Local Level Indicators of Sustainable Forest Management for the Foothills Model Forest

Report

on the

Local Level Indicators (LLI) Workshop

(January 15-16, 2004, Jasper)

and

Recommendations by the LLI Activity Team

Prepared by:

W.R. Dempster Ph.D., R.P.F.

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P.O. Box 6330
Hinton, Alberta
T7V 1X6

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The members of the Local Level Indicators Activity Team responsible for the development of this report were: Harry Archibald (Alberta Environment), Shawn Cardiff (Parks Canada), Dick Dempster (consultant), Laura Graham (Alberta Community Development), Margarete Hee (Alberta Sustainable Resource Development), Kevin Land (Weldwood of Canada), Rich McLeary (Foothills Model Forest), John Parkins (Canadian Forest Service), Kirby Smith (Alberta Sustainable Resource Development), Don Podlubny (Foothills Model Forest), Rob Staniland (Talisman Energy Inc.), Mark Storie (Alberta Sustainable Resource Development), and Christian Weik (Foothills Model Forest).

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DISCLAIMER

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1. Background and Purpose

In June of 2003 the Foothills Model Forest (FtMF) released its *Local Level Indicators of Sustainable Forest Management Initial Status Report*, based on an initial suite of indicators selected by the FtMF and its partners. Following release of report, the FtMF Local Level Indicators (LLI) Activity Team commenced working towards development of the second status report set for release at the end of Phase III of the Canadian Model Forest Program (2007). Shared goals for sustainable forest management (SFM), originally established in 1998, were reviewed, amended by the FtMF Executive Committee, and ratified by the FtMF Board of Directors in December 2003. The team recognized the need and opportunity to review and enhance the initial suite of indicators, based on inputs by managers and experts involved in monitoring achievement of SFM against such goals.

Towards this end, a Local Level Indicators Workshop was held January 15 – 16, 2004, at the Sawridge Hotel in Jasper, Alberta. Desired outcomes of the workshop, as defined by the FtMF and facilitator prior to the event, were:

- A revised, enhanced and workable list of indicators for assessing performance relative to the shared goals of the FtMF partners.
- The selected indicators provide the basis for a comprehensive *State of the Forest* Report for the Foothills Model Forest.
- The indicators are useful to, and used by, the principal partners in reporting the results of their forest management.
- The indicators, together with the shared knowledge of their development and application provided by workshop participants, assist managers of other local forest areas in monitoring forest management.
- Research and development requirements are identified for filling gaps in the workable indicator list.

These desired outcomes were further elaborated at the beginning of the workshop by representatives of the principal FtMF partners, to include:

- Clarification of what works and what needs improvement;
- Link to provincial and national reporting requirements;
- Integration of the selected indicators into institutional planning cycles;
- Development of self-sustaining LLI data management systems;
- Shared indicators, reported across jurisdictional boundaries.

Dr. Keith McClain, Director of Science Policy and Strategy for Alberta Sustainable Resource Development facilitated the workshop.

2. Workshop Proceedings

2.1. Process

Participants (listed in Appendix 3) were FtMF partners and invited experts. The workshop was intended as an opportunity for partners to review the current suite of indicators to ensure they are relevant and practical for the intended purpose of reporting on the achievement of respective

goals. At the same time, attention was directed towards considering plausible indicators for goals for which indicators had not been ascribed. Participants were also encouraged to work towards a common understanding and acceptance of the interpretive value of each indicator and respective monitoring protocols.

Following introductions and a brief historical perspective, representatives from the Government of Alberta, Parks Canada, and Weldwood of Canada outlined their responsibilities as agencies having legislated authority for managing portions of the Foothills Model Forest, and their desired or expected outcomes from the workshop. The facilitator and project team leader then provided an orientation on indicator development and application, and presented the accepted FtMF goals and current suite of indicators. The facilitator assigned participants to working groups, and asked each group to review a sub-set of the current indicators against the following criteria or questions.

- *Clearly stated?* Is the indicator statement unambiguous?
- *Easily understood?* Does the indicator make sense relative to the goal?
- *Data available / where?* Are data available to support this indicator and from whom?
- *Supported by science?* Does scientific understanding support the indicator?
- *Measurement variable*. What variable will be measured to represent the indicator?
- *Frequency of measurement.* How often must data be collected or otherwise obtained?
- *Cost effectiveness.* Does the utility of the variable merit the cost of collecting data?
- *Ease of interpretation.* Is the indicator easy to interpret or is special skill or knowledge required?
- *Breadth of application*. How broadly can the indicator be applied?
- *Timely?* Is the information available for decision making?
- *Measurable?* Is the variable selected for the indicator measurable?
- *Predictable?* Can the indicator be predicted over time (and space)?
- *Reliable?* Is the indicator (variable) reliable? Does it always measure what you think?
- *Sensitive?* Is the indicator sensitive over time and space?
- *Independent?* Is the indicator confounded or otherwise influenced by other indicators?
- *Scale.* At what scale will the indicator be applied?
- *Responsibility.* Who is responsible for this indicator? Who already is collecting the data?

Based on these considerations, the groups provided an overall assessment of each indicator and its suitability. They were asked to conclude whether the indicator should be kept, refined, or deleted and, if deleted, to provide an alternative indicator that satisfied the above assessment criteria relative to the respective goal. The working groups reported their findings to the plenary session. There followed open discussion aimed at developing consensus and recommendations. In particular, ideas were solicited regarding work required, priorities, and immediate and future directions.

2.2. Indicator Evaluations

A total of 64 indicators were specifically considered, including 26 new indicators proposed by participants. Participants identified indicators for all except one goal (4.1). The indicators are listed in Table 1, where they are arranged by goal. (Shared goals of the FtMF partners are highlighted in bold type.)

Table 1. Indicators considered at the LLI workshop

1.1	**Maintain viable populations of all currently occurring native species**
1.1.1	Caribou population status
1.1.2	Grizzly bear population status

1.1.3	Grizzly bear habitat effectiveness
1.1.4	Grizzly bear security area
1.1.5	Fish population status
1.1.6	Percentage of stream crossings meeting standards
1.1.7	Density of stream crossings
1.1.8	Presence and abundance of plants and animals
1.2	**Maintain genetic diversity**
1.2.1	Genetic diversity of reforestation seed lots
1.2.2	Number of in-situ and ex-situ conservation efforts for commercial and endangered tree species per seed zone
1.2.3	Genetic diversity of plantations vs wild stands
1.2.4	Caribou genetics
1.2.5	Grizzly bear genetic diversity
1.3	**Protect rare, unique or special ecological sites and landscape features**
1.3.1	Number of rare unique, etc sites and % intact.
1.4	**Maintain natural diversity, pattern and stages of forest ecosystems over time**
1.4.1	Makeup of forest area by age class and leading species.
1.4.2	Makeup of forest area by size class and leading species.
1.4.3	Road footprint and use
1.4.4	Cancelled roads (combined with 1.4.3)
1.4.5	Area and % of new disturbance reclaimed with native species and designed to provide habitat structure
2.1	**Maintain the sustainable productive capacity of ecosystems**
2.1.1	Percentage of harvest area satisfactorily restocked
2.1.2	Forest productivity
2.2	**Maintain natural ecological processes**
2.2.1	Occurrence & severity of wildfire
2.2.2	Occurrence of insects and disease pathogens
2.3	**Conserve forest land base**
2.3.1	Forest area by protection status (IUCN designation)
2.3.2	Mining area by disposition / oil & gas by disposition /km of seismic lines per year
3.1	**Protect water quality**
3.1.1	Water temperature from streams of monitored watersheds
3.1.2	Compliance with Best Management Practices
3.2	**Sustain quantity and timing of water yields**
3.2.1	Probable estimate of water yield and quantity based on vegetative disturbance and recovery
3.3	**Sustain soil productivity**
3.3.1	Soil quality
3.4	**Minimize erosion and soil losses resulting from human disturbances**
3.4.1	Alberta soil conservation guidelines compliance
3.4.2	Number of disturbed hectares that meet Soil Loss Tolerance.
4.1	**Conserve air quality and maintain contributions of forests to carbon cycling**
	No indicators identified
5.1	**Sustainable use of biological resources**
5.1.1	Timber harvest relative to Annual Allowable Cut
5.1.2	Trapping harvest
5.1.3	Number of fishing licenses sold
5.1.4	Hunting statistics

