goals. A comprehensive test bed for the analysis of the motion sensing collar shall be developed to determine the functionality and performance of the collars prior to field implementation. Analytical results and other aspects of the performance of the prototype will be evaluated by the research team to make sure that the outputs of the models will meet the needs of the Foothills Model Forest Grizzly Bear Research program.

Task 1 - Demonstrated Feasibility of System

Integration of motion sensors, digital image and communication technologies on a grizzly bear collar;

Establishment of a test reference using high precision GPS and motion sensing systems (available at the multi-sensor lab); and

Positioning filter performance analysis with respect to computational efficiency and robustness.

Task 2 - System Performance under Tree Canopy

Complementarities analysis of GPS, motion and other sensors using data acquired from the field; and

Enhancing the proposed Data Processing algorithm with different degrees of signal blockage and attenuation.

Task 3 - Testing the fully integrated system

Testing of prototype in collaboration with the Foothills Model Forest Grizzly Bear Research program; and

Over all performance analysis under operational conditions (accuracy, availability and reliability).

8. Milestones

This applied research project is planned for a period of 1 year (Figure 5) with the following milestones:

Month 1 “Research Stage”: Finalize design modifications to camera systems used in 2003. Conduct a literature review and technology investigation and analysis for motion sensing collar systems. Focus will be on the investigation of appropriate system architecture, and the conceptual design of the integration software.

Month 2 - 7 “Applied Research Stage”: Construct and test 10 camera systems to have ready for May 2004 deployment. Development of data acquisition software and data integration and processing software will be conducted. This period will also include the design and general layout of the board and the placement of all sensors, initial development of prototype, and integration of the various technologies.

Month 8 - 12 “Testing and Improvement Stage for Motion Sensing Camera System”: Undertake field performance tests and demonstration of system feasibility. Field-testing will be designed to ensure that performance goals are met and that necessary design enhancements will be identified to ensure that the system will perform appropriately in a wilderness environment where significant signal blockages exist. Finally, system demonstration/evaluation in conjunction with industrial partners will be undertaken.

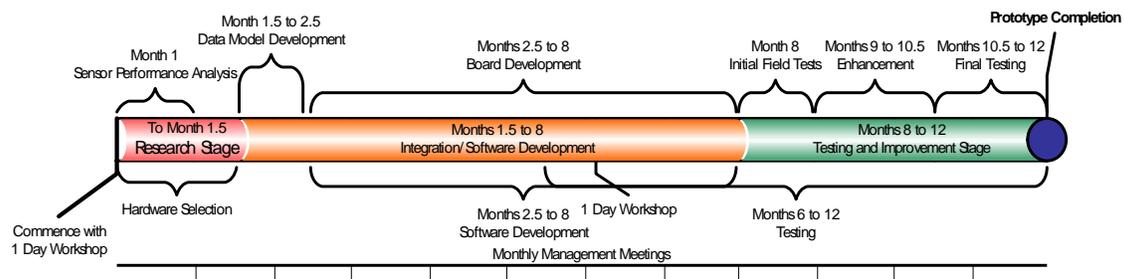


Figure 5. Schematic diagram outlining the Grizzly Bear Camera Collar Project work plan.

9. Deliverables

This project has two major deliverables. The first is the construction and deployment of 10 digital camera systems that will allow the acquisition of important new data to aid in the understanding of grizzly bear ecology and conservation in Alberta. We expect to have this data available in the fall of 2004 and after analysis and writing this work will be submitted for publication in the scientific literature in 2005.

The second major project deliverable will be a prototype motion collar that fully integrates a GPS receiver chip, gyros/accelerometers, environmental sensors, pedometer, digital imagery and communication technologies (Figure 6). It is also anticipated that the results of this motion collar research will be published in a refereed journal. Since the proposed system will be the first fully integrated motion and imaging system for animals, there is high potential of patents resulting from this project.

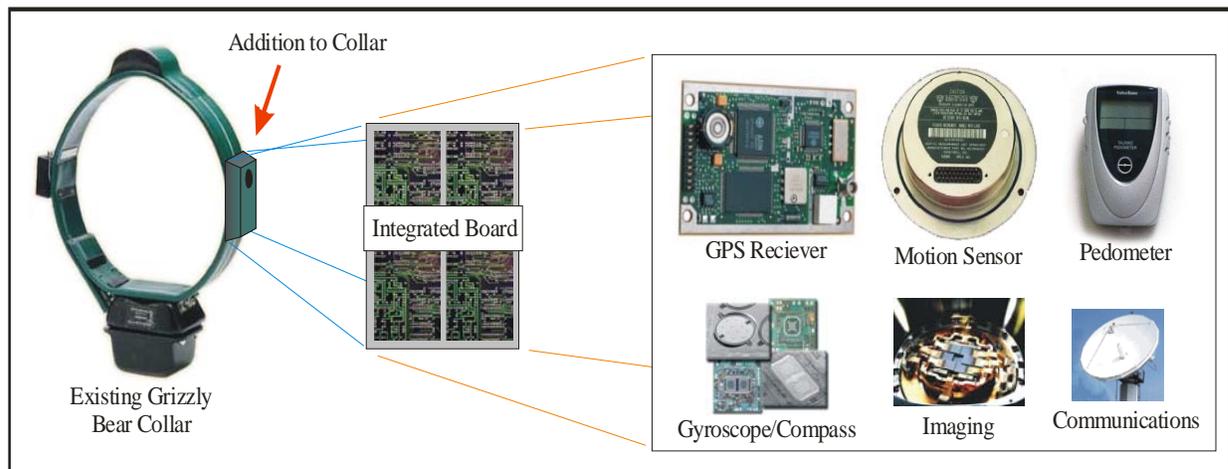


Figure 6. Prototype motion collar that fully integrates a GPS receiver chip, gyros/accelerometers, environmental sensors, pedometer, digital imagery and communication technologies.

10. Budget Requirements

Item	Description	Quantity	Rate (\$)	Cost (\$)
	Redesign and Fabrication of Existing Housing.			
1	Technician (Machinist)	LS	\$500.00	\$500.00
2	Materials	LS	\$150.00	\$150.00
	Fabrication of 10 Cameras			
3	Electronics	10	\$590.00	\$5,900.00
4	Batteries	10	\$210.00	\$2,100.00
5	Memory	10	\$400.00	\$4,000.00
6	Camera	10	\$350.00	\$3,500.00
7	Technician	10	\$1,200.00	\$12,000.00
8	Consumables	10	135.00	\$1,350.00

Electronics for Continuous Movement System				
9	NemeriX GPS Chip	2	\$200.00	\$400.00
10	Honeywell HMC6352 Magnetometer	2	\$100.00	\$200.00
11	Accelerometer	2	\$40.00	\$80.00
12	Batteries plus Circuit Board	2	\$350.0	\$700.00
13	Memory	2	\$380.00	\$760.00
14	VHF	2	\$100.00	\$200.00
15	Electronics and Casing	LS	\$1,500.00	\$1,500.00
16	Camera Chipset and Board	2	\$1,000.00	\$2,000.00
	Technical Design (Technician, part-time)	LS	\$14,500.0	\$14,500.00
			0	
			Total	\$49,840.00

APPENDIX A - Research Team Collaborators

Name	Affiliation
Gordon Stenhouse Location Hinton, AB	Foothills Model Forest (program leader)
Dr. Mark Boyce Edmonton, AB	University of Alberta, Alberta Cons. Assoc.
Dr. Steven Franklin Saskatoon, SK	University of Saskatchewan
Dr. Marc Cattet Saskatoon, SK	Canadian Cooperative Wildlife Health Centre
Dr. Nigel Caulkett Saskatoon, SK	Western College of Veterinary Medicine
Dr. Scott Nielsen Edmonton, AB	University of Alberta, Biological Sciences
Dr. Matt Vijan Waterloo, ON	University of Waterloo
Dr. Janice Barr Urbana, IL USA	University of Illinois
Dr. Samuel Wasser Seattle, WA USA	University of Washington
Dr. Curtis Strobeck Edmonton, AB	University of Alberta
Dr. David Paetkaeu Nelson, BC	Wildlife Genetics International
Dr. John Boulanger Nelson, BC	Integrated Ecological Research
Ms. Barb Schwab Waterloo, ON	Wilfred Laurier University
Dr. Barry Boot Waterloo, ON	Wilfred Laurier University
Dr. Naser El-Sheimy Calgary, AB	University of Calgary
Andrew Hunter Calgary, AB	University of Calgary

Project Management

The Foothills Model Forest Grizzly Bear Research Project has a strong track record of proven delivery of data, reports and products that has been shown annually over the past 5 years. This research team (Stenhouse, Boyce, and Franklin) has demonstrated their ability to meet strict deadlines and deliver products on budget. Numerous scientific publications from this work have been completed and research funding has continued to be awarded based on this level of achievement and production. The outside funding currently identified in this submission (NSERC, HSP, SRD) are examples of this past performance. Gordon Stenhouse will continue as the project manager for this work and will ensure that all program collaborators meet stated deadlines. It is important to emphasize the multi-disciplinary nature of this project proposal. Work of this nature and extent is not possible without a fully integrated research team comprised of specialists from many disciplines. This work is a collaborative effort between remote sensing experts, resource selection modeling experts, geographical/mathematical modeling specialists, wildlife veterinarians, wildlife biologists and geomatic engineers. All team members are dependent on data and products from other collaborators.

APPENDIX B – PROPOSED GRIZZLY BEAR RESEARCH BUDGET 2004

FUNDING SOURCES AND SUBMISSIONS AS OF DECEMBER 16, 2003

FRIAA Open Funds	\$80,000	Applied For
World Wildlife Fund	\$50,000	Applied For
Manning Diversified Trust	\$40,000	Applied For
Federal Habitat Stewardship	\$70,000	Applied For
Alberta SRD	\$100,000	Applied For
Alberta Conservation Assoc.	\$100,000	Applied for
AERI	\$50,000	Applied For
Oil and Gas Commission	\$70,000	Applied For
Alberta Ecotrust	\$25,000	Applied For
Yellowstone to Yukon	\$40,000	Applied For
NSERC	\$69,000	Confirmed
Weldwood	TBA	TBA
Fording Coal	\$20,000	Confirmed
CAPP – ERAC	\$20,000	Confirmed
ConocoPhillips Canada	\$10,000	Confirmed
Foothills Model Forest	\$70,000	Confirmed
Talisman Energy	TBA	TBA
Petro-Canada	TBA	TBA
Weyerhaeuser	TBA	TBA

*Other research proposal submissions for additional funding are underway at the time or preparing this submission.

EXPENSES

1. HABITAT MAPPING AND MODELING		
Purchase Landsat Images (N=3)	\$ 4,000.00	
Pre-process Landsat Images (3x \$6K)	\$ 18,000.00	
Image classification (3x \$8K)	\$ 24,000.00	
Ground truthing of 4 landsat scenes (3x \$16K)	\$ 48,000.00	
Assembly of human use GIS data sets (4 weeks)	\$ 12,000.00	
RSF modeling for 3 TM scenes (4 months)	\$ 15,000.00	
Movement corridor modeling (4 months)	\$ 15,000.00	
Capture and collaring costs of 15 bears	\$ 65,000.00	
Collar data collection (remote via aircraft)	\$ 25,000.00	
Map production/report preparation	\$ 3,000.00	
User workshops (N=3)	\$ 10,000.00	
GIS staff support	\$ 18,000.00	
Computer hardware and software support for expanded area	\$ 5,000.00	
GPS batteries and ear tag transmitters	\$ 20,000.00	
Travel and meeting costs with program collaborators	\$ 5,000.00	
Subtotal		\$ 287,000.00
2. GRIZZLY BEAR HEALTH/ENVIRONMENTAL CONDITIONS		
Part 1:		
Statistician cost	\$ 6,000.00	
GIS analyst support 10 days x \$300/day	\$ 3,000.00	
Project meeting costs 2 days x \$400/day	\$ 800.00	

Publication costs (estimated)	\$ 2,500.00	
Subtotal		\$ 12,300.00
Part 2:		
Sample collection kits (purchase materials and assemble)	\$ 8,000.00	
Distribution of kits and instructional materials	\$ 2,000.00	
Meetings with Cons. Officers and Parks staff	\$ 800.00	
Purchase of new field equipment	\$ 20,000.00	
Laboratory Analysis	\$ 15,000.00	
Immobilization drugs and capture supplies	\$ 10,000.00	
Capture crew wages (2 staff for 2 months)	\$ 24,000.00	
Helicopter costs for aerial capture	\$ 16,000.00	
Field Veterinarian (travel and accommodations)	\$ 7,000.00	
Freight and shipping of samples	\$ 2,000.00	
Subtotal		\$ 104,800.00
Other Program Costs		
Program Biologists (2 - 12 month terms)	\$ 100,000.00	
Program Statistician	\$ 30,000.00	
Travel/Meeting Costs	\$ 8,000.00	
Education and Outreach Costs	\$ 5,000.00	
Vehicle fuel and maintenance costs	\$ 10,000.00	
Relocation costs (fixed wing - currently collared bears)	\$ 15,000.00	
Helicopter support (Capture and data collection/retrieval)	\$ 60,000.00	
Subtotal		\$ 228,000.00
3. CAMERA PROJECT		
Redesign and Fabrication of Existing Housing.		
Technician (Machinist)	\$ 500.00	
Materials	\$ 150.00	
Fabrication of 10 Cameras		
Electronics	\$ 5,900.00	
Batteries	\$ 2,100.00	
Memory	\$ 4,000.00	
Camera	\$ 3,500.00	
Technician	\$ 12,000.00	
Consumables	\$ 1,350.00	
Electronics for Continuous Movement System		
Nemerix GPS Chip	\$ 400.00	
Honeywell HMC6352 Magnetometer	\$ 200.00	
Accelerometer	\$ 80.00	
Batteries plus Circuit Board	\$ 700.00	
Memory	\$ 760.00	
VHF	\$ 200.00	
Electronics and Casing	\$ 1,500.00	
Camera Chipset and Board	\$ 2,000.00	
Technical Design (Technician, part-time)	\$ 14,500.00	
Subtotal		\$ 49,840.00
TOTAL		\$ 681,940.00

Foothills Model Forest 2004-2005 Annual Work Plan

Local Level Indicators

1. Prepared by

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2. Introduction

A major focus of Canada's Model Forest Program in Phase II (1997-2001) has been the development and reporting of Local Level Indicators of Sustainable Forest Management. This initiative was undertaken in Phase II in support of the Canadian Council of Forest Minister's (CCFM) commitment to reporting on Criteria and Indicators of Sustainable Forest Management in Canada. At the outset of Phase III the Canadian Model Forest Network took on reporting Local Levels Indicators of Sustainable Forest Management as a network strategic initiative. At the national level, the Canadian Council of Forest Ministers identified six national criteria of sustainable forest management. These criteria are conditions, which Canada believes must exist for sustainable forest management to become reality. For the criteria to be effective, they must be adopted by land/resource managers and adapted to local conditions.

3. Background Information

Foothills Model Forest accepted the task of assessing these national criteria at a local level, and began by identifying local goals and indicators that would support the intent of Canada's broad commitment to sustainable development. Partners with major forest resource management responsibilities in the Foothills Model Forest worked with stakeholders, including members of the public, to develop their own individual goals for sustainable forest management. They then collaborated with each other to identify shared goals for sustainable forest management. The Board of Directors of the Foothills Model Forest reviewed the resulting set of shared goals, and ultimately endorsed them as reflective of Board members' values and priorities.

The next requirement was to develop a set of indicators that would measure performance against these goals. An initial set of indicators was developed with input from many of the partner agencies, and was reviewed by technical specialists representing the agencies with primary responsibility for forest management within the Foothills Model Forest. This "reality check" allowed those involved to develop categories for those indicators that can reported upon now, and those that will be reported on later.

Foothills Model Forest has assembled and presented some of the scientific data to provide the element of measurement for most of the chosen indicators. Data for others will start to come in later. The intent of the Local-Level Indicator Project is to repeat the monitoring and measuring over time, so that updated reports will show any changes and trends as they occur.

4. Objectives

The FtMF will continue its work on Local Level Indicators in Phase III. Reporting on LLI brings together, in a common document, highlights of much of the research and activities undertaken at the FMF. It brings focus to the fact that many SFM issues cross-jurisdictional boundaries and allow the land / resource management partners a neutral forum for reporting on continuous improvement and progress towards SFM. With this in mind, the following objectives were approved for the FMF LLI Program in Phase III;

Maintain and as new research and information becomes available, improve upon and or enhance the indicator set.

Provide yearly progress /annual reports on maintaining and improving LLI set.

Produce a full, follow-up State of the Forest Report at the end of Year 5 of Phase III (2007)

Pending the outcome of the LLI workshop to be held in January of 2004 make recommendations for research to fill Goal and Indicator GAPS. Option for research will be discussed with FtMF program leads and other researchers if appropriate and if accepted, research would be conducted through the appropriate FMF Program Area. It is expected additional funding would be required for this.

1.) Knowledge Creation

Finalize Initial State of the Forest Report for release at beginning of Phase III.

Maintain, and as new research and information becomes available, improve upon and /or enhance the indicator set.

Provide yearly updates to the Initial Status Report if information which allows the development and reporting of new or enhanced indicators becomes available.

1a. Beneficiaries and Impacts

The Initial State of the Forest report will be beneficial to land and resource managers, Foothills Model Forest partners and the general public. The report will establish benchmarks and where long-term empirical data exists, trends in local level indicators of sustainable forest management on the Foothills Model Forest Landbase. This report will give land and resource managers and the public an easily understood, meaningful measure of the Foothills Model Forest state as it sits today and will aid in identification of potential problem areas, if they arise, in future follow-up reports as trends are established. The Model Forest does not have the mandate to provide much of the information reported on in the report and the creation and provision of data for a large number of these indicators

does, and will continue to, fall on land and resource management partners with FtMF. This initial status report and enhanced or improved indicators over time should help establish priorities for management actions and will allow the public to judge for themselves, based on these reports whether the Foothills Model Forest is being managed sustainably.

2.) Demonstration

In its Phase III Proposal, the Foothills Model Forest has indicated that it will endeavour to create opportunities for projects focused on demonstration of sustainable forest management activities and techniques. The Foothills Model Forest will seek opportunities to include demonstration of indicators as part of these demonstration projects. Foothills Model Forest State of the Forest reporting will demonstrate progress and or issues related to measuring progress towards sustainable forest management. Use of indicators developed at the FtMF and used by its land and resource management partners (Jasper, Weldwood, Alberta Government) will also allow them to measure and demonstrate progress towards sustainable management objectives of their respective organizations. It is the intention of the FtMF to include indicators as a component of Demonstration Projects that will be undertaken during Phase III.

2a. Beneficiaries and Impacts

Demonstration of indicators will allow land and resource management agencies to show how indicators are relevant and crucial at the local level as well as in management planning. It should also be able to demonstrate how indicators are measured and possible management implications of this reporting.

3.) Knowledge / Technology Transfer

Provide knowledge exchange and support to regional planning strategies, such as the Northern East Slopes Integrated Resource Management Strategy , Weldwood, Jasper National Park of Canada, Foothills Model Forest Partners and other groups outside of the Model Forest Landbase, in methodology for development of Local Level Indicators and opportunities for transferring FtMF Local Level Indicators to other landbase or assist in moving indicators to regional scales. This may include working with land managers to help in their understanding of challenges, methodology and opportunities for LLI through sharing knowledge of an LLI implementation process.

Seek as a network initiative, the development of a follow-up Procedural Manual which further highlights both positive and negative learnings, experiences and lessons learned by model forests and their partners in the development of the their initial status reports. This How-to Manual would compliment and act as a useful companion to the “LLI Users

Guide” which was released by the network in Phase II of Canada’s Model Forest Program.

3a. Beneficiaries and Impacts

Working with land and resource managers, partner organizations and other groups to increase knowledge and provide assistance in developing and reporting on Local Level Indicators, supports the CCFM’s commitment to managing forest lands in Canada sustainably.

4.) Communications and Outreach

To increase the general public’s understanding about local level indicators and their link to SFM not only within the Foothills Model Forest, but also at regional, provincial, national and, potentially, international scales. To educate the general public about local level indicators that are monitored on the Foothills Model Forest land base and how they link to sustainable forest management.

To seek opportunities to increase awareness and understanding of, and with a planned approach, capacity to report on local level indicators by other forestry and sustainable development research organizations through such tools as progress reports, indicator templates and protocols for indicator selection, development and data collection and reporting.

Through communications, outreach and knowledge transfer, work with land and resource management organizations to encourage the use of indicators in the development of management plans.

4a. Beneficiaries and Impacts

Beneficiaries could include Foothills Model Forest staff, program leaders, collaborators, contractors, partners, stakeholders, Canadian Model Forest Network, International Model Forest Network, and other Forestry/sustainable development research organizations (University of Alberta Sustainable Development Network; Alberta Science Council, ASRA, International Development Research Centre) and Albertans with an interest in learning about sustainable forest management. This could include students, lay persons, and professionals from all backgrounds and disciplines, and Alberta Government MLAs whose constituencies have major industry alongside the boreal forests of Alberta.

A desired impact would be a common understanding of, and acceptance that LLI reporting was a desirable methodology for neutral reporting on SFM in Alberta, Canada and the world. This could include support for reporting on progress towards SFM in such initiatives as the National Forest Strategy.

5.) Policy Support

To have land and resource management organizations, both inside and outside the FtMF partnership, accept that LLI reporting is a viable and

cost effective method of measuring progress towards sustainable forest management and to have these organizations commit to LLI reporting as part of their management planning frameworks.

5a. Beneficiaries and Impacts

Beneficiaries include land and resource managers and the people of Alberta and Canada

5. Abstract of Methodology

The FtMF obtained commitment from resource management partners to support and deliver on yearly updates of report and the follow-up “State of the Forest Report” set for year 5 (2007). This was accomplished through a series of discussions and follow-up letters with FtMF Board members. These activities centered around clarification from the Board on the following items:

1. Confirmation of shared goals
2. Confirmation of shared priorities of the FtMF land management partners
Commitment to allocation of resources to support the LLI program pending direction/mandate of the program by the FtMF Board.

The results of these discussions have been used as the basis for the direction of the program for the remainder of Phase III.

LLI Activity team has been reconfirmed and continues to define, refine and augment indicators for delivery on annual and follow-up reports. This will include a GAP analysis of the initial status report which would address shared goals for which indicators could not be reported on in the Initial Status Report and make recommendations of future options for reporting progress towards these goals.

Explore options for linkages of LLI with the Alberta Forest Biodiversity Monitoring Pilot Project in Phase III. This could include examination of the pilot project and discussions with managers of the pilot, possibly leading to refinement and augmentation of indicator reporting at the model forest. This may have impacts at regional and provincial scales.

6. Deliverables

Knowledge Creation

- LLI Indicator related Research and Development: If required work with appropriate FtMF Program area in research / development aimed at filling LLI information GAPS. – Completion by March 31, 2007
- Annual / Progress Report – April, 2005

Demonstration

TBA – Pending development of FtMF Demonstration Projects.

Knowledge / Technology Transfer

Development of a follow-up How-to Manual which further highlights both positive and negative learnings, experiences and lessons learned by model forests and their partners in the development of the their initial status reports. – March 2006

Communications and Outreach

Annual / Progress Report – April 2005

Policy Support

N/A

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Annual Progress Report												X
Update Network LLI Framework Report												X
LLI Implementation How-to Manual – Network Initiative – March 31, 2006	X	X	X	X	X	X	X	X	X	X	X	X
Support Research / Development that addresses cross-jurisdictional landscape level indicator GAPS	X	X	X	X	X	X	X	X	X	X	X	X

8. Site Information

Foothills Model Forest Landbase

9. References

N/A

10. Scientific Review

The Initial Status Report and yearly follow-up reports will be developed within the framework of the LLI Activity Team and will include an internal review by that team. The team includes members of Alberta's scientific community.

11. Improvements to Management in Forest Ecosystems

LLI reporting is fundamental in measuring progress toward SFM in Alberta and Canada.

12. Amount of Money Requested From the Foothills Model Forest

2004/2005 activities and annual / progress reports = \$15,000.00

Note – This does not include research activities that may result from GAP and alignment analysis and LLI Workshop to be held in January 2004.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest		\$15,000 – core funding			2 Staff members and 1 consultant for committee - \$ to be determined	
Weldwood of Canada Limited					1 Staff member for committee - \$ to be determined	
Jasper National Park of Canada					1 Staff members for committee - \$ to be determined	
Alberta Sustainable Resource Development					3 Staff members for committee - \$ to be determined	
Alberta Community Development					1 Staff members for committee - \$ to be determined	
Canadian Forest Service					1 Staff members for committee - \$ to be determined	
Canadian Association of Petroleum Producers					1 Staff members for committee - \$ to be determined	
Alberta Environment					1 Staff members for committee - \$ to be determined	
Total		\$15,000			\$ to be determined	

- 14. Proposed Payment Schedule**
N/A
- 15. Subcontracted Work**
N/A
- 16. Project Management**
As per section # 2
- 17. Additional Organisations requesting FRIIA Administered Monies**
N/A
- 18. Other Relevant Information**
N/A

Foothills Model Forest 2004-2005 Annual Work Plan Mountain Parks Visitor Survey

1. Prepared by

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2. Introduction

During Phase II of the MF program the Social Science Research Program developed a computable general equilibrium model to measure the impact of economic shocks (such as the coal mine closure) on the FMF region. Since the model was developed there have been changes in the economy and some better data on the visitor sector have become available. We are proposing to analyze the new visitor data from the Mountain Parks Visitor Survey and to conduct a survey to assist in updating the FMF regional CGE model. We also plan to add Grand Cache to the model; it was outside the FMF when the last model was developed.

3. Background Information

The model developed in Phase II represented state of the art technique in economic impact modelling and was a tool that few regions in Canada possessed. Many peer-reviewed papers were published based on the work and presentations were made to national and international audiences. The template from that work was taken to the Robson Valley in BC and used to develop a similar model for that region and is now being used to look at the economy in the Lakes-Morice area of BC and at the economic impacts of mountain pine beetle in a number of affected areas in BC.

The model allows economic impacts to be measured based on fixed-wage or flexible-wage scenarios. That is, in the event of a shock will the economy keep people at a lower wage or will they be forced to look elsewhere. The model can also estimate the impact of new developments in the area.

4. Objectives

Analyse the expenditure portion Mountain Parks Visitor Survey for the gateway communities of Hinton and Grande Cache and for JNP and prepare a report for FMF. (September 2004)

Survey businesses in the FMF region to allow for the recalibration of the FMF CGE model. (December 2004)

Update the CGE model and deliver an Excel-based DSS to FMF (March 2005)

1.) Knowledge Creation

The Mountain Parks Visitor Survey provides the most comprehensive set of data on park use that has been collected over the past 10 years. The

expenditure portion of the data set will allow for the much better estimates of visitor spending that were estimated by the Social Science Project in Phase II. This will be new knowledge. The updated CGE model will also be unique to the region and will also represent new knowledge.

1a. Beneficiaries and Impacts

Local business and government and FMF will be the primary beneficiaries of the proposed work. The proposed Excel DSS can be used on site to estimate impacts of potential economic shocks to the area. This will benefit local government and businesses but could also benefit the FMF it housed in its offices and other users came to it to obtain the information. Parks Canada will benefit from the analysis of the Mountain Parks data set.

2.) Demonstration

Field demonstration is obviously not practical but other opportunities to demonstrate results would be available in the form of posters and presentations. Hands on demonstrations of the model could be given at open houses and other FMF events. Posters could be developed for the same types of events

2a. Beneficiaries and Impacts

The general public could benefit in the form of increased knowledge of their local economy from demonstrations of the model. Local business and government could benefit from demonstrations of the model and come to now how they could use it for their own benefit.

3.) Knowledge / Technology Transfer

Transfer will occur through the publication of reports and quick notes and through the delivery of a DSS. Transfer will continue to occur “beyond the boundaries” as information gained on this project is used in other projects.

3a. Beneficiaries and Impacts

Academic community through the provision of reports and potentially refereed journal articles
Parks Canada through the analysis and reports on the visitor data set.
Other regions of Canada through the implementation of similar projects.

4.) Communications and Outreach

The work will be developed into posters, presentations and Quick Notes for distribution to interested parties.

4a. Beneficiaries and Impacts

Beneficiaries include FMF staff, partners and interested organizations within the region that maintain an interest in the local economy. Others who attend presentations in and out of the FMF area would benefit.

5.) Policy Support

The analysis of the survey and the updating of the model are important for both local and provincial policy support. It would provide knowledge

about visitors and their expenditure habits that would help governments as they develop policies to optimize the return from visitors to the region. The impact model could estimate impacts of shocks or potential shocks or developments and thereby help governments to develop policy to prevent or at least mitigate the effects of negative events.

5a. Beneficiaries and Impacts

Provincial government: A better understanding of the regional economy and the visitor sector in particular will help it develop appropriate policies.

Local government: A better understanding of the regional economy and the visitor sector in particular will help it develop appropriate policies.

Parks Canada: The analysis of the Mountain Parks Survey will provide information to help it to develop appropriate policies.

5. Abstract of Methodology

The Mountain Park Survey data will be analyzed using conventional techniques to assess spending habits by place and by visitor group. The CGE model will be developed using conventional techniques. A survey will be used to update value of sales and leakage information that is not available from published sources.

6. Deliverables

Knowledge Creation

- A report providing the results from the visitor survey. (30 Sep 2004)
- An economic overview report for the FMF region. (31 Dec 2004)

Demonstration

A spreadsheet based DSS of the CGE model will be available for demonstration purposes. (31 Mar 2005)

Knowledge / Technology Transfer

The reports listed in 1) will be available for tech transfer.

Communications and Outreach

- 2 Quicknotes will be written. (30 Sep 2004; 31 Mar 2005)
- In co-operation with the Communications unit we will develop 2 posters (31 Mar 2005)
- Presentations will be given at a partner workshop and at other meetings and conferences to be determined.

Policy Support

All reports and materials will be passed on to relevant contacts at various government levels for consideration in policy development. Presentations will also serve to provide policy support.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Analyze and write report on MP survey		x	x	x	x	x						
Update economic overview of FMF	x	x	x	x	x	x						
Update CGE model							x	x	x	x		
Develop DSS											x	x

8. Site Information

9. References

10. Scientific Review

11. Improvements to Management in Forest Ecosystems

12. Amount of Money Requested From the Foothills Model Forest

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			40K			
CFS						15,000
Parks Canada						15,000

14. Proposed Payment Schedule

TBD with FMF

15. Subcontracted Work

NA

16. Project Management

17. Additional Organisations requesting FRIIA Administered Monies

18. Other Relevant Information

The Parks Canada database is the result of a \$400K survey to which FMF contributed \$17K but has full access to the results of the Mountain Parks visitor Survey.

Foothills Model Forest 2004-2005 Annual Work Plan The Human Dimensions of Biodiversity Conservation

1. Prepared by

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2. Introduction

The Non-timber Values (NTV) Program will address the model forest program areas of sustainability of multiple benefits to society and the human dimensions of biodiversity. Sustainable forest management requires the incorporation of multiple forest benefits into planning and management decisions. In order to achieve this it is necessary to have an understanding and assessment of multiple benefits and the impacts of policy and management actions on their sustainability. Biodiversity, wilderness, recreation, and community and economic stability are some of the multiple benefits associated with the FMF. In Phase II the NTV program furthered the understanding and assessment of multiple benefits by measuring some of the non-market values associated with recreation (McFarlane and Boxall, 1998), developed a camping DSS (McFarlane, Boxall, and Hiltz 2000), developed standardized data collection instruments for criteria and indicators of non-timber values (McFarlane and Watson 1998; 2000), and examined stakeholder values and attitudes toward forest management (McFarlane and Boxall 1999; 2000a; 2000b). In Phase III the Non-timber Values Program will begin to assess non-use values associated with the forest such as biodiversity. Much research has been conducted in the natural sciences on biodiversity and grizzly bear conservation in the FMF. However, understanding the human dimensions of biodiversity conservation will be necessary for the implementation of sustainable management strategies. Examining stakeholder preferences and the acceptability of trade-offs associated with management scenarios will help policy makers in reaching decisions that are socially acceptable.