5.1.5	Grazing; stocking versus capacity
5.2	**Assure opportunities for consumptive and non-consumptive use**
5.2.1	Recreation by reserve(ation) type
5.3	**Contribute to the social and economic health of the region**
5.3.1	Regional employment statistics
5.3.2	Employment by industry
5.3.3	Regional income distribution
5.3.4	Net regional product
5.4	**Promote the measurement of adaptive capacity as a key element of sustainable communities**
5.4.1	Population migration
5.4.2	Economic diversity index
5.4.3	Education in the region
5.4.4	Regional real estate values
5.5	**Optimize benefits through integration of land and resource uses**
5.5.1	Percentage of LOC's with at least one agreement
5.5.2	% shared alignment of lineal infrastructure
5.5.3	Proportion of aboriginal communities with completed traditional cultural studies
5.6	**Minimize threats resulting from large-scale disturbances**
5.6.1	Occurrence and severity of wildfire
5.6.2	Occurrence of insects and disease pathogens
6.1	**Ensure land use management and planning processes include timely, fair, open and equitable public involvement**
6.1.1	Activities that allow interested parties to participate in the decision making process
6.1.2	Qualitative verification that the above processes are timely, fair, open, and equitable
6.2	**Conserve cultural and historical resources**
6.2.1	Percent of industrial and commercial developments that follow a referral or consultative process for conserving cultural and historical resources
6.2.2	Number of sites identified through the referral and inventory process
6.2.3	Proportion of aboriginal communities that have provided inventory information for the FtMF
6.3	**Promote cooperation, partnership and shared responsibility**
6.3.1	Number of agencies and stakeholders with written commitment to the goal (core indicator of goal)
6.3.2	Number of participants that are satisfied with the level of cooperation, partnership and shared responsibility (satisfaction survey)
6.3.3	General public satisfaction with cooperative and partnership efforts
6.3.4	Diversity of stakeholders involved in cooperative and partnership efforts
6.4	**Foster mutual understanding on the concepts an benefits of sustainable forest management among policy makers, practitioners, researchers and the public**
6.4.1	Activities demonstrating sustainable forest management participation (replaced by 6.3.1-4)
6.4.2	Proportion of FtMF partnership that have been interviewed
6.5	**Continual improvement of sustainable forest management practices**
6.5.1.	Results of an independent review of SFM practices as identified by C&I framework
6.5.2.	Evidence of management response to undesirable trends
6.5.3.	Proportion of indicators that demonstrating desirable trends

Appendix 2 contains summaries of the assessments and recommendations for each indicator, as prepared by the working groups. Indicators are organized by working group, SFM criteria, and FtMF goal.

Only 3 indicators were recommended for rejection. The majority of the recommended indicators were identified as requiring development work before they could be available for reporting. In approximately one third of the retained indicators, the effort required for development and / or data collection was rated as substantial, expensive, or requiring currently non-available support. Work was recommended to identify and develop indicators additional to the 64 considered.

2.3. Prioritization of Indicators

The workshop illustrated and confirmed the problems associated with selecting a workable and meaningful set of indicators that can realistically be addressed and adopted by the FtMF partners. In an attempt to reduce the list to a more workable number of indicators that might realistically be adopted, participants were each requested to, following the workshop, identify the 10 indicators that they considered had overall highest priority. The following process was suggested:

1. Identify up to 10 FtMF goals that the participant believes (a) are critical to sustainable forest management of the local forest area, and (b) have a significant risk of NOT being achieved;
2. Select (not more than 10 in all) indicators that would be most effective in assessing the participants concerns about achievement of the goals.

Table 2 summarizes and ranks the replies received from participants. The top 10 indicators (11 because of equal scoring) are shown in bold type.

Table 2. Prioritization of indicators by respondents

Ref. #	***Indicator***	***Score***
1.4.1	**Makeup of forest area by age class and leading species.**	**12**
1.1.1	**Caribou population status**	**8**
1.3.1	**Number of rare unique, etc sites and % intact**	**8**
2.3.2	**Mining area, oil and gas by disposition; km of seismic lines**	**8**
1.1.8	**Presence and abundance of plants and animals**	**7**
2.1.1	**Percentage of harvest area satisfactorily restocked**	**7**
5.1.1	**Timber harvest relative to Annual Allowable Cut**	**6**
5.5.2.	**% shared alignment of lineal infrastructure**	**6**
1.4.3	**Road footprint and use**	**5**
2.2.1/2	**Occurrence & severity of wildfire, insects and disease**	**5**
5.3.2	**Employment by industry**	**5**
1.1.6	Percentage of stream crossings meeting standards	4
1.2.1	Genetic diversity of reforestation seed lots	4
3.2.1	Probable estimate of water yield based on vegetative disturbance and recovery	4
5.3.3	Regional income distribution	4
5.4.2	Economic diversity index	4

6.1.1	Activities that allow interested parties to participate in the decision making process	4
6.5.2.	Evidence of management response to undesirable trends	4
1.1.2	Grizzly bear population status	3
1.1.3	Grizzly bear habitat effectiveness	3
1.2.3	Genetic diversity of plantations vs wild stands	3
1.4.2	Makeup of forest area by size class and leading species.	3
3.1.2	Compliance with Best Management Practices	3
5.1.2	Trapping harvest	3
5.1.4	Hunting statistics	3
5.1.5	Grazing; stocking versus capacity	3
6.2.1	Percent of industrial and commercial developments that follow a referral or consultative process for conserving cultural and historical resources	3
6.5.3.	Proportion of indicators that demonstrating desirable trends	3
1.1.4	Grizzly bear security area	2
1.1.5	Fish population status	2
1.4.5	Area and % of new disturbance reclaimed with native species and designed to provide habitat structure	2
2.1.2	Forest productivity	2
5.1.3	Number of fishing licenses sold	2
5.3.1	Regional employment statistics	2
6.3.1	Number of agencies and stakeholders with written commitment to the goal	2
6.3.2	Number of participants that are satisfied with the level of cooperation, partnership and shared responsibility (satisfaction survey)	2
6.3.3	General public satisfaction with cooperative and partnership efforts	2
6.3.4	Diversity of stakeholders involved in cooperative and partnership efforts	2
6.5.1.	Results of an independent review of SFM practices as identified by C&I framework	2
1.1.7	Density of stream crossings	1
1.2.2	Number of in-situ and ex-situ conservation efforts for commercial and endangered tree species per seed zone	1
1.2.4	Caribou genetics	1
1.2.5	Grizzly bear genetic diversity	1
3.1.1	Water temperature from streams of monitored watersheds	1
3.4.2	Number of disturbed hectares that meet Soil Loss Tolerance	1
5.2.1	Recreation by reserve (ation) type	1
5.5.3	Proportion of aboriginal communities with completed traditional cultural studies	1
5.6.1	Occurrence and severity of wildfire	1
5.6.2	Occurrence of insects and disease pathogens	1
6.2.3	Proportion of aboriginal communities that have provided inventory information for the FtMF	1
6.5.4	SFM satisfaction - % of people who think SFM is being practised	1

Participants were invited to supplement their choice with comments and justifications. The activity team used the resulting feedback as a basis for the further deliberation required to arrive at a workable set (see Section 3 below).

3. Recommendations of the Activity Team for Selection and Retention of Indicators

The workshop illustrated and confirmed the problems associated with selecting a workable and meaningful set of indicators that can realistically be addressed and adopted by the FtMF partners. A great amount of information and ideas were provided by participants both during and subsequent to the workshop. The LLI activity team held a series of meetings following the workshop to consolidate the information and to develop a definitive set of indicators for recommendation to the FtMF Executive Committee and Board of Directors. The results of these deliberations are itemized in detail in Appendix 1. The appendix tabulates for each indicator the team's recommendations regarding:

- Title of the indicator;
- Whether it should be retained for reporting and / or research by the FtMF;
- What clarifications are required before further work or reporting is undertaken;
- Whether the indicator can and should be reported in the next FtMF *State of the Forest* Report;
- If so, who (i.e. what agency) should assume responsibility for measurement;
- Whether further research and / or development of is required before, or in support of, measurement and reporting;
- If so, who are the recommended partners for research and development.

The following sections (3.1 – 3.23) highlight, by FtMF goal, the main considerations and conclusions of the team in arriving at these recommendations.

3.1. Maintaining Viable Populations of Currently Occurring Native Species (Goal 1.1)

Monitoring of all species is impossible, and attention is therefore focused on a small number of "umbrella" species or species of special local concern. The preferred indicators for these species are population status and trend. Surrogates may include measures of habitat quality and mortality risk. For fish species of concern, in addition to population trends, the percentage of stream crossings meeting established standards was retained as a meaningful measure of risk. Reported fish species should be expanded from the 6 recognized in the 2003 report to include arctic grayling.

Extension to the presence and abundance of a larger number of species may not be feasible at a local level, but such feasibility will be re-assessed depending on the results and relevance of the Alberta Biodiversity Monitoring Program prototype.

3.2. Maintenance of Genetic Diversity (Goal 1.2)

The project team concluded that the most important aspect warranting monitoring, given public concerns and the magnitude of tree improvement programs in managed forests, is a measure of genetic diversity in managed versus natural forest stands. The team was not able to clarify the specific measures, and recommends that this be done by qualified specialists from Alberta

Sustainable Resource Development (ASRD) and Weldwood. The team was also uncomfortable in making recommendations regarding the assessment of in-situ reserves and ex-situ conservation of wild populations. The indicator proposed at the workshop was provisionally retained, pending expert assessment and emergence of provincial approaches and standards.

3.3. Protection of Rare, Unique or Special Ecological Sites and Landscape Features (Goal 1.3)

The team concurred with the workshop respondents that this is a high priority, and one that can benefit from facilitated collaboration among FtMF partners. The primary, but worthwhile, challenge is establishing the feasibility of standardized and integrated reporting across jurisdictional boundaries. The team recommends that this should be addressed by a sub-group of representatives from Parks Canada, ASRD, Weldwood, and Community Development.

3.4. Maintaining the Natural Diversity, Pattern and Stages of Forest Ecosystems over Time (Goal 1.4)

Forest age class structure was recognized by the workshop participants and the team as the most important indicator. A large number of metrics have been developed for measuring achievement of the goal, including some developed by the FtMF Natural Disturbance Program, and some being considered by ASRD as required standards for forest management planning and monitoring. However, at the workshop, only two indicators were elaborated for assessing landscape level structural change. No specific indicators were identified for monitoring changes in stand-level structural biodiversity in managed versus fire-origin stands. Some further consultation is recommended to confirm the need and develop the specifications for additional indicators.

The team found the concept of "road footprint" as defined in the workshop to be rather vague, and therefore attempted to specify it as the amount of linear disturbance by type and extent of human use. Some further clarification is required.

3.5. Maintaining the Sustainable Productive Capacity of Ecosystems (Goal 2.1)

While there was agreement among the team that the existing institutional measure of regeneration following timber harvest should be continued, the desirability of a more comprehensive approach to the assessment of vegetation productivity in general, and post-disturbance response in particular, was recognized as a high priority. The team also believes that an important role could be played by the FtMF in facilitating development, extension and application of the methodologies by an expert group drawn from partners.

3.6. Maintenance of Natural Ecological Processes (Goal 2.2)

Direct and comprehensive monitoring of the multiple and complex natural ecological processes in any forest is clearly impossible. The main concerns about achievement of the goal appeared to focus on anthropogenic disturbances, and the extent to which they differ from, emulate, replace or add to natural disturbances. The type and extent of disturbances, with appropriate categories and interpretation, were identified as the most important routine measures in this regard.

The team recognizes that these statistics have little value, relative to measuring achievement of the goal, unless they can be related in a comprehensible way to historic levels and trends over time. Furthermore, better measures are required for assessing the emulation of natural processes.

The team believes the responsibility for interpretation and enhancement of the proposed indicator prior to the 2007 report should be assigned to the FtMF Natural Disturbance Program, in consultation with the agencies mandated to measure and report disturbances.

3.7. Conservation of the Forest Land Base (Goal 2.3)

Reporting of forest area by IUCN protection status should be continued, since the classification is internationally recognized, and can be easily accomplished for the entire multi-jurisdictional area. However, the indicator is not sufficiently sensitive to changes in actual land use, and tracking of forest land conversion is recommended as a second indicator for this goal. Some development effort is required to extend the scope of the second indicator beyond the commercial timber land base.

3.8. Protection of Water Quality (Goal 3.1)

The team believes that the most effective strategy for this goal is to monitor and report adherence to accepted best management practices or standards for (a) stream crossings and (b) effluent discharge. For this approach to be credible, the standards must be transparent in their linkage to the goal, and broadly recognized as adequate. The reporting of compliance, and the ongoing assessment of standards, will require the participation of a number of organizations. The team suggests that there is an important opportunity here for the FtMF to facilitate pilot development of a cooperative approach for assessment of stream-crossing standards.

3.9. Sustaining the Quantity and Timing of Water Yields (Goal 3.2)

Experts attending the workshop advised that models predicting the quantity and timing of water yields, including the magnitude of peak flows, from measures of vegetative cover, were sufficiently reliable that such measures could serve as inexpensive proxies for direct monitoring of flows. The team noted that, although only one indicator is identified, effective implementation of the approach will actually require reporting of several activity and status indicators, including:

- Number of disturbances assessed;
- Estimated impacts (with and without management response);
- Selected management response to mitigate impacts;
- Results of model validation research.

The team recommends that the estimates should be made and reported wherever significant areas of vegetative cover are disturbed or proposed to be disturbed. This would involve extending application from timber harvesting to prescribed burns, and to large wildfires occurring in areas subject to cumulative impacts from harvesting.

Models used should be validated on an ongoing basis. Validation may be an appropriate role for the FtMF Watershed Program to play, but this would require expertise not currently retained by the Program.

3.10. Sustaining of Soil Productivity (Goal 3.3)

The team has serious reservations regarding the application of direct measures of soil productivity and quality, as distinct from productivity as reflected by vegetation (see Section 3.5 above). A very large body of research has been done on the subject of forest soils, but direct measurement has generally been found impractical.

The team recommends instead continuing to report on adherence to Alberta soil conservation and soil reclamation guidelines. Further research and development may be necessary if the guidelines are judged inadequate or not scientifically based, but the contribution of the FtMF in such an eventuality is currently uncertain.

3.11. Minimization of Erosion and Soil Losses Resulting from Human Disturbances (Goal 3.4)

The team does not consider the number of hectares meeting Soil Loss Tolerance as a necessary or suitable indicator of this goal. Most anthropogenic erosion and soil losses in the FtMF area result from point-source occurrences associated with lineal access development, rather than large areas incurring soil loss through de-vegetation or tillage. Given this situation, adherence to Alberta soil conservation guidelines is the preferred indicator. However, in reporting the indicator, the linkage between specific guidelines and soil stability should be made apparent.

3.12. Conservation of Air Quality and Maintenance of Contributions of Forests to Carbon Cycling (Goal 4.1)

No specific indicators were identified by workshop participants. The activity team proposes that adherence to ambient air quality guidelines should be reported as a measure of the conservation of air quality. The FtMF has already participated in initiatives for assessing the contributions of forests to carbon cycling, and to maintain provincial, national, and international credibility as a model forest should continue to do so. The team recommends that the FtMF and Weldwood test application of the Carbon Budget Model - Canadian Forest Sector version 3, in consultation with other interested parties.