3. Background Information

Managing for biodiversity is a complex and often contentious issue in natural resource management. Building upon research in the Robson Valley Enhanced Forest Management Pilot Project, this study will examine the human dimensions of biodiversity conservation. Following the strategy of the natural sciences, grizzly bears will be used as an indicator of biodiversity and ecosystem health. Managing for a sustainable population of bears may require society to make choices between preservation, industrial use of the forest (e.g., forestry and oil and gas development), and non-timber uses of the forest (e.g., recreational access to wilderness). It is the public acceptance of these trade-offs that is currently lacking from grizzly bear and biodiversity-related research in the Foothills Model Forest. This project will help bridge the gap between what is needed ecologically

to achieve grizzly bear conservation and what is socially acceptable. In other words, the natural sciences will inform natural resource managers and policy makers on the ecological conditions necessary for conservation and the social sciences will inform them on what is acceptable to the public. This project will draw upon the biological and ecological research conducted on grizzly bears for the Foothills Model Forest and incorporate these findings into an assessment of socially acceptable trade-offs for grizzly bear conservation. The project will be conducted in collaboration with Gordon Stenhouse of the FMF and other bear researchers in Alberta.

4. Objectives

The long-term objectives are:

1. To determine attitudes, knowledge, and preferences of the public regarding grizzly bear conservation.
2. To examine trade-offs associated with grizzly bear conservation among the public.
3. To determine socially acceptable management options for grizzly bear conservation.
4. To examine the factors influencing people's choices related to grizzly bear conservation.

1.) Knowledge Creation

The survey results will provide the first social science research into the issue of grizzly bear conservation in Alberta. Data analysis will include a multivariate analysis of relationships among the variables. This will help understand the causal factors influencing preferences and support for bear conservation.

1a. Beneficiaries and Impacts

The survey results be of interest to the Provincial Grizzly Bear Recovery Plan team, AB government, Parks Canada, wildlife management agencies, and others. Causal analysis will be primarily to other researchers examining social science aspects of biodiversity and large carnivore management.

2.) Demonstration

N/A

2a. Beneficiaries and Impacts

N/A

3.) Knowledge / Technology Transfer

The results will be of particular interest to the Provincial Grizzly Bear Recovery Plan team and will communicated as appropriate.

3a. Beneficiaries and Impacts

Provide policy relevant information on what conservation options are acceptable to the public and public support for conservation.

- 4.) Communications and Outreach**
Final report and a CFS Information Report submitted for review.
Progress will be reported using 1 Quicknote.
- 4a. Beneficiaries and Impacts**
The reports will be of interest to model forest administrators, natural resource managers, the Provincial Grizzly Bear Recovery Plan team, Parks Canada, AB provincial government, and the public. The Quicknote will keep these groups informed of progress, preliminary results, and any problems.
- 5.) Policy Support**
The results will be communicated to the Provincial Grizzly Bear Recovery Plan team as appropriate. This will provide the team with initial public input on possible recovery plan options.
- 5a. Beneficiaries and Impacts**
Provincial Grizzly Bear Recovery Plan team and the AB government
- 5. Abstract of Methodology**
The population of interest for the study are residents of the Foothills Model Forest (Hinton and Jasper) and the city of Edmonton. This sampling strategy will allow input from the local residents and it will allow a comparison of local residents with residents in a large urban centre. A combination of attitudinal, knowledge, preference, and socio-economic data will be collected by mail survey.
- 6. Deliverables**
- Knowledge Creation**
- Preliminary data analysis June 30, 2004
 - Final report – March 31, 2005
 - Refereed journal article – Jan.-March, 31 2006
- Demonstration**
No deliverables in 2004-05
- Knowledge / Technology Transfer**
- Partner workshop/presentation in the Foothills Model Forest – March 31, 2005
 - Presentation of results at a conference - 2005
- Communications and Outreach**
- A Quicknote on progress – Dec. 31, 2004
 - Poster for display in the Foothills Model Forest – March 31, 2005
- Policy Support**
Preliminary results will be made available to the Provincial Recovery Plan team.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Preliminary data analysis	X	X	X									
Report writing				X	X	X	X	X	X			
CFS Information Report										X	X	X

8. Site Information

The research will be conducted at the Northern Forestry Centre in Edmonton with business trips to the Foothills Model Foothills.

9. References

McFarlane, B.L. and P.C. Boxall. 1998. *An overview and non-market valuation of camping in the Foothills Model Forest*. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB. Information Report NOR-X-358.

McFarlane, B.L. and P.C. Boxall. 1999. *Forest values and management preferences of two stakeholder groups in the Foothills Model Forest*. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB and the Foothills Model Forest, Hinton, AB. Information Report NOR-X-364.

McFarlane, B.L. and P.C. Boxall. 2000a. Factors influencing forest values and attitudes of two stakeholder groups: The case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources*, 13, 649-661.

McFarlane, B.L. and P.C. Boxall. 2000b. *Forest values and attitudes of the public, environmentalists, professional foresters, and members of public advisory groups in Alberta*. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB.

McFarlane, B., P. Boxall, and C. Hiltz. 2000. *Decision Support System for Camping Site Choice in the Foothills Model Forest*. A report for the Foothills Model Forest, Hinton, Alberta.

McFarlane, B. L. and D. O. Watson. 1998. *Willmore Wilderness Park: Voluntary Self-registration System 1998*. A report for the Foothills Model Forest, Hinton, Alberta and Alberta Environmental Protection.

McFarlane, B. L. and D. O. Watson. 2000. *Willmore Wilderness Park: Second Year (1999) of the Voluntary Self-registration System*. A report for the Foothills Model Forest and Alberta Environmental Protection.

10. Scientific Review

The final report will be published through the CFS publication series. These publications are subject to external peer review. Journal articles will be subject to the peer review process established by the journal.

11. Improvements to Management in Forest Ecosystems

The incorporation of multiple benefits (such as managing for biodiversity) will assist managers in sustainable forest management. This project will assist managers in making decisions to provide a balance of use and non-use benefits that is socially acceptable, and decisions that are justifiable and defensible.

12. Amount of Money Requested From the Foothills Model Forest

Project total: \$100,000
2004-05: \$0

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest						
CFS					20,000	

14. Proposed Payment Schedule

15. Subcontracted Work

No subcontracting is expected.

16. Project Management

Same as #1.

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information

N/A

Foothills Model Forest 2004-2005 Annual Work Plan Socio-Economic Dimensions of Community Vulnerability

1. Prepared by

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2. Introduction

Under the Mountain Pine Beetle Initiative (BC), a series of social science projects are underway to identify and measure critical dimensions community vulnerability. This research is specific to the beetle epidemic in BC, but the theoretical framework and methods can be extended to other communities that face risks from natural or human caused change. We propose an extension of this vulnerability risk assessment in forest-based communities to include human communities in the FMF. Specifically, these would include: Jasper, Grande Cache, Hinton, Edson. More communities may be added depending on cost of data acquisition.

3. Background Information

There is widespread recognition by industry, government, and forest-based communities that natural and man made environmental change can have significant socio-economic impacts on forest communities; however there are few planning or predictive tools to assess community-level susceptibility to these impacts. At the same time, communities groups and the forest sector have little knowledge as to the nature and extent of this vulnerability, representing a serious impediment to advanced planning and policymaking.

Vulnerability can be conceptualized as the risk of unfavourable outcomes to human or environmental communities from large-scale environmental or social change (Smit, 1999; McLaughlin and Dietz, forthcoming). We hypothesize that some communities will, owing to certain social and economic characteristics, be able to persist and adapt to the consequences of MPB, while others without these same characteristics will be less able to adapt.

To assess community vulnerability, this research will identify key social and economic factors contributing to the susceptibility of forest-based communities to impacts from large-scale environmental change. To ensure that results are relevant to community concerns and interests—and can therefore be used in policymaking and planning—we propose a two-phase research process beginning with a community-level exploratory assessment and moving to a quantitative vulnerability assessment. While economic models can assist in predicting

economic impacts under various management regimes, this project takes a broader approach by examining social, as well as economic impacts, including the distribution of these impacts on various stakeholders.

4. Objectives

Using focus groups, survey research and secondary data, this study will:

Identify potential local-level social and economic impacts on forest-based communities

Identify and measure dimensions of social and economic vulnerability to these impacts

Examine the spatial relationship between community-level vulnerability and current and predicted environmental change from climate or other factors.

1.) Knowledge Creation

Census of Canada data, and random sample survey research will provide new information on the social and economic realities of human communities embedded within the forest ecosystem.

1a. Beneficiaries and Impacts

Beneficiaries include not only model forest partners through the ongoing work of the local level indicators working group, but local municipal leader who are interesting in tracking community trends and in monitoring social and economic dimensions associated with community health.

2.) Demonstration

Primary demonstration opportunities will coincide with updates and revisions to the FMF Local Level Indicators “State of the Forest” report. In addition, the project report will make more detailed information available to interested readers. Results may also be made available on line through the model forest web-site SIMFOR.COM. This site makes information readily available in electronic tabular format (PDF file formatting). A *QuickNote* will also be developed to highlight dominant trends and implications for community sustainability.

2a. Beneficiaries and Impacts

Demonstration community vulnerability through various media will show how vulnerability indicators are link to and relevant to management planning.

3.) Knowledge / Technology Transfer

Knowledge transfer will take place through report distribution, QuickNote publication, and integration with FMF LLI activities.

3a. Beneficiaries and Impacts

Those who benefit from the project will include resource managers and municipal leaders, and others interested in the social and economic well being of model forest communities. The LLI working group will also benefit from knowledge transfer the LLI objects associated with revision and updating of indicator data.

4.) Communications and Outreach

Communication will be undertaken primarily through report distribution and QuickNote publication. Efforts will focus on clearly defining the relevant indicators associated with community vulnerability, important trends over the most recent reporting period, and implications for management and policy development.

4a. Beneficiaries and Impacts

Beneficiaries include FMF staff, partners and interested organizations within the region who maintain an interest in community well-being. These may include educators, property developers, municipal leaders, and social workers.

5.) Policy Support

Policy support will be undertaken through regular communication with the Local Level Indicators working group, regarding results and implications for sustainable forest management in the region.

5a. Beneficiaries and Impacts

Beneficiaries include land managers, community leaders, and the people of the Foothills region.

5. Abstract of Methodology

A large body of literature on community resilience, community capacity, environmental hazards, and social risk assessment can be used to inform this study. This literature underscores the importance of identifying dimensions of community vulnerability to enable strategic planning and preparation for large-scale environmental change.

6. Deliverables

- Quantitative vulnerability assessment
- Final Report on Vulnerable communities in the FMF and beyond.
- Quick Note on project results

7. Timelines

Task	2003									2004		
	A	M	J	J	A	S	O	N	D	J	F	M
Acquire Primary and Secondary Data								X	X			
Analysis and Report Writing										X	X	X
Quick Note												X

8. Site Information

Census of Canada 2001
Random sample mail survey
Other secondary sources

9. References

Adger, W.N. and P.M. Kelly. 1999. Social Vulnerability to Climate Change and the Architecture of Entitlements. *Mitigation and Adaptation Strategies for Global Change*. 4:253-266.

Beckley, T., Nadeau, S., Wall, E., Martz, D. 2002. Multiple Capacities, Multiple Outcomes: Delving Deeper Into the Meaning of Community Capacity. Paper presented at the Annual Meeting of the Rural Sociological Society, Chicago IL. Congress Plaza Hotel, August 14-17, 2002.

Dow, K. 1992. Exploring Differences in our Common Futures: The Meaning of Vulnerability in to Global Environmental Change. *Geoforum* 23(3):417-436.

McLaughlin, P. and T. Dietz. Forthcoming. "The Dynamics of Vulnerability: An Evolutionary Perspective." In A. Diekmann, T. Dietz, C. Jaeger, and E. Rosa (eds.) *Global and Environmental Change: Understanding the Social Dimensions*. Cambridge: MIT Press.

Parkins, J., Varghese, J., Stedman, R. Forthcoming. "Measuring the Sustainability of Human Communities in the Robson Valley." *BC Journal of Ecosystems and Management*.

Smit, B., I. Burton, R. Klein and R. Street. 1999. The Science of Adaptation: A Framework for Assessment. *Mitigation and Adaptation Strategies for Global Change*. 4:199-213.

10. Scientific Review

Published paper will be subject to a peer review process.

11. Improvements to Management in Forest Ecosystems

A vulnerability assessment of forest-based communities can assist policy makers in understanding the linkages between environmental change and community well-being. Assessments also trigger early warning signals regarding the ability of a community to adapt to future changes, should they occur.

12. Amount of Money Requested From the Foothills Model Forest

2004/2005 funds required for staffing, data acquisition, and report production
 Total amount requested from FMF = \$20,000.00

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			20,000			
Canadian Forest Service					12,000	

14. Proposed Payment Schedule

N/A

- 15. Subcontracted Work**
Work will be completed by term staff with the Social Science Research Group, Canadian Forest Service, Edmonton.
- 16. Project Management**
Project will be managed by John Parkins, Canadian Forest Service (see section 2)
- 17. Additional Organisations requesting FRIIA Administered Monies**
N/A
- 18. Other Relevant Information**
N/A

Foothills Model Forest 2004-2005 Annual Work Plan

Human Dimensions of Fire Management at the Wildland Urban Interface

1. Prepared by

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2. Introduction

In recent years, the frequency and severity of forest wildfires have increased in Canada affecting timber supply and putting many human communities at risk. Due to increasing wildfire suppression costs, fire management agencies are seeking alternative solutions to prevent fire and lessen the impact of fire on human communities and private property. Recognition of the role of fire as an important function in ecosystem processes has also prompted many agencies to review their fire suppression policies.

Fire management agencies are considering pro-active management strategies directed at the wildland urban interface (WUI) to reduce the threat to private property and human life. The success of this approach depends largely on individual homeowners' willingness to support and engage in fire mitigation measures. Public education programs (such as FireSmart¹) have been initiated in several provinces with a goal of improving homeowner participation in wildfire threat mitigation. It is unclear, however, how property owners in or near the WUI perceive the risks from wildfire, their preferences for mitigation measures, or their willingness to use mitigation measures on their own properties. There is also little understanding of the individual and social-cultural factors that influence such responses. The role of municipal governments and other relevant agencies in influencing responses at the individual and community levels is also not well understood.

A collaborative project is being proposed by the University of Alberta (T.McGee, Dept. of Earth and Atmospheric Sciences, Human Geography) and CFS (B. McFarlane, Social Science Research Group) to address these deficiencies. A proposal is being submitted to the CFS/NSERC/SSHRC Partnership Program for \$115,230. This funding will cover the core needs of the project. An additional \$10,000 is being requested from the FMF to fund a summer student. The summer student will assist with identifying study sites and initial survey design and developing an interview guide. The contribution from the FMF will assist in the initial design phase of the project and ensure that the town of Hinton is included as one of the study sites. The FMF will benefit from being part of a larger study

¹ FireSmart refers to activities that individuals and communities can undertake to reduce the risk of fire losses and enhance safety at the WUI (Partners in Protection 2003).

(rather than funding a separate study) by realizing substantial cost savings associated with survey design, implementation, and report writing.

3. **Background Information**

Previous studies of the human dimensions of wildfire in the WUI have examined public attitudes toward fire, policy and fuel reduction preferences, and information needs, with contradictory results. For example, residents at the WUI in southern California had a low awareness of fire severity, preferred public (rather than private) risk management strategies, and were not receptive to programs aimed at diminishing fire hazard (Gardner *et al* 1987). In contrast, Fried *et al* (1999) found WUI residents in Michigan participated in some form of risk reduction activity and many were willing to invest time or money to reduce their fire risk. In subsequent focus groups, Winter and Fried (2000) found that Michigan residents viewed wildfire as uncontrollable and the resulting damage as random and preferred solutions that reduced the number of ignitions rather than mitigation and control measures.

Although these studies have provided valuable insight into WUI residents' attitudes and preferences their contradictory findings suggest that it is invalid to extrapolate results across geographical areas with differing ecological, social, cultural, and political systems. Thus, there is a need to develop an understanding of risk perception, attitudes, knowledge of fire and fire management, and willingness to engage in risk reduction activities at the WUI in a Canadian context. In addition, the influence of cognitive structures (such as values, attitudes, and knowledge) and their interaction with social-cultural variables (such as gender) on willingness to engage in mitigation activities is absent from the WUI literature.

Characteristics of a person's social setting, including cultural, social, economic and political characteristics of the community and fire history may also influence risk perception and hazard reduction actions. For example, social networks, which can be important sources of social support for people in times of need (Cohen and Wills 1985; Raphael and Wilson 1993), appeared to influence wildfire preparedness in an Australian rural community (McGee *et al* 2000). Emergency service providers can also play an important role in encouraging the adoption of adjustment actions (e.g., Scanlon 1991; Rohrmann 1999; McGee *et al* 2000). The risk literature identifies trust in institutions as an important part of risk management (Slovic *et al.* 2000). McGee *et al* (2000) found that a trusted local fire brigade played an important role in fostering wildfire preparedness within an Australian community. The proposed project's investigation of the influence of municipal government and other organizations on wildfire mitigation at the community level within Alberta WUI communities will provide further insights into the role of these agencies.

4. Objectives

The objectives are to:

- Examine WUI homeowners' attitudes toward fire, perception of risk associated with residing in or near a flammable forest, acceptability of risk, knowledge of fire and mitigation measures, preferences for fire management, and willingness to engage in mitigation activities.
- Identify factors that influence homeowners' engagement in mitigation activities such as attitudes, risk perceptions and risk acceptability, knowledge of fire and fire management, demographic characteristics, social support and influence, the socio-cultural nature of the community, and interventions.
- Examine differences among individuals residing in communities with varying levels of wildfire preparedness.
- Examine the influence of community fire mitigation by municipalities and other relevant agencies on wildfire mitigation and preparedness at the community and household levels.
- Develop recommendations to assist fire management agencies in developing communication strategies, engaging homeowners in mitigation activities, and improving community preparedness.

1.) Knowledge Creation

N/A

1a. Beneficiaries and Impacts

The long-term results will be of interest to the town of Hinton, the provincial government (ASRD), fire management agencies, the forest industry, and Parks Canada.

2.) Demonstration

N/A

2a. Beneficiaries and Impacts

N/A

3.) Knowledge / Technology Transfer

N/A

3a. Beneficiaries and Impacts

The long-term results will be of interest to the town of Hinton, the provincial government (ASRD), fire management agencies, the forest industry, Partners in Protection, and Parks Canada. It will assist in identifying factors that contribute to the adoption of FireSmart activities by homeowners and that contribute to successful community preparedness. The mail survey will provide a tool for data collection in other communities in Alberta or other provinces.

4.) Communications and Outreach

N/A

4a. Beneficiaries and Impacts

The results of this study will be communicated to academic audiences, provincial and municipal agencies involved in fire management (such as the town of Hinton), Partners in Protection, fire researchers at the Canadian Forest Service, the forest industry, and the public.

5.) Policy Support (2004-05)

N/A

5a. Beneficiaries and Impacts

The long-term results will help inform policy makers on what policies might be needed to encourage homeowner mitigation and hazard reduction activities, and to enhance cooperation among various communities and fire management agencies. The town of Hinton and nearby communities, ASRD, and Parks Canada will be direct beneficiaries.

5. Abstract of Methodology

This project utilizes both qualitative and quantitative methods. Six WUI communities in Alberta's boreal forest and eastern slopes areas will be selected for the study. The communities will include those with fire mitigation at the community level, as well as those without; and varied experiences with fire directly affecting the community (e.g. including those with recent fire experience, and those with no recent fire experience). It is proposed that Hinton will be included as one of the study sites.

The first phase of data collection will involve in-depth interviews with a sub-sample of residents and representatives from municipal governments and other relevant organizations in two of the six communities, with differing levels of fire experience and community fire mitigation. The use of interviews will facilitate gathering of more detailed information than is possible with a survey and will assist in formulating hypotheses for further testing.

In the second phase of data collection, specific themes and hypotheses identified in the interviews will be tested on a representative sample of residents in all six communities using survey methodology. The questionnaire will collect data on homeowners' attitudes toward fire, perception of risk associated with residing in or near a flammable forest, acceptability of risk, knowledge of fire and fire mitigation measures, and willingness to engage in fire mitigation activities, demographic characteristics, and socio-cultural factors. The specific questions included in the survey will be developed in consultation with colleagues from Alberta Sustainable Resource Development, and other relevant organizations.

6. Deliverables

Knowledge Creation

Final report – Sept. 2007

Refereed journal article – Sept. 2007

Demonstration

No deliverables

Knowledge / Technology Transfer

The research tools developed as part of this study can also be used in other provinces, in order to assist wildfire management agencies and WUI communities elsewhere in Canada, thereby reducing the cost of future surveys.

Communications and Outreach

In 2006-07 results will be presented at model forest annual general meetings or other public fora and at the 2006 International Symposium on Society and Resource Management, Canadian Association of Geographers or a conference on fire management. Manuscripts will be submitted to peer reviewed journals such as Society and Natural Resources, Environmental Hazards, Canadian Journal of Forestry, Journal of Forestry, and Environmental Management. A public seminar will held at the University of Alberta, or the Canadian Forest Service, Northern Forestry Centre Seminar Series. A final report for the project will be published as a Canadian Forest Service Information Report. These reports are peer reviewed, widely circulated, and catalogued at the National Library of Canada.

Policy Support

This project will provide wildfire management agencies with information that can be used to develop effective communication strategies for WUI communities. This may lead to WUI communities and households being better prepared for wildfires, and potentially suffering fewer losses as a result. Communities that are better prepared may reduce the financial burden on wildfire response agencies at the provincial and municipal levels.

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Select communities, draft survey design, draft interview guide		X	X	X	X								

The project will be conducted between May 2004 and Sept. 2007. Major project milestones are:

- May –Aug 2004 Identify sites, identify elements for draft mail survey and interview guide
- September 2004 PhD student to commence.
- April 2005 Develop interview guide
- July 2005-June 2006 Interviews in selected communities and qualitative analysis
- March 2006 Finalize mail survey design
- May 2006-Jan 2007 Collect mail survey data and data analysis
- June 2006 Draft reports and presentations in 2 communities
- Sept. 2007 PhD thesis preparation and final report to funding partners.

8. Site Information

The research will be conducted at the University of Alberta and the Northern Forestry Centre in Edmonton with trips to the Foothills Model Foothills.

9. References

Cohen, S.; Wills, T.A. 1985. Stress, Social Support, and the Buffering Hypothesis, *Psychological Bulletin*, 98(2):310-357.

Fried, J. S.; Winter, G.; Gilless, K. 1999. Assessing the benefits of reducing fire risk in the wildland-urban interface: a contingent valuation approach. *International Journal of Wildland Fire* 9(1):9-21.

Gardner, P. D.; Cortner, H. J.; Widaman, K. 1987. The risk perceptions and policy response toward wildland fire hazards by urban home-owners. *Landscape and Urban Planning* 14:163-172.

McGee, T.; Reinholdt, S.; Russell, S.; Rogers, N.; Boxelaar, L. 2000. *Effective Behaviour Change Programs for Natural Hazard Reduction in Rural Communities*. Final Report – International Decade for Natural Disaster Reduction project 7/99, Emergency Management Australia, Canberra.

Partners in Protection. 1999. *FireSmart. Protecting Your Community from Wildfire*. Edmonton, AB: Partners in Protection.

Raphael, B.; Wilson, J.P. 1993. Theoretical and Intervention Considerations in Working with Victims of Disaster, in *International Handbook of Traumatic Stress Syndromes*, Wilson, J.P. and Raphael, B. (eds.). Plenum Press, New York.

Rohrman, B. 1999. Community-Based Fire Preparedness Programmes: An Empirical Evaluation, *The Australasian Journal of Disaster and Trauma Studies*, 1.

Scanlon, T.J. 1991. Reaching Out: Getting the Community Involved in Preparedness. In Drabek, T.E. and Hoetner, G.J., *Emergency Management: Principles and Practice for Local Government*, International City Management Association, Washington.

Slovic, P.; Fischhoff, B.; Lichtenstein, S. 2000. Rating the risks. In P. Slovic *The Perception of Risk*, pp.104-120. Sterling, VA: Earthscan Publications Ltd.

Winter, G.; Fried, J. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland urban interface. *Society and Natural Resources* 13:33-49.

10. Scientific Review

A final report will be published through the CFS publication series. These publications are subject to external peer review. Journal articles will be subject to the peer review process established by the journal.

11. Improvements to Management in Forest Ecosystems

The project will contribute to sustainable forest management efforts in Canada by providing forest managers with information on public acceptance of fire management practices and policies.

12. Amount of Money Requested From the Foothills Model Forest

Project total: \$10,000

2004-05: \$10,000

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			10,000			
CFS					9,600	
CFS/NSERC/SSHRC Partnership Program ¹			37,100			
University of Alberta					17,270	

¹ Partners include ATCO Electric, The Institute for Catastrophic Loss Reduction, and Alberta Sustainable Resource Development.

14. Proposed Payment Schedule

Full amount (\$10,000) payable by April 30, 2004.

15. Subcontracted Work

No subcontracting will occur.

16. Project Management

Same as #1.

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information

N/A

**Foothills Model Forest 2004-2005 Annual Work Plan
Prototype Growth and Yield Models for Lodgepole Pine in the Alberta Foothills
under a Changing Climate**

1. Prepared by

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2. Introduction

Forest management planning requires defensible yield forecasts, not only to determine allowable annual cut (AAC), but also, increasingly, to demonstrate to public interest groups that Alberta's forests are being managed sustainably. The traditional approach to calculating AAC for a forest management unit (FMU) requires projections of future forest inventory based on growth and yield (G&Y) tables derived from past observations on sample plots. G&Y tables are robust management tools, but they are based on the implicit assumption that future growth conditions (soils, climate, disturbance regimes) will be similar to past conditions. Local observations over the last few decades, combined with projections of future climate derived from general circulation models (GCM), now raises serious questions about the validity of this implicit assumption. While the extent and rate of climate change are still matters of fervent scientific debate, there is now little doubt that some systematic environmental changes will occur within the next 50 years, and, therefore, that long-term AAC projections must account for this likelihood.

Furthermore, forest management methods continue to evolve, as the general demand for wood fibre increases, but the supply of high quality timber becomes more limiting. Management practices introduced to meet the increasing demand are also likely to invalidate G&Y tables derived from permanent sample plot measurements made in the past.

Canadian Forest Service (CFS) researchers based at the Laurentian Forestry Centre in Ste Foy, Québec, have developed a suite of climate-sensitive forest productivity models that can be used to make yield forecasts or to build G&Y tables for individual stands or larger scale application. The StandLEAP model accounts for the effects of climate on growth by incorporating the length of the growing season, the impacts of frosts and summer droughts, and effects of temperature on photosynthesis and respiration. StandLEAP also simulates climate- and management- caused variations in stand density and composition of the dominant species over the life of the stand.

This work plan focuses on the application of StandLEAP, a process-based model of forest productivity, to simulate past and future effects of climate (i.e., including scenarios of future climate change) on stand-level volume yield of *lodgepole pine* in the Foothills Model Forest study region. The results will be used to create

climate-sensitive G&Y forecasts for this one species in this region. Complementary growth and yield work, either in progress or planned, in collaboration with colleagues from different universities and research institutions in Québec, Saskatchewan, Manitoba and Newfoundland, will provide comparable information for other commercially important species: black spruce, jack pine, balsam fir and aspen.

The proposed modeling work is innovative in that it ties climatic factors directly into the processes by which individual trees allocate photosynthate to wood production. Using plot-level data provides an independent validation of StandLEAP's estimates, and the use of climate scenario data will provide "state-of-the-art" forecasts of future climate scaled to the spatial context of forest stands. This project will depend greatly on the cooperation of Weldwood and the Forest Management Branch of LFD (Alberta Sustainable Resource Development). In spring of 2003, Dave Morgan of ASRD and Hugh Lougheed of Weldwood both agreed to allow us access to stem analysis data. Since then, we have worked with the ASRD data to explore relationships between height growth and past climate. A meeting has been arranged with Weldwood of Canada Ltd representatives, set for February 12 2004, to report on current progress and to reaffirm our interest in looking for relationships between diameter growth and climate. We understand that LFD is also interested in linking stem-analysis data to reconstructed local climate histories as an approach to forecasting growth and yield under changing climate conditions. In particular, Dr Shongming Huang has been developing climate-related Site Indices for lodgepole pine. We are maintaining contact with Dr Huang as both projects progress, and plan to meet with ASRD representatives in the near future (early 2004).

3. Background Information

Local observations suggest that in recent decades, forest productivity (as indicated by Site Index (SI), stand top height in metres at 50 years) has increased at many locations in the Weldwood FMA, for stands both of fire origin and for those regenerated following harvesting. Given the observed trends in regional climate, a logical hypothesis is that at least some of these increases in growth rates are a direct consequence of climate warming (with a possible minor contribution resulting from increased atmospheric CO₂ concentrations). In previous work Price et al. (2002) applied StandLEAP to a 2,700 km² study region in the Foothills Model Forest (FMF), focusing on its estimates of NPP and comparing these to mean annual increment expressed in biomass terms (tonne ha⁻¹ yr⁻¹). We believe our success was limited because work is still required to develop soils and climate data for the study region with sufficient detail to generate plausible spatial estimates. Here, we propose a more rigorous approach targeted at using data from individual plot locations: We understand from Dick Dempster that there may be stem analysis measurement data available from 300-400 plots scattered across the Weldwood FMA. These could be used to construct past observations of stand growth at these locations and the results compared to time series of past climate spatially interpolated from local observations. The level of correlation between climate and observed growth rates (estimated from stem analysis data) will be

established and used to assess the accuracy of StandLEAP estimates of past merchantable volume productivity at these same plot locations.

4. Objectives

1.) Knowledge Creation

Provide a process-based model able to predict merchantable volume MAI of lodgepole pine stands within the FMF and surrounding region. Because the model estimates average tree size (DBH), it will also produce estimates of local Site Index (SI).

Create preliminary Growth and Yield models for lodgepole pine derived from recent climate data and future climate scenarios, interpolated to stand locations and grouped according to ecosite characteristics.

Investigate possible impacts of “state-of-the-art” scenarios of future climate on productivity of lodgepole pine-dominated forests in the Alberta Foothills region

1a. Beneficiaries and Impacts

Foothills Growth and Yield Association (FGYA) of Alberta.

Successful completion of this project will provide the tools needed for FGYA members to incorporate forecasts of future climate into yield forecast and AAC calculations.

2.) Demonstration

Demonstrate whether growth and yield predictions obtained with StandLEAP are of comparable precision to those obtained with the present operational yield tables, as compared to stand-level observations.

Demonstrate how process-models have the potential to contribute to G&Y forecasting, particularly in an era of environmental change.

2a. Beneficiaries and Impacts

Forest industry

Provincial forest management agencies (i.e., Alberta Sustainable Resource Development. ASRD)

- will benefit in their efforts to assess and communicate the risks (and possible benefits) of climate warming on forest productivity and future AAC in the Foothills region.

3.) Knowledge / Technology Transfer

Generate process-based estimates of climate effects on lodgepole pine growth rates that can be used to modify existing yield models and/or to create new Yield Tables for this species.

3a. Beneficiaries and Impacts

FGYA members will benefit from the focus on production of climate-dependent yield tables for lodgepole pine.

4.) Communications and Outreach

Six Quick-Notes (see deliverables below).

Fall/Winter 2004: partner workshop at NoFC, with presentations by the project PIs (Price, Raulier and others).

Final report in Spring 2005. *Simulating volume productivity of lodgepole pine in the Alberta Foothills under climate change.*

4a. Beneficiaries and Impacts

forest industry and Provincial forest management agencies;
forest research community, particularly those concerned with impacts of climate change on forest productivity in Canada.

5.) Policy Support

Provide members of FGYA with a scientifically-based, and well-validated tool that can be used to create defensible projections of future forest productivity in the Alberta Foothills.

Enable use of the model by FGYA members to project future AACs and demonstrate to public interest groups that these projections are reasonable given current knowledge of future climate trends.

Use model projections as a basis for demonstrating future sustainability of current and planned forest management practices in the region.

5a. Beneficiaries and Impacts

Forest industry;
Alberta Sustainable Resource Development;
Public interest groups

5. Abstract of Methodology

Raulier and Bernier will continue previous research aimed at testing and implementing StandLEAP for the prediction of annual merchantable volume growth of lodgepole pine, the dominant species in much of the Alberta Foothills region. Past work concentrated on parameterizing and testing StandLEAP at the locations of Permanent Growth Sample Plots (PGSP) within the FMF study region. Here, we will compare plot-level measurements of merchantable volume increment (derived from stem analysis data, possibly supported by PGSP data) to volume growth estimates for those plots generated using StandLEAP, and to growth estimates obtained from current G&Y models. In addition, because StandLEAP can predict the peak mean annual stem volume increment of a plantation, itself strongly correlated to SI, it will be possible to produce estimates of local SI that can be compared to field observations.