3.13. Sustainable Use of Biological Resources (Goal 5.1)

The activity team believes that some measure of consumption relative to productive or regenerative capacity is necessary for ensuring and demonstrating sustainable use of any biological resource that is subject to regulated or managed harvest. Techniques and approaches will necessarily differ between resource types, and surrogate indicators may suffice where direct measures are impractical; but the principle remains the same.

Currently, assessment techniques are most developed for timber, because the Minister responsible for timber allocation is required by law to ensure that allocations to FMA holders are sustainable. The activity team recommends retention and development of indicators for timber, sport fishing, trapping, hunting, and grazing. The necessary accuracies vary between resource types depending on the extent to which consumption approaches sustainable capacities, and levels of concern regarding consumption exceeding productivity.

3.14. Assuring Opportunities for Consumptive and Non-consumptive Use (Goal 5.2)

Some workshop participants and activity team members were concerned that the established indicator for this goal failed to measure opportunities, particularly recreational opportunities, provided in areas that have no formal reservation. The team retained the current indicator, recognizing that the goal statement requires that opportunities be assured, and that this includes commercial development opportunities. It also recognized that non-reserved recreational use is a legitimate category, and should be reported.

3.15. Contribution to the Social and Economic Health of the Region (Goal 5.3)

Four indicators are recommended for retention under this goal. All the required data are available from Statistics Canada, although custom runs will have to be made to achieve the appropriate level of resolution. Reporting should be accompanied by an expert interpretation of trends.

3.16. Promotion of the Measurement of Adaptive Capacity as a Key Element of Sustainable Communities (Goal 5.4)

Four indicators are recommended for retention under this goal. As for the previous goal, all the required data are available from Statistics Canada. Reporting will be accompanied by an expert interpretation of trends.

3.17. Optimization of Benefits through Integration of Land and Resource Uses (Goal 5.5)

Shared alignment of lineal infrastructure (roads, pipelines, power lines, etc.) is recognized as a major opportunity and indicator for optimizing the benefits of integrated land and resource uses. The team proposes that the FtMF GIS Coordinator will take the lead in clarifying the required techniques, data sources, and database linkages required for measurement, in consultation with ASRD, CAPP, and Weldwood.

An indicator is also defined for recognizing aboriginal uses in the optimization and integration of benefits.

3.18. Minimization of Threats Resulting from Large-scale Disturbances (Goal 5.6)

The occurrence and severity of the major agents of large-scale disturbances (forest fire, insect, and disease) are accepted as the key status indicators for achievement of this goal. However, for the reported information to be useful and understandable in interpreting threat minimization, improved definition of and localization of threats are required. The occurrence and size of fires or insect outbreaks, for example, are difficult to interpret relative to the goal, unless they are reported relative to the values lost or at risk.

3.19. Ensuring that Land Use Management and Planning Processes Include Timely, Fair, Open and Equitable Public Involvement (Goal 6.1)

The team proposes that activities allowing interested parties to participate in the decision making process should continue to be itemized and reported. The need for a qualitative measure assessing public perceptions of these activities was also noted at the workshop. Such an indicator is endorsed and recommended by the activity team.

3.20. Conservation of Cultural and Historical Resources (Goal 6.2)

Subject to some further procedural clarifications, 2 indicators are strongly endorsed and recommended by the activity team for assessment by the Heritage Resource Management Branch of Community Development.

3.21. Promotion of Cooperation, Partnership and Shared Responsibility (Goal 6.3)

The activity team perceived that the majority of the indicators proposed for assessing this goal were ineffective, difficult to measure, or difficult to interpret. It proposes retaining one indicator (the number and type of stakeholders engaged in cooperative and partnership efforts) that can be reported by the FtMF with minimal effort.

3.22. Fostering Mutual Understanding of the Concepts and Benefits of Sustainable Forest Management among Policy Makers, Practitioners, Researchers and the Public (Goal 6.4)

Participation in SFM "events" of the FtMF and its partners, with appropriate categorization of events and participants, is considered a reasonable measure of the extent to which understanding is fostered. The FtMF is willing to develop and report on this indicator.

3.23. Continual Improvement of Sustainable Forest Management Practices (Goal 6.5)

An appropriately formulated periodic "*State of the Forest* Report", as planned and initiated by the FtMF, is an appropriate means for assessing achievement of this goal. Two integrative indicators are identified for summarizing positive versus negative trends relative to SFM goals, and management response to undesirable trends. The team also recommends that an independent peer review be conducted of the report. Terms of reference for this review would include an objective assessment of the evidence presented for improvement of SFM practices.

4. Recommendations for Development of the LLI Program

4.1. Opportunities and Priorities for Collaborative Development of Indicators

The activity team recommends that the FtMF targets approximately 50 indicators for inclusion in its 2007 *State of the Forest* Report, to assess and demonstrate progress against all 23 of the shared goals of the partnership. Some of these can be developed with minimal effort, by virtue of already being adopted by partners, or previous work conducted by the FtMF. However, the team believes that the following 10 areas require and justify special cooperative effort among the partners (indicators are referenced in parentheses and elaborated in Appendix 1).

- Genetic diversity (1.2.3)
- Rare, unique or special ecological sites and landscape features (1.3.1)
- Natural diversity of forest ecosystems (1.4.2, 1.4.5, 2.2.1)
- Productive capacity of ecosystems (2.1.1, 2.1.2)
- Water quality - stream crossing standards (3.1.2.a)
- Water yields (3.2.1)
- Carbon fixation (4.1.2)
- Recreational opportunities (5.2.1)
- Integration of lineal infrastructure (5.5.2)
- Threats from large-scale disturbances (5.6.1, 5.6.2)

Specific partnerships for measurement and / or research and development in the above areas are recommended in Appendix 1. In most of these areas the FtMF can play a useful role in facilitating the required collaboration.

4.2. Development and Scheduling of the LLI Program

The FtMF local level indicators program is at a crossroads. On the one hand, at the January workshop the principal FtMF partners re-affirmed their commitment, expectations, and interest in the program. On the other, the current approach to delivery is unlikely to be effective in meeting the expectations of the partnership, or implementing the recommendations contained in this report. The program has been constrained by inabilities of partners to provide timely inputs, which have resulted in inefficiencies, frustration, and delays.

Since its inception, the program has relied for delivery on in-kind contributions from partners, coordinated by a small activity team of FtMF and partnership staff with limited availabilities to work program tasks. The team believes that for the program to meet its objectives and commitment as set out for Phase III of the FtMF, this *status quo* requires change. Specifically, given the difficulties and delays experienced by partners in providing in-kind contributions, the services of a paid Project Coordinator should be retained to support program implementation. The Coordinator would be responsible for implementing the recommendations contained in Sections 3 and 4 and Appendix 1 of this report, with oversight by the activity team. The anticipated required level of effort is 2 person years. Although this assignment would greatly facilitate program delivery, the team stresses that effective implementation would still require the inputs of partners as identified in Appendix 1.

The team recommends that the recruitment of the Coordinator, and the implementation of program activities for the remainder of Phase III, should be scheduled as shown in Table 3.

Table 3. Recommended program schedule

Task	Critical dates
Acceptance of plan by FtMF Executive Committee	August 2004
Commence identification and development of task teams	September 2004
Hire Project Coordinator	January 2005
Data acquisition and indicator development	January – December 2005
Cut-off for data submissions	December 2005
Data compilation, analysis, and draft report writing	December 2005 – October 2006
Board and peer review of draft report	October – mid-November 2006
Report finalization	Mid-November 2006 – January 2007
Approval of report by Executive Committee and Board	January 2007
Release of final report	April 2007

Scheduling of tasks for the remainder of Phase III is predicated on the necessary completion of a *State of the Forest* Report by April 2007.

Appendix 1. Indicators Recommended by the Activity Team for Reporting and Development

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
1.1	**Maintain viable populations of all currently occurring native species**						
1.1.1	Caribou population trend	Y	Scope (provincial lands v. JNP)	Y	SRD[1], (PC[2]?)	Ongoing	SRD, WCACSC[3]
1.1.2	Grizzly bear population status and trend	Y	Provided by G. Stenhouse	Y	SRD (recovery program)		
1.1.3	Grizzly bear habitat value	Y (subordinate to 1.1.2)	Based on research findings	May be reported to supplement 1.1.2	SRD / FtMF[4]	Ongoing	FtMF, SRD
1.1.4	Grizzly bear mortality risk	Y (subordinate to 1.1.2)	Provided by G. Stenhouse	May be reported to supplement 1.1.2	SRD, FtMF	Ongoing	FtMF, SRD
1.1.5	Fish population trend	Y	Species (expand scope)	Y	SRD, ACA[5]		
1.1.6 (see 3.1.2a)	Percentage of stream crossings meeting standards	Y	See 3.1.2.a	Y	See 3.1.2.a	See 3.1.2.a	See 3.1.2.a
1.1.7	Density of stream crossings	N					

[1] Alberta Sustainable Resource Development
[2] Parks Canada
[3] West-central Alberta Caribou Steering Committee
[4] Foothills Model Forest
[5] Alberta Conservation Association

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
1.1.8	Presence and abundance of plants and animals	Y	ABMP[6] status	N		Evaluate outcome and relevance of ABMP prototype to LLI	ABMP Secretariat Working Group
1.2	**Maintain genetic diversity**						
1.2.1	Genetic diversity of reforestation seed lots	N (other than as required input to 1.2.3)		N			
1.2.2	Number of in-situ and ex-situ conservation efforts for wild populations of commercial and endangered tree species per seed zone	Y (provisionally)	Emerging SRD policies and standards	?		Evaluate development and relevance of provincial standards	SRD, WWC[7]
1.2.3	Genetic diversity of managed versus wild stands	Y	Monitoring requirements not clarified	Y (if possible)		Clarify required measures	SRD, WWC (tree improvement, genetics specialists)
1.2.4	Caribou genetics	N (Research sub-set of goal 1.1, better addressed at regional provincial level)		N		Not by FtMF	
1.2.5	Grizzly bear genetic diversity	N (As 1.2.4)		N		Not by FtMF	

[6] Alberta Biodiversity Monitoring Program
[7] Weldwood of Canada

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
1.3	**Protect rare, unique or special ecological sites and landscape features**						
1.3.1	Number of rare or unique sites and % intact	Y	Yes (see R&D)	Y (if possible)	PC,WWC, ASRD, CD[8]	Feasibility of standardized, integrated reporting	PC, WWC, ASRD, CD
1.4	**Maintain natural diversity, pattern and stages of forest ecosystems over time**						
1.4.1	Makeup of forest area by age class and leading species	Y	Inter-agency standardized (or comparable) definitions	Y	WWC, PC, SRD, CD		
1.4.2	Makeup of forest area by size class (patch size) and leading species	Y	Adequacy, or need for additional indicators	Y	WWC, PC, SRD, CD	Identification of additional indicators if required	FtMF Natural Disturbance program
1.4.3	Amount of linear disturbance by type and human use	Y	Definitions of type, use, recovery	Y	WWC, PC, SRD, CD		
1.4.4	Cancelled road dispositions	N (combined with 1.4.3)					
1.4.5 (linked to 2.1.1.b	Area and % of new disturbances reclaimed with native species	Y	Data collection and reporting system	Y (if possible – to establish baseline)	See R&D partners	Reporting system	SRD, AE[9], CD, PC, industrial users
2.1	**Maintain the sustainable productive capacity of ecosystems**						
2.1.1	Post-disturbance vegetation response:						

[8] Alberta Community Development
[9] Alberta Environment

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
2.1.1.a	- percentage of area satisfactorily restocked after timber harvesting	Y	No	Y	WWC (FMA); SRD (CMU's)		
2.1.1.b (linked to 1.4.5)	- vegetative response following disturbance	Y	Scope (e.g. include structure), variables, methods	N		Develop and extend methodology	SRD, WWC, CD, PC, CFS[10], FGYA[11]
2.1.2	Vegetation productivity	Y	Yes: variables, methods	N		Combine with 2.1.1.b	As 2.1.1.b
2.2	**Maintain natural ecological processes**						
2.2.1	Type and extent of disturbance	Y	Types and categories (agency, area, size class, severity, #). Relate extent to natural	Y	SRD, PC, WWC, CD	Identify ways to assess emulation of natural disturbances	FtMF Natural Disturbance program
2.3	**Conserve forest land base**						
2.3.1	Forest area by protection status (IUCN designation)	Y(internationally recognized)		Y	SRD, PC, CD		
2.3.2	Forest land conversion	Y	Should record net loss / gain by land use	Y	SRD, PC, CD, WWC	Develop to include wetland impacts	SRD, WWC
3.1	**Protect water quality**						
3.1.1	Water temperature from streams of monitored watersheds	N		N			

[10] Canadian Forest Service
[11] Foothills Growth and Yield Association

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
3.1.2	Adherence to accepted best management practices or standards:						
3.1.2.a	- stream crossings	Y	Applicable codes of practice and standards	Y	WWC, PC, SRD, AE, CD, AT[12], DFO[13], municipalities, industrial operators	Cooperative approach to assessment of standards	As for measurement
3.1.2.b	- effluent	Y	Standards and reporting systems	Y	AE, PC		
3.2	**Sustain quantity and timing of water yields**						
3.2.1	Estimated water yield and quantity based on vegetative disturbance and recovery	Y	Variables, scope, scale (watershed level)	Y	WWC, PC, CD, SRD	Model validation; tech. transfer	FtMF, AE, SRD
3.3	**Sustain soil productivity**						
3.3.1.a (link to 3.4.1)	Soil quality – adherence to Alberta Soil Conservation and Soil Reclamation guidelines	Y	Link between standards and soil productivity	Y	Weldwood, SRD	May be required if links not established or sound	FtMF receptive to engagement in cooperative research
3.3.1b (link 2.1.2, 3.3.1.a)	Soil quality – direct measurement	N (need to rely on surrogates)	Large body of research, not fully evaluated	N		Role and potential contribution of FtMF uncertain	As above

[12] Alberta Transportation
[13] Department of Fisheries and Oceans

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
3.4	**Minimize erosion and soil losses resulting from human disturbances**						
3.4.1 (link to 3.3.1a)	Adherence to Alberta Soil Conservation Guidelines	Y	Specific attributes and links to erosion, soil loss	Y	SRD, WWC		
3.4.2	Number of disturbed hectares that meet Soil Loss Tolerance.	N	Not applicable given land use and point-source nature of soil losses	N			
4.1	**Conserve air quality and maintain contributions of forests to carbon cycling**						
4.1.1	Adherence to ambient air quality guidelines	Y	Variables, scope (e.g. major emitters)	Y	AE, West-central Airshed Society		
4.1.2	Carbon fixation	Y	Emerging provincial and national policies and procedures	Y (at least a situation report)	FtMF, WWC	Assessment of model	FtMF, WWC, ASRD, AE, CFS
5.1	**Sustainable use of biological resources**						
5.1.1	Timber harvest relative to Annual Allowable Cut	Y	AAC procedure and validity	Y	WWC, SRD		

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
5.1.2	Trapping quotas relative to productive capacities	Y	Procedures, confidence intervals, linked research	Y	SRD		
5.1.3	Status of fish stocks (for sport fish species[14]): harvest relative to production potential.	Y	Procedures (reporting of population size relative to carrying capacity); description of uncertainties	Y	SRD	Monitoring protocols for reporting status in streams & large rivers (ongoing). Additional research required to decrease level of uncertainty of reported status.	SRD; ACA; UofA[15]
5.1.4	Hunting quotas relative to productive capacities	Y	Procedures, confidence intervals, linked research	Y	SRD		
5.1.5	Grazing; stocking versus capacity	Y	Procedures, confidence intervals	Y	SRD	Ongoing: SRD agriculture - forestry initiative	SRD