We hope to make the best use possible of the available PGSP and stem analysis data. If the latter are available, they will allow reconstruction of tree height and diameter growth for much longer periods than available from the PGSP data alone; this provides the possibility that the historical climate data may be better correlated with observations of height growth derived from stem analysis data than we can infer from diameter growth alone (which is inherently noisier and more subject to influences of stocking density).

A hierarchical modelling approach will be used. Fine scale processes (particularly those involved in photosynthesis) are captured in simulations for the species of interest using FineLEAP, a detailed canopy-level gas exchange simulator (Raulier

et al. 2000, Bernier et al. 2001). FineLEAP has already been parameterized for lodgepole pine. Results from these simulations are then rolled up to the coarser level represented by the StandLEAP model and combined with processes that are best tackled at the stand level and on an annual time step. Some problems were identified with StandLEAP during previous work and will be corrected.

Specifically, these are:

calibration of a locally specific “self-thinning line” from PGSP data. If possible this will be done using empirical relationships derived locally by S. Huang of ASRD for the GYPSY model. The self-thinning line determines the density-dependent mortality rate simulated by StandLEAP;

development of better representations of the effects of soil drainage and nutrition on lodgepole pine growth. Two approaches will be used to resolve this. Firstly, by developing a better representation of the effects of water stress on growth rates; and secondly by relating soil profile information already collected from several sources to topography (elevation, slope gradient, aspect, and slope curvature).

In a second component of the project, Price will work with McKenney’s group at Great Lakes Forestry Centre (Sault Ste. Marie) to build climate “histories” interpolated to the locations of the sample plots using ANUSPLIN software (see previous work by Price et al. 2000, 2001). This is certainly feasible for the period after 1950, but we will attempt to go back further in time if possible (the climate record from most local climate stations is likely to be incomplete or absent prior to 1945). These climate histories will then be compared to reconstructions of annual wood volume growth derived from PGSP and/or stem analysis data. It may prove necessary to normalize these data to individual tree sizes to make valid comparisons among trees and between plots. The objective will be to establish whether year-to-year variations in normalized growth based on a large number (hundreds) of plot-level measurements are correlated with the climate data reconstructed from available records. Further, the climate data should demonstrate a clear and consistent trend of warmer mean temperatures and longer growing seasons. We hope to show that this trend and the interannual variations correlate well with available evidence that the volume productivity in the managed and unmanaged stands has increased over the same period.

The third step will then be to run StandLEAP, driven by the reconstructed climate histories, to compare StandLEAP’s estimates of merchantable volume productivity at the sample plot locations with the observed data. Assuming this comparison shows that StandLEAP at least captures the general trends in growth rates, if not the interannual variations, the final step will be to add climate change scenario data to the observed climate histories to project future growth trends. By this time we anticipate having access to a set of 4-6 detailed climate projections for Canada based on IPCC “SRES” greenhouse gas emissions scenarios—following work on another proposed project led by McKenney and Price—that can be used to create local projections of future climate change.

The results of these projections could be used to provide input to build new G&Y models. Discussion with project partners would be required to determine the best approach. One possibility is that StandLEAP is used to simulate the growth of representative plots used to build the actual G&Y tables, in order to determine

“correction factors” which would be applied to the existing yield tables as a means of extending their applicability under different climate projections. Specific diagnostic variables simulated by StandLEAP that might be used this way include: site index, diameter increment and stand mortality.

6. Deliverables

Knowledge Creation

- CD of sample input data for sample plot locations including interpolated time series of temperature and precipitation data for the period 1951-2000, and 4-6 climate scenario time series for the period 2001-2100. 31 October 2003.
- Quick-Note 1: Site-level climate data for selected sites in the Foothills Model Forest, past and future. (Price and McKenney). (To document CD of sample data) ca. 31 October 2003.
- Quick-Note 2: Correlation of historical climate with sample plot data for lodgepole pine in the Alberta Foothills. (Price and Dempster?) ca. 31 December 2003.
- Quick-Note 3: Validation of the StandLEAP process-based model of forest productivity against sample plot data. (Raulier and Price) ca. 30 June 2004.
- Quick-Note 4: Summary of simulation results obtained using StandLEAP at representative plot locations for different climate scenarios. (Price et al.) 31 December 2004.

Demonstration

- Peer-reviewed journal article on comparison of StandLEAP estimates of forest growth with stand-level observations and operational yield tables, and the use of StandLEAP for forecasting forest G&Y under climate change. Abstract will be submitted to SAF-CIF meeting in Edmonton 2004. Target publication: SAF-CIF conference proceedings or Forestry Chronicle (31 January 2005)

Knowledge / Technology Transfer

- CD containing copy of StandLEAP calibrated for lodgepole pine, with sample input data set and output, and basic user information. 31 October 2004
- Quick-Note 5: Using the StandLEAP process-based model of forest productivity. (Raulier and Bernier). (To document CD with model code/data) ca. 31 October 2004.
- CD containing results of simulations of forest productivity under different scenarios of future climate in the Alberta Foothills regions. 31 January 2005
- Quick-Note 6: Simulating lodgepole pine volume productivity in the Alberta Foothills region under a changing climate. (Raulier et al.) (to document CD of model results) ca. 31 January 2005.

Communications and Outreach

- Partner workshop at NoFC, with presentations by the project PIs (Price, Raulier and others). October/November 2004:
- Final report: Simulating volume productivity of lodgepole pine in the Alberta Foothills under climate change. Spring 2005

Policy Support

- Same as (3.) Knowledge / Technology Transfer
CD containing copy of StandLEAP calibrated for lodgepole pine, with sample input data set and output, and basic user information. 31 October 2004
- Same as (3.) Knowledge / Technology Transfer
Quick-Note 4: Using the StandLEAP process-based model of forest productivity. (Raulier and Bernier). (To document CD with model code/data) ca. 31 October 2004.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Run StandLEAP with historical climate data; compare to stem analysis estimates and report		X	X									
Run StandLEAP with climate scenarios, produce yield forecasts and models.		X	X	X	X	X			X			
Draft and submit scientific article	X		X		X		X		X	X		
Organize/hold partner workshop. Discuss implementation							X					
Produce preliminary yield tables.							X	X	X	X		
Prepare final report.									X	X	X	X

8. Site Information

No field work is planned in this project.

9. References

Bernier P.Y., F. Raulier, P. Stenberg and C.-H. Ung. 2001. Importance of needle age and shoot structure on canopy net photosynthesis of balsam fir (*Abies balsamea*): a spatially inexplicit modeling analysis. *Tree Physiol.*, 21: 815-830.

Price, D.T., R. Hall, F. Raulier, M. Lindner, B. Case and P. Bernier. 2002. Simulating climatic impacts on, and adaptive management options for, boreal forest ecosystems in Western Canada. Final report to Prairie Adaptation Research Cooperative, Foothills Model Forest and the Sustainable Forest Management Network, August 2002.

Price, D.T., D.W. McKenney, I.A. Nalder, M.F. Hutchinson and J.L. Kestevan. 2000. A comparison of statistical and thin-plate spline methods for spatial interpolation of Canadian monthly mean climate data. *Agricultural and Forest Meteorology* 101: 81–94.

Price, D.T., D.W. McKenney, D. Caya, M.D. Flannigan and H. Côté. 2001. Transient climate change scenarios for high resolution assessment of impacts on Canada's forest ecosystems. Final report to Climate Change Action Fund, June 2001. http://www.cics.uvic.ca/scenarios/index.cgi?Other_Data#transienthighres

Raulier F., P.Y. Bernier and C.-H. Ung 2000. Modeling the influence of temperature on monthly gross primary productivity of sugar maple stands. *Tree Physiol.*, 20: 333-345.

10. Scientific Review

This work is planned to provide the information needed to develop one peer-reviewed article, although it may well contribute to other peer-reviewed papers, in which case appropriate acknowledgements will be made. Given the technical focus of the application, however, we expect that most scientific review will arise from discussions with the Alberta Forest Growth and Yield Association, and other experts in the industry and Alberta Sustainable Resource Development.

11. Improvements to Management in Forest Ecosystems

Increased concerns about the possible impacts of a warmer climate, and perhaps a strengthening belief that a warming trend is already in progress, have led to greater interest in understanding and anticipating the potential effects on forest productivity and long-term sustainable AAC. The boreal-cordilleran forests of the Alberta Foothills are characterized by drought-adapted species, notably lodgepole pine, in a region subject to relatively low annual precipitation. Hence, the effects of a warmer climate on forest productivity (as well as on fire regimes and post-fire regeneration), are of critical concern to future forest management. This study will provide important input to growth and yield forecasting, ultimately to be used in the development of future management plans for the FMF and neighbouring regions under a range of plausible climate scenarios.

12. Amount of Money Requested From the Foothills Model Forest

\$30,000 for 2004/05

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			30,000			
CFS in-kind					50,000	
FGYA (Dempster)					3,000	
Alberta SRD				50,000		
Weldwood Canada					100,000	

14. Proposed Payment Schedule

1 April 2004 \$20,000
 1 October 2004 \$10,000

15. Subcontracted Work
N/A

16. Project Management
David Price will be the CFS contact for management of this project.

17. Additional Organisations requesting FRIIA Administered Monies

18. Other Relevant Information

Foothills Model Forest 2004-2005 Annual Work Plan

Foothills Growth and Yield Association

1. Prepared by

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2. Introduction

Companies holding Forest Management Agreements on the Eastern Slopes have recognized for some time the potential value of a co-operative lodgepole pine growth and yield program. In response to interest by industry and government, the Foothills Model Forest (FtMF) facilitated collaboration among these companies to create a Foothills Growth and Yield Association (FGYA) for co-operative forecasting and monitoring of managed stand growth and yield.

This is the fifth annual work plan of the Association.

3. Background Information

In 2000, 9 companies holding forest management agreements, the Alberta Government, and the FtMF entered into an agreement to develop and manage the Association. The 9 companies sponsor the program and act as voting members of the Association. The Alberta Land and Forest Division and the FtMF participate as non-voting members, with the Model Forest acting as the coordinating agency. In 2002 the Association's Steering Committee reviewed, endorsed and accepted a 5-year business plan.

The FtMF, acting as applicant on behalf of the 9 sponsoring members, submitted a proposal to the Forest Resource Improvement Association of Alberta (FRIAA) in July 2000. A contract was issued (FOOMOD-01-01 – Foothills Growth and Yield Association) on July 25, 2000, facilitating use of FRIP (Forest Resource Improvement Program) funds to cover membership costs and project activities. The original proposal and contract had an initial term of 2 years, and were amended in September 2001, extending the term to 5 years (April 1, 2000 to March 31, 2005). In June 2003, FRIAA approved an additional project for the measurement and maintenance of historic research trials (FOOMOD-01-02).

To date the Association has:

- Completed installation of a major lodgepole pine regeneration trial, developed an associated database and procedural manual, and undertaken scheduled measurements and treatments;
- Completed a study of site-index change between pre- and post-harvest stands;

Commenced scheduled re-measurements and maintenance of historic research trials, under a formal agreement with the Canadian Forest Service and Alberta Sustainable Resource Development;
Commenced collaborative work with the Land and Forest Division of ASRD (Alberta Sustainable Resource Development) for the pilot development of improved regional yield estimation techniques;
Commissioned an expert review of opportunities for nutrition and density management in lodgepole pine, and prepared a detailed project proposal for filling knowledge gaps identified in the review (selected for funding under FRIAA's Open Funds Initiative commencing April 1, 2004).
Held at least one technical conference and / or field tour per year.

4. Objectives

The overall goal of the Association is to continually improve the assessment of lodgepole pine growth and yield in managed stands. This will be achieved by forecasting and monitoring responses to silvicultural treatments, facilitating the scientific development and validation of yield forecasts used by members in managing their tenures, and promoting knowledge, shared responsibility and cost-effective cooperation.

Desired outcomes of the program are listed below.

Stand-level timber yield forecasts are defensible and accepted by scientists and regulators.

Recognized scientific, regulatory and certification standards for validation and monitoring of sustainable forest management practices are met.

Managers' knowledge, and their abilities to predict responses to management practices, are improved, facilitating management by objectives rather than by arbitrary prescription.

Stakeholders influencing forest management decisions understand the probable effects of management interventions on stand development.

Investments in growth and yield assessment are cost effective, and there is no unnecessary duplication of effort.

Participants remain committed to the program, and share costs equitably.

Work is user-driven, results-focused, and directly applicable to management and crop planning.

Specific program objectives, beneficiaries and impacts are described below, relative to each of the strategic objectives of the FtMF.

1.) Knowledge Creation

The following projects and objectives pertain to knowledge creation.

Regenerated Lodgepole Pine Trial. Objective: forecast and monitor the growth and yield of lodgepole pine, regenerated after harvesting, in relation to site, initial spacing of planted stock, natural ingress and mortality, competing vegetation (brush), and density regulation (pre-commercial thinning).

Comparison of Pre-harvest and Post-harvest Stand Productivity.

Objective: provide credible and reliable forecasts of post-harvest stand productivity and development, relative to pre-harvest values.

Cooperative Management of Historic Research Trials. Objective: provide forest managers the full and continued benefit of relevant established long-term field trials assessing responses of fire-origin lodgepole pine to nutrition and density management.

Regional Yield Estimators. Objective: develop stratum-based stock and stand table generators for lodgepole pine ecosystems, with compatible forward and retrospective projection capability, providing an improved basis for productivity estimation, yield planning, and evaluation of crop performance standards.

Enhanced Management of Lodgepole Pine. Objectives: predict response of lodgepole pine stands to thinning and fertilization across a range of site and stand types, develop managed stand yield tables, and develop diagnostic criteria (guidelines) for prescribing silvicultural treatments.

In spite of considerable interest in, and an established need for, enhanced forest management (EFM), Alberta has no accepted system for predicting managed stand development (e.g. “managed stand yield tables”), verification of yields resulting from enhanced practices, or for linking silvicultural practice to EFM objectives (e.g. silvicultural assessment guidelines and interpretative criteria). The above projects will address these knowledge gaps in regards to lodgepole pine. Lodgepole pine forests are particularly subject to intensifying land-use pressures, threats, and uncertainty.

The targeted audiences for created knowledge are the voting members of the Association, the Alberta government, forest scientists, and members of the public who influence forest management decisions. The primary and direct beneficiaries will be the 9 sponsoring members of the Association and the Alberta Department of Sustainable Resource Development. However, informed and enhanced management of lodgepole pine is essential to overall enhancement of the forest resources of Alberta, providing benefits to a broad portion of Albertans.

2.) **Demonstration**

Field demonstrations of how lodgepole pine responds to different management treatments will be provided by the Regenerated Lodgepole Pine Trial, approximately 12 historic trials being measured and maintained by the program, and the proposed Enhanced Management of Lodgepole Pine Project experimental sites. Interpretative signage will be targeted at forestry practitioners and public groups interested (and influential) in sustainable forest management. Beneficiaries will be these groups, members of the Association, and forest research agencies.

3.) Knowledge and Technology Transfer

Knowledge and technology transfer will be achieved through:
Technical conferences and field tours (anticipated audiences: Association members, scientists, forestry practitioners, and educators);
Technical and information reports (anticipated audiences: Association member organizations, collaborating agencies, forestry practitioners);
Published scientific papers and presentations (anticipated audiences: members, scientists, other forestry professionals);
Predictive computer models (anticipated audiences: Association member organizations and collaborating agencies).

4.) Communications and Outreach

Outreach to broader audiences, in addition to those listed above, will be facilitated by:
Advertising reports and publications, and making them available for downloading from the FtMF website;
Publication of news, events and findings on the FtMF website, and through FtMF Quick Notes;
Interpretative signage of experimental sites.

5.) Policy Support

Senior policy makers in Alberta Sustainable Resource Development² have repeatedly stated that the biggest question mark, and highest priority, regarding sustainable forest management (SFM) is the growth and yield of post-harvest regenerated stands, and that a cooperative approach to collecting growth and yield information to support SFM strategies is essential.

Information, models, and techniques provided by this program will support the development and use of policy tools including:
Regeneration and performance standards linked to management objectives;
Assessment criteria for enhanced forest management treatments (e.g. brushing, thinning and fertilization);
Silvicultural prescriptions, manuals, and crop plans;
SFM monitoring protocols;
Forest management planning guidelines;
Forest productivity estimators;
Managed stand yield tables.

It must be stressed that the FGYA, as an impartial scientific provider of information, does not itself participate in policy development or advocacy.

² R. Fessenden, Deputy Minister ASRD (presentation to FGYA Annual General Meeting, Edmonton, 2002-03-06), and D.Sklar, Executive Director Forest Management Branch (presentation to FGYA Annual General Meeting, Edmonton, 2003-2-27).

5. **Abstract of Methodology**

The following is a brief description of the 6 projects currently defined within the program.

Project 1. Development and Management of the Association

The roles, responsibilities, and activities for developing and managing the Association are described in the Memorandum of Agreement. The primary activities are project management, field co-ordination, organization of meetings, and distribution of information. A part-time contract Director and Field Coordinator undertake these activities, with administrative support from the FtMF.

Project 2. Regenerated Lodgepole Pine Trial

The Project consists of a long-term field trial, established in 2001, and interim forecasting of effects using available models and data. The trial is a three-level split-plot design. The basic balanced design consists of 90 field installations (5 ecosites x 6 spacings x 3 replications), with each installation split 2 ways into 4 treatment plots (brushing / no brushing and thinning / no thinning). Twelve additional installations (6 spacings x 2 replications) have been added in the modal ecosite category, to produce a total of 102 installations. Main activities in 2004-05 will be scheduled measurements and treatments, analysis of data, and preparation of a crop performance report and technical paper.

Project 3. Comparison of Pre-harvest and Post-harvest Stand Development

The methodology has so far involved paired-plot sampling of a total of 50 stands located in the 5 ecosite categories recognized in the Regeneration Project, in combination with analysis of data contributed by members from permanent sample plots (PSPs) where measurements are available before and after harvesting. The FGYA Technical Committee, together with Alberta government specialists, is currently reviewing what follow-up is required to work undertaken in 2003. A technical paper will be submitted for presentation at an international forestry conference and / or for publication in a forestry journal.

Project 4. Cooperative Management of Historic Research Trials

The Project involves 3 main tasks: maintenance and protection of the field installations, synthesis of results to date, and ongoing measurement and analysis. This is a cooperative effort shared between the Association, Canadian Forest Service (CFS) and ASRD (Alberta Department of Sustainable Resource Management). The main activities of the FGYA in 2004-05 will be scheduled re-measurement and maintenance of trials, and development and placement of interpretative signage.

Project 5. Regional Yield Estimators

The work is mainly analytical, and led by the Senior Biometrician of ASRD. The Association Director, and interested members of the Steering and / or Technical Committees, have participated in reviewing available data and developing the

analytical design. The Association's involvement in 2004-05 will primarily be testing of prototype models currently under development, and assessing results.

Project 6. Enhanced Management of Lodgepole Pine

A scope assessment and proposal have been completed for this work. The proposal was submitted to FRIAA for funding consideration, with letters of support from all 11 members of the FGYA. The key elements of the Project are:

Scope assessment;

Site and stand assessment;

Experimental treatment plots;

Diagnostic fertilizer response testing;

Treatment response forecasting and management interpretations;

Creation of opportunities for demonstration and linked research;

Inputs from related FGYA projects.

FRIAA has selected the project for funding under its Open Funds Initiative, commencing April 1, 2004. The main tasks for the year will be site reconnaissance, selection, and enumeration, nutrient analyses, and detailed design.

6. Deliverables

The following products and services are scheduled for delivery by March 31, 2005.

Knowledge creation

Field measurements, data entry, and verification (Projects 2, 4, 6);

Data analyses (Projects 2, 3, 4, 5, 6).

Demonstration

Sites maintained (Projects 2 and 4) and identified (Project 6).

Knowledge and technology transfer

Technical forum and / or field tour;

Technical and information reports (Projects 2 and 4);

Detailed project design (Project 6);

Scientific paper / conference presentation (Project 3);

Computerized database (Project 2).

Communication and outreach

Program information and reports available on the FtMF website;

2 Quick-Notes distributed;

Interpretative signage of experimental sites.

Policy support

Regeneration performance reports (Projects 2 and 3);

Prototype regional yield estimation model (Project 5).

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
1. Association development and management												
Direction and analysis (person days)	10	10	10	10	10	10	10	10	10	10	10	10
Field coordination (person days)	7	10	10	10	10	10	8	7	7	7	7	7
Data management services (person days)	2	2	2	2	2	2	2	2	2	2	2	2
Progress reports	X			X			X			X		X
Annual meeting												X
2. Regenerated lodgepole pine												
Planning	X	X										
Fieldwork (treatments and re-measurements)			X	X	X	X						
Compilation and analysis							X	X	X	X		
Reporting										X	X	X
3. Comparison of pre- and post-harvest stands												
Prepare and present scientific paper(s)	X	X	X	X	X	X	X					
Additional data collection and research	Requirement currently under review by Technical Committee											
4. Cooperative management of historic trials												
Draft synthesis and interpretive report	Dependent on CFS input – currently under review											
Field re-measurements				X	X	X						
5. Regional yield estimators												
Prototype assessment and development	X	X	X	X	X	X	X	X	X	X	X	X
6. Enhanced management of lodgepole pine												
Stand reconnaissance and selection	X	X	X	X	X	X						
Sample plot enumeration				X	X	X	X	X	X	X	X	
Foliage analysis								X	X	X	X	
Detailed design	X	X	X	X	X	X	X	X	X	X	X	X
Analysis						X	X	X	X	X	X	X

8. Site Information

The program will be based out of the FtMF headquarters in Hinton. Research and monitoring sites are not limited to the Foothills Model Forest and will be distributed along the Eastern Slopes, in the tenures of the 9 sponsoring members. Research trials will primarily be located in the Lower and Upper Foothills and the Subalpine Natural Sub-regions.

9. References

Memorandum of Agreement among Members of the Foothills Growth and Yield Association (December 1999).

Foothills Growth and Yield Association: proposal submitted to the Forest Resource Improvement Association of Alberta (FRIAA) by the FtMF, July 2000.

Forest Resource Improvement Association of Alberta; Project FOOMOD-01-01 – Foothills Growth and Yield Association; Amendment # 1, September 12, 2000.

Forest Resource Improvement Association of Alberta; Project FOOMOD-01-01 – Foothills Growth and Yield Association; Amendment # 2, October 11, 2001.

Project Proposal: Comparison of Pre-harvest and Post-harvest Site Indices, Foothills Growth and Yield Association, February 2002.

Foothills Growth and Yield Association Business Plan, April 2002.

Letter of Agreement between Canadian Forest Service, Alberta Sustainable Resource Development, and Foothills Growth and Yield Association for Cooperative Management of Historic Lodgepole Pine Research Trials, July 2002.

Evaluating Opportunities for Nutrition and Density Management of Fire Origin Lodgepole Pine in Alberta: An Opinion Paper, B. White, D. McNabb, S. Chang, V. Liefvers, Alberta Research Council, 2002.

Measurement and Maintenance of Historic Research Trials, proposal submitted to FRIAA by FtMF, April 2003.

Regenerated Lodgepole Pine Project - Effects of Site, Competition, and Density Management on Early Crop Performance and Stand Growth and Yield of Lodgepole Pine - Establishment Report, April 2003.

Forest Resource Improvement Association of Alberta, Project FOOMOD-01-02 – Measurement and Maintenance of Historic Research Trials; Project acceptance document, June 3, 2003.

Regenerated Lodgepole Pine Project - Comparison of Pre-harvest and Post-harvest Site Indices – Technical Report, May 2003.

Lodgepole Pine Regeneration Project Field Manual, version 2.1, July 2003.

Enhanced Management of Lodgepole Pine, proposal submitted to FRIAA Open Funds Panel by Foothills Growth and Yield Association, October 2003.

10. Scientific Review

Recognized scientific experts in growth and yield, biometrics, and forest ecology have reviewed or will review project plans and results. Drs. P. Blenis, S. Titus, V. Liefvers and P. Comeau of the University of Alberta reviewed the experimental design and procedures for Project 2 (lodgepole pine regeneration). Dr. Shongming Huang of ASRD assisted in the initial design of Project 3 (site index comparison), is collaborating in interpretations and publication of project results, and is playing a lead role in Project 5 (regional yield estimators). Dr. James Stewart of the CFS assisted in the design, and is leading analysis of Project 4 (historic research trials). Drs B. White and D. McNabb of the Alberta Research Council, and Drs. S. Chang and V. Liefvers of the University of the University of Alberta prepared an extensive review of nutrition and density management, which was used as the basis for the Project 6 proposal (enhanced management of lodgepole pine).

Meetings will be held at least once a year, to which experts will be invited to attend and review projects. Peer-reviewed publication of results in scientific journals is intended for Projects 2, 3, 4,5 and 6.

11. Improvements to Management in Forest Ecosystems

The program will improve the management of forest ecosystems through:
 improved assessment of ecosystem productive capacity;
 improved assessment of the sustainable use levels of a biological resource;
 promotion of cooperation, partnership, and shared responsibility among forest managers and researchers;
 increased levels of knowledge and awareness of sustainable forest management;
 continual improvement of sustainable forest management practices;
 stand-level data providing the basis for assessing impacts of enhanced forest management practices on natural ecosystem processes and contributions to global ecological cycles.

12. Amount of Money Requested from the Foothills Model Forest

No money is requested from the FtMF for 2004-05. In-kind services are requested as noted below.

13. Partner Contributions

Partner / Organization	Cash (\$)			In-kind (\$)	
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions
FtMF GIS services					12,000
Industrial FGYA members		165,000 ³			200,640 ⁴
ASRD	10,000 ⁵				
Other / various	102,043 ⁶	115,400 ⁷			
Total	112,043	280,400			212,640

The above table is provisional, as costs estimates are subject to refinement by the FGYA Technical Committee, and approval by the Steering Committee. The table does not include costs of the following contributions by members that will be essential for proper and successful functioning of the Association:

- Participation on Technical and Steering Committees;
- Attendance of meetings;
- Review of minutes, reports, and scientific papers;
- Contribution of existing information and data;

³ \$135,000 in annual fees, plus approx. \$30,000 contribution to Project 4 field measurements and maintenance.

⁴ Indicative cost of Project 2 scheduled measurements and treatments.

⁵ Grant for publication of management interpretations, Project 4.

⁶ Forecast balance forward from 2003-04.

⁷ Project 6, first year expenditures as per project proposal.

Identification of candidate experimental sites
Provision and support of models;
Protection of trials, and restoration in event of damage or loss;
Direct participation in analysis and interpretation of data;
FtMF administration costs.

The table shows in-kind contributions by the FtMF for data management (GIS) services, but does not include other administrative and financial services provided by the FtMF. The following in-kind contributions from the LFD and CFS also are also not reflected:

Project 4 management, analysis and interpretation (CFS and LFD);
Project 5 data analysis (LFD).

14. Proposed Payment Schedule

Payments to the FtMF will be scheduled as follows:

Membership fees through FRIAA: Members will be requested to submit letters of authorization to FRIAA by May 1, 2004. FRIAA will release payments to the FtMF on receipt of letters and a consolidated annual report for 2003-04.

Membership fees paid directly to FtMF: members will be invoiced by May 1, 2004 for payment by June 1, 2004.

Funds promised or sort for Projects 4 and 6 will be requested for payment upon approval of annual work plans and reports, with a 10% holdback pending completion of work.

Payments to the contract Director and Field Coordinator will be based on approval of monthly invoices by the FtMF General Manager.

Other contract services and meeting costs will be paid on receipt of invoices approved by the Association Director.

Contracted Work

The following tasks will be completed under direct contract to the FtMF:

Project 1: program direction, field coordination, data analyses, provision of meeting facilities etc.

Project 4: fieldwork.

Project 6: field and laboratory work, data analysis.

Project Management

Project management and management responsibilities are described in the Memorandum of Agreement among members of the Association. The Director will act as the project manager for all 6 projects. The Field Coordinator will supervise fieldwork and sub-contracted components of Projects 2, 4, and 6.

15. Organizations Requesting FRIAA Administered Monies

Funding of contributions to the Association, and the identification of sources for such funding, are generally the responsibilities of the individual members. Seven members have elected to authorize FRIAA to transfer funds for membership fees directly to the FtMF. One member has utilized FRIP funds, but directed the fee payment itself. One member has not utilized FRIP funds for its contributions to the Association. The Association successfully submitted a proposal to FRIAA in October 2003, for use of FRIP open funds for Project 6.

**Foothills Model Forest 2004-2005 Annual Work Plan
Susceptibility/ Risk Rating Systems and Spread Modelling for the Mountain Pine
Beetle in Lodgepole Pine Stands of the Foothills Model Forest, Northeastern Slopes,
Alberta.**

1. Prepared by: Name: FMF Mountain Pine Beetle Working Group

Parks Canada, Jasper: Dave Smith & Dr. Peter Achuff
Alberta SRD, Forest Protection: Erica Lee & Hideji Ono
Weldwood of Canada Ltd (Hinton Division): Hugh Lougheed
Canadian Forest Service (Victoria): Dr. Terry Shore & Bill Riel
Foothills Model Forest: Dr. David Andison

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2. Introduction

This ongoing project proposes to validate the recently developed susceptibility/risk rating systems and spread modelling for the mountain pine beetle in lodgepole pine stands of the Foothills Model Forest (and east slopes of Alberta in general). It is a specified project within the Foothills Model Forest (FMF) Natural Disturbance Program (Andison, 2001).

Although the mountain pine beetle (MPB) has no history of reaching epidemic proportions along the northeastern slopes (NES), large populations are periodically present in British Columbia forests to the west and a rapidly growing population is developing to the south in Banff National Park and Mount Robson Provincial Park (British Columbia). Monitoring in NES drainages near the continental divide of Willmore Wilderness Park and Jasper National Park has revealed populations in the very early incipient stage. Partners within the Foothills Model Forest are concerned about the implications for more active or widespread MPB populations. All parties are in agreement that reliable predictive models are required to forecast the susceptibility of lodgepole pine forests, rate the risk of damage by MPB and predict potential MPB spread across the landscape in order to plan and manage forests of the north eastern slopes over the long term. A first draft of the report based on the model's predictions was presented to the committee in December of 2003. The final report will be completed in early February 2004.

With the completion of the Mountain Pine Beetle Risk and Susceptibility model for the Foothills Model Forest, the next logical step is to validate the model. In order to achieve this task we propose to use data from the recent MPB infestation in the Bow Valley of Banff National Park and areas of the valley further to the east on the Canmore area. This is one of only a few documented cases of MPB infestation east of the continental divide. Application of this model in the Bow Valley will also help The FMF achieve the phase III objective to "spread the

word—to share what it has learned and developed. Beyond its geographic boundaries, it will reach out to researchers and the public in support of ecologically sensitive stewardship”. As well, model outputs will also be available for CFS work focusing on the spread of the MPB infestation towards the burial forest under different climatic conditions. This project has received strong support from the West Yellowhead Mountain Pine Beetle Working Group.

3. **Background Information**

The MPB is the most destructive native forest insect of lodgepole pine in western North America. It is likely *endemic* to Jasper and throughout the eastern slopes of Alberta, but has only reached *epidemic* levels in British Columbia and in southern Alberta. Climatic factors are believed to be the historic regulators of MPB populations however, the effects of climatic warming and increased amounts of old forest (due to fire suppression) raise concerns that the past may not be a template for the future.

Typically, MPB populations progress through a number of stages (endemic, incipient, epidemic outbreak and outbreak collapse). In the Willmore/Smoky areas, MPB is at the very early incipient stages with indications that climatic controls are still exerting an impact on MPB survival. Epidemic outbreaks cannot be suppressed.

The MPB continues to be the subject of numerous meetings and discussions between the Alberta Sustainable Resource Development, Parks Canada, the Canadian Forest Service and Weldwood (Hinton). There was and continues to be consensus that a co-operative effort to develop a well reasoned, proactive long-term approach to MBP issues and management is required. This approach places an emphasis on preventative management of pine forests (MPB habitat) with less emphasis on reactive management directed towards the beetle itself.