[14] Species priorities are bull trout, rainbow trout, cutthroat trout, Arctic grayling and walleye.
[15] University of Alberta

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
5.2	**Assure opportunities for consumptive and non-consumptive use**						
5.2.1 (linked to 5.1.3, 5.1.4)	Recreation by reservation type	Y	Include Jasper Nat. Park and non-reserved areas	Y	SRD, CD, WWC, PC, municipalities	Define types, categories and information sources	SRD, CD, PC, WWC
5.3	**Contribute to the social and economic health of the region**						
5.3.1	Regional employment statistics	Y	Fewer stats, more interpretation, trends	Y (reporting and interpretation by CFS)	Stats Can (2001 data & previous 20 years	Minimal	CFS
5.3.2	Employment by industry	Y	Finer filter, interpretation, trends	Y (reporting and interpretation by CFS)	Stats Can (custom run data)	Minimal	CFS
5.3.3	Regional income distribution	Y	Finer filter, aboriginal category	Y (reporting and interpretation by CFS)	Stats Can (custom run data)	Minimal	CFS
5.3.4	Net regional product	Y	Trends	Y (reporting and interpretation by CFS)	Stats Can (custom run data)	Minimal	CFS
5.4	**Promote the measurement of adaptive capacity as a key element of sustainable communities**						
5.4.1	Population migration	Y(major changes in resource communities; trend to stay)	Variables, mobility, trends, interpretation	Y (reporting and interpretation by CFS)	Stats Can (custom run data)	Minimal	CFS

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
5.4.2	Economic diversity index	Y	Calculation, interpretation	Y (reporting and interpretation by CFS)	Stats Can (custom run data)	Minimal	CFS
5.4.3	Education in the region	Y	Add categories (e.g. trade diplomas, aboriginal)	Y (reporting and interpretation by CFS)	Stats Can	Possibly, depending on data limitations	CFS
5.4.4	Regional real estate values	Y	Value, plus rental v. owned	Y (reporting and interpretation by CFS)	Stats Can	Feasibility of update since 2001	CFS
5.5	**Optimize benefits through integration of land and resource uses**						
5.5.1	Percentage of LOC's with at least one agreement	N	Cannot currently get from all users			Only if requested	
5.5.2.	% shared alignment of lineal infrastructure	Y	Measurement technique; required database linkages	Y	SRD	FtMF (GIS Coordinator) assess feasibility	ASRD, WWC, Can. Assoc. of Petroleum Producers
5.5.3	Proportion of aboriginal communities with completed traditional cultural studies	Y	Clarify completeness	Y	FtMF		
5.6	**Minimize threats resulting from large-scale disturbances**						
5.6.1 (see also 2.2.1)	Occurrence and severity of wildfire	Y	Threat definition, necessary resolution, new indicators	Y, include additional risk indicators	SRD, PC	Model and indicator development	SRD, FtMF, Firesmart Coordination groups

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
5.6.2 (see also 2.2.1)	Occurrence of insects and disease pathogens	Y	Threat definition, new indicators	Y, include additional risk indicators	SRD, PC	Evaluate MPB model; economic threat assessment	SRD, PC, WWC, W. Yellowhd. MPB Coord. Committee; CFS
5.6.3	Activity indicators?						
6.1	**Ensure land use management and planning processes include timely, fair, open and equitable public involvement**						
6.1.1	Activities that allow interested parties to participate in the decision making process	Y	More specificity: extent of activities; participation	Y	SRD, PC, CD, WWC, AE, FtMF		
6.1.2 (also linked to Goal 6.3)	Perceived quality and effectiveness of involvement processes	Y	Relates to activities identified in 6.1.1 Necessarily subjective; limited trend assessment	Y	FtMF	Question-naire development	FtMF; CFS

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
6.2	**Conserve cultural and historical resources**						
6.2.1	Percent of industrial and commercial developments that follow a referral or consultative process for conserving cultural and historical resources.	Y	Identification of qualifying resources and development processes (e.g. Site Info. Rep., Env. Field Rep., AOP	Y	CD (HRMB[16])		
6.2.2	Number of sites identified through the referral and inventory process.	Y	Are SRD prot. notations referred to HRMB?	Y	CD (HRMB)		
6.2.3	Proportion of aboriginal communities that have provided inventory information for the FtMF	N (covered by 5.5.3)		N			
6.3	**Promote cooperation, partnership and shared responsibility**						
6.3.1	Number of agencies and stakeholders with written commitment to the goal (core indicator of goal)	N (Difficult to interpret)					
6.3.2	Number of participants that are satisfied with the level of cooperation, partnership and shared responsibility (satisfaction survey)	N (Difficult to measure and interpret)					

[16] Heritage Resource Management Branch

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
6.3.3	General public satisfaction with cooperative and partnership efforts	N Difficult to measure and interpret)					
6.3.4	Number and type of stakeholders involved in cooperative and partnership efforts	Y	Definition and categories of stakeholders and efforts	Y	FtMF	Scope and reporting format	FtMF
6.4	**Foster mutual understanding on the concepts and benefits of sustainable forest management among policy makers, practitioners, researchers and the public**						
6.4.1	Participation in SFM events	Y	Qualifying events (e.g. website use); partitioning of participant categories; relate to event objectives	Y	FtMF	Develop scope, definitions and reporting format	FtMF
6.4.2	Proportion of FtMF partnership that have been interviewed.	N					
6.5	**Continual improvement of sustainable forest management practices**						
6.5.1. (link to 6.5.2-3)	Peer review of SOF report	Y	TOR - to assess evidence of improvement	Y	Will seek CMFN[17] guidance on process and selection of reviewers		
6.5.2.	Evidence of management response to undesirable trends	Y		Y	FtMF		

[17] Canadian Model Forest Network

Ref. #	Indicator (recommended title)	Retain? (Yes, No)	Clarification required?	Report? (Yes, No)	Measurement by:	Research / develop?	R&D partner
6.5.3.	Proportion of indicators that demonstrating desirable trends	Y		Y	FtMF		

Appendix 2. Indicator Assessments by Workshop Groups

Group	1								
Criterion	**1**	**CONSERVATION OF BIOLOGICAL DIVERSITY**							
Goal	**1.1**	**Maintain viable populations of all currently occurring native species**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
1.1.1	Caribou Population Status	Yes					Ongoing	H	
1.1.2	Grizzly Bear Population Status	Trend added					Yes	H	
1.1.3	Grizzly Bear Habitat Effectiveness		Effectiveness replaced by "Value"				Ongoing	M	
1.1.4	Grizzly Bear Security Area		Security replaced with mortality risk				Ongoing	H	
1.1.5	Fish Population Status	Yes, expansion to come from Forest/Fish Conference					Ongoing	L (until further expansion provided)	
1.1.6	Percentage of stream crossings meeting standards	Yes					Ongoing	H	
1.1.7	Density of stream crossings	Yes					Ongoing	H	
1.1.8	Presence and abundance of plants and animals					New	Support of pilot project	H	

Group	1								
Criterion	1	CONSERVATION OF BIOLOGICAL DIVERSITY							
Goal	1.2	Maintain genetic diversity							
No.	Full Statement of Indicator	Accepted, but	Rejected replaced by	Rejected & not replaced	Revised (link)	New	Work required?	Priority H,M,L	Direction
1.2.1	Genetic diversity of reforestation seed lots					New	Minimal	H	
1.2.2	Number of in-situ and ex-situ conservation efforts for commercial and endangered tree species per seed zone					New	Lots	M	
1.2.3	Genetic diversity of plantations vs wild stands					New	Lots	L	
1.2.4	Caribou genetics					New	Ongoing (support required)	M	
1.2.5	Grizzly bear genetic diversity					New	Ongoing (support required)	M	

Group	1								
Criterion	1	CONSERVATION OF BIOLOGICAL DIVERSITY							
Goal	1.3	Protect rare, unique or special ecological sites and landscape features							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
1.3.1	Number of rare unique, etc sites and % intact.					New	Ongoing, but currently not collated.	H	

Group	1								
Criterion	**1**	**CONSERVATION OF BIOLOGICAL DIVERSITY**							
Goal	**1.4**	**Maintain natural diversity, pattern and stages of forest ecosystems over time**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
1.4.1	Makeup of forest area by age class and leading species.	Revised to include leading species					Obtained from TM as a product from GB program. (Ongoing AVI in Weldwood	H	
1.4.2	Makeup of forest area by size class and leading species.	Revised to include leading species					Obtained from TM as a product from GB program. (Ongoing AVI in Weldwood	H	
1.4.3	Road footprint and use	Revised to include “use”					Ongoing, but coordination required.	H	
1.4.4	Cancelled road (Combined with 1.4.3)								
1.4.5	Area and % of new disturbance reclaimed with native species and designed to provide habitat structure					New	Lots including policy change.	M – L	

Group 1

Additional Comments

1.2 Maintain genetic diversity

- Handout that provides a comparison of tree genetic diversity between species.
- PPt handout that provides background and rationale for developing Local Level Indicators based on National Criteria and Indicators.
- Compare genotypes between natural and commercial blocks. Ellen McDonald's work should be referenced (and repeated and/or replicated). Check out
- Discuss fish (Rainbow Trout) – Monitoring/Eliminating fish planting of non-native (non-Athabasca Rainbows).
- Wolverine (research project – probably wouldn't end up being reported on with any frequency.
- Eastern Brook Trout hybridization with Bull Trout.
- Grizzly Bear genetics – Mike Proctor's Ph.D. results. Hair snagging/transplants will be a management action that will occur with sufficient frequency that trends can be reported on.
- Caribou – same indicator.(Kirby to fill out).

Parking Lot

Indicator 2.3.1 (just one indicator) forest area by protection status should be added to reflect the percent of the land base rather than the area. E.g., to be used as benchmarks. Smaller ecological units are relevant to biological diversity (representativeness)

Also useful to report context with the natural subregion instead of jus the FMF boundary

Some measure of fine scale diversity (e.g. snags, dead wood, stream and watershed morphology) should be investigated for inclusion under goal 1.4.

Mid to large scale patch size measures may be considered for inclusion that specifically relate to SFM– see recent work by Andison.

Group	2								
Criterion	**2**	**FOREST ECOSYSTEM CONDITION AND PRODUCTIVITY**							
Goal	**2.1**	**Maintain the sustainable productive capacity of ecosystems**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
2.1.1	Percentage of harvest area satisfactorily restocked		Post-disturbance vegetation response				Need to establish plots and baseline info.	High, currently no indicator	
2.1.2	Forest productivity	Vegetation productivity (expanded beyond timber, changed to sample rather than census approach)					Need to establish plots and baseline info.	High, currently no indicator for portions of landbase	

Summary

- Currently focuses on trees. Do not address soil, water, wildlife productivity.
- Difficult and expensive to measure other ecosystem components.
- If indicators in criteria 1 establish baselines then can measure the productivity of these other components in indicators in 2.1.

Group	2								
Criterion	**2**	**FOREST ECOSYSTEM CONDITION AND PRODUCTIVITY**							
Goal	**2.2**	**Maintain natural ecological processes**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
2.2.1 & 2.2.2	Occurrence & severity of wildfire / Occurrence of insects and disease pathogens		2.2.1 Area, size, type and severity of disturbance (changed to incorporate many disturbances)				Data exists but needs to be compiled.	High. An important all-encompassing indicator for the goal	

Summary

- Addressed the agents of change but do not have indicators to measure the actual change in the processes eg. carbon cycling, hydrological cycle, nutrient cycling etc.
- Difficult to measure process side. Very complex. Need to investigate if there are possible indicators to address these processes. Need some "canaries" to indicate a change in these processes.
- Resiliency or regenerative capacity, conservation of biological diversity may be indicators that these processes are still occurring.

Group	2								
Criterion	**2**	**FOREST ECOSYSTEM CONDITION AND PRODUCTIVITY**							
Goal	**2.3**	**Conserve forest land base**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
2.3.1	Forest area by protection status (IUCN designation)						Data already exists, work is done		
2.3.2	Mining area by disposition / oil & gas by disposition /km of seismic lines per year	2.3.2 Forest land conversion (A new indicator was created to include 3 indicators (2.3.2, 2.3.3, 2.3.4) as well as expanding the list to include other land/resource uses.			2.3.2, 2.3.3, 2.3.4		Huge data collection. Needs review and feasibility assessment		

Group	3								
Criterion	**3**	**CONSERVATION OF SOIL AND WATER**							
Goal	**3.1**	**Protect water quality**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
3.1.1	Water temperature from streams of monitored watersheds			X			Need confirmation with Fish Biologist Input regarding thresholds for fish – need to determine if we have an issue (review departure s of water temperature); If so, may need to review of study plan for predicting water temperature with other organizations including AENV (lots of data)	Low, may or may not be well linked for this goal.	Not to collect data for this indicator at this time – potentially assign equipment data loggers to ACA to develop a study plan (Craig Johnson)
3.1.2	Compliance with Best Management Practices	X, reworded					Scope needs to be expanded.	H	Onward and upward!
Comments GAP…. Look at new? Investigate pollutants - sewage, selenium, toxins from towns, industrial activities, how far to extend? Use of Water Quality Index? (AENV)									

Group	3								
Criterion	**3**	**CONSERVATION OF SOIL AND WATER**							
Goal	**3.2**	**Sustain quantity and timing of water yields**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
3.2.1	Probable estimate of water yield and quantity based on vegetative disturbance and recovery					X	Comparison of two models and reconciliation to a common approach; Future science required to address roads and drainage and its impact on this indicator	M	Already in place.

Group	3								
Criterion	**3**	**CONSERVATION OF SOIL AND WATER**							
Goal	**3.3**	**Sustain soil productivity**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
3.3.1	Soil quality					X	Workplan identified	H	Work with AENV and partners.

Group	3								
Criterion	**3**	**CONSERVATION OF SOIL AND WATER**							
Goal	**3.4**	**Minimize erosion and soil losses resulting from human disturbances**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
3.4.2	Number of disturbed hectares that meet Soil Loss Tolerance.					X	Comparison of various approaches and reconciliation to a common approach; Relate to new indicator under Group #2 Extent of certified reclaimed land to disturbed landbase and other stream crossing indicators 1.1.6 and 1.1.7.	M; less applicable for forest management activities except roads.	Work with AENV and partners.

Group	**3**	
Criterion	**4**	**GLOBAL ECOLOGICAL CYCLES**
Goal	**4.1**	**Conserve air quality and maintain contributions of forests to carbon cycling**
Comments Investigate Potential indicators of air quality. Air Quality Index; Maintenance of leaf area. Potential linkage to indicator 2.1.1 Percentage of harvest area satisfactorily restocked/1.4.1 Makeup of forest by age class. Work with AENV. Potential indicators of carbon cycling: carbon uptake – investigate FtMF Carbon Model and other initiatives. Eg. AENV; Potentially link up with Goal 1.4 and indicator 1.4.1 Makeup of forest by age class. Check on model to be finalized and bring into LLI report. Low priority		

Group	**4**								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.1**	**Sustainable use of biological resources**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
5.1.1	Timber harvest relative to Annual Allowable Cut						Not new	H	go
5.1.2	Trapping harvest			X					
5.1.3	Number of fishing licenses sold			X					
5.1.4	Hunting statistics	X – unit of measure limited to unit of effort						H	Go SRD
5.1.5	Grazing; stocking versus capacity							M	Go
5.1.2, 5.1.3, 5.1.4 ….. should be replaced with a measure which captures depletions versus stock.									