The Canadian Forest Service developed and tested a susceptibility/ risk rating system (Shore and Safranyik, 1992) and MPB spread models (e.g. MPB-SELES) that are acknowledged as the best available templates for future modelling efforts. These models were developed and tested in British Columbia. With the completion of Phase I of this FMF project, the model has been adapted to reflect local (FMF) climatic conditions.

4. **Objectives**

To develop the best possible model to allow FMF managers to predict the probability of a stand being attacked (risk) and the amount of potential pine mortality (susceptibility) within one year. This capability will allow managers to prioritize long term management activities in the FMF (e.g. monitoring surveys, prescribed burning, harvesting patterns and “beetle-proofing” activities) and will be achieved by modifying and validating existing B.C. models for Alberta conditions and incorporating climatic model inputs specific to the eastern slopes of Alberta.

To Validate the MPB spread model for the Foothills Model Forest (based on MPB Spatially Explicit Landscape Event Simulator, MPB SELES and MPBSim

models) to allow FMF managers to understand possible scenarios for beetle expansion across the landscape in response to geography, forest cover, weather, beetle populations and management activities.

To increase common understanding about modelling approaches and inter-jurisdictional mountain pine beetle management.

To develop transferable technology that will benefit other FMA holders and other land managers along the eastern slopes of Alberta.

1.) Knowledge Creation

At the present time there is tremendous uncertainty about the potential for spread of MPB to the northeastern slopes however of the Rockies, the potential for damage to commercial forests is significant if it does. Until the development and validation of this model, no tested or accepted models to forecast such events are available. Therefore, the models and simulations produced during this project represent new knowledge to concerned managers. The outcome of this project will have considerable local relevance and importance to all land managers operating within the FMF.

1a. Beneficiaries and Impacts

All FMF partners will benefit by having the most reliable information possible to base future actions upon. Given the collaborative science-based process involved, acceptance of the results is assured.

Weldwood will benefit by having the ability to focus harvesting and stand tending operations in geographic areas that have the greatest probability of mpb activity, thus reducing the economic impact of the beetle and increasing its return on investment.

Similarly, JNP and Alberta Sustainable Resource Management will benefit by having the knowledge required to more effectively focus prescribed burning capacity in watersheds most likely to develop MPB populations that are problematic to FMA holders.

Since these models and simulations will be equally valid adjacent Banff, Waterton and provincial wilderness areas, the benefits noted above will accrue to these agencies and to other FMA holders north and south of the FMF along the eastern slopes.

The Canadian Forest Service may benefit by continuing its tradition of developing innovative technologies for the benefit of forest-based industries.

2.) Demonstration

This project will produce short- term products that are immediately applicable (and demonstrable) on the ground

- 2a. Beneficiaries and Impacts**
By resolving this issue, the FMF partnership, as a whole, will demonstrate its ability to respond quickly and effectively to an issue that is, potentially, of vital socio-economic importance.
- 3.) Knowledge / Technology Transfer**
Knowledge and technology (in the form of working models) produced by this project will be immediately transferable and of great interest to adjacent FMA holders for the same reasons that they are important to the FMF.
- 3a. Beneficiaries and Impacts**
The FMF will benefit by showing leadership and relevance beyond its own boundaries.
- Alberta SRD, Banff National Park and adjacent FMA holders will benefit by being able to use this model to refine their earlier, less reliable forecasts of MPB expansion.
- Alberta Newsprint Company, Weyerhaeuser, Sunpine, Spray Lakes Sawmill and other FMA holders have immediate applications for these models in order to establish the most effective mpb prevention or response measures.
- 4.) Communications and Outreach**
Because of their highly visual nature, the model and simulations produced by these models, they are easily presented and understood by technical and non-technical audiences.
- 4a. Beneficiaries and Impact**
Products and presentations resulting from the project will help the public to better understand forest insects as a disturbance component in Alberta forests and how partners within the FMF are managing them.
- 5.) Policy Support**
Because of the nature and potential implications of a MPB epidemic, this project may lead to immediate shifts in operational policies in several FMF jurisdictions including the prescribed burning plans of JNP and BNP, Weldwood's harvesting schedule and fire management within Wilmore Wilderness Park.
- 5a. Beneficiaries and Impacts**
There will be mutual benefits to all FMF partners due to a resultant reduction of MPB threat to commercial forests and accelerated programs of fire restoration for ecological purposes.
- 5. Abstract of Methodology**
A project working-group with representation from all major FMF partners and Canadian Forest Service researchers was established in 2001. In the late fall of

2003, this group met and reached consensus. With the completion of the model for the FMF, a program for the validation of the model should be undertaken; Methods used in this project will parallel proven methods developed and applied by Dr. Terry Shore and Bill Riel of CFS to similar MPB population issues in British Columbia. As was the case with the FMF model, it will require data inputs and adjustment of modelling programs specific to forests, climate and beetle populations of the northeastern slopes;

The lower Bow Valley of Banff National Park and areas further downstream in the Canmore area are in the midst of a MPB infestation. This infestation is well documented. By running the model using data from the Bow Valley, we can compare model predictions to the actual spread of MPB in this region. Unlike the case of developing the FMF model, here there are few data gaps, the data is far more compatible and accessible;

A significant portion of the modelling work will again be sub-contracted to Dr. Andrew Fall of Gowlland Technologies Ltd.

Corrections or adjustments to the models will then be made, and more production runs conducted. The results of production runs will be presented (with interpretations) to a broader management group consisting of industry and agency representatives. This will provide an opportunity for critique and to pose additional modelling questions or scenarios prior to completion of the project and final reports.

Final modifications to the models (if required) and produce final model runs and reports with management interpretations for the FMF landbase.

6. Deliverables

Knowledge Creation/Demonstration/Knowledge / Technology Transfer

An evaluation and amalgamation of forest and park inventory databases as applicable to MPB risk rating systems;

Interim models and interpretations;

Validated operational susceptibility and risk rating system (maps) for the mountain pine beetle in lodgepole pine stands of the Foothills Model Forest, northeastern slopes.

Mapped predictions of MPB spread and impacts (expressed as numbers of trees, volume and value of timber) of MPB outbreaks over space and time and under different management scenarios (treatments) using the MPB Spatially Explicit Landscape Event Simulator (MPB SELES)

Key inputs to long term planning for timber harvesting and fire restoration (prescribed burn) planning.

Communications and Outreach

FMF QuickNotes on MPB issue, MPB modelling and simulation project, results of FMF MPB modelling project;

Stakeholder workshop on MPB ecology, predictive modelling and management;

Manuscript(s) for submission either as a FMF Technical Report or to a scientific journal, based on the above reports;

Policy Support

Policy deliverables will not be produced until project completion approximately October of the 2004/05 fiscal year. Upon completion, the expected policy deliverable will be a change in prescribed fire priorities by JNP and alteration of forest management practices to enhance sustainability by Weldwood.

7. Timelines

The time required to complete the validation phase of this project will be less than one year. The timeline is represented in the following table:

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Project launch; review progress to date	X											
Full climate data to CFS	X											
Summarize/assess data compiled to date	X											
Finalize field data requirements	X											
Short-list model questions and scenarios		X										
CFS/Gowlland Tech. re-write models			X	X								
Summarize results and document methods					X							
Stakeholders meeting, evaluation						X						
Revisions and final reports							X					

8. Site Information

The entire land base of FMF; the Bow Valley and eastern slopes of the Rockies.

9. References

Andison, David W. 2001. Foothills Model Forest disturbance dynamics long-term research plan, version 6.0 for 2001 – 06. Draft internal document. 20pp.

Shore, T. L. and L. Safranyik. 1992. Susceptibility and risk rating systems for the mountain pine beetle in lodgepole pine stands. Canadian Forest Service Information Report BC-X-336. Victoria, BC.

Shore, T. L., L. Safranyik, and J.P Lemieux. 2000. Susceptibility of lodgepole pine stands to the mountain pine beetle: testing of a rating system. Canadian J. of Forest Research. 30: 44-49.

10. Scientific Review

Other CFS collaborators (e.g. Dr. Allan Carroll)
Dr. David Andison (FMF ND Project)
Possible publication in peer reviewed journal

11. Improvements to Management in Forest Ecosystems

NA

12. Amount of Money Requested From the Foothills Model Forest

There is approximately \$ 24,000.00 still available from the initial contributions provided for the development of the model. An additional \$10,000.00 of Parks Canada’s Mountain Pine Beetle fund is committed to the Foothills Model Forest for validation of the model as well. It is therefore proposed that \$10,000 of the original MPB model funds plus Parks Canada’s \$10,000.00 be used for this phase of the project. This would result in an extra \$14,000.00 (est) available for other FMF programs.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contribution	Funding Pending	Current Funding	Promised Contribution	Funding Pending
Foothills Model Forest	10,000	0				
Weldwood of Canada		0				
SRD, Forest Protection		0			20K	
Banff and Jasper National Park		10,000			20K	
Canadian Forest Service					20K (est)	

14. Proposed Payment Schedule

payments to Gowlland Technologies as per contract to be established

partners pay S&W expenses for working group members

15. Subcontracted Work

Gowlland Technologies Ltd. (Dr. Andrew Fall) will be contracted and supervised by CFS, Victoria to program and write models, input data, translate or interpret data, produce simulations and write reports describing methods, results and interpretations for this project.

16. Project Management

Project manager as per contact at top of proposal. FMF MPB Working group as listed will co-ordinate stakeholder inputs to the project while Dr. Terry Shore and Bill Riel of CFS, Victoria are primary researchers.

17. Additional Organisations requesting FRIIA Administered Monies
N/A

18. Other Relevant Information

The FMF MPB Working Group, a partnership of concerned stakeholders, has been active since September, 2001. It has worked to gather relevant information and position this project for success.

Foothills Model Forest 2004-2005 Annual Work Plan
Design and incorporation of spotting and breaching of fire break functionality in
Prometheus-the Canadian Wildland Fire Growth Model

1. Prepared by

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2. Introduction

The term spotting refers to the production of sparks or embers that once carried by the wind, subsequently start new fires outside the perimeter of the main fire. Spotting can adversely impact efforts to suppress fire. Fire growth model computer simulations in Canada, currently do not include spotting and breaching of natural or man-made barriers to fire spread. This is, in part, because the Fire Behaviour Prediction (FBP) Sub-System of the Canadian Forest Fire Danger Rating System (CFFDRS) is an empirical based system. The observed rates of spread from experimental fires and wildfires include spotting. Therefore, there is no separate stand alone spotting model in the FBP system.

Breaching refers to spotting across a barrier. Although breaching may also occur across a barrier by actual fire spread, this project is designed to specifically to address the phenomena of spotting across barriers.

Development of *Prometheus* began in February 2000 as a project administered by the Foothills Model Forest. Work continued on the model within the Foothills Model Forest Program until March 31, 2002 when it was transferred to CIFFC as a National Interagency Project. Version 1.0 of *Prometheus* was completed and released in March 2002, to fire management agencies across Canada. A *Prometheus* user course was held at the Environmental Training Centre March 4 – 6, 2002.

The design and incorporation of spotting and breaching of fire breaks is a collaborative project between the Prometheus Project Steering Committee (CIFFC National Interagency Project) and the Chisholm-Dogrib Fire Research Initiative. Alberta Sustainable Resource Development is the lead agency on this National Interagency Project.

3. Background Information

Spotting is a complex and stochastic phenomena. There are many factors related to the likelihood of spotting (wind speed, fire intensity, number of firebrands, probability of ignition, weather conditions, type of firebrands, probability of

firebrand production). Albin (1979) developed a basic model to predict the maximum spot fire distance from burning tree crowns. The model inputs included quantity and surface/volume ratio of foliage, tree height, wind speed and the firebrand production rate. This event based (torching of individual trees or small groups of trees) model was later improved to predict spotting from firebrands generated from isolated sources such as a piles of fuel and high concentrations of surface fuels, or from several torching trees (Albin 1981).

In 1983 Albin described a theoretical model to predict the intermediate range transport of firebrands from wind driven surface fires. Albin's spotting model was simplified and incorporated in nomograms and in the BEHAVE program (Rothermel 1983, Andrews 1989). The same equations are also used in the FARSITE program (Finney 1998). The spotting module in the BEHAVE program allows users to predict the maximum spotting distance from torching trees, a burning pile of debris or from a wind driven surface fire. Each source uses the same method to calculate spotting distance. The input requirements to predict spotting distance are flame length, wind speed and terrain description.

Since the Albin model was not intended to predict spotting from a sustained crowning fire, spotting research was conducted by Albin during the International Crown Fire Modeling Experiment (ICFME) research project. A new crown fire spotting model has been developed, but not yet published (personal communication P. Andrews).

4. Objectives

1.) Knowledge Creation

Gain a better understanding of the science of spotting, and the methodology and tools available. This will involve an extensive literature review of spotting. The objective is to design and incorporate the functionality of spotting and breaching of fire breaks in Version 2.0 of *Prometheus*. A workshop will be held to review and interpret the current knowledge of spotting, and to solicit the expertise of fire behaviour personnel to develop an innovative and flexible methodology for a suitable and defensible approach to incorporate spotting and breaching of fire breaks in *Prometheus*.

1a Beneficiaries and Impacts

All users of *Prometheus* will benefit by being able to use an extended functionality of *Prometheus*. This will be particularly useful to evaluate different landscape and stand level fuel management strategies to mitigate wildfire threat.

2.) Demonstration

Demonstration of the project research results will occur once the methodology and algorithm have been coded in the *Prometheus* model. This will include the demonstration of spotting and breaching of fire

breaks using a test data set. The end user will also have the flexibility to modify the parameters (inputs).

The observed and documented spotting in the Chisholm and Dogrib fires will be used to calibrate and validate the spotting algorithm.

2a Beneficiaries and Impacts

Enhanced functionality and use of the model.

3) Knowledge / Technology Transfer

The methodology used for spotting and breaching of fire breaks will be documented and included on the website(<http://www.firegrowthmodel.com>)user manual, and on-line help information. This information will also be included in the *Prometheus* User Course.

3a Beneficiaries and Impacts

Greater understanding of the potential applications of the model.
Opportunity for other researchers to contribute, enhance and optimize the spotting algorithm .
Useful as an educational and training tool

4.) Communications and Outreach

The *Prometheus* Project Steering Committee has been actively engaged in communications and outreach through the development of posters, course and workshop presentations, and preparation of technical and general documents. The model was used for SRD's Expert Panel analysis in 2004 to reconcile the budget for typical and severe fire seasons.

4a Beneficiaries and Impacts

There are many stakeholders that will benefit from using *Prometheus*
Many of the model applications are planning oriented rather than operational (i.e. suppression)

5.) Policy Support

Prometheus is a decision support tool that can be used to enhance the capability for sustainable forest management, and to reduce the potential for losses due to wildfires.

Prometheus can be used to support existing policy and to facilitate and guide future policy development.

5a Beneficiaries and Impacts

Improved public safety
Reduced potential for losses due to wildfires
Enhanced capability for sustainable forest management

5. Abstract of Methodology

To achieve the desired objectives, the project needs input and participation from fire behaviour experts involved in fire management in Canada. This will be achieved by holding a one day workshop. The current state of the art and science of spotting and breaching of fire breaks will also be reviewed. The methodology and conceptual design of the model will be based on the best available science available.

6. Deliverables

Knowledge Creation

By April ,2004 complete a quick note describing the methodology used for the Expert Panel model runs or the real time application of the model on the House River Fire.

Demonstration

Demonstration of the project research results will occur once the methodology and algorithm have been coded in the *Prometheus* model. This will include the demonstration of spotting and breaching of fire breaks using a test data set. The end user will also have the flexibility to modify the parameters (inputs). The observed and documented spotting in the Chisholm and Dogrib fires will be used to calibrate and validate the spotting algorithm.

Knowledge / Technology Transfer

The methodology used for spotting and breaching of fire breaks will be documented and included on the website (<http://www.firegrowthmodel.com>), user manual, and on-line help information. This information will also be included in the *Prometheus* User Course.

Communications and Outreach

The *Prometheus* Project Steering Committee has been actively engaged in communications and outreach through the development of posters, course and workshop presentations, and preparation of technical and general documents. These initiatives will continue throughout 2004/2005.

Policy Support

Fundamental science support for the Expert Panel report for SRD and Treasury Board.

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Quick note	x												
Workshop								x					
Website update								x					

8. Site Information

This project does not include any field work. However, the actual observed and documented fire behaviour for the Chisholm and Dogrib fires will be used to calibrate and validate the spotting and breaching of fire break methodology that will be used.

9. References

Albini, F. A. 1979. Spot fire distance from burning trees - a predictive model. USDA For. Serv. Gen. Tech. Rep. INT-56, 73 p. Intermtn. For. And Range Exp. Stn., Ogden, Utah.

Albini, F. A. 1981. Spot fire distance from isolated sources – extensions of a predictive model. USDA For. Serv. Res. Note INT-309, 9 p. Intermtn. For. And Range Exp. Stn., Ogden, Utah.

Andrews, P. L., and C. H. Chase. 1989. BEHAVE: fire behaviour prediction and fuel modeling system – BURN subsystem, Part 2. Gen. Tech. Rep. INT-260. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 93 p.

Finney, M. A. 1998. FARSITE: Fire Area Simulator – model development and evaluation. Res. Pap. RMRS-RP-4, Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 47 p.

Rothermel, R. C. 1983. How to predict the spread and intensity of forest and range fires. Gen. Tech. Rep. INT-143. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 161 p.

10. Scientific Review

The methodology will be reviewed by various practitioner and academic fire behaviour experts. We also intend to publish the methodology that will be used.

11. Improvements to Management in Forest Ecosystems

Prometheus is a tool that can be used to enhance sustainable forest management and fire management.

12. Amount of Money Requested From the Foothills Model Forest

\$29,750 from the Chisholm Dogrib Fire Research Initiative

13. Partner Contributions

The development of *Prometheus* is a national interagency model with numerous collaborators across Canada providing support and funding. During the 2002/03 year, funding will also be provided by Alberta Sustainable Resource Development, Canadian Interagency Forest Fire Centre and Canadair.

14. Proposed Payment Schedule

April 30 - \$12,000.00

May 30 - \$12,000.00

June 30 - \$5,750

15. Subcontracted Work

The potential exists for considerable subcontracted work, including project management (see below), aerial photography, stream classification, and workshop preparations. These tasks are necessities that require specific expertise not available in-house.

16. Project Management

The project will be overseen by the *Prometheus* Technical Sub-Committee on Spotting and breaching of fire breaks. This Committee includes Dr. Marty Alexander (Canadian Forest Service) and Kurt Frederick (Alberta SRD). Kurt Frederick is the Provincial Fire Behaviour Officer for Alberta SRD. The overall development of *Prometheus* is administered by CIFFC. Administrative support will be provided by the Foothills Model Forest to complete this component (module) of the model.

17. Additional Organisations requesting FRIIA Administered Monies

None.

18. Other Relevant Information

None.

Foothills Model Forest 2004/5 Annual Work Plan

Fire behavior in immature v. mature aspen stands under severe spring burning conditions: does fire history matter?

1. Prepared by

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2. Introduction

The Chisholm Fire was Alberta's most devastating and expensive fire event on record. A subsequent independent review panel recommended significant improvements regarding extreme fire behaviour and community safety. The erratic fire behaviour characteristics of this event have been documented. However, the role of the aspen fuel type requires further study in two aspects—first, the unprecedented fire intensity of the Chisholm fire, and second, the role of the young aspen originating from the adjacent 1968 Vega fire in slowing the fire's progress south of Slave Lake.

3. Background Information

The May 2001 Chisholm Fire re-burned 13 benchmark fire behavior research plots that had been burned originally in May 1972, and two of them experimentally re-burned in May 1978. The experimental burning in semi-mature 44 year-old pure aspen stands in 1972 by Canadian Forest Service Fire Research contributed data points on rate of fire spread, fuel consumption and frontal fire intensity to the Canadian Forest Fire Behavior Prediction (FBP) System national model for Leafless Aspen (D-1). While the 1972 research burns and the 1978 re-burns on two of the plots were conducted under low and moderate burning conditions, the 1978 re-burns were characterized by a 10-fold increase in fire intensity, attributed to the aspen mortality and subsequent increase in fuel load following the 1972 burns.

An assessment of the impact of the 1972 burns on aspen mortality and understory vegetation response was made in August 1972, and again in August 1978, following the re-burns. In addition to the significant differences in fire behavior on the re-burns, the virtual elimination of aspen was noted after the combined fire treatments (Quintilio et al. 1991). Aspen suckering was minor after burning in 1972, but some vegetative species re-sprouted prolifically.

The Chisholm Fire also burned into 33 year-old aspen stands the regenerated following the intense Lesser Slave Lake (Vega) Fire of May 1968, immediately to the west of the Chisholm Fire. These aspen stands were observed to retard then

stop the forward and flanking spread of the Chisholm Fire, acting as a “firebreak”, once the fire penetrated a few tens to hundreds of metres.

The 2001 Chisholm Fire and re-burns creates an opportunity to explore questions raised by the original aspen fire research, and to contribute to the possible refinement of the FBP System in a way that has wide-ranging significance for the protection of wildland resources, as well as life and property values.

By re-evaluating in the field the 1972 and 1978 aspen treatments and adjacent controls, re-burned in the 2001 wildfire, indirect estimates of 2001 fire intensity and fuel consumption should be possible. Any differences between observable and measurable fire behavior and impacts may be attributable to known differences in stand age and fire history.

4. Objectives

To quantify fuel consumption in aspen stands of various ages and fire histories, burned in the 2001 Chisholm fire, including fire research plots from the 1970s. To compare estimated fuel consumption with predicted values from the Canadian Forest Fire Behavior Prediction (FBP) System, and recommend FBP System Fuel Type parameter changes, if warranted.

1.) Knowledge Creation

Over 50% of Alberta’s forest cover is dominated by aspen and the fire behaviour characteristics are becoming more significant as fire seasons lengthen and increase in severity. This study can add critical information to the research effort of the CFS in the 1970’s, and quantify fuel consumption correlation with stand age and moisture levels-both which have changed substantially since the previous study.

1a. Beneficiaries and Impacts

Fire behavior specialists in the CFS responsible for refining the Canadian Forest Fire Behavior Prediction System.
Operational fire behaviour officers working on overhead teams on major fires.

2.) Demonstration

This study is adjacent to the Slave Lake Highway and is accessible for field tours and outreach activities.

2a. Beneficiaries and Impact

Forest managers, researchers, professional groups that have field tours as a component of technical sessions.

3.) Knowledge / Technology Transfer

The ASRD trains all in-service fire specialists at the Environmental Training Centre and the results of this work will be incorporated into advanced fire behaviour courses.

3a. Beneficiaries and Impacts

Students and instructors from across Canada will benefit from the study and the CFS will have an opportunity to refine the aspen fuel type in the FBP System.

4.) Communications and Outreach

This study will provide an excellent follow-up on previous research and provide an important indication of stand age and fire season severity changes.

4a. Beneficiaries and Impacts

The fire community in general will learn from this comparison and specifically fire behaviour analysts.

5.) Policy Support

The proliferation of aspen stands associated with rural communities is significant and this study has implications for fuel management programs at the provincial level.

5a. Beneficiaries and Impacts

Both wildfire operations and pro-active fire smart community plans will be more sensitive to the range of fire behaviour potential in the aspen fuel type.

5. Abstract of Methodology

It is known that leafless aspen stands are capable of exhibiting extreme fire behavior (fast spread, intensities > 10 000 kW/m), but only under severe burning conditions in spring, or under severe drought in the fall when crowning has been observed. However, weather conditions, prior and current, do not have to be quite so severe when the aspen fuels have been disturbed by herbicides, cutting or a recent fire (Wright and Bailey 1982). The Chisholm Fire creates an opportunity to quantify these relationships between fire behavior, burning conditions and fire history. Increasing Build up Index (BUI) currently can contribute a maximum of 1.5 kg/m² surface fuel consumption in FBP Fuel type D-1, less than half the observed fuel consumption in the 1978 experimental re-burns. Since the 2001 Chisholm Fire occurred under near-record BUI values, it will be important to quantify fuel consumption in representative aspen stands before any changes to fire behavior models can be contemplated.

The 1972 and 1978 plots have been protected over the years by a research reserve, and have been visited after the Chisholm Fire by D. Quintilio. While plots are easily located and near the main highway, the access road is presently obstructed by blowdown, which can be cleared by ASRD fire crews prior to re-measurement in May, 2002. Original plot measurement detail and data is available at CFS NoFC, through the cooperation of M. Alexander. Overstory, understory, dead down and forest floor remaining fuels and aspen suckering data will be collected on all 13 original plots and controls during May, 2002. New plots will be established in the NW corner of the Chisholm Fire, within the area of the 1968

Lesser Slave Lake (Vega) Fire reburned in 2001, in order to determine pre- and post-burn quantitative data on aspen stand characteristics and fuel consumption. Measured fuel consumptions by stand age and fire history will be compared with FBP System predicted fuel consumptions.

It is planned that field work be expedited through the cooperation of CFS NoFC in agreeing to release contracted former CFS Fire Research Technician (now retired) Murray Maffey to work in the field with Ember during May, 2002, since Murray worked on and is familiar with the original 1972 and 1978 plots. Bruce Lawson and crew spent two weeks in May re-measuring the 1972 CFS plots and in addition documenting the re-burn of the 1968 Vega burn.

6. Deliverables

Knowledge Creation

-Final Report by March 31, 2004(submitted in January/04)

Demonstration

-By May 31, 2002, re-measure re-located plots in Chisholm fire to be marked for field tours and outreach activities, as they are easily accessible from Slave Lk. Highway.

Knowledge / Technology Transfer

-Ensure that Final Report incorporates graphics that facilitate incorporation of results into ASRD fire specialist training courses and Environmental Training Centre.

-Participation in ASRD-led workshop that should include CFS Fire Research partners, in order to encourage appropriate refinements to the deciduous fuel type fire behavior model in the FBP System, and Partners in Protection, in order to expedite transfer of results to community protection guideline specialists.

Communications and Outreach

-Ensure that Final Report simply and effectively communicates the findings concerning fire history and fuel load interactions with aspen fire behavior under severe burning conditions so that the relationships are understandable to the public. A quick note was submitted in 2003 and posted on the website. As well two papers were presented at technical conferences in 2003 :

Quintilio,D. 2003. Fuel and fire behaviour characteristics of the Chisholm fire. CIF Technical Session, March 2003.

Lawson, Bruce. 2003. Fuel management implications for aspen types: Chisholm fire analysis. FERIC Fuel Management Workshop. September,2003.

Policy Support

Ensure that Final Report and follow-up Workshop focuses on how project findings with respect to fire behavior potential in aspen stands can be incorporated into FireSmart community programs and guidelines, and wildfire suppression program strategy.

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Final report		x											
Workshop presentation								x					

8. Site Information

Chisholm Fire Research Reserve; 1968 Lesser Slave Lake (Vega) Fire.

9. References

Quintilio, D., M.E. Alexander, R.L. Ponto. 1991. Spring fires in a semi-mature trembling aspen stand in central Alberta. For. Can. NW Region, Nor. For. Cent., Edmonton, AB, Inf. Rep. NOR-X-323, 30p.

Wright, H.A., and A.W. Bailey. 1982. Fire Ecology, United States and southern Canada. John Wiley & Sons, New York, NY.

10. Scientific Review

CFS Fire Research review of Work plan and draft report.

11. Improvements to Management in Forest Ecosystems

Project relates to management of aspen ecosystems, mainly in context of community protection.

12. Amount of Money Requested From the Foothills Model Forest

\$23 000 from FMF CD Fire initiative.

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest			\$19,550			
CFS Fire Research					Data, review	
ASRD Fire Mgt.					Field access clrg.	

14. Proposed Payment Schedule

FMF CD Fire Initiative, April 15, 2003 total of \$19,550 payable to Ember Research Services Ltd.

- 15. Subcontracted Work**
Field assistance, Murray Maffey.
- 16. Project Management**
Brad Armitage, President
Ember Research Services Ltd.
4345 Northridge Crescent
Victoria BC V8Z 4Z4
Phone: 1-800-431-6861
EMAIL: Ember@islandnet.com
- 17. Additional Organisations requesting FRIIA Administered Monies**
Nil
- 18. Other Relevant Information**
Nil

Foothills Model Forest 2004/5 Annual Work Plan
Ecological Functions of Coarse Woody Debris Under Fire and Harvesting:
Implications for Management of Surface Materials and Site Productivity

1. Prepared by

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2. Introduction

Soil disturbance results in changes in nutrient availability that may affect both short and long term site productivity. Many aspects of nutrient dynamics under disturbance are related to the accumulation and decomposition of soil organic matter, including coarse woody debris, and the release or retention of nutrients from organic forms and their availability to plants. Natural and anthropogenic disturbances such as fire and harvesting may result in different amounts, sizes and distribution of coarse woody debris and rates of decomposition (eg. Pedlar et al. 2002). Further, the combined effects of multiple natural disturbances, or natural and anthropogenic disturbances may be cumulative. Multiple fires, fire on harvested areas, and salvage logging on burned areas are all scenarios which may occur in the boreal mixedwood and for which the scientific basis for the management of coarse woody debris is required.

The biological mechanisms by which nutrient availability is influenced by the decomposition of coarse woody debris is poorly understood, especially under disturbance. This research will integrate the expertise of several researchers (B. Kishchuk, Canadian Forest Service; Tyler Cobb, Department of Renewable Resources, University of Alberta; Michael Simpson, Department of Biological Sciences, University of Alberta) in investigating linkages among coarse woody debris and forest floor properties under different disturbance types, distribution and community structure of saproxylic beetles and bryophytes, effects of these organisms on decomposition of coarse woody debris, and the net effect of forest floor and coarse woody debris properties on decomposition, nutrient availability, and site productivity. The end result will be a better understanding of the mechanisms of nutrient turnover through organic materials under fire and harvesting and the scientific basis for options for the management of surface organic materials in maintaining or improving productivity from a nutritional perspective.

3. Background Information

Long-term plots have already been established in burned areas (B. Kishchuk, CFS, 2001) and soils have been sampled for most of the nutrient analyses, with nutrient analyses underway at the CFS. The requested funds are required to:

- continue establishing long-term research plots in harvested, salvage logged, and undisturbed stands
- implement integrated research into the biological processes and mechanisms controlling nutrient availability and productivity under fire and harvesting in Alberta's boreal mixedwood forest

4. Objectives

1. To characterize surface organic matter properties (including size, distribution and decomposition rates of coarse woody debris) under different disturbance types (burning, harvesting, salvage logged, undisturbed) in the first and second years of the study (2002 and 2003).
2. To identify the role of saproxylic beetle and bryophyte communities in the decomposition of coarse woody debris and turnover of nutrients through decomposition experiments and measurement of soil nutrients in the first and second years of the study (2002 and 2003)
3. To identify relationships among surface organic matter, nutrient availability, foliar nutrition and productivity of regenerating stands under these disturbance types (2003-2004)
4. To provide the scientific basis for the treatment of surface organic materials under harvesting or salvage logging to be applied by government and stakeholder agencies

1.) Knowledge Creation

This research will advance our understanding of:

Coarse woody debris, soil organic matter properties, and nutrient dynamics under severe fires and in comparison to harvesting and salvage logging in a controlled and replicated experiment

Biological mechanisms of coarse woody debris and nutrient turnover

The scientific basis of, and potential management options for optimal structure and retention levels of coarse woody debris and surface organic matter.

1a. Beneficiaries and Impacts

Beneficiaries will be:

1. Government agencies, FMA holders and licensees, and forest managers who may apply findings about relationships between retention and distribution of coarse woody debris, and productivity
2. Managers and planners who may integrate these findings with other management objectives eg. economic feasibility, biodiversity
3. Other researchers who may test these findings in other locations and under other conditions to improve the predictive capacity for effects of disturbance on productivity

- 2.) **Demonstration**
This study will be used for demonstration purposes in field tours, site visits, and outreach activities in conjunction with SRD and other agencies to facilitate the transfer of information to appropriate agencies.
- 2a. **Beneficiaries and Impacts**
Beneficiaries will be forest managers, forestry researchers, other applied researchers, and the general public who will have on-site demonstration of the research and supporting materials (handouts, field guides, etc)
- 3.) **Knowledge / Technology Transfer**
Knowledge and technology transfer will be through progress reports, scientific and technical presentations (2002-2004), Workshop/Forum presentations, non-technical summaries, and on-site demonstration signage
- 3a. **Beneficiaries and Impacts**
Beneficiaries of knowledge and technology transfer will be:
Forest managers and field staff who may be required to recognize site characteristics with respect to coarse woody debris and soil organic matter, and implement this information into planning activities,
Researchers in similar disciplines who may test these findings in other boreal environments, and
Researchers from other disciplines who may integrate these results with other findings
- 4.) **Communications and Outreach**
These results will provide direct and relevant information to other scientists, government agencies, FMA holders and licensees, and other stakeholders about the role of disturbance in site productivity of Alberta's boreal mixedwood forest. This study will provide specific information about options for the management of coarse woody debris: how much and what kind of coarse woody debris to retain on site to maintain or improve site productivity under disturbance. I will work in conjunction with SRD to develop linkages between the scientific findings and operational opportunities.
- 4a. **Beneficiaries and Impacts**
Beneficiaries include forest managers and other scientists, government agencies, FMA holders and licensees, and other stakeholders.
- 5.) **Policy Support**
Results from this study may be utilized in policy decisions related to prediction of site productivity response to disturbance, identifying options for forest practices, and identifying potential for use of prescribed fire and use of forest management to manipulate forest fuels. This information will be used in the context of understanding catastrophic events such as the Chisholm fire, and understanding the ecological, operational, and policy implications of such events.

5a. Beneficiaries and Impacts

Beneficiaries related to policy support will be forest planners and government agencies requiring information about the scientific basis for the retention of coarse woody debris on harvested and salvage logged sites.

5. Abstract of Methodology

The proposed research will systematically characterize and identify relationships among surface organic matter properties, nutrient availability, foliar nutrition, and productivity under four conditions: severe burn, harvesting, salvage-logged burns, and undisturbed conditions. Long-term research plots were established in the burn area in 2001, and plots will be established in the remaining three disturbance types in 2002. There will be three replicates of each disturbance type. Soil and coarse woody debris properties, and interactions among coarse woody debris and organisms in the first several years following disturbance will be addressed in this study. Medium and longer-term effects on soil properties and on productivity will be addressed in subsequent re-measurements beginning with five-year re-measurement of soil properties and measurement of foliar nutrition in 2006 and 2007.

Four interrelated suites of data will be collected at replicated sampling locations within each plot:

Characterization of coarse woody debris and forest floor properties: size, amount, and distribution of coarse woody debris; forest floor depth, mass, and organic matter content; decomposition rates (2002-2003)

Nutrient availability: forest floor nutrient concentration, content (kg/ha), N mineralization rates (2002-2004)

Foliar nutrition: nutrient status of natural regeneration (2003-2004)

Productivity: natural regeneration and long-term productivity

In addition, integrated experiments examining the role of saproxylic beetle and bryophyte communities in decomposition and nutrient turnover will be established at a subset of sampling locations (2002-2003). The common focal point in data collection and integration will be the characterization of coarse woody debris and forest floor properties, and the relationship of coarse woody debris to biological communities and decomposition rates. Soil organic matter and nutrient turnover will be the focus of this component of the project. The integrated research will be done using the plots established by B. Kishchuk. Researchers will pool resources in the selection of the plots, development of a protocol for characterizing coarse woody debris, field measurements of coarse woody debris properties at these sites, and establishing decomposition studies.

6. Deliverables

Knowledge Creation

Final Report: (October 2004) Each researcher in this collaboration (Kishchuk, Cobb, Simpson) to submit individual final reports of findings to date. A one-page synthesis of the three final reports in this collaborative proposal to be prepared by B. Kishchuk pending submission of all three final reports. (October 2004).
Possibility of Scientific Paper pending results.

Workshop/Forum Presentation of Results at Results, recommendations, future needs (2004)

Demonstration

Field tour for the CIF/SAF Joint Meeting in October/04

Knowledge / Technology Transfer:

Workshop/Forum: Presentation of Results at Results, recommendations, future needs (2004)

Non-technical summary: One **Quick Note** in 2004-2005

Communications and Outreach:

Workshop/Forum: Presentation of Results , recommendations, future needs (2004)

Field tour for the Joint CIF/SAF Meeting in October,04.

Policy Support:

Final Report: (October 2004) Each researcher in this collaboration (Kishchuk, Cobb, Simpson) to submit individual final reports of findings to date. A one-page synthesis of the three final reports in this collaborative proposal to be prepared by B. Kishchuk pending submission of all three final reports. (October 2004).
Possibility of Scientific Paper pending results.

7. Timelines

Task	2004											
	A	M	J	J	A	S	O	N	D	J	F	M
Soil and foliar analyses	X	X	X	X								
Data analysis	X	X	X	X	X	X						
Final Report							X					
Workshop							x					
Next quick note				x								

8. Site Information

Burned sites have previously been selected in provincially designated Natural Areas or protected areas within the Chisholm Fire area (2001). Site selection continued in early 2002 following the same protocol. Stands are:

mixed aspen and white spruce
white spruce.

Sites were deemed productive based on the size, density and composition of trees located in the stand as classified by the Alberta Vegetation Inventory. Spruce dominant stands are composed of $\geq 80\%$ of white spruce and Mixedwood stands consists of at least a 60%/40% split between coniferous (Sw) and deciduous (Aw, Pb). Stands have 'C' density (51-70 % crown closure) with a tree height of 25m.

9. References

Pedlar, J.H., J. L. Pearce, L. A Venier, and D.W. McKenney 2002. Coarse woody debris in relation to disturbance and forest type in boreal Canada. *For. Ecol. Manage.* 158: 189-194.

10. Scientific Review

Dr. Ken Mallet, Director, Forest Biology, Northern Forestry Centre, and Dr. Sylvie Quideau, Assistant Professor, Department of Renewable Resources, University of Alberta have reviewed the proposed research. The work of collaborators Tyler Cobb and Mike Simpson has been reviewed by their PhD supervisory committees.

11. Improvements to Management in Forest Ecosystems

The implications of this work for forest management are that changes in surface organic material and nutrients resulting from fire and harvesting can be directly compared and linked to the productivity of Alberta's boreal forest. This work will provide a scientific basis for the amount and kind of coarse woody debris retention on boreal mixedwood sites following harvesting or salvage logging for maintenance of site productivity. By addressing organic matter and nutritional linkages in an integrated fashion, it will be possible to determine whether different disturbances have a similar effect on surface organic matter properties, nutrient dynamics, and site productivity, and to identify implications for the management of surface organic matter including coarse woody debris in harvesting operations.

12. Amount of Money Requested From the Foothills Model Forest

\$50,150 following 15% budget reduction request March 2002

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest						
Canadian Forest Service				25K	49K	
SFMN Forest Nutrition Group	6K					

14. Proposed Payment Schedule2002-2003: **\$27,200**2003-2004: **\$22,950****15. Subcontracted Work**

none

16. Project Management

Dr. Barbara Kishchuk, Canadian Forest Service

17. Additional Organisations requesting FRIIA Administered Monies**18. Other Relevant Information**

The Foothills Model Forest Chisholm-Dogrib Research Initiative

Follow-up Information Request

Cumulative effects of wildfire and post-fire harvesting on the diversity and stability of saproxylic beetle assemblages – T.P. Cobb, J.R. Spence, and D.W. Langor

Short and long-term application of the results

Short-term

Few guidelines currently exist for the management of post-fire salvaging operations because so little is known about the impact of this practice on wildlife or their boreal habitats. By examining relationships between saproxylic beetle communities (species associated with decaying wood) and key habitat parameters (*e.g.* volume of coarse woody debris) subjected to various disturbances, we will be able to provide recommendations for silvicultural and/or harvest manipulation that minimize the impact of post-fire salvaging on saproxylic species composition and diversity.

Long-term

To achieve goals for sustainable forest management and biodiversity conservation, data are needed to increase our understanding of effects of natural and anthropogenic disturbances. Global circulation models predict an increase of 1.5 to >5 °C in average air temperature over the next 50-100 years (Schneider 1992, Houghton *et al.* 1996, Kacholia and Reck 1997) which, in Canada, is expected to lengthen the fire season by as much as 30 days (Wotton and Flannigan 1993) and increase the amount of area burned each year by as much as 50% (Flannigan and Van Wagner 1991, Kasischke *et al.* 1995). As a result, knowledge about the combined effects of wildfire and various harvesting practices will become increasingly important. This research will use saproxylic beetle assemblages to provide insight into the individual and combined effects of wildfire and timber harvesting on the stability of boreal ecosystems.

Deliverables

Year 2:

March 2004 – provide a summary of up to date findings and recommendations to B. Kischuck to

assist in the preparation of a brief synthesis of collaborative findings on the ecology of beetles bryophytes, and nutrient turnover associated with the decomposition of coarse woody debris as outlined in **linkages and partnerships** and Fig 1.

April 2004 – submit a final report of findings to date to FHMF incorporating:

total beetle abundance data;

initial species-level analysis (*e.g.* composition and richness); and

recommendations for post-fire salvaging guidelines based on coarse woody debris management.

Tech transfer / outreach

In addition to the presentation of findings at the next FHMF Chisholm-Dogrib Research Initiative Workshop and the publication of results in scientific journals, research from

this study will be presented in the form of posters and oral presentations at several scientific meetings. Potential upcoming meetings include the following:

- Entomological Society of Alberta (Lethbridge, AB)
- Ecological Society of America (Savannah, GA)
- Entomological Society of Canada (Winnipeg, MB)
- Sustainable Forest Management Network (Edmonton, AB)
- International Workshop on Disturbance Dynamics in Boreal Forests
(Prince George, BC)

Also, portions of this research will be presented in several seminars at the University of Alberta and in the Environmental Research and Studies Centre Newsletter as part of the PhD requirements for T.Cobb. Any support provided by the FHMF under this proposal will be gratefully acknowledged.

Linkages and Partnerships

Coarse woody debris (CWD) has recently been identified as one of the most important substrates for the maintenance of the diversity of insects, cryptogams, and fungi in boreal forests (Harmon 2001, Siitonen 2001). In northern Europe, for example, more than a thousand beetle species are known to depend on CWD (Ehnström 2001), and the loss of this substrate from managed stands has already resulted in the extirpation of many red listed species (Siitonen and Martikainen 1994). Fire and harvesting differentially affect the distribution of CWD (Pedlar *et al.* 2002), but the ecological consequences are poorly understood. Thus, research is needed to examine the linkages between CWD, decomposition, nutrient turnover, and site productivity.

The FHMF Chisholm-Dogrib Research Initiative workshop (15/02/02) brought to light a potential collaboration between T. Cobb, B. Kishchuk (Canadian Forest Service), and M. Simpson (Dept. of Biological Sciences, University of Alberta). Following the workshop, details for this collaboration were developed during three meetings (27/02/02, 28/02/02, 12/03/02) held at the Northern Forestry Centre. By drawing on the expertise of each individual, we propose to investigate the ecological function of CWD under fire and harvesting. The focal point of this collaborative effort is on the characterization of CWD and forest floor properties of spruce dominated stands in relation to decomposition rates (Fig. 1). T. Cobb will focus on saproxylic beetle communities, M. Simpson will focus on bryophyte communities, and B. Kishchuk will focus on soil organic matter and nutrient aspects of the project. Each researcher will be responsible for individual and integrated data collection for specific components of the research. However, we propose to pool resources in the selection study plots (to augment those already selected by B. Kishchuk), development of a protocol for characterizing CWD suited to the needs of all three researchers, field measurements of CWD properties, and establishing decomposition studies. In addition, each researcher will assist in the preparation of a brief synthesis of findings from all three components of this research at the conclusion of year 2 with recommendations for the development of ecologically sound guidelines for the management of CWD in spruce dominated stands.

Foothills Model Forest 2004/5 Annual Work Plan
Cumulative effects of wildfire and post-fire harvesting on the diversity and stability of saproxylic beetle assemblages – T.P. Cobb, J.R. Spence, and D.W. Langor

1. Prepared by

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2. Introduction

Accelerating extinction rates have prompted concern over the ecosystem consequences of anthropogenic disturbances such as those associated with industrial forestry. Species comprising the Earth's flora and fauna are disappearing at rates faster than those documented in the fossil record (Smith *et al.* 1993, Bloom 1995, Pimm *et al.* 1995) and human dominance of natural areas is implicated in this decline (Vitousek *et al.* 1997). In boreal ecosystems, approaches to sustainable management are increasingly embraced but are constrained as our demand for timber and non-timber resources increases (Stelfox 1995). Increasing fibre demand shifts the dominance of disturbance regimes from one that was natural (*e.g.* fire) to one that is more anthropogenic (*e.g.* harvesting) and the effect on boreal organisms or the stability of boreal ecosystems remains unclear. Moreover, because natural disturbances will not be eliminated, we need to know more about how boreal ecosystems will respond to the cumulative and interactive effects of multiple environmental stressors.

3. Background Information

The concept of ecological stability has been variously, and often ambiguously, used in the ecological literature (Grimm and Wissel 1996). However, according to Pimm (1984), ecological stability generally refers to how ecosystems cope with disturbance and can be quantified by three components (Fig.2), which are resistance (capacity to withstand disturbance), resilience (rate of recovery after disturbance) and variability (background variation not associated with disturbance). This idea becomes particularly important when trying to predict the response of boreal ecosystems to complex disturbance interactions such as those caused by increasing human demands for natural resources. Indeed, our understanding of the cumulative effects of wildfire and harvesting has undoubtedly been hindered by the complexity of responses to the individual and interactive effects of both disturbance types. However, quantitative application of the concept of stability to these types of questions may offer a simpler way to

compare the effects of multiple disturbances and provide the insight that is required to achieve goals of sustainable forest management and biodiversity conservation.

Saproxylic beetles (species associated with decaying wood) are ideally suited to this type of research because they perform diverse ecological functions in forest ecosystems (Speight 1989), they are easily sampled (Siitonen 1994, Hammond 1997), and previous research has shown that they are sensitive to habitat changes arising from forest harvesting (Siitonen and Martikainen 1994, Käila *et al.* 1997, Siitonen 2001). In fact, serious concerns about forest harvesting have been corroborated with data about saproxylic beetles in northern Europe (Siitonen and Martikainen 1994, Saaristo & Siitonen 2000, Siitonen 2000). In addition, many saproxylic species are pyrophilous (attracted to burned timber) suggesting that they may be particularly sensitive to post-fire harvesting (Evans 1971, Holliday 1992).

4. Objectives

Our objective is to apply the concept of ecological stability (Pimm 1984) to assess the cumulative effects of wildfire and harvesting (*i.e.* post-fire salvaging) on boreal forest ecosystems. Specifically, we will use saproxylic beetle species assemblages to address the following questions:

Are the combined effects of anthropogenic (e.g. forest harvesting) and natural disturbances (e.g. wildfire) cumulative?

Do multiple natural disturbances (e.g. fire + fire) have less of an effect on the stability of saproxylic beetle assemblages than combinations of anthropogenic and natural disturbances (e.g. post-fire salvage logging)?

*Is there a relationship between the effects of disturbance combinations and habitat parameters such as volume and condition (*i.e.* standing or fallen) of coarse woody debris?*

Can coarse woody debris management be used to mitigate the effects of disturbance combinations on the stability of saproxylic beetle assemblages?

1.) Knowledge Creation

In Canada, forest fires account for an average annual loss of 70 million m³ of wood, which has an estimated value of \$1 billion (Canadian Council of Forest Ministers 2000). As a result, post-fire salvage logging is now commonly used to recover some the economic value of burned timber. In Alberta, however, companies are encouraged to salvage as much as possible with little consideration of potential impacts on regenerating forests or biodiversity because so little is known about the ecological consequences of removing burned habitats from the boreal landscape. By applying the concept of ecological stability to current management issues (*e.g.* guidelines for post-fire salvage logging and management of coarse woody debris), this research will benefit ecologists, conservation biologists, and forest managers.

2.) Demonstration

In addition to providing information for the “Quick Notes” portion of the FHMF web site, we will provide guided tours of field sites as requested by the FHMF and the University of Alberta. Participants will gain: a better understanding of the importance of saproxylic organisms to the ecology of disturbed forest ecosystems and the value of burned habitats for biodiversity conservation; and first-hand experience of a field experiment designed to address current forest management issues such as the development of guidelines for post-fire salvage logging through coarse woody debris management.

3.) Knowledge / Technology Transfer

Knowledge and technology transfer will occur through progress reports, scientific and technical publications, and various scientific meetings and workshops (2002-2004). Upon completion of this study, voucher insect collections will be deposited at the Northern Forestry Centre and the University of Alberta for future reference and Tyler Cobb’s PhD thesis will be made available through the University of Alberta Library. In addition, through the training of field personnel, this research will benefit as many as 6 senior undergraduate students in areas of field techniques, insect taxonomy, experimental design, and statistical analysis.

4.) Communications and Outreach

Findings of this research will be presented at scientific and technical meetings and published in both scientific and technical reports. The proposed research has already been presented at the FHMF Chisholm-Dogrib Research Initiative workshop (Edmonton, AB, March 2002) and at the Albert-British Columbia Intermountain Forest Health Workshop (Jasper, AB, April 2002). In addition, findings from this study will be made available to a more general audience through public presentations (*e.g.* Wild Voices in Jasper – scheduled for Sept 12, 2002) and the Environmental Research and Studies Centre Newsletter administered by the University of Alberta. Therefore, this research will be available to ecologists, conservation biologists, forest managers, students, and the public.

5.) Policy Support

At present, policy surrounding the practice of post-fire salvaging in Alberta is primarily based on recovering economic value of burned timber. By investigating the linkage between saproxylic beetle assemblages and coarse woody debris management, this research will provide the sort of data required to develop guidelines for post-fire salvaging that balance economic and ecological values boreal forests.

5. Abstract of Methodology

This study will take place approximately 200 km northwest of Edmonton, AB within the boundaries of the Chisholm fire, a large-scale wildfire (~120,000 ha) that occurred during the spring of 2001. Salvaging of the Chisholm fire is scheduled to occur during winter of 2001/2002, but the companies involved have agreed to leave behind study sites for research. To address the questions listed above, we propose to conduct a stand-level, nested, 1-factor (stand treatment) experiment (Underwood 1997) in which the effects of various stand treatments are nested within two different forest cover types (spruce dominated, and spruce-aspen mixedwood). We propose to study the following stand treatments:

- control (relatively undisturbed)
- harvested (harvested during 2001, but not burned)
- single burn (Chisholm fire)
- salvaged (Chisholm fire and subsequently salvaged)
- double burn [Chisholm and Mitsue (1998) fires]
- burned after harvest 2001 (harvested in 2001 and then Chisholm fire)
- burned after harvest 1998 (harvested in 1998 and then Chisholm fire)

For each stand-treatment, 4 sites *c.* 5 ha each (total of 56 sites; 4 sites X 7 stand treatments X 2 cover types) will be selected on the basis of stand characteristics (*e.g.* stand age, size, tree density, plant species composition) prior to disturbance and accessibility. Wherever possible, sites will be selected to overlap with the research of Kishchuk and Simpson (see submitted proposals).

Saproxylic beetle communities will be sampled continuously from all sites during the summer months of 2002, 2003, and 2004 using 8 window traps (4 on standing trees, and 4 on fallen logs; see Hammond 1997 for trapping methods) located near the centre of each site. Traps will be charged with ~150 ml of silicate-free ethylene glycol and contents of all traps at a sampling station will be removed biweekly and preserved in 70% ethanol. In all single burned sites (8 sites), we will also collect 3 bolts (50 cm each) from 3 randomly selected spruce trees (~25 cm dbh) in order to rear individual beetles from the wood (24 harvested trees, 72 bolts). The ends of each bolt will be sealed with paraffin to slow moisture loss and then each will be held in a separate rearing cage for 2 years to collect emerging beetles (Hammond 1997). All saproxylic beetles will be identified to species with the help of taxonomists and collections at the University of Alberta and the Canadian Forest Service. Dry mass estimates will be calculated based on weighed individuals of each species and all data will be standardized by the number of trap-days (or unit volume of rearing material). To assess effects on stability, we will quantify the resistance (capacity to withstand change) and resilience (rate of recovery) of beetle assemblages to each disturbance combination. Resistance will be measured as the absolute difference in total biomass and species composition between control and disturbed sites during the first sample date. Resilience will be measured by monitoring the change in this absolute difference during subsequent

sample dates in 2002, 2003, and 2004. Finally, we will use ordination techniques (e.g. CCA, Jongman *et al.* 1995) to relate variation in beetle species data to variation in several habitat parameters (e.g. wind speed, soil moisture, and volume of coarse woody debris). These data will be used to identify key habitat parameters subject to silvicultural and/or harvest manipulation to minimize the impact of post-fire salvaging on saproxylic beetle species composition and diversity.

6. Deliverables

Knowledge Creation

Year 2:

Sept. 2004 – provide a summary of up to date findings and recommendations to B. Kischuck to assist in the preparation of a brief synthesis of collaborative findings on the ecology of beetles bryophytes, and nutrient turnover associated with the decomposition of coarse woody debris as outlined in **linkages and partnerships** section of the “additional information request” submitted to Kris McCleary (see Fig 1). Possibility of a collaborative scientific paper pending results.

October 2004

- submit a final report of findings to date to FHMF incorporating: total beetle abundance data; initial species-level analysis (e.g. composition and richness); and recommendations for post-fire salvaging guidelines based on coarse woody debris management.

Demonstration

In addition to providing information for the “Quick Notes” portion of the FHMF web site, we will provide guided tours of field sites as requested by the FHMF and the University of Alberta.

Knowledge / Technology Transfer

Knowledge and technology transfer will occur through progress reports, scientific and technical publications, and various scientific meetings and workshops (2002-2004). Upon completion of this study, voucher insect collections will be deposited at the Northern Forestry Centre and the University of Alberta for future reference and Tyler Cobb’s PhD thesis will be made available through the University of Alberta Library. In addition, through the training of field personnel, this research will promote the development of 1-2 senior undergraduate students per year. Each student will receive training and experience in field techniques, insect taxonomy, experimental design, and statistical analysis.

Communications and Outreach

Participate in Joint CIF/SAF Tour in October, 2004

In addition, as part of the PhD requirements for T.Cobb over the next 3 years, portions of this research will be presented in several seminars at the University of Alberta and in the Environmental Research and Studies Centre Newsletter.

Policy Support

At present, policy surrounding the practice of post-fire salvaging in Alberta is primarily based on recovering economic value of burned timber. By investigating the linkage between saproxylic beetle assemblages and coarse woody debris management, this research will provide the sort of data required to develop guidelines for post-fire salvaging that balance economic and ecological values boreal forests.

7. Timelines

Task	2004											
	J	F	M	A	M	J	J	A	S	O	N	D
Site Selection												
Trap set up												
Bolt Collection												
Beetle sampling					X	X	X	X	X			
Identify families						X	X	X	X	X		
Identify species	X						X	X	X	X	X	
Climate monitoring												
Vegetation												
Data analysis		X	X									
Progress report												
Finding submitted to B. Kishchuk									X			
Final Report to FtMF (based on yr 1+2 results)										X		

8. Site Information

The proposed research will be conducted in productive spruce-dominated and spruce-aspen mixedwood forest cover types in and around Chisholm fire. Site will be selected on the basis of stand characteristics and accessibility. Specific stand treatments are outlined in section 4 (above). Wherever possible, sites will be selected to overlap with the research of Kishchuck and Simpson in order to facilitate collaboration (as outlined in the FtMF Chisholm-Dogrib Research Initiative request for additional information and in submitted proposals).

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10. Scientific Review

This research is part of the PhD requirement for T. Cobb and will therefore be reviewed by his advisory committee (Dr. John Spence, Dr. David Langor, Dr. Bruce Heming, and Dr. Ellen McDonald) at the University of Alberta.

11. Improvements to Management in Forest Ecosystems

By applying the concept of ecological stability to questions surrounding the cumulative effects wildfire and harvesting, we will:
 be able to provide recommendations for the development of ecologically sound management guidelines for post-fire salvage logging based on coarse woody debris management;
 establish benchmark associations between habitat parameters such as coarse woody debris and saproxylic beetle species compositions and diversity; and
 gain insight into the cumulative effects of both disturbances on the resistance, resilience, and variability of boreal ecosystems.

12. Amount of Money Requested From the Foothills Model Forest

\$25,500 over 2 years (total project cost \$151,700 over 3 years)

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
University of Alberta (Graduate Research Assistantship 2001-2002)	\$10,500					
University of Alberta (Graduate intern tuition supplement 2001-2002)	\$3,300					
Canadian Forest Service (taxonomic expertise)					\$15,000	
Biodiversity Challenge Grant (2002-2004)	\$14,700					
Sustainable Forest Management Network (2002-2005)	\$65,000					
NSERC IPS-2 (2002-2004)		\$38,200				

14. Proposed Payment Schedule

Preferred Alternate – as discussed with Dennis Quintilio (28/02/02)
 Year 1: \$12,750 Year 1: \$10,000
 Year 2: \$12,750 Year 2: \$15,500

15. Subcontracted Work

N/A

16. Project Management

Tyler Cobb – contact information same as #1

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information

N/A

Foothills Model Forest 2004/5 Annual Work Plan

Boreal moss communities: succession and implications for establishment after fire in Alberta's spruce-dominated forests.

1. Prepared by

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2. Introduction

Mosses dominate the floor of boreal spruce forests and their contributions to the functioning and biodiversity of this ecosystem are substantial. They are the proximate habitat of many invertebrates and amphibians, provide nesting material for birds and mammals, and interact with a variety of micro-organisms, some of which influence nutrient cycling. In mature stands feathermosses can form thick layers on the forest floor, and therefore affect the establishment and productivity of vascular plants. Carpets of feathermoss may prevent seeds reaching the soil, thus inhibiting seed germination, or may provide a moist substrate conducive to germination and establishment. Feathermoss carpets can also lower soil temperatures and moisture content, and different moss species might either inhibit or facilitate organic matter decomposition. Successional changes in the species composition and total cover of mosses might also have implications for the flammability of forest floor material. These effects are likely to differ between dominant moss species and vascular plants. Despite their importance to the biotic and abiotic dynamics of spruce forests, however, we know little about the factors that determine the species composition of moss communities and the extent to which specific species of moss affect site characteristics over time.

3. Background Information

A number of studies have considered succession following fire (Alberta Fire and Harvest Residual Project 1999, Frego 2000, Gauthier *et al.* 2000, Kuuluvainen & Seppo 2000, Nguyen-Xuan *et al.* 2000, Reich *et al.* 2001), but most of this research has considered mosses at the phylum level or only included species common in the study system of interest. Numerous researchers have looked at specific moss species in terms of recovery potential after mechanical disturbance (Jonsson & Esseen 1990, Myrmael 1993, De Las Heras *et al.* 1995, Sollows *et al.* 2001), reproductive strategies (Stoneburner *et al.* 1992, Kimmerer & Young 1995, During 1997, Longton 1997) and establishment in new habitats (Frego & Carleton 1995, Hassel & Söderström 1998, Cleavitt 2001). Only a few studies have considered competition in moss communities (Rydin 1997, Mulligan *in press*) and the interactions between mosses, vascular plants and environmental variables during post-fire succession (Hörnberg *et al.* 1996).

4. Objectives

This research addresses the importance of mosses as mediators of successional development, with an emphasis on links between the moss community and factors affecting regeneration and nutrient cycling at different successional stages. My objectives are to: (i) describe changes in the structure of the moss community in *P. glauca* forests in north-central Alberta in the first decade after fire; (ii) to study factors that might explain differences in the moss community at different stages in succession; (iii) to study species-specific effects of moss cover at different successional stages on the establishment of selected vascular species that can influence regeneration and site productivity; and (iv) to assess the influence of particular species of moss on coarse woody debris decomposition.

1.) Knowledge Creation

This research is unique in that it addresses outstanding questions concerning the specific effects of 6 species of moss upon succession in plant communities, with an emphasis on interactions that affect the growth of economically important plants. Data from this study will allow forest managers to make more detailed predictions of natural changes in vegetation and better assessments of potential productivity and fire hazard based on site characteristics. Results from experiments looking at the effects of mosses on vascular plant establishment and coarse woody debris decomposition might also suggest appropriate treatments that can improve productivity and reduce fire hazard. In addition, this study will provide data on the ecology of individual species and the ways in which their inter-relationships determine successional development that could inform attempts to minimize disruption to ecological processes resulting from human disturbances.

1a. Beneficiaries and Impacts:

Biologists, forest managers. The findings will supplement the limited published research on the role of mosses in forest succession. Furthermore it could improve guidelines for managing forests for biodiversity, and the results of the collaboration proposed in (4a.) have implications for assessing site productivity and fire hazard. Mosses with species-specific habitat requirements and effects upon the biotic and abiotic environment could serve as indicators of site conditions and constraints on regeneration.

2.) Demonstration

The field and lab components of this program will be accessible through guided tours of the study sites and laboratory.

2a. Beneficiaries and Impacts

Scientists, forest managers, public-interest groups. Beneficiaries can gain first hand experience of field studies and laboratory methods and how they are being used to answer important ecological and social questions.

3.) Knowledge / Technology Transfer

The proposed research is of particular value to biologists and forest managers. In conjunction with other research supported by the Research Initiative this project should also be of particular interest to residents of forest-based communities that want to better understand their immediate environment.

3a. Beneficiaries and Impacts

Links between boreal moss communities and post-fire succession have been neglected in the scientific literature. This research will benefit scientists concerned with boreal forest ecology, and forest managers that rely on sound scientific data to guide their assessment of site conditions and decisions concerning the control of vegetation and woody debris to reduce fire risk, maintain biodiversity and maximise productivity. More generally, the project can be used to stimulate and inform public interest in ecology.

4.) Communications and Outreach

Opportunities include collaboration with other researchers involved in the CD Initiative; presentation of findings in posters and talks at workshops, conferences and private meetings, and in Quick Notes for the FMF website; formal reports and scientific journal articles; and articles and presentations for a public audience.

4a. Beneficiaries and Impacts

The CD Research Initiative, collaborators Barb Kishchuk (NR Canada) and Tyler Cobb (Renewable Resources, U of A); forest managers, ecologists and consultants; conservation organisations; the general public. Communications initiatives would be directed at informing scientists, forest managers, forestry consultants and the public about natural history in general and the relevance of this research to forest management for biodiversity and timber production.

5. Policy Support

This project will strengthen the scientific basis for forest management planning by FMA holders. More detailed knowledge of changes in the forest floor moss community over time and the effects of this on the vascular plant community and coarse woody debris could lead to better recommendations for long term stand management, particularly with regard to treatments that might improve site nutrient status, regeneration potential and minimizing fire hazard. In addition, the outreach proposals outlined above, if applied to the entire suite of projects encompassed under the Chisholm Fire Research Initiative, could be directed at improving public understanding of the basis for policy regarding sustainable, productive and safe management of forests.

5a. Beneficiaries and Impacts:

Policy makers, environmental and industry consultants.

5. **Abstract of Methodology**

The approach to this project involves a combination of descriptive studies and manipulative experiments. These will be conducted in stands selected on the basis of the criteria given under **Site Information**, below. Where possible, sites be shared with other researchers with whom I am collaborating on aspects of this project (see **4a**, above). Within each stand, sampling will be conducted in randomly placed quadrats. To assess the similarity of stands, a variety of biotic and abiotic variables will be measured, including soil pH, surface temperature and moisture content, precipitation (amount and chemical concentration), humidity, coarse woody debris and litter characteristics, burn depth, microtopography, canopy cover and vascular plant species present. Most measures will be taken within quadrats used for recording moss species composition and percentage cover and these data will be assessed statistically to find factors that might explain moss species distribution. Manipulative experiments will be designed to achieve the objectives given in (**4**) above.

6. **Deliverables**

Knowledge Creation

A final report, including a synthesis of collaboration with other research, will be compiled in the summer of 2004. A presentation summarising findings so far will be presented at the Chisholm-Dogrib Fire Research Initiative workshop planned for 2004. Because this research will continue beyond the 2-year duration of the Research Initiative, a contribution to the FMF's 5-year plan can be made upon completion of the project. Posters or talks will be given at the ABLS conference in the summer of 2003 and 2004.

Demonstration

I shall be conducting a field site tour for soil scientists at my Chisholm research site on October, 2004 when I will describe my research objectives and the ecological and forest management relevance of the research. I shall also prepare a poster contribution to the public presentation at or in the vicinity of Chisholm in 2 years proposed by Dennis Quintilio.