Group	4								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.2**	**Assure opportunities for consumptive and non-consumptive use**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
5.2.1	Recreation by reserve (ation) type	Change indicator stmt and include JNP data					Acquire JNP data	H	Go

Group	4								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.3**	**Contribute to the social and economic health of the region**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
5.3.1	Regional employment statistics	Would like to see a few changes relative to YH94 and labour force participation			5.5.1 (old #)		As stated	H	Go
5.3.2	Employment by industry	Finer filter			5.5.2. (old #)		As stated	H	Go
5.3.3	Regional income distribution	'total' not just distribution			5.5.3 (old #)		Address filter comments	H	Go
5.3.4	Net regional product	Verify source and results (CFS)			5.5.6 (old #)		Clarify responsibility	H	Go

Group	4								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.4**	**Promote the measurement of adaptive capacity as a key element of sustainable communities**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
5.4.1	Population migration	Use population migration and totals; include aboriginal						H	Go
5.4.2	Economic diversity index						Use finer filter	H	Go
5.4.2	Education in the region	Finer filter (especially aboriginal) required			5.5.4 (old number)			M	Go
5.4.3	Regional real estate values				5.5.5 (old number)		Missing owned versus rented	M	Go

Group	4								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.5**	**Optimize benefits through integration of land and resource uses**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
5.5.1	Percentage of LOC's with at least one agreement					X	GIS ; Weldwood / SRD; est $5k/yr	H	Go SRD
5.5.2.	% shared alignment of lineal infrastructure					X	GIS Weldwood / SRD ; est $5k/yr	H	Go Weldwood
5.5.3	Proportion of Aboriginal Communities with completed traditional cultural studies (TCS)					X		H	Go FtMF

Group	4								
Criterion	**5**	**MULTIPLE BENEFITS TO SOCIETY**							
Goal	**5.6**	**Minimize threats resulting from large-scale disturbances**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
	Occurrence and severity of wildfire?				2.2.1?				
	Occurrence of insects and disease pathogens?				2.2.2?				
Goal not mentioned, indicators not included, in received workgroup report (editor)									

Group	**5**								
Criterion	**6**	**SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT**							
Goal	**6.1**	**Ensure land use management and planning processes include timely, fair, open and equitable public involvement**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
6.1.1	Activities that allow interested parties to participate in the decision making process	X			As 6.2.1		None		
6.1.2	In order to be able to verify that the above processes are 'timely, fair, open, and equitable', a qualitative component should be included.					X	Yes, to establish criteria for satisfaction survey		Define fair, open, and equitable

Group	5								
Criterion	**6**	**SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT**							
Goal	**6.2**	**Conserve cultural and historical resources**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
6.2.1	Percent of industrial and commercial developments that follow a referral or consultative process for conserving cultural and historical resources.					X	Minimal		
6.2.2	Number of sites identified through the referral and inventory process.					X	Minimal		
6.2.3	Proportion of Aboriginal communities that have provided inventory information for the FtMF					X	Minimal		

Group	5								
Criterion	**6**	**SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT**							
Goal	**6.3**	**Promote cooperation, partnership and shared responsibility**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
6.3.1	Number of agencies and stakeholders with written commitment to the goal (core indicator of goal)					X	Moderate		
6.3.2	Number of participants that are satisfied with the level of cooperation, partnership and shared responsibility (satisfaction survey)					X	Moderate to high		Suggested alternative
6.3.3	General public satisfaction with cooperative and partnership efforts					X	Low, but expensive		Suggested alternative
6.3.4	Diversity of stakeholders involved in cooperative and partnership efforts					X			Suggested alternative

Group	5								
Criterion	**6**	**SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT**							
Goal	**6.4**	**Foster mutual understanding on the concepts an benefits of sustainable forest management among policy makers, practitioners, researchers and the public**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
6.4.1			6.3.1, 2, 3, 4						
6.4.2	Proportion of FtMF partnership that have been interviewed.					X	High		

Group	**5**								
Criterion	**6**	**SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT**							
Goal	**6.5**	**Continual improvement of sustainable forest management practices**							
No.	**Full Statement of Indicator**	**Accepted, but**	**Rejected replaced by**	**Rejected & not replaced**	**Revised (link)**	**New**	**Work required?**	**Priority H,M,L**	**Direction**
6.5.1.	Results of an independent review of SFM practices as identified by C&I framework					X	High	Deemed to be a high priority	
6.5.2.	Evidence of management response to undesirable trends					X	Low		
6.5.3.	Proportion of indicators that demonstrating desirable trends					X	Low		

Appendix 3. Workshop Participants

1st Name	Last Name	Agency	JobTitle	Location
Angie	Larocque	Foothills Model Forest	Project Administative Assistant	Hinton
Bill	White	Canadian Forest Service	Senior Economist/Project Leader	Edmonton
Bob	Phillips	Foothills Model Forest	Aboriginal Community Liaison	Hinton
Bob	Swanson	RH Swanson and Associates	Forest Hydrology Consultant	Canmore
Bob	Udell	Weldwood of Canada Ltd.	Forest Policy & Government Affairs Manager	Hinton
Brenda	Dobson	Parks Canada	Conservaion Biologist, Jasper National Park	Jasper
Brian	Ronaghan	Community Development	Eastern Slopes Archaelogist	Edmonton
Christian	Weik	Foothills Model Forest	GIS Coordinator	Hinton
Dave	Andison	Bandaloop Landscape-Ecosystem Services	Consultant	Belcarra (B.C.)
Dave	Kmet	Weldwood of Canada Ltd.	Land Use Coordinator	Hinton
Dick	Dempster	Dick Dempster Consulting Ltd.	Consultant	Edmonton
Don	Podlubny	Foothills Model Forest	General Manager	Hinton
Gordon	Stenhouse	Foothills Model Forest	Wildlife Biologist	Hinton
Harry	Archibald	Alberta Environment	Team Leader, Regional Strategies, IRM Branch	Edmonton
Heather	Sinton	Alberta Environment	Land Quality Program Manager	Edmonton
Hugh	Lougheed	Weldwood of Canada Limited, Hinton Division	Forestry Manager	Hinton
Jeff	Reynolds	Alberta Forest Products Association	Director, Forestry	Edmonton
Jerry	Sunderland	Alberta Sustainable Resource Development	Executive Director, Forestry Operations Branch	Edmonton
Jim	LeLacheur	Weldwood of Canada Ltd.	Alberta Woodlands General Manager	Hinton
Jim	Schieck	Alberta Research Council	Manager, Biodiverity Monitoring Program	Vegreville
John	Parkins	Canadian Forest Service	Sociologist	Edmonton
John	Taggart	Monitoring and Evaluations Branch	Head, Evaluation & Reporting Section	Edmonton
Keith	McClain	Alberta Sustainable Resource Development	Director, Science Policy and Strategy	Edmonton
Kevin	Land	Weldwood of Canada Ltd.	Fibre Supply Forester	Hinton
Kirby	Smith	Alberta Sustainable Resource Development	Edson Area Wildlife Biologist	Edson
Laura	Graham	Alberta Community Development	Regional Parks Planner	Hinton
Leonard	Barnhardt	Sustainable Resource Development	Manager, Alberta Tree Improvement & Seed Centre	Smokey Lake
Margarete	Hee	Alberta Sustainable Resource Development	Unit Lead, Landuse Planning	Edmonton
Mark	Storie	Alberta Sustainable Resource Development	Forest Resource Manager	Hinton
Rich	McCleary	Foothills Model Forest	Fisheries Biologist	Hinton
Rick	Bonar	Weldwood of Canada Ltd.	Chief Biologist / Planning Coordinator	Hinton
Rob	Staniland	Talisman Energy Inc.	Environmental Biologist	Calgary
Shawn	Cardiff	Parks Canada	Limnological Specialist, Jasper National Park	Jasper
Stan	Kavalinas	Alberta Sustainable Resource Development	Forester	Edmonton