Knowledge / Technology Transfer

I anticipate being in a position to forward reports and make presentations of preliminary results to forest ecologists, consultants and forest managers from the winter of 2002 onwards.

Communications and Outreach

An article about my research was recently printed in *Environmental News* (Vol 2, #1 - [www. http://www.ualberta.ca/ERSC/level2news.htm](http://www.ualberta.ca/ERSC/level2news.htm)), a newsletter for the general public published by the Environmental Research and Studies Council. A follow-up article describing progress will be written in 1 year. A Quick Note article describing research progress will be produced for the FMF website in the Fall of 2003.

Policy Support

The interim and final reports to be compiled for the Chisholm-Dogrib Initiative (referred to under Knowledge Creation) will be available to policy makers. Outreach proposals are intended to improve public understanding of links between conservation, resource management and social policies that apply to the boreal forest.

7. Timelines

To satisfy the requirements of my PhD, some aspects of this project will continue until 2006.

Task	2004												
	J	F	M	A	M	J	J	A	S				
Yr 2 sampling													
Field and Lab experiments	X												
Species ID and data analysis	X	X	X	X									
Final report and workshop presentation													X
													X

8. Site Information

Three burned and three unburned stands will be chosen within the boundary of the Chisholm fire and the Mariana Lakes fire Required stand characteristics are (a) the canopy is (or was, prior to disturbance) at least 80% *Picea glauca*, with a pre-fire crown closure of 51-70% and an average tree height of 20-25m, and (b) stands are mesic with low or no apparent slope and similar pre-fire vegetation.

9. References

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10. Scientific Review

This work will be reviewed by my PhD supervisory committee at the University of Alberta (Dr. Mark Dale (supervisor), Dr. J.F. Cahill and Dr. Dennis Gignac (Faculté St. Jean)) at committee meetings and my thesis defence.

11. Improvements to Management in Forest Ecosystems

This research is specifically concerned with forest regeneration after disturbance. The issues it addresses have implications for coarse woody debris management, site productivity and the ecological integrity of the boreal ecosystem. Hence, they are pertinent to management of forests for multiple values.

12. Amount of Money Requested From the Foothills Model Forest

\$9,350 over two years (as discussed with Dennis Quintillio, Northern Forestry Centre, February and May 2002)

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest						
U of A Biodiversity Grant		\$5,000				

14. Proposed Payment Schedule

Year 1 (2002-2003): \$4675

Year 2: (2003-2004): \$4675

15. Subcontracted Work

N/A

16. Project Management

As principal researcher of this project, I will hold management responsibility.

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information

Foothills Model Forest 2004-2005 Annual Work Plan
The Ya Ha Tinda Elk and Wolf Ecology Project:
Effects of Fire on Elk Forage Quality and Availability across Spatial and Temporal Scales in the Eastern Slopes of the Rockies.

1. Prepared by

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2. Introduction

The Dogrib fire presents an opportunity for our ongoing research near the Ya Ha Tinda Ranch to focus attention on the effects of fire on elk population dynamics. Fire can affect elk demography (Taper and Gogan 2002) through effects on forage quality and distribution (Merrill and Boyce 1991; Turner et al. 1994). In Yellowstone National Park (YNP), positive effects of the 1988 fires were significant, but short-lived, on elk demography (Taper and Gogan 2002). Much of Alberta's foothills, however, consist of closed forests with little grasslands relative to YNP, and as such, effects of fire may be predicted to be more important in Alberta. Other factors such as wolf predation, human hunting, and previous habitat enhancement logging (Morgantini et al. 1994) may affect elk demography as well. The objectives of our long-term ongoing research are to investigate the effects of both predation and forage (including effects of fire) on demography of the Ya Ha Tinda Elk herd to provide recommendations that will help provincial and federal agencies meet ecosystem management objectives. One of the key management questions that this research will address is whether elk respond to large burns such as the Dogrib by shifting summering and/or wintering areas to take advantage of forage resources provided by the burn.

3. Background Information

Our research focuses on the Ya Ha Tinda elk herd, one of Alberta's three largest elk herds. This elk herd migrates between winter ranges at the Ya Ha Tinda Ranch in the Red Deer River valley to upper elevation alpine ranges in the front ranges of the Rocky Mountains including the Dogrib fire (Morgantini and Hudson 1988). During migration, elk cross provincial and federal boundaries, necessitating an interagency approach for elk management. The Ya Ha Tinda study area is provincially significant as one of Alberta's largest remaining relatively undisturbed Montane grasslands. Management concern is developing for these rare rough fescue (*Festuca campestris*) grasslands as an increasing part of this elk herd is forgoing migration. Instead, elk are remaining on winter range through the sensitive summer period when Montane grasslands are most vulnerable to overgrazing. Changes in elk migratory behaviour may be related to a variety of natural and human factors, including fire suppression/prescribed fire,

habitat changes due to logging, changes in predator-prey relationships, and elk & wolf harvest management.

4. Objectives

1.) Knowledge Creation

Our research will fill a much needed knowledge gap in Alberta on the effects of prescribed fires on ungulate populations. Current elk habitat modeling approaches (i.e. H.S.I. models, Buckmaster et al. 1995) use fixed relationships between habitat or structural characteristics (i.e. stem density) and elk habitat suitability. This approach does not fully incorporate effects of fire on quality of forage. Research on fire-ungulate relationships is rare in Alberta, and few have linked effects of fire to populations. Furthermore, our research will investigate effects of salvage logging on forage quality and availability relative to burned and unburned treatments for ungulates, information in demand across Alberta and western North America (McIver and Starr 2000). Therefore, our specific objectives are to develop statistical models relating forage quantity to independent variables fire (age/size), habitat types, and forest stand characteristics, including post-fire logging treatments.

1a. Beneficiaries and Impacts

The beneficiaries of our research will be Parks Canada (PC), AB-SRD, forestry companies (Sunpine/Weyerhaeuser) working in Alberta's foothills, and other NGOs such as Rocky Mountain Elk Foundation (RMEF). The main impact of our research will be to guide the use of prescribed fires and post-fire logging in the foothills adjacent to the National Parks for interagency forest and wildlife management. Secondary impacts will be to provide information on long-term effects of prescribed fire on elk by taking advantage of older burns inside the BNP portion of the study area.

2.) Demonstration

Although we currently have no plans to incorporate development of demonstration materials as a direct result of this funding proposal, we are developing long-term proposals with Parks Canada and Alberta Sports, Parks, Recreation and Wildlife Foundation for a joint-provincial communications strategy focusing on the ecological effects of fire with an interpretive site and trail at the Dogrib burn and/or at Ya Ha Tinda Ranch. We expect to begin this outreach component during 2003/04, and will acknowledge the key role of FMF in funding our research.

3.) Knowledge / Technology Transfer

Our research will provide knowledge/technology transfer to cooperating agencies through provision of statistical elk forage quality models, included in dynamic GIS-layers (forage quality within a season), and links to population dynamics through inclusion of these elk-forage models as a result of the long-term survival modeling. These statistical models will be developed into management recommendations, non-technical reports, and

new guidelines for the application and management of prescribed fire for wildlife.

3a. Beneficiaries and Impacts

Short-term goals will be to provide elk forage quality models relating forage quality to selected habitat and stand characteristics to cooperating management agencies. Long-term goals include adding these forage quality models to demographic models of factors affecting elk survival.

4.) Communications and Outreach

We have a strong background in community and research co-operator outreach. We are already scheduled to present as part of Banff National Park's annual research update series during May/June, and at the Rocky Mountain Elk Foundation Edmonton/Leduc chapter annual meeting in April. We will make continued effort to give public presentations in local communities (Sundre, Rocky Mountain House), with local groups such as Rocky Mountain House trappers association (tentative talk during June 2002), and Rod/Gun clubs. In addition to public outreach, we have established biannual stakeholder meetings as a forum for cooperating agency research (1st meeting Mar 21).

4a. Beneficiaries and Impacts

Short-term beneficiaries of our outreach program include members of the public in the Bow Valley and communities in the foothills east of the study area. Our intended impact is to increase ecological awareness in these communities especially with respect to ecological effects of fire on wildlife.

5.) Policy Support

Our research will provide policy support & guidance for proposals to use prescribed fire to limit provincial risk from Mountain Pine Bark Beetle (Olsen and Olsen, 2001, Parks Canada 2002), and to improve wildlife habitat through use of prescribed fire in the foothills of Alberta. Furthermore, our research will be used to guide policy by managers to assess trophic implications of the effects of fire on elk through other wildlife species including wolves and other ungulates.

5a. Beneficiaries and Impacts

Anticipated audience is cooperating resource management agencies, forestry companies, Rocky Mountain Elk Foundation, and other research co-operators. Policy impacts will be to provide guidance for managing salvage logging and fire for wildlife habitat.

5. Abstract of Methodology

Our long-term research goals will be to compare success of migratory and non-migratory elk and determine how success is influenced by wolf predation and forage, including effects of fire. We will measure success using radiocollared elk survival, requiring a sample of ~ 100 elk-years in each migratory strategy to obtain reliable estimates. We will ear tag over 100 elk, and radiocollar

approximately 40 elk/year for the next 3 years using corral trap(s) donated by Rocky Mountain Elk Foundation, ground darting, and helicopter netgunning¹. We presently have 38 radiocollared elk (35 VHF, 3 GPS), and over 96 ear tagged elk to monitor responses during this first year to the dogrib fire. We will focus on adult females, as population growth rate is most sensitive to changes in this age-sex class. We will assess calf survival using herd composition counts and summer calf survival for radiocollared females. We will deploy 20 GPS collars on elk and 6-8 GPS collars on wolves for which funding is identified, to determine fine scale habitat selection and movements during winter 2002/03. We will maintain these GPS radiocollar samples for 2 full years from winter 2002/03 to 2004/05.

We will quantify predation risk by radiocollaring and monitoring the 3-4 wolf packs that use the Ya Ha Tinda study area. Wolves will be captured by helicopter netgunning during winter and foothold trapping during summer months⁸. We will develop habitat use models using both radio-telemetry and snow tracking, with the aid of previous research in the area (Hebblewhite 2000). We will be able to determine whether landscape features, including fires, affects elk vulnerability to predation following similar methods as Kunkel and Pletscher (1999).

To determine how predation by wolves, and forage (see below) affect success of migratory strategies, we will use Cox-proportional hazards regression (Andersen and Gill 1982) to estimate elk survival as a function of exposure times to factors (i.e. predators, forage). We will use Resource Selection Functions (RSF, Boyce and McDonald 1999) to determine how land use changes affect habitat selection and survival. Our two approaches, RSF and survival modeling, will allow an assessment of the relative effects of predation and forage on elk demography. Using these RSF and survival models, we will develop a cumulative effects assessment framework through spatially explicit simulation modeling.

Our ***short-term goals*** for the **FMF-Chisholm/Dogrib Fire Research Initiative** will be to first determine use of the Dogrib burn by radiocollared elk. We will then determine the underlying factors driving the patterns of use by comparing non-burned forests to burned and post-fire logged forests in terms of elk forage biomass and forage phenology. We are in a unique position to determine how elk in the Ya Ha Tinda elk herd respond to the Dogrib burn, with 38 radiocollared elk and >90 ear tagged elk during this first post-fire year. By year 2, we expect to have ~60 radiocollared elk, 20 of which will be GPS collars, and 200 ear tags to examine movements in response to the Dogrib burn. We will be able to conduct a preliminary test of the hypothesis that elk selected the Dogrib burn in year 1 and/or 2.

Then, to examine factors explaining patterns of use, we will estimate peak summer elk forage biomass during July and August, and at a reduced number of plots that are revisited from May to September, determine how elk forage phenology differs between forest treatments over time. To estimate peak forage biomass in the burn relative to other habitats we anticipate sampling elk forage in the following strata: 1) broad habitat types identified by Sachro and Gates (unpubl.data, grassland, shrub, closed forest, open forest), 2) three aspects (north/south/flat; Mysterud et al. 2001), and 3) 2 burn intensities (high, low) for a

⁸ Animal Care protocol #353112; For a copy of the approved Animal Care protocol, please contact the P.I.

total of 24 strata. We will conduct preliminary analyses during our first winter to optimize our sampling design for the second year. We will use ARCVIEW to locate $\geq 60 \times 60$ m pixels falling entirely within a habitat strata found close (< 1 km) to trails to facilitate economic sampling. Within each of these pixels we will locate a sampling site in which we will use a 30 m transect laid out perpendicular to the dominant slope or at a random direction if flat. We will estimate composition of dominant grass, sedge, and forb species within three 1.5×1.5 plots centred at 7.5, 15, and 22.5 m along the transect. We will estimate biomass and quality by clipping all standing live biomass at the 7.5 and 22.5 m plots within a 20 cm x 50 cm sampling frame. We will separate samples into vegetation classes (shrub, forb, grass), and record wet and dried mass. We will estimate the percent shrub composition within a 30×10 m plot around the transect for deciduous and coniferous species between 1 and 2.5 m in height. Canopy cover will be measured using a spherical densiometer at 7.5, 15, and 22.5 meters along the transect. We will estimate tree density within a 2×30 m belt transect recording dbh and average height. Finally, we will record aspect, slope, and elevation for comparison to DEM values. These tree, shrub, and site data will be only recorded during the first visit in the spring. Plots will be permanently marked for revisiting.

To assess elk forage phenology changes in biomass over the season, we will revisit a subset of these permanent plots at monthly intervals during the summer. We will estimate grass/forb/shrub percent composition, percent emergent, and estimate forage biomass, and forage quality using four 50×50 cm sampling frames placed at different distances along the transect spaced 1 m away from other clipping samples. We will build statistical models of forage quality and quantity as functions of strata and non-linear functions of time (Merrill et al. 1993; Post and Klein 1999). We will collaborate with Cormack Gates and students at UofC to combine our detailed work in and around the Dogrib fire with their large scale mapping to compare the Dogrib fire to other fire ages.

6. Deliverables

Knowledge Creation

Analyse the 110 biomass plot data in the Dogrib burn and compare to the plots from the non-burned study area. Build predictive models to determine effects of fire on elk forage biomass.

Demonstration

We are developing a complementary outreach proposal for an interpretative sign and trail at the Dogrib fire on the Ya Ha Tinda Ranch road.

Knowledge / Technology Transfer.

All relate to our short-term FMF research goals. Knowledge/Technology transfer will include, following from above: 1) univariate models of diet quality/quantity differences between strata (e.g. burned, post fire), 2) GIS based spatial models of diet quality/quantity from 2 years of field data, and 3) non-technical summary, quick notes, progress reports, and recommendation report, including guidelines for prescribed fire and post-fire differences.

Communications and Outreach

Presentation of a paper summarizing elk-forage RSF/Survival models at the 2004 ACTWS hosted international meeting of TWS.

Participation in the final FMF-C/D research initiative workshop.

Complete a quick note by June/04

Policy Support

We will provide management recommendations on differences between burned and post-fire logging treatments relative to non-burned forest to guide policy for the use of prescribed fire in wildlife management.

7. Timelines 2004/5

Task	2004								2005				
Vegetation Sampling	X	X	X	X	X					X			
Laboratory Vegetation Analyses						X	X	X	X	X			X
FMF quicknotes completed						X							
Preparation of interim progress report (Project Completion Report Mar 2004)			X										
Public presentations	X	X	X		X			X		X			

8. Site Information

The Ya Ha Tinda Ranch study area lies east of BNP on the Red Deer River, approximately 90 km west of Sundre, AB in the foothills of the Rocky Mountains. The ranch itself is ~40km², consisting of montane fescue-grasslands interspersed with aspen, and surrounded by lodgepole pine grading into subalpine fir at upper elevations. The study area will cover approximately ~5000km², dependent on movements of radiocollared elk, including high elevation summer ranges, including the Panther-Dormer corners and the Dogrib Burn. The study area provides a unique opportunity to examine the cumulative effects of fire on elk. A variety of prescribed fires inside BNP and outside (the recent Dogrib Fire) provide a broad range of fire ages (0-30 years) and sizes (5 to >5,000 ha) to assess the role of fires on elk forage (BNP, unpubl.data). In addition, a ten- year old habitat enhancement forestry project in the Bighorn creek area, combined with ongoing salvage logging and new commercial forestry in and immediately adjacent to the study area provides opportunities to examine the effects of forest management on elk.

9. References

Follows are personal references for Mark Hebblewhite:

1) Dr. Dan Pletscher, Director, Wildlife Biology Program, School of Forestry, University of Montana, Missoula, MT, 59812, 1-406-243-6364

2) Dr. John Theberge, Professor Emeritus, University of Waterloo, Oliver, BC, VOH 1T0, 1-250-498-5432

3) Dr. Paul Paquet, University of Calgary and World Wildlife Fund, P.O. Box 150, Meacham, SK, S0K 2V0, 1-306-376-2065

Please advise if personal references are required for Dr. Evelyn Merrill, Advisor.

10. Scientific Review

The *long-term* objectives of this research will form a Ph.D. Dissertation at the University of Alberta, from which several (up to 3-5) peer reviewed scientific publications will be generated for publication, as well as scientific presentations at international calibre conferences. *Short-term* scientific review will be conducted through the following: 1) review by Dr. Evelyn Merrill, Ph.D. advisor for the project, 2) an academic committee meeting prior to the 2002 summer field season; 3) bi-annual co-operators steering meeting consisting of invited representatives from Parks Canada, AB-SRD, Alberta Conservation Association, Foothills model forest, and Rocky Mountain Elk Foundation; and 4) presentation of preliminary research findings at appropriate annual conferences, such as the Alberta Chapter of the Wildlife Society.

11. Improvements to Management in Forest Ecosystems

Current habitat modeling for ungulates such as Elk rely on fixed assumptions between physical stand characteristics and habitat quality, and do not adequately address the impact of fire on ungulate habitat quality. With fire predicted to be a more important factor in the future of Alberta's forests because of global climate change, managers need knowledge of effects of fire on forest-wildlife relationships. Furthermore, there is a policy directive within Alberta to increase the use of prescribed fire within the foothills of the Rockies for the twin purposes of 1) mountain pine bark beetle management and 2) wildlife habitat enhancement. Our research will provide much needed information about the impact of fire on wildlife and thereby provide managers with the information necessary to improve the management of Alberta's forests to include a role for fire. Finally, given high demands for post-fire logging following fire, understanding differences between post-fire logging and burned forests for wildlife habitat will provide forest managers information required to integrate forest and wildlife management.

12. Amount of Money Requested From the Foothills Model Forest

We are requesting \$17,000/year to quantify effects of fire on elk forage biomass and forage phenology. We must stratify sampling to determine the relative role of fire on habitat quality. This funding will cover field research assistant expenses, equipment, laboratory analyses of digestibility, and some student support for GIS analysis.

13. Partner Contributions (2003/2004 Fiscal Year)

Partner/Organisation	Cash			In-kind		
	Current Funding 2002/03	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	17,000		17,000			
Parks Canada	100,000			25,000		
AB-SRD				10,000		
RMEF		10,000				
Alberta Cooperative Conservation Research Unit - UofA	40,000 ⁴					
University of Alberta	70,800 ²			10,000 ³		
Totals	170,800	10,000	78,000	45,000		

3- in-kind support includes equipment, laboratory supplies.
ACCRU funding for elk GPS collars.

14. Proposed Payment Schedule

We propose this research **grant** to be administered by the University of Alberta, starting April 2002, including a 15% overhead charge levied by the University on similar research agreements with the Foothills model forest. Payment schedule would be \$17,000 in each year based on satisfactory progress reports.

15. Subcontracted Work

We anticipate little subcontracting work required for field collection of forage quality data, elk data, or laboratory analysis of plant quality with appropriate funding for field and laboratory assistants. Mark Hebblewhite will conduct most of the GIS analysis. However, there is some potential for considerable time/cost savings through a small (2-3K) contract with Lindsay Sachro, currently EVDS masters student with Dr. Cormack Gates who is conducting a habitat mapping project inside BNP portion of the study area.

16. Project Management

Project Management will be coordinated by Dr. Evelyn Merrill through the University of Alberta, Department of Biological Sciences Industrial Liason Office.

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information/ Literature Cited

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Foothills Model Forest 2004-2005 Annual Work Plan
FireSmart – ForestWise Communities in the Foothills Model Forest

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2. Introduction

Rapid population and recreational growth combined with heavy accumulations of forest fuel and a trend towards warmer climates place hundreds of Alberta communities at increased risk from wildfires. Extensive wildfires in mountain national parks and the catastrophic “wildland/urban interface” fires of British Columbia in 2003 further reinforced the lessons of the Alberta’s catastrophic Chisholm and House River fires in 2001/02.

While fire agencies have been quick to recognize risks, progress at implementing known prevention solutions and creating “*FireSmart*” * communities has been slow. In many cases, the public cite concerns about the impact of standard fuel management practices on wildlife and aesthetic qualities and concerns about secondary environmental impacts resulting from fuel treatments as reasons NOT to implement hazard reduction measures.

The FireSmart – ForestWise project was initiated in the Foothills Model Forest in 2002 to develop, implement and evaluate effective solutions for reducing wildfire threats that are also ecologically-based, optimize benefits for wildlife and supportable by the public.

In it’s first two years the project has made significant progress towards each of the five key FMF objectives. Consequently, the FireSmart – ForestWise Communities project is drawing significant attention from agencies, municipalities and fire prevention personnel from around Alberta and beyond. In particular, the communication and demonstration aspects of the project are of interest because of their success in gathering public support and actively engaging people in community protection and forest stewardship actions.

3. Background Information

3.1 Project Purpose

The purpose of this project is to create a positive model for other Canadian communities for reducing the risk of wildfire losses while also practising sound forest stewardship in forests adjacent to populated areas (i.e. the wildand/urban interface). This will be accomplished by integrating new and existing knowledge from the fields of forest ecology, fire behavior and wildlife biology. Innovative communication and demonstration techniques will be applied to inform and

engage the public and gather increased support for wildfire hazard abatement (i.e. fuel management) and ecological restoration programs. We call this the FireSmart – ForestWise approach.

3.2 Integration of Research and Operational Fire Protection Activities

The scope of this project combines development of new knowledge with operational programs of fire protection/forest restoration through an “adaptive management” approach. This approach involves anticipating the potential effects of fuel management in light of ecological needs, documenting initial forest/wildlife conditions, prescribing detailed treatments, monitoring the results of treatments and then incorporating results in subsequent management actions. Responsibility for integrating research with project implementation lies with the project manager, Alan Westhaver (JNP).

Partnering within the Foothills Model Forest

Protecting interface communities from wildfire is an urgent issue affecting both Jasper and Hinton. Both communities are implementing major fuel management or forest restoration programs however, they are located in different jurisdictions. Therefore, a working partnership has been formed between JNP and SRD personnel in order to allow both agencies to move ahead while ensuring that knowledge and innovations resulting from this project are fully accessible through the FMF. The partnership also now involves personnel in Robb, Edson, Whitecourt, Grand Cache, Fox Creek and Robson valley B. C.

In this way, the several communities within the Foothills Model Forest are benefiting from this research as they work simultaneously towards *FireSmart – ForestWise* status.

PROJECT GOAL AND OBJECTIVES

Project Goal: To develop, implement and assess innovative methods for managing forest fuels in ways that reduce wildfire risks but also optimize or improve ecological conditions, wildlife habitat values and aesthetic qualities in wildland/urban interface areas of the Foothills Model Forest, and beyond. In simpler terms, this project will reduce the probability of catastrophic community losses associated with extreme wildfire events – such as those experienced during most Alberta fire seasons. This goal will be reached by providing managers first with innovative hazard reduction solutions, and second, by providing effective communication techniques to develop the public understanding and support required to implement them.

As the project enters year three it will shift from the initial phase of raising public awareness and support, developing methods and indicators, establishing permanent sampling plots, collecting baseline data and assessing environmental impacts. In 2004/05 the project enters an operational phase of full-scale implementation, monitoring treatment effects on habitat structure and wildlife use, large scale demonstration and knowledge/technology transfer. A strong

emphasis on communication and outreach continues in 2004/05, but is more focused on keeping stakeholders informed, actively engaging the public in community protection/ restoration activities and carrying messages and knowledge/technology beyond FMF boundaries. Several important opportunities to influence local, regional and national policy will be acted upon in 2004/05.

Key initiatives for 2004/05 are:

- 1). Assessing the effect of prescribed forest restoration and fuel reduction treatments (i.e. thinning) on habitat conditions and wildlife use in permanent sampling plots;
- 2). Expanding the large scale demonstration of fuel reduction & forest restoration techniques to 250 hectares involving at least 5 different forest habitat types;
- 3). Expanding the operational and demonstration aspects of the project to include prescribed burn treatments on a portion of the study area thinned in 2003/04;
- 4). Preparing databases and additional GIS products;
- 5). Expanding the scope of outreach and technology/knowledge transfer activities to include stakeholders and decision-makers beyond the FMF.
- 6). Influencing local, regional and national policies regarding risk management in the wildland/urban interface.

4. Project Objectives

1.) Knowledge Creation

To fill current knowledge gaps so that real and perceived conflicts between nationally accepted standards for fuel management and wildlife or wildlife habitat protection can be avoided; and to help reduce secondary environmental impacts of hazard abatement in wildland/urban interface areas.

The research component of this project involves: 1) literature review to gather, compile and evaluate existing information and predictive models, 2) developing and implementing fuel management prescriptions that accommodate forest structure and wildlife habitat needs, 3) documenting pre-treatment stand and wildlife condition, 4) documenting post-treatment conditions and responses, 5) incorporating these results into preferred fuel management prescriptions and 6) publishing results in a variety of formats.

Steps 1 – 3 were completed during 2003/04 thus providing useful preliminary information to other practitioners and managers. Steps 4 – 6 are the focus of 2004/05 and 05/06.

1a. Beneficiaries and Impacts

As demonstrated by the large number of information requests experienced during the first 18 months of this project, there is widespread demand for information on techniques and approaches for conducting “ForestWise” forms of fuel management. Participation by the University of Calgary has strengthened the scientific basis for the project. This research will result in accelerated implementation of improved fire protection measures in communities within and external to the Foothills Model Forest. More specifically, this information will be used by:

Agency managers and land planners at the municipal, provincial and federal levels (e.g. Jasper, Hinton, Alberta Sustainable Resource Development, Parks Canada) with responsibility for community wildfire protection will benefit by resolving current conflicts and controversy about traditional fuel management practices;

Resource industry and utility companies that operate in interface areas will benefit by better protecting values at risk and reducing fire occurrence or losses;

Citizens owning residential or recreational property in the wildland/urban interface will benefit through reduced risk and potential improvement to wildlife habitat;

Aboriginal people, ranchers and farmers operating in rural interface areas will benefit through reduced risk and improved opportunities to sustain their livelihood;

The FMF will benefit by showing leadership and gaining profile as a progressive organization that is concerned about forest-based with communities.

Interface fires result in extraordinary social and economic impacts.

Knowledge created by this project will reduce losses and suppression costs from future interface fires and likely prevent some altogether. This project will result in significant positive impacts on public expenditures and long-term forest sustainability.

2.) Demonstration

To provide real-world applications of Foothills Model Forest research by engaging the public to conduct small scale (neighbourhood) demonstrations of FireSmart – ForestWise methods, and by implementing large scale fuel management and forest restoration operations that will make the municipality of Jasper a template for other Alberta and Canadian communities.

Over 400 FMF residents have now been directly involved in one-day forest restoration/fuel management “work bees” as part of this project. The

resulting 1 hectare demonstration sites have been heavily visited and also featured on network and regional television/radio programs. Demonstration will continue to take several forms in 2004/05:

Small Scale Demonstration Projects: Three additional 1 hectare “demonstration projects” will be sponsored by the FSFS project in 2004 as a means of further increasing public awareness and providing opportunities for hands-on involvement in fuel management/forest restoration activities by area residents.

Neighbourhood Initiatives: As a result of small scale demo projects conducted in 2002 and 2003, several groups of residents and a local businessman have approached the FS-FW project with requests to assist their neighbourhoods to conduct similar projects adjacent to their homes or business. In 2004 the FSFW project will work with these people to implement further demonstration projects.

Operational Projects in Hinton/Grand Cache/Lake Louise: The project manager will continue to meet with SRD, Parks Canada and municipality personnel to offer information regarding fuel management methods and concepts.

Large Scale Demonstration Projects: During the winter of 2004/05 the operational demonstration of FireSmart – ForestWise approaches will be increased by an estimated 150 hectares to a total of over 250 hectares adjacent the towns of Jasper and the Lake Edith subdivision. Work around the Lake Edith subdivision should be completed thus that community will become “model community” in terms of fire prevention and environmental stewardship. As such, it will provide a positive example for other Alberta and Canadian communities.

Prescribed Fire Demonstrations: In 2004, two demonstration areas previously thinned to recreate historical forest structure will be exposed to prescribed fire in order to return natural disturbance to these sites. These demonstrations will bring the restoration process full circle and greatly increase the ecological understanding of FMF residents.

2a. Beneficiaries and Impacts

Demonstration projects are critical to achieving FMF Phase III goals. As well, they are a vital component of the communications/outreach and technology transfer objectives of this project (see 3 and 4 below). They will provide constant opportunities for stakeholders, residents and visitors or administrators from other jurisdictions to see and participate in project activities rather than just hear about them.

FMF residents will have opportunities to benefit by becoming engaged and taking responsibility for fire prevention/forest stewardship in their community;

Demonstration projects become focal points for constructive discussions with environmental advocates, potential critics and average citizens;

Communities will benefit directly since demonstration project areas are important components of overall community protection programs; The FMF will benefit because demonstrate projects show how local fire managers are applying and integrating natural disturbance research findings from the FMF into practical fire protection programs for the benefit of interface residents.

3.) Knowledge and Technology

To efficiently disseminate information and methods for improved fuel management approaches to end users (e.g. managers, residents, woods operators, planners) in order to accelerate the pace of interface fire prevention programs within the FMF and beyond.

The catastrophic wildfire losses of 2003 increased the existing demand for sound information on fuel management and hazard reduction actions. Now that this project has started to generate new knowledge and has tangible evidence of implementation (i.e. large and small scale demonstration sites) it has begun to play a very active and increasing role in knowledge and technology transfer. Knowledge and technology will be transferred in the following ways:

Guided Tours: To date, over 450 fire professionals, researchers and municipal managers have inspected existing sites during hosted tours of the FSFW project. In 2003 this included tours for Directors of the Canadian Model Forest Network, the Partners in Protection annual general meeting and the FERIC fuel management workshop. This highly effective means of knowledge and technology transfer will be continued in 2004/05.

Professional Conference and Workshop Presentations: Formal presentations and displays are critical means of disseminating project knowledge and technology. The FSFW project has responded to requests from several organisations in 2004/05 for speaking engagements including the Pacific Business and Law Institute: Managing Risks in the Urban/Wildland Interface – Getting the Public on Board; the Canadian Institute of Forestry/Society of American Foresters Joint Annual Meeting: Forest Health and Protection - FireSmart – ForestWise; and British Columbia Fire 2004- Fuel Management in Protected Areas. Other opportunities will be considered.

Public Forums and Open Houses: With assistance from the communications support group (composed of JNP and FMF staff), volunteers and members of the Jasper Interface Steering Team (JIST) the FSFW project will continue to participate in public forums that provide positive opportunities to transfer project knowledge to the general public. In 2003 it is conservatively estimated that over 3,000 local people were exposed to and contacted in this manner. In 2004 the opportunities include SRD Fire Smart functions, Fire Prevention Week, Jasper Safety Fair,

Jasper in January events and the Jasper Chilli Cook-off event. Other opportunistic events will be attended too.

Interpretive Signing: Effective on-site interpretive signs that describe project goals and community involvement in forest restoration/fuel management of demonstration sites will be developed and placed strategically near demonstration sites in 2004.

Print Media: In 2004, the FSFW project will continue to generate information products (e.g., fact sheets, advertising and media coverage) to aid in knowledge and technology transfer. A feature article in Canadian Forestry Industry magazine is anticipated.

Other Media: In 2004, wildfires and interface disasters resulted in several opportunities to profile the FMF project on regional and national television. Such opportunities will be utilized again in 2004 and actively pursued to meet knowledge transfer and communication objectives.

Best Practices Guide: During the course of this project a “Best Practices Guide” will be prepared for industry and contractors interested in getting involved in environmentally sensitive methods of fire hazard reduction (i.e. fuel management operations) in the wildland/urban interface.

3a. Beneficiaries and Impacts

Many of the beneficiaries and impacts of knowledge and technology transfer opportunities developed through this project are very similar to those stated for “Knowledge creation” and “Demonstration” and are not repeated here.

In addition, this project has already had significant benefit to the FMF by helping to fulfill its Phase III commitment to develop and deliver knowledge and technologies that have positive impacts beyond the borders of the FMF.

4.) Communications and Outreach Objective

To actively promote public awareness of interface issues and the improved solutions made possible by this research through a comprehensive “Communication Framework” that identifies key audiences, develops key messages and outlines communication and outreach methods to ensure effective delivery of the information.

The original Communications Framework for this project continues to be periodically revised and improved to strengthen communication and outreach and to take advantage of the many “ready made” audiences and communication opportunities that exist.

The level of interest in this project by local, regional and national media have exceeded our expectations. Much of the effort in 2002 to 2003 focused on developing communication resources and tools (e.g. fact sheets, display panels, signs, and illustrated presentations) whereas emphasis in 2004/05 will turn to delivery of communications messages. Now that it is perceived that residents within the Jasper zone of the FMF

are supportive of FSFW initiatives, outreach efforts will increasingly focus on stakeholders beyond the FMF. As described in Section 3, important communication and outreach initiatives for 2004/05 include:

Guided Tours

Professional Conference and Workshop Presentations

Public Forums and Open Houses

Interpretive Signing

Print Media

Other Media

Additional communication and outreach initiatives for 2004/05 include:

Expanded information on the FMF and Parks Canada web sites regarding the FSFW project.

Completion of QuickNotes # 1 - #5 and the addition of Quicknotes #'s 6 – 9.

Continuing to present project “updates” to audiences including the Jasper Interface Steering Team, Jasper Town Council, Jasper Chamber of Tourism, Rotary Club, Lake Edith Cottage Association, Forest Resource Advisory Group, and others.

Circulating information to the staff of Parks Canada and the Municipality of Jasper via local “intranet” services.

Actively soliciting articles in popular magazines and journals.

Continue to make presentations at local schools (e.g. Gr.6 forestry science unit).

4a. Beneficiaries and Impacts

It is a unique situation for any research project to be so heavily involved in a formal communications program. However, because of the operational nature of this project, active communications and outreach programs are essential. All partners (e.g. Weldwood, Alberta Sustainable Resource Development and Parks Canada) within the FMF will benefit from this approach by:

increased exposure and profiling of the FMF and its accomplishments to the public;

increased understanding of natural disturbance, fuel management and forest restoration issues;

pro-active identification of public concerns by providing feedback opportunities;

public awareness that concerns for wildlife and aesthetics are being addressed;

increased public support for community protection initiatives.

5.) Policy Support Objective

To resolve public concerns regarding fuel management that lead to delays or deferral of critical community fire prevention programs.

Early in development of the FSFW project, it was theorised that generating solutions for protection of communities from wildfire that also that address ecological, wildlife and aesthetic issues would result in broader public support for fire protection in communities where residents are concerned about wildlife habitat and “natural” values. This has now been confirmed, and is evidenced by the many requests for FSFW information, assistance and participation in other jurisdictions. In effect, the project has the attention of many local administrators, fire prevention officers and municipal officials. This leads to a tremendous opportunity to influence public policy regarding wildfire risk reduction in the wildland/urban interface. Key initiatives in this area for 2004 are:

Jasper Interface Steering Team: Aided by the project manager, this group will prepare a brief to the SRD/provincial policy and priorities committee advocating greater provincial spending on preventative actions in the wildland /urban interface to reduce fire suppression costs and fire losses.

Pacific Business and Law Institute: A presentation titled *Managing Risks in the Urban/Wildland Interface – Getting the Public on Board* will be made to 200 – 400 elected officials and municipal administrators at this Vancouver conference in March, 2004.

Premier’s Enquiry – B.C. Fires of 2003: A paper advocating the advantages of the FMF FireSmart – ForestWise approach will be prepared and submitted to the enquiry chairperson (former Manitoba premier, Gary Filmon).

5a. Beneficiaries and Impacts

The general public, business and government institutions at all levels will all benefit if more proactive policies concerning wildfire risk reduction are implemented. As well, the profile of the Foothills Model Forest will increase if it is viewed as a leading edge organization for facilitating development and transfer of this type of information and policy. Policies that encourage implementation of *FireSmart – ForestWise* prevention practices will:

- benefit public agencies (and taxpayers) through reduced fire protection costs;
- benefit forest-based industries by reducing the wildfire threat to green timber;
- benefit forest-based communities by reducing the risk of catastrophic wildfire losses.

5. Abstract of Methodology

Preliminary research questions and methods for this project have undergone significant refinement during the initial year of this program. These have been restated below.

Research Objectives, Questions and Predictions

The main objective of this research is to develop, implement and assess innovative, ecologically based methods for managing forest fuels in ways that

reduce wildfire risks but also optimize or improve ecological conditions and wildlife habitats in interface areas located in coniferous or mixed-wood forests. Several, more quantifiable sub-objectives are:

To better understand and describe potential implications of standard fuel management measures on a wide array of wildlife species common to Alberta forests and rural settings;

To develop and distribute alternative fuel management prescriptions that incorporate forest structure and wildlife habitat concerns while still meeting requirements for reduced fire potential as predicted by the Canadian forest Fire Danger Rating System (1987).

To measure and evaluate resultant (actual) stand level characteristics, the response of wildlife indicator species following implementation of preferred fuel management prescriptions, and the modeled response of fire behavior to modified fuel complexes.

To identify field criteria for measuring secondary impacts caused by fuel management activities and develop means of avoiding or mitigating unnecessary environmental impacts.

A basic tenet of this research is that forest stand structure (wildlife habitat) as measured by key indicator variables can be managed to ensure sufficiently reduced fire intensity while also restoring ecological conditions within the historic range of variability and better accommodating the life requirements of indigenous wildlife species.

5.2 Methods

A research advisory committee composed of subject area experts in vegetation ecology, fire behavior, wildlife biology and geographic information systems will guide the research component of this project. See section 10 for details. Research methods are outlined below:

Initially, a broad-based literature review will gather information describing wildlife habitat requirements, predict changes in under-story conditions and vegetation composition, and identify the potential implications of fuel management activities on a wide range of wildlife species. Considerable literature describing the impacts of forestry practices and several habitat suitability models exist, and are applicable to this study. I will also draw upon studies previously funded by the Challenge Grants program. Criteria for choosing key indicators for future monitoring will also be developed at this stage of the research.

The second phase of the research involves development of alternative fuel management prescriptions that incorporate forest structure and wildlife habitat elements identified in phase one. Research methods will include classification and mapping of existing forest stands based upon the ecological land classification (Holland and Coen 1982); measuring baseline indicators of habitat structure (e.g. fixed plot relevés for species composition and ground cover, densiometer for canopy cover, range disc for grass productivity; forest fuel loading (McRae et al 1979); and wildlife use (e.g. breeding bird abundance (Hutto and Hoffland 1996), ungulate pellet counts, small mammal density by track tubes.

Accepted standards for fuel reduction will be used as a guide. Sampling design will allow for permanent, paired plots in treated and untreated (control) areas thus allowing for analysis within the three year timeframe of the project as well as long term follow-up studies. Resources permitting, dendrological sampling to reconstruct historical stand densities will be conducted using methods borrowed from Yosemite National Park (Pers. Com. Paintner).

Data collection methods developed in phase two will be replicated following stand treatments scheduled for the winters of 2003/04 and 2004/05 to measure and evaluate resultant (actual) stand level characteristics and the response of wildlife indicator species following implementation of preferred fuel management prescriptions. This will allow for pre and post-treatment comparisons on the same site and comparison of conditions on treated and untreated sites. The potential for field testing changes in fire ignition probability may also be incorporated by applying heat to one meter square areas in treated and untreated stands.

In the final phase of the project several variables (e.g. amount of bare soil on haul roads, density of haul trails, % of damaged “leave” trees including habitat trees, frequency of top-damaged trees, tree root exposure and damage to forest regeneration) will be monitored to assess their value as criteria for measuring secondary impacts caused by fuel management activities and to develop means of avoiding or mitigating unnecessary impacts.

6. Deliverable

Knowledge Creation

Collect post-treatment data on response of stand/wildlife conditions.

Assess environmental impacts and revise mitigations as required.

Develop databases describing pre and post-treatment habitat conditions.

Sampling methods for monitoring habitat conditions and wildlife use in fuel treatment areas prepared for peer review.

Summarize timber volumes and cost/revenue of treatments by fuel type.

Demonstration

Small Scale Demonstration Thinning Projects (1 hectare or smaller).

3 or 4 “neighborhood” restoration/fuel mgmt demo projects within townsite boundaries

1 restoration/fuel mgmt demo project @ Jasper Park Lodge

2 restoration/fuel mgmt demo projects at Lake Edith

Large Scale Demonstration Thinning Projects.

25 additional ha. of treated forest surrounding Lake Edith

60 additional ha. of treated forest around Jasper town site

30 additional ha. of treated forest around Jasper Park Lodge

Prescribe Burns for Restoration/Fuel Reduction.

4 hectare “Adrienne’s Prairie” prescribed burn at Lake Edith

15 hectare “Jimmy’s Prairie” prescribed burn at Lake Edith

Knowledge / Technology Transfer

Evaluation of equipment & treatments vs. expectations for low environmental impacts.

FireSmart – ForestWise stand prescriptions for multiple fuel types posted on web
Assessment of shortwood harvesting system for wildland/urban interface projects
Summary of timber volumes and cost/revenue analysis of treatments by fuel type
On-site tours for managers, contractors and municipal officials (approx. 200/year)
Quick-notes # 6 through # 10.

Place amended terms of reference for thinning contract on FMF web site.

BC Wildfire Conference – WUI Fire in the New Era: Invited speaker, “Fuel Management in Parks and Protected Areas”.

Canadian Institute of Forestry/Society of American Foresters: Presentation to joint international conference.

Provide *FireSmart – ForestWise* advice to business and residents as requested.

Communications and Outreach

Continue to facilitate activities of the Jasper Interface Steering Team.

Liaison with the Lake Edith Fire Prevention Committee.

Place advertisements and feature articles in local and regional press.

Arrange interviews with regional and national press, radio, television.

Produce and mount “legacy” signs at major access points and on trails that intersect FireSmart – ForestWise demonstration/operating areas.

Updated FireSmart – ForestWise fact sheet for residents, visitors, public.

Presentations to local stakeholders (e.g. Chamber of Commerce, Town Council, Rotary, etc.).

Continued participation in public displays for SRD FireSmart Program, Fire Prevention Week, Safety Fair, etc.

Policy Support

Pacific Business and Law Institute - Managing Risks in the Urban/Wildland Interface: Invited speaker, “Getting the Public on Board” presentation to 200+ mayors, councilors and municipal administrators.

Continued participation on SRD’s Regional FireSmart Co-ordinating Committee.

Prepare presentation to Alberta SRD Policy and Planning Committee in favor or increased funding for interface fire prevention to reduce fire suppression costs.

Prepare information summaries and recommendations to Alberta Culture and Parks Canada to influence current policy regarding flammable roofing on historic buildings.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
<i>Knowledge Creation</i>												
Collect post-treatment data; stand/wildlife conditions.	X	X	X	X	X							
Assess environmental impacts and revise mitigations.	X	X	X									
Develop databases of pre/post-treatment habitat conditions.	X					X	X	X				
Sampling methods prepared for peer review.												
Summarize timber volumes and cost/revenue by fuel type	X	X	X							X	X	X
Prepare burn plans and screenings for prescribed burns	X											
<i>Demonstration</i>												
3 “neighborhood” FSFW demo projects in within townsite			X		X		X					
2 restoration/fuel mgmt demo projects at Lake Edith				X	X							
1 restoration/fuel mgmt demo project @ Jasper Park Lodge			X									
25 additional ha. of treated forest surrounding Lake Edith								X	X			
60 additional ha. of treated forest around Jasper town site									X	X	X	X
30 additional ha. of treated forest at Jasper Park Lodge									X	X		
4 hectare “Adrienne’s Prairie” prescribed burn at Lake Edith	X	X										
15 hectare “Jimmy’s Prairie” prescribed burn at Lake Edith	X	X										
<i>Knowledge / Technology Transfer</i>												
Evaluate environmental impacts of equipment & treatments	X	X	X									
Post FSFW stand prescriptions for fuel types on FMF web	X											
Assessment of shortwood harvesting system for WUI work		X										
Analysis of timber volumes and cost/revenue by fuel type	X	X										
On-site tours for 200 managers and municipal officials	X	X	X	X	X	X	X	X	X	X	X	X
Quick-notes # 6 through # 10.			X		X		X		X			X
Place terms of reference for thinning contract on FMF web	X											
BC Wildfire Conference presentation – “Fuel Management in Parks and Protected Areas”.	X											
Canadian Institute of Forestry/Society of American Foresters presentation to joint international conference.		X					X					

Provide FSFW advice to business + residents as requested.	X	X	X	X	X	X	X	X	X	X	X	X
<i>Communications and Outreach</i>												
Facilitate activities of the Jasper Interface Steering Team.	X	X	X	X	X	X	X	X	X	X	X	X
Liaison with the Lake Edith Fire Prevention Committee.												
10 advertisements or feature articles in local/regional press.		X	X	X	X	X	X			X		
5 interviews with regional/national press, radio, television.	X			X	X				X	X	X	
Erect “legacy” signs at major access points and trails.				X	X							
Updated FSFW fact sheet for residents, visitors, public.							X					
Participation in at least 4 public events to profile FSFW	X	X	X	X	X	X	X	X	X	X	X	X
<i>Policy Support</i>												
Participate SRD’s Regional FireSmart Co-ordinating Comm.	X		X		X		X		X		X	
Presentation to SRD Policy + Planning Committee												
Prepare FSFW info for AB Culture and Parks Canada	X											

8. Site Information

This research involves study locations in Jasper National Park with a wide variety of forest stand types including Douglas fir, Douglas fir/pine, Douglas fir/pine/white spruce, aspen and pine forests of variable ages. Co-operation with SRD personnel working in the Hinton and Grande Cache areas provide an opportunity to examine mixed-wood (aspen/conifer), black spruce and white spruce/fir stand types. Demonstration areas will eventually include over 350 hectares.

All FMF communities (Jasper, Hinton, Lake Edith) share common concerns for wildfire protection. In addition, JNP’s ecological mandate to restore representative forest conditions and processes of natural disturbance (i.e. fire) lends additional justification. Long-standing education and communication programs within JNP have raised awareness and linked the issues of fire protection and forest restoration in the public eye.

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10. Scientific Review

Aside from meeting the objectives of the Foothills Model Forest and Parks Canada, this research is the basis of a Masters of Science project at the University of Calgary. The primary scientific/peer review associated with this project will be provided through the University of Calgary, Faculty of Resources and the Environment.

Principal Reviewers	Organization	Phone	Email
Dr. Cormack Gates	Univ.of Calgary (Env.)	(403)220-3027	ccgates@nucleus.com
Dr. Rich Revel	Univ.of Calgary (Env.)	(403) 220-3622	revel@ucalgary.ca
Dr. Brad Hawkes	Canadian Forest Service	(250) 363-0665	bhawkes@pfc.forestry.ca
Dr. Darren Bender	Univ. of Calgary (Geog)	(403)	dbender@ucalgary.ca

In addition to the members listed above, further scientific review and consultation is being provided by Dr. David Andison, Dr. Brad Stelfox, Dr. Geoff Holroyd (Canadian Wildlife Service), Mr. Dave Schroeder (FERIC), Dr. John Yackel (UofC), Dr. Shelly Alexander (UofC) and, at the request of a local environmental group, Mr. Herb Hammond of Silva Ecosystem Consultants. Other subject area experts will be consulted throughout this project as opportunities and needs arise.

11. Improvements to Forest Management in Ecosystems

Important improvements to the management of forest ecosystems will occur in four major ways as a result of this project:

Small portions of ecosystems that fringe highly developed areas (wildland/urban interface) will be intensively managed to improve ecological conditions (biodiversity) and wildlife habitat while also meeting objectives for public safety;

Fuel management activities will be tempered with knowledge of natural disturbance processes and historic forest structure so that the historical role of fire in stands previously subject to low intensity, “stand maintaining” fire regimes can be duplicated as closely as possible;

By protecting forest-based communities and major human developments in forested ecosystems the opportunities for expanding prescribed burn programs to restore natural disturbance in protected areas are greatly expanded. The likelihood of maintaining planned harvesting regimes in fibre production forests is also enhanced as a result of reduced fire occurrence;

During the course of this project, public awareness and understanding of natural disturbance and the natural range of variability in forest structure will increase, thus paving the way for future advances towards sustainable forest management.

Overall public and private sector expenditures for fire suppression actions and recovery or mitigation of fire losses should decrease as a result of this work.

12. Amount of Money Requested from the Foothills Model Forest

The amount requested for the FireSmart – ForestWise Project from the FMF in Fiscal year 2004/05 is \$15,000.00. This project is imbedded in a larger operational program of fuel management and forest restoration. Within Jasper National Park, that program is projected to cost about \$1.5 million over six (5) years and is 90% funded by Parks Canada.

An approximate breakdown of 2004/05 FMF funding expenditures is as follows:

Direct research and scientific monitoring costs	\$6,200.00
Small scale demonstration projects	\$ 500.00
Communication and Outreach	\$3,000.00
Knowledge and Technology transfer	\$5,300.00

13. Partner Contributions

Partner/Organisation	Cash		In-kind	
	Current Funding	Promised or Requested Contribution	Current Funding	Promised or Requested Contribution
Foothills Model Forest		15.0		
Jasper NP (capital)		26.0		
Jasper NP (timber revenue)		117.0		
Jasper NP (prescribed burns)		37.5		
Municipality of Jasper		15.0		
Metis Nation of Alberta		81.0		
ATCO Electric		3.0	10.0	
Researcher Self Funding		(6.5)		
Lake Edith Cottage Assoc.		0.5		
Unknown sources*		100		
TOTAL		395.0	10.0	

* Currently, JNP and the Municipality of Jasper are seeking a source of additional operating funds to pay for another manual crew to increase the rate of slash and debris disposal. The project can, and should, move ahead without this additional capacity but it would be far more effective if all debris could be disposed of concurrent with mechanical forest thinning.

14. Proposed Payment Schedule

The FMF will be invoiced by JNP for FMF funds and they will be administered through JNP finance for stated project purposes.

15. Subcontract Work

None of the research work proposed in this project will be sub-contracted.

16. Project Management

Project Manager: Alan Westhaver (under supervision of Chief Park Warden, Brian Wallace, JNP). It is proposed that the Jasper Interface Steering Team act as a de facto program activity team for this project. This group consists of over 20 stakeholder groups and includes ASRD, representatives from Hinton and Jasper and Don Podlubny (FMF).

17. Additional Organisations requesting money

N/A

18. Other Relevant Information

N/A

Foothills Model Forest 2004-2005 Annual Work Plan Communications and Extension Program

1. Prepared by

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2. Introduction

The Communications and Extension Program focuses its energies and resources on supporting the achievement of the three of the four Phase III objectives. The three objectives are:

Knowledge and technology transfer: Develop and implement mechanisms that result in a wider understanding and application of accrued knowledge and technology for sustainable forest management.

Communications and outreach: Deliver communications and outreach programs that improve understanding of, and support for, sustainable forest management.

Inform policy: Support and influence policy that improves the practice of sustainable forest management.

The communications and extension plan is organized by these three subheadings. Objectives have been identified, as well as the strategies that will achieve each objective.

The plan also addresses the areas of fund development, intellectual property, developing and implementing systems to effectively track and monitor the incorporation of Foothills Model Forest knowledge and technologies into forest management practice and policy. These areas are proving to require significant human resources therefore they should be included in the work plan. They also signify a shift in Foothills Model Forest direction therefore effective and efficient systems and processes are required. These require thought and attention.

3. Background Information

The Communications and Extension Program plays a critical role in supporting the achievement of the three of the four Phase III goals. In 2002/2003, systems and processes were established that better enable the program to provide support to the organization and individual program areas in the areas of knowledge and technology transfer; communications and outreach; and inform and support policy. In 2004-055 the Communications and Extension Program will continue to focus their energies and resources on the achievement of these three of the four Phase III goals.

4. Objectives

1.) Knowledge Creation

N/A

1a. Beneficiaries and Impacts

2.) Demonstration

N/A

2a. Beneficiaries and Impacts

3.) Knowledge / Technology Transfer

Introduction to Natural Disturbance Short Course

Budget: \$28,000.

Please note: The Natural Disturbance Program has committed \$29,000 to the development of the course. Based on research and funding proposals development costs are in excess of \$60,000. In large part this is because of the complex and cutting-edge nature of the course material.

Objective: By April 1, 2004 have a plan for the Natural disturbance short course.

Objective: By June 30, 2004 have developed funds for the development of the *Introduction to Natural Disturbance* short course.

Objective: By March 31, 2005 have promoted the *Introduction to Natural Disturbance* short course and begin delivery.

Objective: By March 31, 2005 have developed the *Introduction to Natural Disturbance* short course (terminology, definitions, core concepts)

Audiences

Target audience:

Program partners and supporters of the Natural Disturbance short course.

Secondary audience:

Sustainable forest management professionals (including foresters, biologists, GIS professionals) in Alberta, Saskatchewan, Manitoba, Ontario and Quebec.

Strategy:

An important step towards the acceptance of the Natural Disturbance paradigm in forest management is developing a common understanding of core natural disturbance concepts. This is also critical to the effective and successful integration of the research in planning and operations. The first step in achieving this goal is the development of an *Introduction to Natural Disturbance* short course. This course content would introduce core concepts, terminology and definitions.

Based on research, a course of this nature does not currently exist. Research included internet searches and interviewing individuals across North America involved in the field of forest management extension. Based on secondary research and interviews with activity team members there is a need for this short course, in and beyond Alberta.

The *Introduction to Natural Disturbance* short course is the building block for future short courses. It will be designed to educate government and forest industry personnel at the planning and operational levels about Natural Disturbance. The rationale is that a planner cannot properly integrate the patterns of natural disturbance into a forest management plan if the basic concepts are not understood. Likewise a forester with the government cannot intelligently approve forest management plans or compartment plans if they are not well-versed in natural disturbance concepts. Equally important, is the adoption of same terminology and definitions by the forest industry and government. If the forest industry and Alberta government have a common understanding of natural disturbance and use the same language, negotiations will be based on science versus semantics. Initially it is proposed that all government employees involved in approving forest management plans, compartment plans and ground rules within Alberta Newsprint Company and Weldwood's, and perhaps Sunpine's, forest management areas participate in this course. Likewise, Alberta Newsprint Company and Weldwood, and perhaps Sunpine, employees involved in forest planning and operations should participate in this course. Companies should also incorporate this course into their stewardship training so that contractors are knowledgeable about Natural Disturbance and understand the rationale behind changing and new ground rules and on-the-ground practices.

A course of this nature will lead to government and industry incorporating this information in their respective organizations, including using natural disturbance in company's detailed forest management plans, ground rules, annual operating plans, compartment plans and Alberta Sustainable Resource Development's planning manual. Once in these documents, specifically ground rules because of their legal implications, this information will be implemented on-the-ground and integrated into forest management practices. This course, in and of itself, cannot achieve this however it is an important step in this direction and a critical component of the Natural Disturbance Communications and Extension Plan.

The *Introduction to Natural Disturbance* course gives industry and government the foundation to begin integrating natural disturbance concepts into forest management plans and practices. Additional short courses will be required to maximize the integration and effectiveness of the natural disturbance paradigm in forest management. In keeping in the spirit of extension, it is advised that focus groups are conducted

immediately after the delivery *Introduction to Natural Disturbance* short course. The objective of the focus groups is to guide direction and content of future short courses. Holding the focus groups immediately after the delivery of the first short course is advantageous because participants' memories will be fresh from the *Introduction to Natural Disturbance* short course.

The *Introduction to Natural Disturbance* short course will play a key role in developing a common understanding about Natural Disturbance among the Natural Disturbance Program partners and other sustainable forest management professionals. However, there are other communications and extension tools that will help achieve this goal, for example, "Quick Notes". "Quick Notes" has been extremely effective at raising awareness about the Natural Disturbance Program and beginning to develop a common understanding about its research. This tool should continue to be part of the Natural Disturbance Program's communications and extension activities. Other communications and extension tools are highlighted below.

There is a need for the *Introduction to Natural Disturbance* short course, however because a structured and strategic Extension Program is new to both the Foothills Model Forest and the Natural Disturbance Program there are some unanswered questions. Therefore, the first step in developing this short course is to conduct further research and to develop a plan for the development of the course. It is recommended that the Natural Disturbance Program and the Foothills Model Forest Communications and Extension Program work collaboratively on developing this plan. It is recommended that experienced knowledge transfer specialists are engaged early in the process, for example the Hinton Training Centre or the Saskatchewan Institute of Applied Technology and Science. The plan should speak to the following:

Funding: How will course development be funded?

Development: Who will develop the short course? For example, will there be an advisory committee to guide course content? If so, who will the committee members be? Will a professional be contracted to develop the course?

Delivery: Who will deliver the short course?

Roles and Responsibilities defined.

Partnerships: Will the FMF partner with other organizations (i.e. Hinton Training Centre) and researchers (SFM Network) when developing the course?

Cost Recovery: Will the course be delivered on a cost recovery basis?

Future Natural Disturbance Short Courses: How will this course link to future natural disturbance short courses?

Custom and Generic Courses: As a result of the *Introduction to Natural Disturbance* short course, a partner wants knowledge and technology s

specific to their organization delivered who is responsible for its development and delivery? Who pays for this type of activity?

Course Materials: What course materials will be required?

Timeline

Budget

Audience

Primary audience:

Forest, watershed and fish managers; and GIS professionals with interests in the northeast slopes of Alberta.

Secondary audience:

Companies consulting in watershed and fish management.

Associations focused on watershed and fish management.

Quick Notes and Collection of Quick Notes

Budget: Time of Lisa Jones and Fran Hanington.

Objective: By June 30, 2004 have compiled existing Quick Notes into thematic collections and distributed electronically to target audience.

Have hard copies available on a cost-recovery basis.

Audience:

Primary audience:

Sustainable forest management professionals in Alberta.

Secondary audience:

Interested general public including public advisory groups, media, associations and special interest groups.

Strategy:

The Foothills Model Forest has accumulated over thirty Quick Notes. To date, the distribution of Quick Notes has been done by individual program leaders and is somewhat sporadic. In an effort to ensure these valuable knowledge transfer tools are available to a larger audience it is recommended that the existing Quick Notes be organized and distributed electronically to the aforementioned audiences. Hard copies can be sent out but will need to be done on a cost-recovery basis.

Objective: By April 1, 2004 have developed a plan for the writing and production of Quick Notes.

Audience:

Primary audience:

Sustainable forest management professionals, practitioners and policy makers, in Alberta.

Secondary audience:

Interested general public including public advisory groups, media, associations and special interest groups.

Strategy:

Quick Notes have proven to be the most effective tool at raising awareness and building credibility for research programs. The Natural Disturbance Program and its Quick Notes proves this. It is recommended that in 2004/2005 a plan for Quick Notes is developed. The plan will outline a delivery schedule of Quick Notes, a distribution plan and the evaluation and monitoring of this tool. This plan will better ensure all Foothills Model Forest research programs are producing Quick Notes and that they are being distributed, tracked and monitored in a coordinated manner. The plan will take into consideration how programs are currently managing Quick Notes.

Interpretive Notes

Budget: \$10,000

Objective: By December 31, 2004 have produced and distributed one Natural Disturbance Interpretive Note.

Audience:

Primary audience: Sustainable forest management professionals, practitioners and policy makers, in Alberta.

Secondary audience: Sustainable forest management professionals who operate in similar jurisdictions as Alberta.

Objective: By March 31, 2005 have conducted an evaluation on the natural disturbance interpretive note.

Objective: By July 1, 2004 recommend how Interpretive Notes can be incorporated into Foothills Model Forest research programs.

Strategy

In 2004/2005, one or two Natural Disturbance "Interpretive Notes" will be produced. To date, the Natural Disturbance Program has over 20 "Quick Notes" and has been committed to knowledge transfer for a number of years. Additionally, the program has budgeted \$10,000 of its own dollars to this initiative. In 2004/2005 the Communications and Extension Program has also budgeted \$10,000 to this initiative with money from the 2003/2004 budget being spent on developing a template for this product. After a Natural Disturbance Interpretive Note is developed and evaluated a recommendation will be brought forward on how to proceed (or not) with this product for other Foothills Model Forest research programs.

“Interpretive Notes” are a bridge between the existing one-page “Quick Notes” and “Research Reports”. The “Interpretive Notes” would be similar to the BC Ministry of Forest’s Extension Notes. The “Interpretive Note” would condense research reports into operative examples. Each “Interpretive Note” would be two to eight pages in length, include simple interpretations about natural disturbance patterns. They would include many images.

Newsletter

Budget: \$5,000 for layout and printing

Objective: To produce two newsletters annually which keep Foothills Model Forest R&D and events at the forefront of the target audience’s minds.

Primary audience: Sustainable forest and resource management professionals in Alberta.

Secondary audience: Interested general public in Alberta including, but not limited to, the media, educators, public advisory groups.

Strategy:

The Foothills Model Forest newsletter is a good tool to maintain awareness about the organization and its programs. The template has been recently designed to feature single research programs and provide information that is more meaningful, rather than “newsy”, in nature. However, the template lends itself to provide quick updates on other programs to remind the audience that the model forest is involved in worthwhile R&D. Another significant change is that the newsletter will be written in-house. With the addition of a full-time position, the Communications and Extension Program is better equipped, from a human resources perspective, to write the newsletter.

Web Site

Budget: \$10,000

Objective: On an ongoing basis develop the web site into a tool that facilitates the efficient distribution of Foothills Model Forest knowledge.

Objective: On a quarterly basis, provide report on the knowledge being transferred from the Foothills Model Forest web site outwards.

Objective: By June 30, 2004⁹, write a recommendation on how to best proceed with the Foothills Model Forest web site.

⁹ The Canadian Model Forest Network web site should be complete by this date and have provided Foothills Model Forest with the time to analyze it and deta

Audience:

Target audience: Sustainable forest management professionals in Alberta and Canada.

Secondary audience: The interested general public in Alberta and Canada.

Strategy:

The Foothills Model Forest web site is not reaching its full potential of a communications and knowledge transfer tool. This can largely be attributed to the lack of strategy when the web site was developed. Since September, the Communications and Extension Program has committed to improving this tool within the parameters of its structure. Continual improvement and regular updates will remain the status quo until the Canadian Model Forest Network web site is developed. Lisa Jones is a member of the committee overseeing its development therefore has an opportunity to articulate the needs of the Foothills Model Forest in the development of this web site. Once the Canadian Model Forest Network web site is complete and has been operating for a two or three months, an assessment will be done on its compatibility with the Foothills Model Forest's web site needs, and a recommendation will be brought forward to the communications steering committee.

Knowledge Transfer Sessions

Budget: \$10,000

Where possible and appropriate knowledge transfer sessions will be operated on a cost-recovery, cost-sharing or sponsorship basis. Communications and Extension is helping to facilitate the delivery of three different knowledge transfer sessions. It is foreseen that these sessions will require follow-up and that opportunities for other sessions will arise therefore the program will be accommodate requests that best facilitate the integration of Foothills R&D into practice.

Audience:

Primary audience: Sustainable forest management professionals with operations in or management authority over Alberta's northeast slopes.

Secondary audience: Sustainable forest management professionals from Alberta and similar jurisdictions.

Objective: By June 30, 2004 organized three knowledge transfer sessions for the Grizzly Bear research program.

Objective: By September 30, 2004 develop a follow-up plan based on feedback at the Grizzly Bear research program knowledge transfer sessions.

Strategy:

In the spring of 2004 the Foothills Model Forest Grizzly Bear Research Program is delivering three knowledge transfer sessions to the oil and gas sector, government and the forest industry. The Communications and Extension Program is supporting and coordinating the delivery of these sessions. A follow-up from the sessions will be to identify additional knowledge transfer activities to facilitate the integration of grizzly bear maps and models into resource management activities.

Objective: By June 30, 2004 organized and delivered an intense, three-day knowledge transfer session for senior Alberta Sustainable Resource Development managers.

Objective: By September 30, 2004 develop a follow-up plan based on feedback at the SRD knowledge transfer session.

Strategy:

In December 2003, senior managers from Alberta Sustainable Resource Development approached the Foothills Model Forest and expressed their interest in co-organizing a workshop for SRD senior management. The goal of the workshop is to provide SRD senior managers with current Foothills Model Forest knowledge to inform and support policy. The desired outcomes of the workshop are as follows:

To identify potential applications of research in policy and practice.
Recommendations for policy, training, future tool development, future research and development.

The Communications and Extension Program will help coordinate this workshop and be involved in the development of a plan to address managing recommendations.

Objective: By March 31, 2004 develop a plan with Rich McCleary and Christian Weik for the next generation development of the stream classification database. The plan will include a budget and timeline.

Objective: By June 30, 2004 have researched intellectual property and develop a recommendation for the management of the stream classification database from an intellectual property perspective.

Audience:

Primary audience: Forest, fish and watershed managers and GIS professionals operating in the NE slopes of Alberta.

Secondary audience: Consultants and associations with interests in fish and watershed management, and GIS.

Strategy:

In February 2004 the Foothills Model Forest is hosting a stream classification database workshop. The objectives of the workshop are as follows:

- To raise awareness and build support for the fish classification database
- To solicit input from users for next generation development of this technology

Feedback from the workshop will determine the role of the Communications and Extension Program in further developing this database. At this point in time, the following objectives have been set as they relate to the database.

3a. Beneficiaries and Impacts

4.) Communications and Outreach

In Phase III there is increased focus on informing policy, knowledge and technology transfer. However, Communications and Outreach advances SFM (informed publics is a criterion of the Canadian Council of Forest Ministers' C&I), therefore it is an important element of the Foothills Model Forest. As outlined in the Phase III Strategy, communications and outreach will be done in a collaborative manner with other organizations such as the Provincial Museum of Alberta, Alberta Innovation and Science and our sponsoring partners. Additionally, activities which are proven expensive and ineffective at meeting objectives, for example the Woods Tours, are eliminated from the 2004/2005 work plan. Communications and outreach will target audiences who are interested in sustainable forest management issues, as opposed to undertaking large campaigns in an effort to change opinions. Communications and outreach activities will communicate messages that are consistent with the desired outcomes of knowledge and technology transfer, and informing policy efforts. For example, in 2004/2005 there is a strong focus on developing a common understanding of natural disturbance concepts and terminology among forest practitioners and policy makers. Therefore, the messages communicated to the general public should support these efforts.

FEESA – EcoTours
Budget: \$15,000

Audience: Educators.

Objective: In 2004/2005 to provide twenty teachers with a balanced view of natural resource management issues.

Hardisty Creek Restoration Program
Budget: \$16,000 (dollars from CN Rail)

Audiences:

Primary audience: Teachers and students from Hinton schools

Secondary audience: Hinton public

Objective: By July 31, 2004 develop, produce and install an interpretive kiosk at the CN culvert on Hardisty Creek.

Strategy:

CN Rail has contracted the Foothills Model Forest to manage the writing, design and layout, production and installation of interpretive signs. In addition to the management of the interpretive signs, Foothills Model Forest will also be managing the addition of a platform to a bridge that is adjacent to the CN culvert on Hardisty Creek. CN has given Foothills Model Forest latitude in terms of content and design for the interpretive signs however a communications plan for this project will be drafted to ensure all partners support and endorse the messages being communicated. The CN dollars, and the contribution from other partners for the restoration portion of Hardisty Creek will be used to leverage additional dollars to support this project.

Provincial Museum of Alberta

Budget: \$7,500

Audiences:

Primary audience: Edmonton and area school groups

Secondary audience: Edmonton and area residents

Objective: In 2004/2005 develop and deliver a GIS educational program to 1 000 Edmonton and area grade eight students.

Objective: By September 1, 2004 develop one discovery box for the Field Station.

Objective: Provide regular updates to the Grizzly Bear display within the Wild Alberta Exhibit.

Objective: By April 30, 2004 develop a plan for additional opportunities for collaboration between Foothills Model Forest and the Alberta Provincial Museum.

Objective: In 2004/2005 deliver four research talks targeted at an adult audience at the Provincial Museum of Alberta.

Strategy:

Foothills Model Forest is establishing a relationship with the Provincial Museum of Alberta. The 2004/2005 work plan commits to the delivery of activities currently underway as well as the development of a formal plan of activities. In January, Lisa Jones and Greg Nelson will be meeting with the museum to formalize the partnership. After this meeting, a plan will be developed and presented to the communications steering committee for review and approval.

Summer Interpretive and School Programs

Budget: \$2,000

Objective: In the summer of 2004 deliver summer interpretive programs to 4,000 visitors of Jasper National Park and William A. Switzer Provincial Park.

Objective: Deliver the Foothills Model Forest interpretive programs within the Grande Yellowhead region.

Strategy:

Foothills Model Forest will continue to communicate the message of sustainable forest management research, findings and its application through summer interpretive programs. Foothills Model Forest will do two interpretive programs weekly, one in William A. Switzer Provincial Park and one in Jasper National Park, from the May long weekend to the end of August.

Public Advisory Group Tour

Budget: \$5,000

Objective: By October 31, 2004 organize a weekend seminar for members from Alberta's forest industry public advisory groups, which includes a tour of the Foothills Model Forest.

Strategy:

For a forest company to be third-party certified they must practice public involvement and have a public advisory group. Weldwood's public advisory group is well-versed in the work of the Foothills Model Forest, however other groups are not as familiar with the Foothills Model Forest. The funding the Foothills Model Forest receives from other forest companies increases on annual basis, therefore it may be worthwhile to host a weekend seminar for members of Alberta's public advisory groups.

Communications Kits and Workshops for Foothills Model Forest Partners

Budget: \$2,000

Objective: By September 1, 2004 develop a kit for Foothills Model Forest partners that provides their public relations professionals with information to incorporate Foothills Model Forest messages into their communications activities.

Objective: By December 31, 2004 deliver a workshop to Foothills Model Forest partners' public relations professionals.

Strategy:

The Foothills Model Forest has over 80 partners. Many of the partners are large organizations who have public relations and communications divisions who could help tell the Foothills Model Forest story as it relates to their organization. Some of our partners do this, for example the World Wildlife Fund is using the grizzly bear research program in their fundraising; Suncor Energy used the grizzly project as a testament to their efforts to conserve biodiversity. Enabling our partners to tell good news SFM stories will increase exponentially the number of individuals who hear this message.

4a. Beneficiaries and Impacts

5.) Policy Support

A Phase III objective is to inform and support policy. The Foothills Model Forest Communications and Extension Program can provide support to the Board of Directors, General Manager and program leaders in their efforts to achieve the objective. The two initiatives that the Communications and Extension Program will lead in this area the development of the annual report and a regular series of talks targeted at senior managers from industry and government.

Annual Report

Budget: \$15,000

Objective: By June 30, 2004 produce an annual report that links Foothills Model Forest R&D to current policy issues.

Objective: By June 30, 2004 to distribute the Foothills Model Forest annual report to individuals who influence or make policy within industry and government.

Audiences:

Primary audience: Key decision-makers within industry, government and associations with influence.

Strategy:

The Foothills Model Forest 2003/2004 Annual Report will attempt to link Foothills Model Forest R&D to current policy issues. The achievement of

this will require research and consultation with senior managers who sit on the Foothills Model Forest Board of Directors. The exercise will be valuable because it will ensure the communications and extension manager, as well as program leaders, are aware of the information needs, as they relate to the Foothills Model Forest, of senior managers within industry and government. The annual report will be written and managed in-house but will the design and printing will be contracted to a design firm.

Executive Series Meetings
Budget: \$2,000

Objective: On a quarterly basis a Foothills Model Forest program leader will present and meet with senior management from industry (forestry and oil and gas) and government.

Strategy:

Face-to-face meetings are the most effective form of communication. For Foothills Model Forest research to inform and support policy, those who make policy must be made aware, on a regular basis, about Foothills Model Forest research. The executive series meetings will provide structure and organization to face-to-face communication with senior managers. The Communications and Extension Program will develop a plan for this initiative to ensure presentation topics are relevant. The manager will consult with key board members and program leaders when developing the plan. It will be presented to the CSC and Executive committee for approval.

- 5a. Beneficiaries and Impacts** – Already identified
- 5. Abstract of Methodology**
N/A
- 6. Deliverables**
Knowledge Creation
N/A

Demonstration
N/A

Knowledge / Technology Transfer

Natural Disturbance Short Course – March 31, 2005

Collection of Quick Notes – June 30, 2004

Plan for Management of 2004/2005 Quick Notes – April 1, 2004

Interpretive Note – December 31, 2004

Recommendation for how Interpretive Notes can be incorporate into Foothills Model Forest research programs – December 31, 2004

Web Site, its maintenance and management
 Grizzly bear knowledge transfer sessions – June 30, 2004
 Plan for further grizzly bear knowledge and technology transfer – September 30, 2004
 Workshop for senior managers from Public Lands and Forest Division – June 30, 2004
 Plan based on feedback from Public Lands and Forest Division workshop – September 30, 2004
 Plan for next generation development of stream classification database – March 31, 2004
 Research and recommendation for intellectual property at Foothills Model Forest – June 30, 2004

Communications and Outreach

One FEESA EcoTour – September 1, 2004
 Interpretive site with three panels and alteration of bridge – August 1, 2004
 GIS Education Program – March 31, 2004
 Discovery Box for Provincial Museum – September 1, 2004
 One new interpretive program – June 1, 2004
 Plan for Foothills Model Forest-Provincial Museum of Alberta partnership – April 30, 2004
 Four research talks at Provincial Museum of Alberta – March 31, 2005
 Public Advisory Group Tour – October 31, 2004
 Communication Kit and Workshop – December 31, 2004

Policy Support

Annual Report – June 30, 2004
 Four presentations as part of the Executive Series – March 31, 2005

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Fund development for natural disturbance short course	X	X	X									
Development of natural disturbance short course	X	X	X	X	X	X	X	X	X	X	X	X
Promotion of natural disturbance short course							X	X	X	X	X	X
Plan for management of Quick Notes	X											
Compile Collection of Quick Notes	X	X	X									
Interpretive Notes						X	X	X	X			
Evaluation of Interpretive Notes										X	X	X
Recommendation of		X	X									

Interpretive Notes in FtMF research programs													
Newsletter – June 2004	X	X	X										
Newsletter – January 2005								X	X	X			
Web Site – Ongoing	X	X	X	X	X	X	X	X	X	X	X	X	X
Report web site usage and stats			X			X			X				X
Recommendation for FtMF web site			X										
PLFD Workshop	X	X	X										
Plan based on feedback from workshop						X							
Grizzly bear knowledge transfer sessions	X												
Plan based on feedback from workshop						X							
Research and recommendation for intellectual property at Foothills Model Forest	X	X	X										
Inside Education EcoTour				X	X	X							
Interpretive Sign at Hardisty Creek	X	X	X	X	X								
Develop and deliver GIS Educational Program	X	X	X			X	X	X					
Discovery Box for Provincial Museum	X	X	X	X									
Regular updates for grizzly bear display	X	X	X	X	X	X	X	X	X	X	X	X	X
Plan for additional opportunities at Provincial Museum	X												
Research series at Provincial Museum	X	X	X	X	X	X	X	X	X	X	X	X	X
Interpretive Programs	X	X	X	X									
Public Advisory Group Tour				X	X	X							
Communications Kits and Workshop for Partners	X	X	X	X	X	X	X	X	X				
Annual Report	X	X	X	X	X	X	X	X	X	X	X	X	X
Executive Series Meetings	X	X	X	X	X	X	X	X	X	X	X	X	X

8. Site Information

N/A

9. References

N/A

10. Scientific Review

N/A

11. Improvements to Management in Forest Ecosystems

The Communications and Extension Program does not improve the management of forest ecosystems. The program facilitates and supports the process which may lead to the integration of FtMF research into forest management policy and practice.

12. Amount of Money Requested From the Foothills Model Forest

\$245,000

13. Partner Contributions

Partner/Organisation	Cash			In-kind
	Current Funding	Promised Contribution	Funding Pending	Current Funding
Foothills Model Forest	\$245,000			
Canadian National Railway (carry forward)	\$16,000			
Natural Resources Canada, Science and Technology Internship Grant	\$8,000			
TOTAL	\$269,000.00			

14. Proposed Payment Schedule

15. Subcontracted Work

Inside Education for Eco-Tour
Design agency for design and printing of newsletters and annual reports

16. Project Management

Unless otherwise noted the project manager is Lisa Jones, Communications and Extension Manager unless otherwise noted above.

17. Additional Organisations requesting FRIIA Administered Monies

18. Other Relevant Information

Foothills Model Forest 2004-2005 Annual Work Plan
Forest History Project: “A Case Study of Policies and Practices Leading to Adaptive Forest Management”

1. Prepared by

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2. Introduction

In 1996, Weldwood initiated a history and case study of its sustainable forest management program at Hinton. This initial study was expanded at the suggestion of Model Forest board member Dennis Quintilio to encompass the model forest landbase and, in 1997 the model forest accepted the revised program as a model forest project.

By March 31, 2002, final draft reports had received for all five volumes in the history series and these were submitted to FRIAA, which also supplied considerable funding for the project.

Two of the final reports – “A Hard Road to Travel”, and “Learnings from the Forest” were proposed for publication in book form in 2003/04. “Learnings” was published by Fifth House in July 2003 and has been well received. “Hard Road” is not yet published. The remaining reports are posted on the model forest website.

The 2004/05 workplan proposed the publication of two volumes in the History Series.

3. Background Information

Five reports have been completed for the history series, and one more is pending. These are:

Volume 1. To Be Published – in .pdf form
A Hard Road to Travel: Land, Forests and People in the Upper Athabasca Region to 1955.

By: PJ Murphy with Bob Stevenson and Bob Udell

This volume describes the history of the largely unmanaged forest prior to 1955, including the larger landbase which is Foothills Model Forest. It traces early explorations, the historic role of fires and aboriginal peoples in the area, early days in forestry including the establishment of dominion forestry reserves and the

transfer of resources to the Province in 1930. Generally, it examines the history and ecology of the largely unmanaged state of nature that existed before 1955.

“Hard Road” was sent for external review in 2003, then reworked to expand on certain elements of early forest history, and reduce overlap with “Learning from the Forest”. Editing was completed and discussions are underway with the Forest History Society as well as Fifth House relative to publishing it in 2004.

The book has been reviewed by Fifth House, which advises that it does not have sufficient commercial merit to justify their investment in it. On the positive side, they found it a very informative read, giving a forestry perspective on many historical events that have been examined from other perspectives. As a result of this meeting, we are reconsidering the approach and will probably proceed with a designer to bring the book to a publishable stage in .pdf format and use a combination of posting on the Foothills Website and a selected publication run of hard copies for a limited audience.

Volume 2. *The Hinton Forest : A Case Study in Sustainable Forest Management*

By: PJ Murphy, Bob Udell, Bob Stevenson and Bob Bott

This volume examines the evolution of forest practices on the Hinton FMA from early days to 2001. Individual chapters examine the range of forestry practices from inventory, silviculture, multiple values and uses, protection, research, harvesting and the planning and management cycle for sustainable forest management. One of the major contributions of the Company was its demonstrated commitment to forest renewal and silviculture. It was both a precedent-setting and significant achievement.

Volume 3. *Evolution of the Forest Management Agreements -- A Policy Review and analysis*

By: PJ Murphy, M. Luckert

Originally proposed as a component of Volume 2, this stand-alone document describes, from a policy perspective, how the Forest Management Agreement evolved from its concept in the 1949 Forests Act to the first Agreement with North Western Pulp & Power Ltd. signed by Robert Ruben in 1951, then through successive re-negotiations to 1998. As well, discussions are included about the major events -- both successes and disappointments -- that took place along the way. The story ends with the start of re-negotiations for a new FMA started during the fall of 2000.

Volume 4. *Development of Adaptive Forest Management in Protected Areas of the Foothills Model Forest*

By: M den Otter

This provides a history and evaluation of the progression of policy and adaptive management practice in three protected areas within the Foothills Model Forest landbase -- Jasper National Park, Willmore Wilderness and Switzer Provincial Park -- and makes comparisons among them. This volume was prepared by Michael den Otter, a graduate student in the Department of Rural Economy, studying under direction of Marty Luckert at the time this work began.

The project was initially structured to serve as a Masters-level thesis study. He conducted literature reviews and interviews during 2000, wrote his thesis, and successfully defended it late fall 1999. The thesis formed the basis for this report, completed at the end of 2000, comprising 122 pages.

Volume 5. *Learning from the Forest: A Fifty-Year Journey towards Sustainable Forest Management*

By: R. Bott, PJ Murphy, R. Udell

This book is an illustrated, user-friendly synopsis of the practice of forest management at Hinton, based on material written specifically for it. The goals of this work were (a) to tell the story in an engaging fashion and (b) to illustrate the principles and practices of adaptive management as applied to a specific land base. Work on this report started late fall 1999.

A foreword by Dr. Gordon Baskerville provides an overview of the significance of the book and its importance to forestry practitioners and others (see attached).

Fifth House/ Fitzhenry and Whiteside published the book in July 2003.

Volume 6: *Mountain Trails: The Story of an Early Alberta Forest Ranger*

This report was originally published in serial form in the Western Producer magazine, beginning in 1969. It describes the work and social life on an early Alberta Forest Service ranger who worked out of Entrance, Alberta from 1920 to 1942, starting in the Dominion Forestry Branch days and spanning the transition to the Alberta Forest Service. The family of John Glen, the author has kindly agreed to allow Foothills Model Forest to re-publish the works and have also supplied the complete manuscript upon which the serials were based, as well as his extensive photo collection from the period.

We propose to add this work to the model forest history series, supplemented by photos from the period – as provided by John Glen's family or from the Alberta Forest Protection historical photo series. We also propose to include maps chronicling his travel routes during the period.

4. Objectives

1.) **Knowledge Creation**

The series of reports in the history series provide insights into all aspects of sustainable forest management, drawing on the history of the model forest landbase. Volumes, 2, 3 and 4 are complete. Work in 2004-05 will complete the project, through publication of Volumes 1 and 6.

Volume one – Hard Road to Travel – provides little-known detail – some never published - on the history and evolution of forestry in the area in early days. This is of particular interest to students of history, especially forestry history in Alberta. There has been no other such comprehensive examination of this fascinating history.

Volume six – Mountain Trails – is a republication, with additional material including text, photos and maps of the journals of an early Alberta government forest ranger whose experiences working out of Entrance, Alberta, spanned the transition between the federal and provincial governments in the ownership and management of the forest resources in Alberta.

1a. **Beneficiaries and Impacts**

These reports will provide adequate information for general readers and for students and practitioners of forestry, resource management, ecology and related disciplines. They will also be of high value to students of the early history of Alberta and western Canada. They will be essential reference for practitioners, educators and regulators considering where we have come from, and how that has shaped where we are today.

2.) **Demonstration**

Some of the information presented in these reports is still discernable in the landbase of the Foothills Model Forest, and could be the basis for field demonstration and historical tours in the model forest landscape.

2a. **Beneficiaries and Impacts**

N/A – there will be no field elements of this project, although the information provided is also reflected in components of some of the FMF demonstration projects – e.g. Firesmart, Integrated Land Management, Landscape Disturbance.

3.) **Knowledge / Technology Transfer**

See preceding discussion.

3a. **Beneficiaries and Impacts**

Educators, historians, practitioners, regulators and interested members of the public.

4.) **Communications and Outreach**

These reports provide a fascinating insight into the evolution of forest policy and forest practice in both protected areas as well as the working

landscape in the foothills of Alberta. Furthermore, they highlight the pivotal role played by this area as the pre-eminent trading route for western Canada in the 19th century, bringing together in one book the stories of many pioneers of that era.

4a. Beneficiaries and Impacts

Preliminary reviews of drafts of these reports by forest historians as well as informed members of the public and forestry community indicate that these books are making a significant contribution to improved knowledge and forest practice. Unfortunately, their appeal is limited to a narrow band of potential buyers and educators, not sufficient to support the costs of publication.

5.) Policy Support

The books will provide insights for policy makers by providing a comprehensive overview of how forest policies and practices have evolved in this area from the earliest times.

5a. Beneficiaries and Impacts

A must read for provincial regulators and forestry practitioners in Alberta.

5. Abstract of Methodology

Of the major reports, all but one are in circulation or on the website. “A Hard Road to Travel” is currently being finished up, some map work and photo selection remaining. Next stages are to complete the final edits, do the design work, print a limited run of copies and post to the website.

“Mountain Trails” will be published internally as well as placed on the model forest website.

6. Deliverables

The publication of two books on forest history - one from the view of a ranger on the ground, one a more comprehensive review of lands, people and forests in west central Alberta for the period before 1955. Elements of the books cover all aspects of the 5 broad goals of Foothills Model Forest listed below.

Knowledge Creation

Demonstration

Knowledge / Technology Transfer

Communications and Outreach

Policy Support

7. Timelines

Task	2004										2005		
	A	M	J	J	A	S	O	N	D	J	F	M	
Complete design and layout for “A Hard Road to Travel”			X										
Post “Hard Road” on website, produce limited editions						X							
Complete edits to “Mountain Trails”		X											
Design work “Mountain Trails”				X									
Post “Mountain Trails” on website, produce limited editions						X							

8. Site Information

The books cover the complete landbase of Foothills Model Forest and relevant activities/events beyond the model forest area.

9. References

10. Scientific Review

These books are not scientific studies per se, merely reports of history, activities and learnings over time.

11. Improvements to Management in Forest Ecosystems

These books will make a significant contribution to the literature.

12. Amount of Money Requested From the Foothills Model Forest

Original Budget for “Learning” and “Hard Road” was \$90,000. Approximately \$20,000 will remain at 2003/04 year end which we propose to carry over to 2004/05 budget.

Partner contributions will be solicited when the final costs of publication have been identified.

13. Partner Contributions

To date, over \$250,000 has been spent on bringing the five volume history series to the final report stage and Weldwood has been continuing to support the project through direct and indirect funding throughout the project.

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
Foothills Model Forest	20,000					
Alberta Forest Protection Division						
Weldwood/FRIP						

14. Proposed Payment Schedule

15. Subcontracted Work

Design and printing.

16. Project Management

Bob Udell will remain as project manager.

17. Additional Organisations requesting FRIIA Administered Monies

18. Other Relevant Information

ADDENDUM – A

Foothills Model Forest 2004-2005 Annual Work Plan An Exploration of Wildfire Risk Reduction Within Communities Directly Affected by the Lost Creek Fire in 2003

1. Prepared by

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2. Introduction

The 2003 fire season had devastating consequences in many areas of Canada, including the Crowsnest Pass area of Alberta where over 1,500 residents were evacuated. The traditional response by fire management agencies to wildfire at the wildland-urban interface (WUI) has followed a common paradigm for reducing risk from natural hazards, stressing an engineering solution (e.g., the creation of defensible space, fire resistant building materials) based on technological judgments (e.g., fire behaviour models) (McDaniels et al. 1997). What is lacking in the technological solution is the inclusion of psychological, social, cultural, and political factors that influence people's perception of risk and their willingness to support and engage in risk reduction activities. A small number of studies have examined wildfire risk perception amongst WUI residents, including awareness of fire severity and probabilities of occurrence; wildfire risk reduction; and policy preferences. Most of this research has been conducted in the U.S. (eg. Gardner et al 1987; Fried et al 1999; Winter and Fried 2000; Jakes et al 2003), with some being conducted in Australia (McGee and Russell forthcoming). Some of the pioneer work in applying mitigation activities in Alberta has occurred in Jasper National Park with the assistance of the Foothills Model Forest. This mitigation has focused on engaging residents in reducing fuel loads around the Jasper townsite. However, research on the human dimensions of wildland-urban interface fire is in its infancy in Canada.

3. Background Information

This proposed project examines perceptions of wildfire risk and the extent to which risk reduction activities were known, understood, and applied within in the MD of Crowsnest Pass and surrounding communities that were directly affected by the 2003 Lost Creek

fire. The timing of this project will provide unique insights about how knowledge and actions by residents and their communities reduced vulnerability and ability to recover after the fires. The project will also identify whether residents and municipalities have or intend to apply known mitigation measures during the recovery period, and identify obstacles and incentives to such mitigation activities. The study results will provide valuable information for fire management agencies and related organizations responsible for developing and implementing wildfire risk reduction. The research results will also contribute to the human dimensions of environmental hazards literature.

Research funding is also being sought from Public Safety and Emergency Preparedness Canada, to complete a similar study within a B.C. community. If this funding is obtained, the combination of a study focusing on the Crowsnest Pass area of Alberta, and a community in B.C. also affected by fires in 2003 will provide an important opportunity to gain knowledge about post-fire risk reduction in Canada. It will also enable investigation of perceptions of risk, knowledge, understanding and application of risk reduction to communities across political jurisdictions and associated risk reduction activities within the two provinces. This work plan will focus only on the Crowsnest Pass study.

4. Objectives

The project that is the subject of this proposal aims to examine wildfire risk reduction amongst households and municipal governments within the MD of Crowsnest Pass and surrounding communities that were directly affected by wildfire in 2003.

Research objectives:

- * To identify perceptions of wildfire risk amongst a sample of residents and relevant municipal government staff (emergency services);
- * To identify the extent to which risk reduction activities (such as those identified by Partners in Protection 2003) were known, understood, and applied by municipal government staff and local residents;
- * To examine the role of this knowledge and risk reduction actions in reducing vulnerability to the 2003 fires and ability to recover post-fire;
- * To identify whether residents and municipal government staff have already or intend to apply known mitigation measures during the recovery period; and
- * To identify obstacles and incentives to such mitigation activities.

1.) Knowledge Creation

The results of this study will provide important information about how recent experience with wildfire influences the use of mitigation measures; and how the knowledge and actions by residents and municipal governments before a wildfire affect their vulnerability and ability to recover post-fire.

1a. Beneficiaries and Impacts

The results of this project will be of interest to the Lost Creek Research Advisory Group, Alberta Sustainable Resource Development, Partners in Protection, Canadian Forest Service, Public Safety and Emergency

Preparedness Canada, and other organizations in Alberta and elsewhere involved in wildfire mitigation and preparedness.

2.) Demonstration

N/A

2a. Beneficiaries and Impacts

N/A

3.) Knowledge / Technology Transfer

The results will be of particular interest to the Lost Creek Research Advisory Group and will be communicated as appropriate.

3a. Beneficiaries and Impacts

The results of this project will provide information about risk perception, risk reduction decision-making and actions by local residents, and factors influencing such decisions and actions. This information will be a valuable resource for those wishing to encourage adoption of risk reduction recommendations within the communities included within this project.

4.) Communications and Outreach

A final report will be submitted by 1 March 2005. The local fire chief, and other relevant municipal government staff responsible for the project, will receive regular updates on progress throughout the study period. A brief summary of progress will be presented to the Advisory Group twice during the study period – at the end of the fieldwork phase of the project, and once initial results are available. These written progress reports will be made available to other interested organizations upon request, and will be posted on Dr. McGee's research website at the University of Alberta (<http://research.eas.ualberta.ca/hdeh/main.html>) and made available for posting on the Foothills Model Forest website.

4a. Beneficiaries and Impacts

The final project report will be of interest to the Lost Creek Research Advisory Group, Alberta Sustainable Resource Development, Partners in Protection, Public Safety and Emergency Preparedness Canada, other relevant organizations in Alberta and elsewhere, and the public. Copies of the final report will be distributed to key contacts within listed organizations, and others will be made available upon request. Interview participants will receive a summary of the final report upon request. A copy of the final report and publications arising from this study will also be given to the local library, to be included within their collection. The progress report will be of most interest to the Lost Creek Research Advisory Group.

5.) Policy Support

The results will be communicated with the Lost Creek Research Advisory Group as appropriate, including two written progress reports. This will provide the group with information on wildfire risk reduction decision-making and activities within the selected communities. The results will also help inform provincial policy and programs such as Alberta Sustainable Resource Development, Forest Information and Community Programs.

5a. Beneficiaries and Impacts

The main beneficiaries will be the Lost Creek Research Advisory Group members, including the Municipality of Crowsnest Pass, MD of Pincher Creek, and Alberta Sustainable Resource Development.

5. Abstract of Methodology

Communities will be selected in collaboration with the Lost Creek Fire Research Advisory Group. Interviews will be conducted with a sample of residents and key municipal government contacts including the local fire chief(s), to gain an understanding of perceptions of wildfire risk, knowledge and understanding of risk reduction practices, implementation of risk reduction activities, how knowledge and risk reduction activities contributed to recovery, post-fire mitigation activities, and obstacles and incentives to implementation of mitigation activities.

6. Deliverables

Knowledge Creation

Preliminary data analysis - 12 November 2004.

Final report - 1 March 2005.

Report suitable for posting on the Foothills Model Forest website – 31 March 2005

Refereed journal article - September 2005.

Demonstration

N/A

Knowledge / Technology Transfer

Presentation to Lost Creek Fire Research Advisory Group and other interested individuals and groups to report study findings - 28 January 2005.

Presentation at a conference - 2005.

Communications and Outreach

Progress reports following fieldwork (31 August 2004), and preliminary data analysis (30 November 2004)

Final Report 1 March 2005.

Policy Support

Progress reports – 31 August 2004, and 30 November 2004.

7. Timelines

Task	2004									2005		
	A	M	J	J	A	S	O	N	D	J	F	M
Site selection and fieldwork preparation		X	X									
Fieldwork			X	X	X							
Preliminary data analysis						X	X	X				
Report Writing								X	X	X	X	
Follow-up visit										X		

8. Site Information

The research will be conducted at the University of Alberta, Department of Earth and Atmospheric Sciences, with fieldwork being conducted in the Crowsnest Pass area of Alberta.

9. References

McDaniels, T., Axelrod, L.J., Cavanagh, N.S. and Slovic, P. (1997). Perception of ecological risk to water environments, *Risk Analysis*, 17(3):341-352.

Gardner, P.D., Cortner, H.J. and Widaman, K. (1987). The risk perceptions and policy response toward wildland fire hazards by urban home-owners, *Landscape and Urban Planning*, 14:163-172.

Fried, J.S., Winter, G. and Gillies, K. (1999). Assessing the benefits of reducing fire risk in the wildland-urban interface: a contingent valuation approach, *International Journal of Wildland Fire*, 9(1):9-21.

Winter, G. and Fried, J.S. (2000). Homeowner perspectives on fire hazard, responsibility and management strategies at the wildland-urban interface, *Society and Natural Resources*, 13:33-49.

Jakes, P.J., Nelson, K., Lang, E., Monroe, M., Agrawal, S., Kruger, L. and Sturtevant, V. (2003). A model for improving community preparedness for wildfire, in Jakes, P. (ed). *Homeowners, Communities, and Wildfire: Science Findings from the National Fire Plan*, pp. 4-9, Proceedings of the 9th International Symposium on Society and Resource Management, June 2-5, 2002, Bloomington, Indiana.

McGee, T.K. and Russell, S. (forthcoming). 'Fostering Prepared Communities: An Investigation of Wildfire in Rural Australia', *Global Environmental Change Part B: Environmental Hazards*, 5, 1/2.

Partners in Protection. (2003). *FireSmart. Protecting Your Community from Wildfire*. 2nd edition. Partners in Protection, Edmonton.

10. Scientific Review

Journal articles arising from this project will be subject to the peer review process established by the journal.

11. Improvements to Management in Forest Ecosystems

The results of this study will assist those responsible for designing and implementing wildfire risk reduction for the study area, by providing information about knowledge levels of residents (thus potentially identifying knowledge gaps), and information about incentives and barriers to encouraging risk reduction.

12. Amount of Money Requested From the Foothills Model Forest

\$35,650

13. Partner Contributions

Partner/Organisation	Cash			In-kind		
	Current Funding	Promised Contributions	Funding Pending	Current Funding	Promised Contributions	Funding Pending
University of Alberta					\$6000	
CFS					\$5000	

14. Proposed Payment Schedule

Signing of contract \$27,300

Receipt of second progress report 30 November 2004 \$5250

Receipt of final report 1 March 2005 \$3100

15. Subcontracted Work

None

16. Project Management

Same as #1

17. Additional Organisations requesting FRIIA Administered Monies

N/A

18. Other Relevant Information

N/A